Jan. 21, 1947. H. E. PAGE 2,414,484

FLUID OPERATED DEVICE

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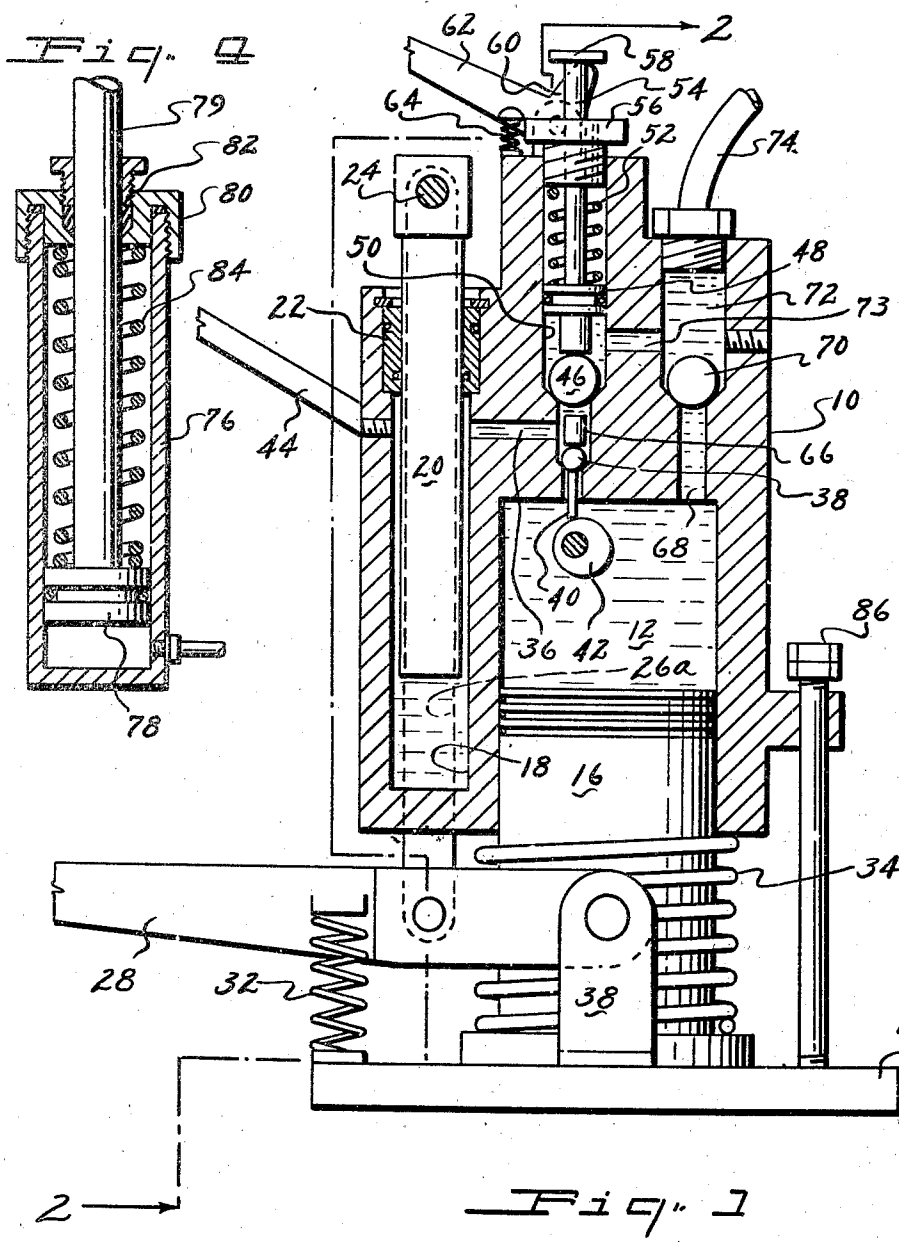


Fig. 1

INVENTOR.

