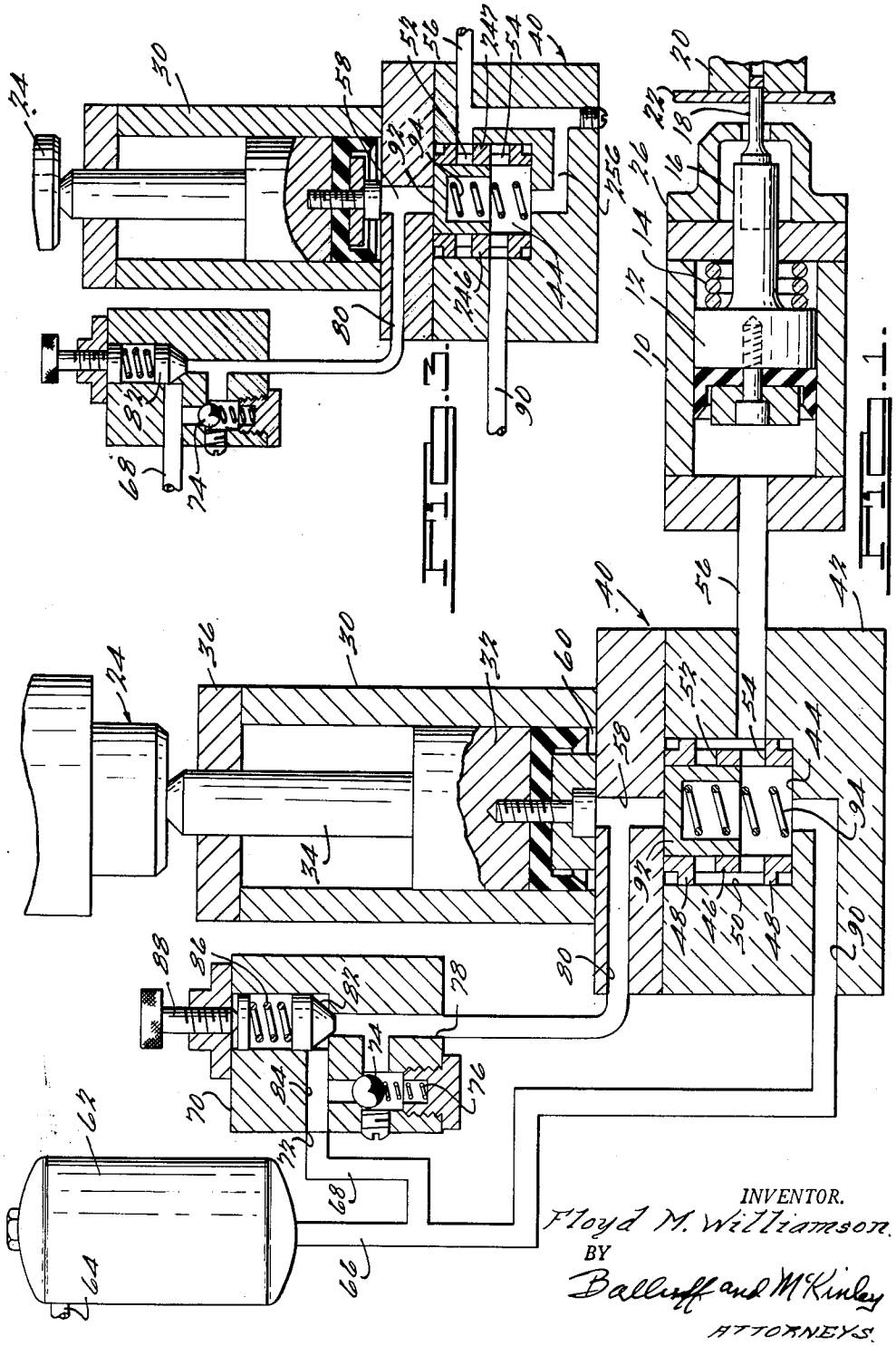
May 14, 1963 F. M. WILLIAMSON 3,089,375

HYDRAULICALLY ACTUATED PIERCING UNIT

