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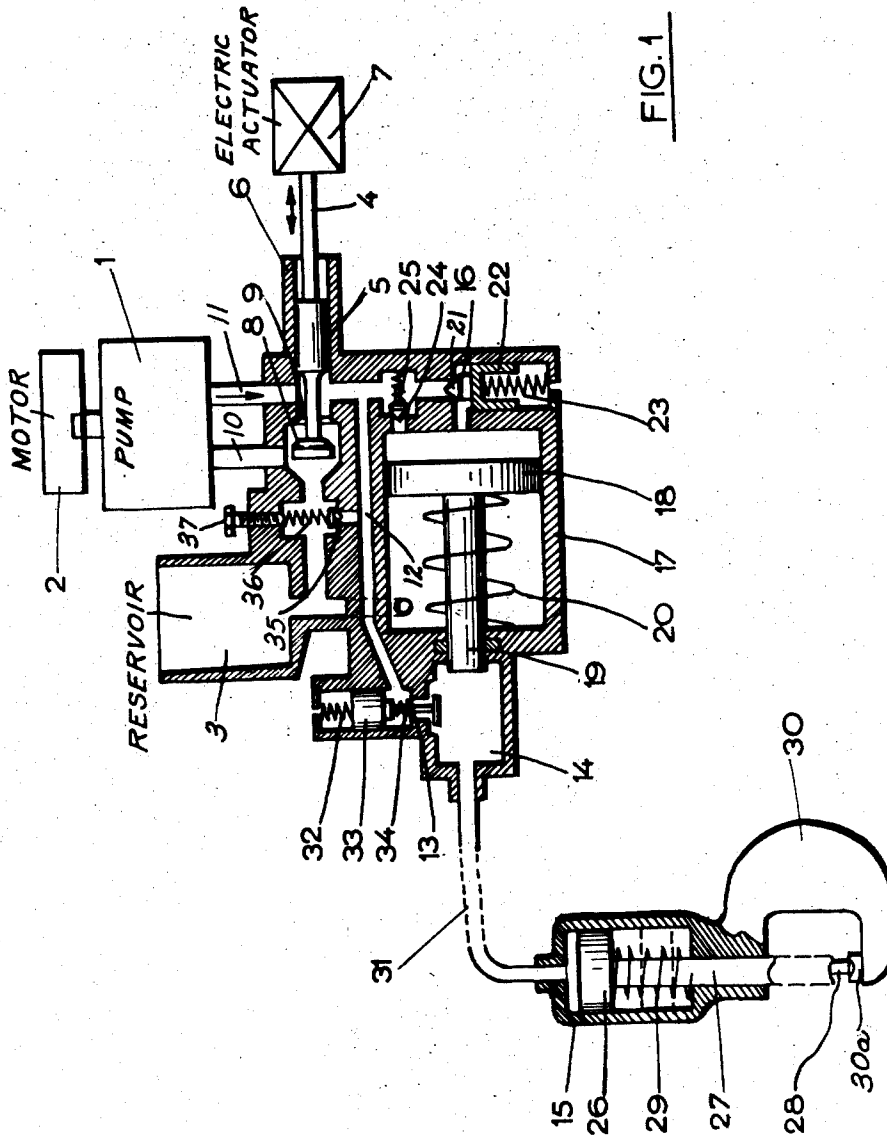
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HYDRAULIC SYSTEM FOR RIVETING PRESSES

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2 Sheets-Sheet 1



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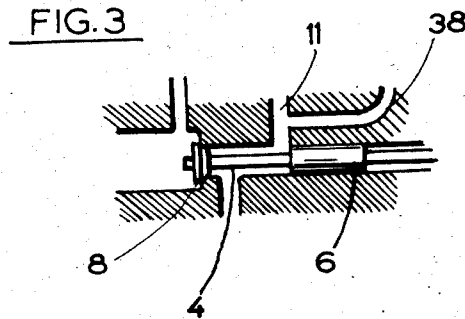
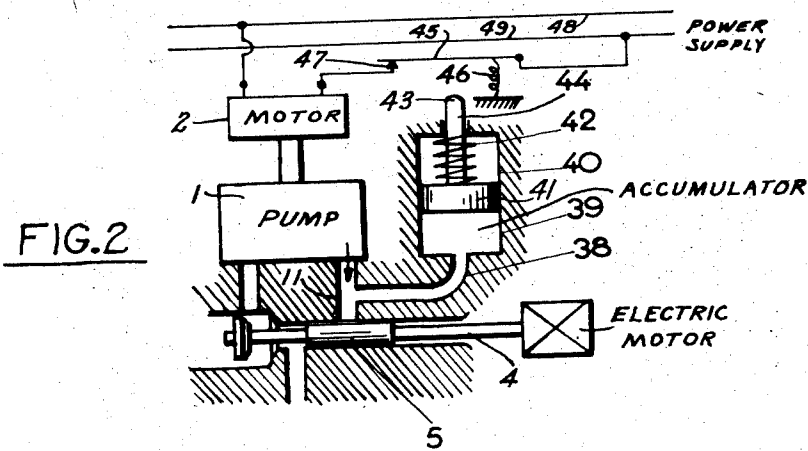
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HYDRAULIC SYSTEM FOR RIVETING PRESSES