Herbert E. Page

BY

Mann & Graham

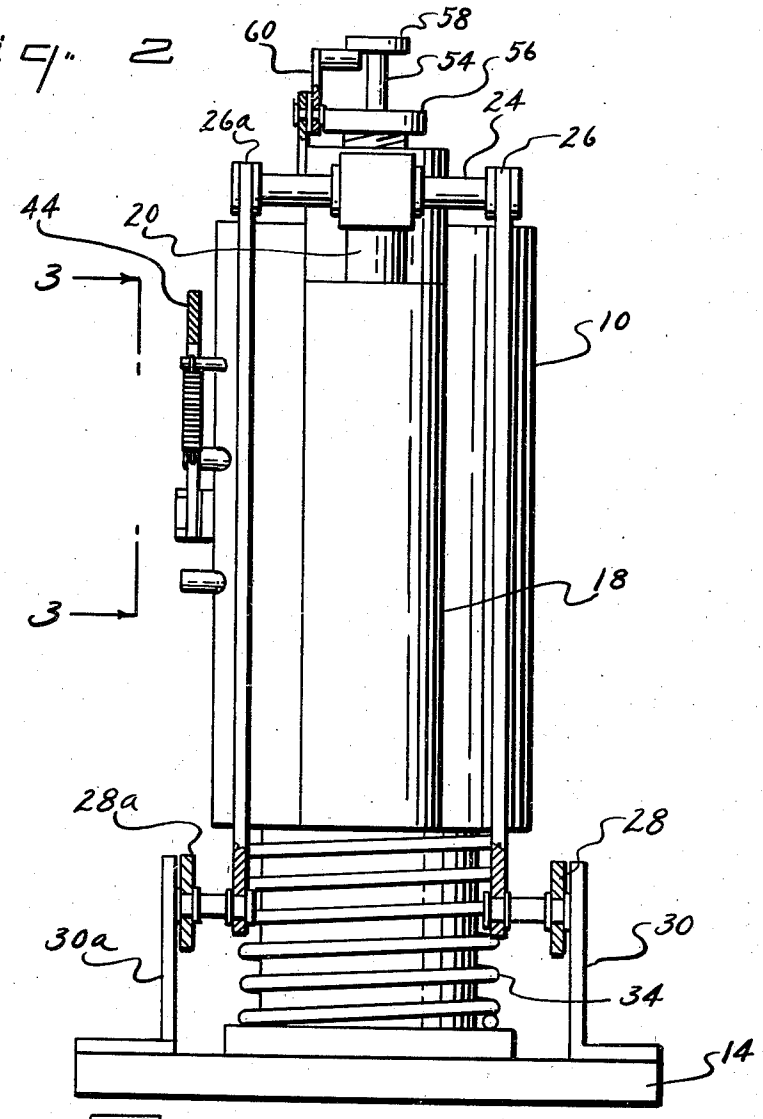
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Fig. 2



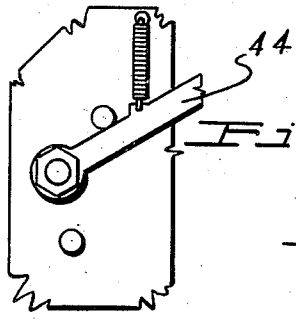


Fig. 3

INVENTOR.

Herbert E. Page

BY Mann & Graham

Attys.