Filed Aug. 10, 1959 2 Sheets-Sheet 1



INVENTOR.
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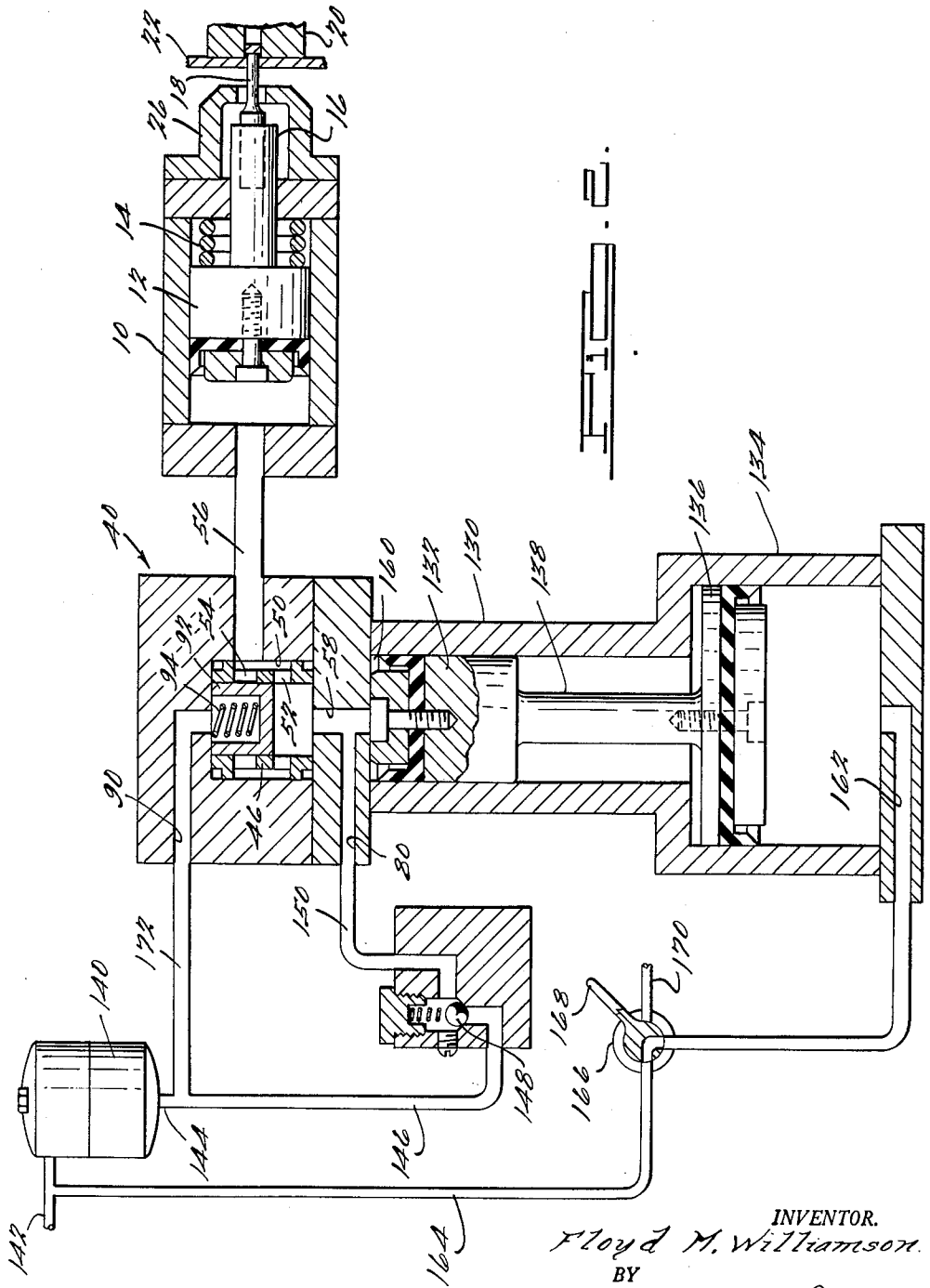