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4 Claims. (Cl. 78—42)

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It is well known, for riveting or other applications, to use presses operated by continuous pressure under the action of a compressible fluid such as air, which transmits its pressure through a relatively incompressible fluid such as oil, to press members operating in two successive phases comprising a preliminary phase and a work phase. Such presses can operate only by the use of two different fluids, which complicates their manufacture and increases their cost.

An object of this invention is to overcome these disadvantages by allowing the use of a single substantially incompressible hydraulic fluid, which simplifies the apparatus.

Another object of the invention is to increase the pressure with a small length of stroke for the piston of the intensifier.

Riveting presses allowing the attainment of the above objects offer characteristics which will appear from the following description and more particularly from the appended claims.

Riveting presses in accordance with the invention are shown, by way of illustration in the accompanying drawing wherein:

Figure 1 shows diagrammatically, in section, a first type of embodiment of the riveting press.

Figure 2 shows diagrammatically, in partial section, another type of embodiment of the press shown in Figure 1, comprising a pressure accumulator.

Figure 3 shows diagrammatically, in partial section, the press shown in Figure 2 in its operating position.

The riveting press whose assembly is shown in Figure 1 comprises a pump 1 driven by a motor 2. This pump aspirates and expels a fluid such as the oil contained in a tank 3 towards the hydraulically actuated members of the press proper.

The hydraulically actuated members of the press proper comprise the following main components:

- (1) Control valve 4;
- (2) The preliminary phase circuit;
- (3) The pressure multiplying circuit;
- (4) The tool carrying press members.

The control valve 4 comprises a valve piston or slide 5 sliding within cylinder 6. The sliding motion of this slide is controlled by an electric actuator 7. Slide 5 carries an extending valve head 8 which can block an aperture 9 controlling the direct connection of the intake pipe 10 of the pump 1 with the discharge pressure piping 11 of said pump 1.

Further, the discharge piping 11 of pump 1 is

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connected directly through a duct 12, through a valve 13 and a pressure chamber 14 with the cylinder 15 of the press proper.

The pressure piping 11 of pump 1 is also in communication through a valve 16 with the cylinder 17 of the low pressure side of a pressure multiplier. This pressure multiplier consists of a large area piston 18 movable with a small area plunger 19 extending from cylinder 17 into the pressure chamber 14 for producing a high pressure therein.

A spring 20 yieldingly urges piston 18 towards the right end of the cylinder.

Valve 16 consists of a conical valve head 21 integral with a piston 22; valve 16 is restored to its closing position by a spring 23, acting on piston 22.

The cylinder 17 of the pressure multiplier also communicates through a check valve 24 having a spring 25 with the discharge piping 11 of the pump.

Spring 25, normally, presses the valve head 24 against its valve seat so as to close the passage between the cylinder 17 of the pressure multiplier and the discharge piping 11 of pump 1.

The press proper comprises a piston 26 sliding within a press cylinder 15. The press piston 26 is connected to a piston rod 27 whose free end carries a riveting press tool 28. The piston 26 is yieldingly urged upwardly by a compression spring 29 which surrounds the piston rod 27 within press cylinder 15. Press cylinder 15 is mounted on a tool supporting press frame 30 which also carries a press tool 30a cooperating with the press tool 28 carried by press piston rod 27. Press cylinder 15 is connected through a duct 31 with the pressure chamber 14.

The above described press operates as follows:

Initially, the control valve 4 being opened, pump 11 operates without load since the discharge piping 11 is in direct communication with the intake piping 10. Thus, the fluid is not under pressure, and the tool operating piston 26 of the press proper is at its upper or initial position and piston 18 of the pressure multiplier is urged by spring 20 to the right end of cylinder 17 of the pressure multiplier.

Valve 13, controlling the direct communication of the discharge of pump 1 with the pressure chamber 14 is opened by the action of spring 32 acting on piston 33 connected to the stem of said valve.

A spring 34 opposing spring 32 but of smaller strength makes it possible, by building up pres-

sure in pressure chamber 14 to cause closure of valve 13.

To operate the press, a traction is exerted on the rod of the control valve 4 by means of the electric actuator 7 so as to close said valve by movement of slide 5 to the right.

Pump 1 then feeds the fluid into duct 12. This fluid goes through valve 13, reaches the pressure chamber 14 whence it flows through duct 31 into press cylinder 15 of the press proper. The fluid acts on the tool operating piston 26 by compressing its spring 29 until pressure applying contact is established with the work to be pressed (for example a rivet).

This constitutes the preliminary phase.

From this time on, pump 1 continues to operate, the pressure of the fluid keeps increasing and pushes piston 33 of the valve 13, compressing spring 32; this cuts off duct 31 from direct communication with the discharge of the pump.

The pressure continues to build up within the discharge piping 11, valve 16 is forced open and this pressure is then exerted on the piston 22 of said valve 16, the latter thereafter remaining open without any flutter.

The fluid under pressure then goes through valve 16 into the cylinder 17 of the pressure multiplier and forces piston 18 to the left. The plunger 19 of piston 18 then enters the pressure chamber 14, which causes the increment of pressure necessary for effecting the desired press operation on the work; this pressure increase is a function of the ratio between the transverse and areas of piston 18 and plunger 19.

Valve 13 prevents back flow from pressure chamber 14 to the discharge passage 11 of pump 1 during operation of the pressure multiplier.

The portion of the pressure multiplier cylinder 17 to the left of piston 18 is in free communication with fluid reservoir 3 so that movement of piston 18 in either direction is not opposed by fluid in this left hand portion of cylinder 17.

The pressure developed by the press proper is proportional to the discharge pressure of the pump.

To adjust and limit the maximum value of this pressure, an adjustment valve 35 biased by a spring 36 and a control screw 37 connects the piping 12 for the direct return of the fluid to reservoir 3.

To each position of the screw 37 there corresponds a load on spring 36 and, therefore, a predetermined maximum working pressure, the valve rising when the fluid reaches said pressure and allowing the return of said fluid to reservoir 3.

To return the press to its initial position, the control valve 4 is opened, the discharge pipe 11 of pump 1 is then placed again in direct communication with pump intake pipe 10, the pressure drops in the discharge pipe 11, and valve 16 return into engagement with its seat closing communication between the discharge pipe 11 and cylinder 17 of the pressure multiplier.

The piston 18 of the pressure multiplier is restored towards the right by its spring 19, and the fluid to the right of piston 18 returns to the discharge pipe 11 through check valve 24.

Spring 32 presses piston 33 of valve 13 downwardly, thereby opening valve 13.

Cylinder 15 of the press proper is thus in simultaneous communication with the discharge pipe 11 and reservoir 3.

Spring 29 restores the tool operating piston 26 and the tools to their respective initial positions.

Numerous modifications may be effected in the

above described press without departing from the scope of the invention.

Figures 2 and 3 illustrate a modified form of the invention to which a hydraulic accumulator has been added to store up hydraulic energy during intervals when the press is idle, this stored energy being available whenever desired for operation of the press. The provision of a hydraulic accumulator permits the use of a pump motor of smaller rating than is otherwise possible.

Referring to Fig. 2, a hydraulic accumulator 39 is shown connected to the pump discharge outlet 11. The accumulator comprises a cylinder 40 having a piston 41 vertically slidably disposed therein, piston 41 being yieldingly urged downwardly by a helical compression spring 42 surrounding an upwardly extending piston rod 44.

The upper end of piston rod 44 carries a tip 43 formed of electrical insulating material which is engageable with a movable contact member 45. A tension spring 46 urges movable contact member into engagement with a cooperating stationary contact member 47 to complete a circuit for the energization of pump motor 2 from power supply conductors 48 and 49.