Fig. 1

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United States Patent Office 3,089,375 Patented May 14, 1963

3,089,375

HYDRAULICALLY ACTUATED PIERCING UNIT

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Filed Aug. 10, 1959, Ser. No. 832,720
15 Claims. (Cl. 83—571)

This invention relates to a hydraulically actuated piercing unit and has particular reference to an improved hydraulic circuit and valve means for controlling operation of the unit.

This application is a continuation in part of my prior application, Serial No. 788,544, filed January 23, 1959, for Hydraulically Actuated Piercing Unit, now abandoned.

A piercing unit of the type to which this invention relates comprises a punch or other piercing tool carried by a piston working within a cylinder which is actuated by hydraulic pressure from a master cylinder with no mechanical connection between the pistons of the two cylinders. The master cylinder may be actuated by the ram of a press so that the piercing unit can be used to pierce work at angles not in line with the direction of travel of the ram of the press. A unit of this type is also adapted for use as a portable unit, in which case the master cylinder may be actuated by air pressure or in some other suitable manner. In either type of unit, however, it is desirable to provide a means for insuring that the piston which carries the punch can retract under the force of the stripper spring. The present invention is directed to the provision of an improved valve means for insuring that the work piston will return to its retracted position even though the punch may hang or drag in the work for a short time after completion of the working stroke. The present valve arrangement prevents oil from being trapped in the two cylinders in the event that the actuating piston should return to its initial position prior to the return of the punch piston, such as might occur if the punch should drag in the work.

It is a principal obect of the invention to provide a new and improved hydraulically actuated piercing unit.

Another object of the invention is to provide a piercing unit for use with a press for piercing work at angles not in line with the direction of travel of the ram of the press.

A further object of the invention is to provide a new and improved portable piercing unit.

A further object of the invention is to provide a new and improved compensating valve means for use with a piercing unit of the type described.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawings, of which there are two sheets, which by way of illustration show preferred embodiments of the invention and what I now consider to be the best mode of applying the principles thereof. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

FIGURE 1 is a schematic illustration of a hydraulically actuated piercing unit embodying the invention;

FIGURE 2 is a schematic view illustrating a modified form of the invention; and

FIGURE 3 is a fragmentary schematic view illustrating a modification of the apparatus illustrated in FIGURE 1.

FIGURE 1 discloses a hydraulically actuated piercing unit adapted for use with a press of any conventional type for the purpose of piercing work at angles not in line with the travel of the ram. The piercing unit includes a work cylinder 10 having a piston 12 therein and urged to its retracted position by a stripper spring 14. The piston 12 has a piston rod 16 which carries a punch 18

which cooperates with a die 20 to pierce the workpiece 22 upon operation of the press with which the device is used. The ram of the press is indicated at 24. The work cylinder 10 has a stripper 26 through which the punch 18 extends for stripping the workpiece 22 from the punch as the piston 12 returns to its retracted position under the force of spring 14.

The actuating cylinder 30 is provided with a piston 32 having a piston rod 34 extending through the upper end wall 36 of the cylinder 30 so as to be engaged and moved by the ram 24 of the press during the working stroke of the ram. The unit includes a compensating valve indicated at 40 which includes a valve body 42 provided with a recess 44. A sleeve 46 is arranged within the recess 44 and is provided with spaced collars 48 so as to define an annular valve chamber 50 between the sleeve 46 and the valve body 42. The sleeve 46 is provided with one or more ports 52 defining the inlet port to the chamber 50 and one or more ports 54 defining an exhaust port for the valve chamber 50.

The left-hand end of the work cylinder 10 communicates with the valve chamber 50 through a hydraulic pressure line 56. The valve body 42 is provided with a passage 58 which connects the space 60 at the lower end of cylinder 30 with the interior of the sleeve 46.

An oil supply tank 62 is filled with oil, and air is supplied to the tank 62 under pressure through a line 64 above the level of the oil in the tank 62 so that the oil is maintained at a predetermined pressure within the system. Oil is supplied from the tank 62 to the lower end 60 of the actuating cylinder 30 through a line 66 having a branch 68 leading to a valve body 70 having an inlet 72 and a check valve 74 backed up by a light spring 76. The oil under pressure flows past check valve 74 through the outlet 78 and through passage 80 to passage 58. A pressure relief valve 82 is interposed in a by-pass passage 84 around the check valve 74. The pressure relief valve 82 is urged against its seat by a spring 86 and an adjusting screw 88 is provided for adjusting the compression of the spring 86 and therefore adjusting the pressure at which the valve 82 will unseat. The valve body 42 is provided with a passage 90 leading from the valve chamber recess 44 back to the supply tank 62.

The unit is shown in FIGURE 1 just after completion of a working stroke in which the punch 18 has been moved into workpiece 22. A cup-shaped valve 92 is slidably disposed within the sleeve 46 and is urged to the position shown by a spring 94. In this position of the valve the inlet ports 52 are closed while the exhaust ports 54 are open, thereby enabling the work cylinder 10 to communicate with the exhaust passage 90 so that oil can flow in response to the retractile movement of piston 12 from the cylinder 10 through passage 56, valve chamber 50, exhaust ports 54, into the recess 44 and then through exhaust passage 90, back to supply tank 62. The force of the spring 14 is sufficiently strong to retract the piston 12 against the relatively low pressure under which the oil in the tank 62 is maintained. As soon as the ram 24 begins its upward stroke, the oil under pressure from tank 62 will be supplied through lines 66 and 68, past check valve 74, and through passages 78, 80 and 58 into the lower end 60 of the cylinder 30 to raise the piston 32 to the upper end of the cylinder 30. The pressure on opposite sides of the valve 92 is equal and, therefore, the valve 92 will be free to move under the influence of spring 94 to the position shown.

Upon the next working stroke of the ram 24, the ram will engage the upper end of the piston rod 34 to force the piston 32 downwardly. The oil trapped in the lower end 60 of the actuating cylinder 30 will be forced through passage 58 against the upper surface of valve 92 to move

the valve downwardly against the force of spring 94 to open the ports 52 and close the exhaust ports 54. The oil cannot return through passages 80 and 78 because of the check valve 74 and the pressure relief valve 82 will be unseated to relieve the pressure in the unit only at a predetermined high pressure, which will be much greater than that required to move the punch piston 12 against the spring 14. As soon as the piston 32 is actuated by the ram 24, the valve 92 will open the ports 52 and close the ports 54 to supply high pressure oil through line 56 into the work cylinder 10 to move the punch into the work. The punch will complete its stroke prior to the end of the travel of piston 32 and during the continued movement of the piston 32 after the punch has completed its stroke the excess pressure will force valve 82 to open. As soon as the ram completes its stroke, the valve 82 will close and the pressure in passages 58 and 90 will be equalized so that the valve 92 will be moved by spring 94 to close the ports 52 and open the exhaust ports 54, whereupon the work cylinder 10 will be exhausted in the manner described as the piston 12 is moved to its retracted position by the spring 14.

The valve arrangement described above insures that the work cylinder 10 is always connected to the supply tank, except for the very brief period in the cycle of operation which corresponds to the working stroke of the punch 18. The punch 18 will therefore be able to retract even though the cylinder 30 may again fill with oil before the piston 12 has had sufficient time to be retracted by the spring 14.