This device operates in the following manner:

With slide 5 of control valve 4 in its open position, as shown in Fig. 2, the pump discharge pipe 11 is cut off from the press apparatus, and the pump discharge pipe 11 communicates through a duct 38 with the accumulator cylinder 39. Pumping action forces accumulator piston 41 upwardly against the yielding pressure of a helical compression spring 42. If the pumping action continues until accumulator cylinder 39 is filled and piston 41 reaches its uppermost position, the insulated tip 43 of piston rod 44 engages movable contact member 45 and moves member 45 out of its normal engagement with stationary contact member 47, thereby opening the energizing circuit for pump motor 2. When hydraulic fluid is withdrawn from accumulator 39, piston 41 moves downwardly under pressure applied by compression spring 42 and piston rod 44 also moves downwardly permitting reclosure of pump motor control contacts 45-47. If the pump motor 2 is a pneumatic motor, a suitable valve may be controlled by piston rod 44 instead of the electrical contacts 45 and 47 as illustrated.

When valve 4 is moved to its open position as shown in Fig. 3, the accumulator 39 and the pump 1 jointly supply hydraulic fluid under pressure to the press. Having thus described my invention, what I claim as new and desire to secure by Letters Patent is the invention as defined in the following claims.

I claim:

1. An hydraulic press of the class described, comprising: a tool supporting press frame; an hydraulically actuatable press cylinder carried by said frame, said press cylinder comprising a press piston movable therein and a tool carrying piston rod connected to said press piston, said frame and piston rod tools being cooperatively engageable with a workpiece inserted therebetween; resilient means urging said press piston to a predetermined initial position in which said tools are spaced apart to receive a workpiece therebetween; a pressure chamber communicating with said press cylinder; hydraulic pressure multiplying means comprising two interconnected slidable members of different transverse areas, the ratio of pressure multiplication being determined by the ratio of said areas, the member of smaller area being disposed to produce a high pressure in

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said pressure chamber, said pressure multiplying means further comprising resilient means for yieldingly urging said slidable member of larger area to expel hydraulic fluid from the low pressure side of said multiplying means; a controllable source of substantially incompressible hydraulic fluid under pressure, said source including reservoir means permitting back flow of fluid thereto; a first duct means connecting said source with said pressure chamber; pressure actuable normally open valve means included in said first duct means for preventing back flow from said pressure chamber to said source during operation of said pressure multiplying means; a second duct means connecting said source to the low pressure side of said pressure multiplying means for applying pressure to said slidable member of greater area; pressure actuable normally closed valve means included in said second duct means, said normally closed valve means opening in response to a predetermined minimum pressure differential between said source and said low pressure side of said pressure multiplying means; and check valve means connected between said low pressure side of said multiplying means and said source for permitting hydraulic fluid to flow from said low pressure side back to said source when said low pressure exceeds said source pressure.

2. A press according to claim 1, wherein said source of hydraulic fluid comprises a motor driven pump having an intake communicating with said reservoir means and a discharge passage, and control valve means for selectively connecting said discharge passage either to said pump intake or to both of said first and said second duct means.

3. A press according to claim 1, wherein said source of hydraulic fluid comprises a motor driven pump having an intake communicating

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with said reservoir means and a discharge passage, an hydraulic accumulator connected to said discharge passage, and selectively operable control valve means for connecting both said first and second duct means either to said reservoir means or to said discharge passage.

4. A press according to claim 3 further comprising control means for starting and stopping operation of said pump motor, and means responsive to accumulation of a predetermined amount of fluid under pressure in said accumulator for actuating said control means to stop further operation of said pump, said accumulation responsive means actuating said control means to start said pump upon withdrawal of fluid from said accumulator.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,888,990	Kurath	Nov. 29, 1932
1,970,999	Ferris	Aug. 21, 1934
2,030,966	Crane	Feb. 18, 1936
2,058,377	Francis	Oct. 20, 1936
2,241,645	Peterson	May 13, 1941
2,330,739	Piron	Sept. 28, 1943
2,331,800	Rockwell	Oct. 12, 1943
2,351,872	Parker	June 20, 1944
2,357,632	Cornelius	Sept. 5, 1944
2,398,165	Stelzer	Apr. 19, 1946
2,403,912	Doll	July 16, 1946
2,405,759	Schnell	Aug. 13, 1946
2,452,292	Cousino	Oct. 26, 1948

FOREIGN PATENTS

Number	Country	Date
556,205	Germany	Aug. 8, 1932