FIGURE 2 illustrates a portable piercing unit constructed according to the present invention. In a unit of this type the actuating cylinder may be actuated by compressed air rather than by the ram of a press. In this embodiment of the invention the working cylinder and the punch actuated therefrom are identical with the corresponding parts of FIGURE 1 and are therefore given the same reference characters. The compensating valve 40 is also the same as described in connection with FIGURE 1 and the several parts thereof are therefore given the same reference characters as the corresponding parts of the FIGURE 1 modification. In this embodiment of the invention the actuating means includes a hydraulic cylinder 130 having a piston 132 therein and an air cylinder 134 having a piston 136 therein. The pistons 132 and 136 are connected by a connecting rod 138 so that the two pistons are movable together. The supply tank 140 contains oil and air under pressure is supplied to the tank 140 above the level of the oil through a line 142 leading from a source of compressed air. Oil is supplied from the discharge line 144 of the tank 140 through line 146, past a check valve 148 and through line 150 to passage 80. Oil under the predetermined low pressure is supplied to the upper end 160 of the hydraulic cylinder 130 and moves the pistons 132 and 136 to their lowermost positions. The lower end of the cylinder 134 is provided with a passage 162 through which the cylinder 134 is supplied with compressed air through line 164. A valve 166 is interposed in the line 164 and may be moved between the position shown in which the valve connects line 164 with passage 162, and a second position in which handle 168 is turned 90° in a counterclockwise direction so as to connect passage 162 with the exhaust line 170.

When the unit is to be actuated the valve handle 168 is moved to the position shown in FIGURE 2 so that compressed air will be supplied to the lower side of piston 136. The diameter of piston 136 is substantially larger than the diameter of the hydraulic piston 132 so that the air pressure on the underside of piston 136 will be sufficient to move the pistons 132 and 136 to the position shown, thereby forcing the oil in the upper end 160 of the cylinder 130 through passage 58 into interior of sleeve 46 and through ports 52 and passage 56 into the work cylinder 10 to effect the working stroke of the punch 18. The oil under pressure forced from the upper end of cylinder 130 will cause the valve 92 to open the ports 52 and close the exhaust ports 54. As soon as the valve 166 is manipulated to connect the exhaust passage 162 leading from the cylinder 134 to the exhaust line 170, the pistons 132 and 136 will be retracted due to the pressure of the oil supplied from the tank 140 past the check valve 148 and through passages 150, 80 and 58 into the upper end of the cylinder 130. A passage 172 leads from the exhaust passage 90 and valve 40 back into the supply tank 140 so that the pressure will be equalized on opposite sides of valve 92 and the valve will therefore be free to move under the influence of spring 94 to open the exhaust ports 54 and close the inlet ports 52. The work cylinder 10 can then be exhausted through passage 56, valve chamber 50, exhaust ports 54 and passages 90 and 172.

In the modification shown in FIGURE 3 the construction is essentially the same as that of FIGURE 1, except that the hydraulic pressure line 56 is provided with a branch 256 which communicates with the valve chamber 44 inside of the valve sleeve 246. The sleeve 246 is the same as the sleeve 46, except that an annular rib or collar 247 cooperates with the cylindrical wall of the valve chamber 44 to separate ports 52 from the ports 54 externally of the sleeve 246. Except as above noted the construction of FIGURE 3 is the same as that of FIGURE 1 and the operation is essentially the same, except that one side of the valve member 92 is continually exposed to the oil in line 56 through branch 256 whereby the pressure in the line 56 reacts on one side of the valve member 92. In this way the pressure differential on opposite sides of the valve member 92 is minimized, and only slight pressure is needed to return the valve member 92 to its seat. As the cycling of the press creates a variable velocity in the oil flow, decreasing to zero at the end of the stroke before the reverse flow of the oil starts from the pressure of the stripper spring 14 on piston 12, the valve 92 will start to seat or close the ports 52 as such flow of oil decreases due to the action of the spring 94. Such seating movement of the valve 92 will open the ports 54 and permit the flow of oil from the valve chamber 44 through the ports 54 to the return line or exhaust passage 90. The valve unit illustrated in FIGURE 3 may be employed in the modification of FIGURE 2.

The valve arrangement described herein not only insures that the work cylinder can be exhausted upon retraction of the punch and prevents trapping of oil in the two cylinders at the same time, but also has the further advantage of effecting a circulation of the oil so that upon each actuation of the unit a fresh supply of oil from the tank 140 is utilized. This has the advantage of preventing heating of the oil and consequently reduces the operating temperature of the device.

While I have illustrated and described preferred embodiments of my invention, it is understood that these are capable of modification, and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, a spring for retracting said piston, an actuating cylinder having a piston therein, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line leading from said supply tank to said actuating cylinder for supplying oil thereto at said predetermined pressure, a check valve in said line, passage means providing a commu-

nication between said work cylinder and said actuating cylinder, an exhaust passage leading from said work cylinder back to said supply tank, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder to increase the pressure of the oil therein above said predetermined pressure and to discharge oil from said actuating cylinder into said passage means, and valve means interposed in said passage means and operable responsive to the flow of oil effected by said movement of said piston in said actuating cylinder for opening said communication between said work cylinder and said actuating cylinder while closing said exhaust passage to supply oil at said increased pressure to said work cylinder thereby to effect movement of the piston in said work cylinder to its extended position, said valve means being operable upon release of said force for closing said communication while opening said exhaust passage to permit movement of said piston in said work cylinder to its retracted position under the force of said spring.

2. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, a spring for retracting said piston, an actuating cylinder having a piston therein, an oil supply tank, a hydraulic pressure line leading from said supply tank to said actuating cylinder for supplying oil thereto, a check valve in said line, passage means providing a communication between said work cylinder and said actuating cylinder, an exhaust passage leading from said work cylinder back to said supply tank, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder to increase the pressure on the oil therein and to discharge oil from said actuating cylinder into said passage means, and valve means interposed in said passage means and operable responsive to the flow of oil effected by said movement of said piston in said actuating cylinder for opening said communication between said work cylinder and said actuating cylinder while closing said exhaust passage to supply oil at said increased pressure to said work cylinder thereby to effect movement of the piston in said work cylinder to its extended position, said valve means being operable upon release of said force for closing said communication while opening said exhaust passage to permit movement of said piston in said work cylinder to its retracted position under the force of said spring.

3. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, means for retracting said piston, a valve body having a valve chamber therein, said valve chamber having an inlet port and and exhaust port therein, a hydraulic pressure line connecting said work cylinder to said exhaust port in said valve chamber, an actuating cylinder having a piston therein, said actuating cylinder communicating with said inlet port in said valve chamber, an oil supply tank, means for maintaining the oil in said tank under pressure, a hydraulic pressure line leading from said supply tank for supplying oil under said pressure to said actuating cylinder, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder for increasing the pressure of the oil therein above said pressure and to discharge oil from said actuating cylinder, an exhaust passage leading from the exhaust port in said valve chamber to said supply tank, valve means in said valve chamber and operable in one position thereof for opening said inlet port while closing said exhaust port and operable in a second position thereof for closing said inlet port while opening said exhaust port, and means urging said valve means to said second position, said valve means being movable to said one position in response to the increased pressure developed in said actuating cylinder and the oil discharged therefrom by movement of the piston therein.

4. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, means for retracting said piston, a valve body having a valve chamber therein, said valve chamber having an inlet port and an exhaust port therein, a hydraulic pressure line connecting said work cylinder to said valve chamber, an actuating cylinder having a piston therein, a passage connecting said actuating cylinder to said inlet port in said valve chamber, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line leading from said supply tank to said passage for supplying oil at said predetermined pressure to said actuating cylinder, a check valve in said last-mentioned line, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder to increase the pressure of the oil therein above said predetermined pressure and to discharge oil from said actuating cylinder into said passage, an exhaust passage leading from the exhaust port in said valve chamber back to said supply tank, a valve in said valve chamber and operable in one position thereof for opening said inlet port while closing said exhaust port and operable in a second position thereof for closing said inlet port while opening said exhaust port, means urging said valve to said second position, said valve being movable in said one position in response to said increased pressure developed in said actuating cylinder and the discharge of oil from said actuating cylinder by movement of the piston therein thereby to supply oil at said increased pressure to said work cylinder to effect the working stroke of said punch, and a pressure relief valve in said hydraulic pressure line leading from said supply tank for maintaining the pressure in said actuating cylinder below a predetermined maximum pressure.

5. A hydraulically actuated piercing unit comprising a work cylinder, a piston in said work cylinder, a punch carried by said piston, a spring urging said piston to its retracted position, an actuating cylinder having a piston therein, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line leading from said supply tank to said actuating cylinder for supplying oil thereto at said predetermined pressure, a check valve in said line, passage means providing a communication between said work cylinder and said actuating cylinder, an exhaust passage leading from said work cylinder back to said supply tank, an air cylinder, a piston in said air cylinder and connected to the piston in said actuating cylinder for movement therewith, means for supplying compressed air to said air cylinder for effecting movement of the piston in said actuating cylinder to increase the pressure on the oil therein above said predetermined pressure and to discharge oil from said actuating cylinder, valve means interposed in said passage means and operable responsive to said increased pressure in said actuating cylinder and the dicharge of oil therefrom for opening said communication between said work cylinder and said actuating cylinder while closing said exhaust passage to supply oil at said increased pressure to said work cylinder and thereby to effect movement of the piston in said work cylinder through its working stroke, and spring means for moving said valve means to close said communication while opening said exhaust passage to permit movement of said piston in said work cylinder to its retracted position.

6. A hydraulic system for a hydraulically actuated

piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, a spring for retracting said piston, a valve body having a valve chamber therein, a first hydraulic pressure line connecting said work cylinder to said valve chamber, an actuating cylinder having a piston therein, a fluid flow conduit interconnecting the discharge side of said actuating cylinder and said valve chamber, a supply of oil under pressure, a second hydraulic pressure line interconnecting said oil supply and said conduit for supplying oil at a predetermined pressure to said actuating cylinder and valve chamber, a check valve in said last-mentioned line, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder to increase the pressure of the oil therein and in said conduit above said predetermined pressure and to discharge oil from said actuating cylinder, an exhaust passage leading from said valve chamber back to said oil supply, a normally closed valve in said valve chamber operable in the open position thereof to permit flow of oil from said conduit to said first hydraulic pressure line and in the closed position thereof to prevent return flow from said line to said conduit, a normally open valve in said valve chamber operable in the open position thereof to permit flow of oil from said first hydraulic pressure line to said exhaust passage and in the closed position thereof to prevent such flow, said valves being responsive to said increased pressure developed in said actuating cylinder by movement of the piston therein thereby to open said normally closed valve so as to supply oil at said increased pressure through said first hydraulic line to said work cylinder to effect the working stroke of punch, and so as to close said normally open valve to prevent return of oil from said valve chamber through said exhaust passage at such time.

7. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, a spring for retracting said piston, a valve body having a valve chamber therein, a first hydraulic pressure line connecting said work cylinder to said valve chamber, an actuating cylinder having a piston therein, a fluid flow conduit interconnecting the discharge side of said actuating cylinder and said valve chamber, a supply of oil under pressure, a second hydraulic pressure line interconnecting said oil supply and said conduit for supplying oil at a predetermined pressure to said actuating cylinder and valve chamber, a check valve in said last-mentioned line, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder to increase the pressure of the oil therein and in said conduit above said predetermined pressure and to discharge oil from said actuating cylinder, an exhaust passage leading from said valve chamber back to said oil supply, a normally closed valve in said valve chamber operable in the open position thereof to permit flow of oil from said conduit to said first hydraulic pressure line and in the closed position thereof to prevent return flow from said line to said conduit, a normally open valve in said valve chamber operable in the open position thereof to permit flow of oil from said first hydraulic pressure line to said exhaust passage and in the closed position thereof to prevent such flow, said valves including a common valve member movable responsive to said increased pressure developed in said actuating cylinder by movement of the piston therein thereby to open said normally closed valve so as to supply oil at said increased pressure to said work cylinder to effect the working stroke of punch, and so as to close said normally open valve to prevent return of oil from said valve chamber through said exhaust passage at such time.

8. Apparatus according to claim 7, wherein one face of said valve member is exposed to the oil in said conduit and the opposite face of which is continually exposed to the oil in said first hydraulic pressure line whereby the pressure in such line reacts on said valve member.

9. Apparatus according to claim 7, wherein one face of said valve member is exposed to the oil in said conduit and the opposite face of which is continually exposed to the oil in said first hydraulic pressure line whereby the pressure in such line reacts on said valve member, and a spring reacting on said opposite face of said valve member and biasing it in a direction to close said normally closed valve.

10. A hydraulic system for a hydraulically actuated piercing unit including a punch, said system comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position to effect the working stroke of the punch, a valve body having a valve chamber therein, said valve chamber having an inlet port and an exhaust port therein, a hydraulic pressure line connecting said work cylinder to said exhaust port in said valve chamber, an actuating cylinder having a piston therein, said actuating cylinder communicating with said inlet port in said valve chamber, an oil supply tank, means for maintaining the oil in said tank under pressure, a hydraulic pressure line for supplying oil under pressure from said supply tank to said valve chamber and to said actuating cylinder, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder for increasing the pressure of the oil therein above said pressure, an exhaust passage leading from the exhaust port in said valve chamber to said supply tank, valve means in said valve chamber and operable in one position thereof for opening said inlet port while closing said exhaust port and operable in a second position thereof for closing said inlet port while opening said exhaust port, and means urging said valve means to said second position, said valve means being movable to said one position in response to the increased pressure developed in said actuating cylinder by movement of the piston therein.

11. A hydraulic system according to claim 3 wherein said exhaust passage is connected to said valve chamber so that said valve means therein in all positions thereof is interposed between said inlet port and said exhaust passage.

12. A hydraulic system according to claim 3 wherein the opposite ends of said valve chamber are connected to said oil supply tank in such manner that the opposite sides of said valve means in said valve chamber are always subject to the pressure of the oil in said supply tank.

13. A hydraulic system according to claim 3 wherein said first-mentioned hydraulic pressure line is connected to said valve chamber in such a manner that one side of said valve means in said valve chamber is always in open communication with said work cylinder.

14. A hydraulic system for actuating the punch of a piercing unit comprising a hydraulic work cylinder, a piston in said work cylinder operable in response to hydraulic fluid pressure in said work cylinder to move in one direction toward its extended position for actuating said punch, a valve body having a valve chamber therein, said valve chamber having three ports therein, a hydraulic pressure line connecting said work cylinder to a first one of said ports in said valve chamber, an actuating cylinder having a piston therein, said actuating cylinder communicating with a second port in said valve chamber, an oil supply tank, means for maintaining the oil in said tank under pressure, a hydraulic pressure line

for supplying oil from said supply tank to said actuating cylinder, means external of the hydraulic system for applying a force to move the piston in said actuating cylinder for increasing the pressure of the oil therein above said pressure, a fluid passage between a third port in said valve chamber and said supply tank, valve means in said valve chamber and operable in one position thereof for closing said third port, said valve means being movable to said one position in response to the increased pressure developed in said actuating cylinder by movement of the piston therein.

15. A hydraulic system according to claim 7 wherein said valve chamber is provided with oppositely disposed ports with said common valve member disposed therebetween, one of said ports communicating with said conduit and the other with said exhaust passage.

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