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Fig. 6

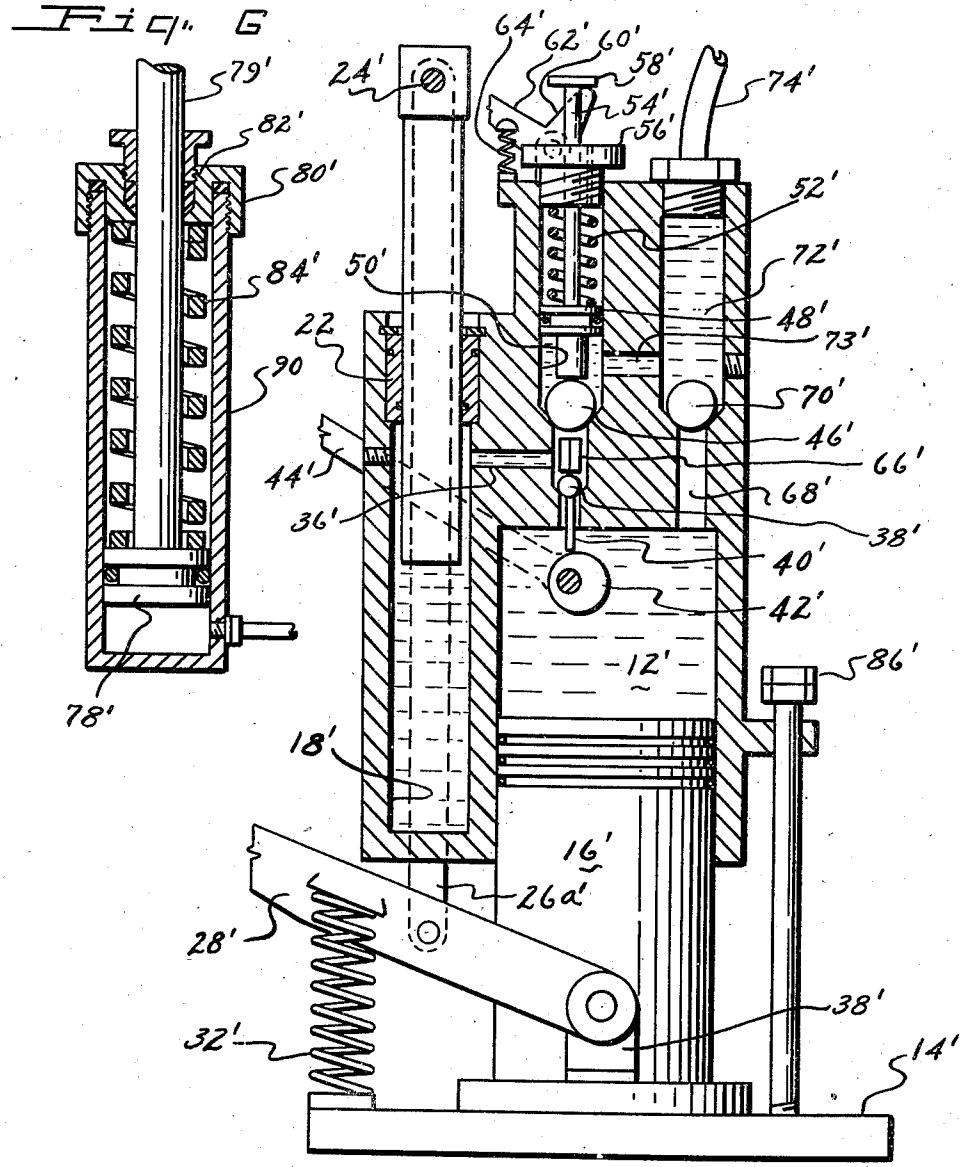


Fig. 5

INVENTOR.

Herbert E. Page

BY Mann & Graham

Attys.

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UNITED STATES PATENT OFFICE

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FLUID OPERATED DEVICE

Herbert E. Page, Alhambra, Calif.

Application October 1, 1945, Serial No. 619,661

5 Claims. (Cl. 60—52)

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This invention relates to means for supplying fluid under pressure for the operation of devices such as vises which may be positioned at a different point or different level than the pressure supplying means. For instance, the vise may be mounted on a work bench while the pressure supplying means may be placed under the bench for foot operation.

It is pointed out, however, that the pressure supplying means of the invention is not restricted to the operation of any particular device but has a wide field of usefulness.

It is an object of my invention to provide a novel and efficient fluid pressure generating device which functions by virtue of a fluid containing body moving relative to a stationary piston to force a relatively large volume of fluid into a work cylinder at low pressure to move a piston in such cylinder relatively rapidly into work engaging position and which then functions by virtue of a high pressure-low volume pressure generating member to more slowly move the piston in its work lifting operation.

It is a further object of the invention to provide a pressure supplying means of the kind described which may be located in any position convenient for operation.

Another and more specific object is to provide, in such a device, means for rendering inoperative the large volume-low pressure supplying means at will when it is desired only to use high pressure-low volume operation.

Still further features and objects of the invention will hereinafter appear from the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a central section through one form of the pressure supplying means of the invention;

Fig. 2 is an elevation of the form of the invention shown in Fig. 1, parts being shown in section on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary detail view on line 3—3 of Fig. 2;

Fig. 4 is a central section through the cylinder, and parts enclosed thereby, of a hydraulic device supplied with pressure fluid by the device of the invention;

Fig. 5 is a central section through another form of the pressure fluid supplying means; and

Fig. 6 is a central section of a cylinder supplied with pressure fluid by the pressure supplying means of the form shown in Fig. 5.

Referring now to Fig. 1, the pressure supplying means comprises a casing 10 formed to provide a

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cavity 12 which, in the form shown, may be a cylindrical bore. The casing is mounted for sliding movement toward and away from the base or mount 14 on a stationary piston 16 supported on the base, the cavity and stationary piston forming a variable volume reservoir for hydraulic fluid. The casing is also formed with an open ended cylinder 18 in which a plunger 20 is arranged for reciprocating movement through a cylinder head and packing gland construction 22, the plunger being operated as shown in Fig. 2 by means of a yoke 24 passing through the head of the plunger and connected at each end to a pair of links 26 and 26a connected at their lower ends to a pair of levers 28 and 28a which are mounted in bearings 30 and 30a supported on the base.

The levers may be connected together by a bar (not shown) in a known manner to provide for operation by the foot of the user. The levers are normally held in raised position by means of compression springs 32, and the weight of the casing 10 in this form of the invention is counterbalanced by a spring 34. The cylinder 18 is connected to the cavity 12 by means of a conduit 36 controlled by a ball valve 38 which may be raised off its seat by means of a rod 40 resting on the periphery of a cam 42 arranged within the cavity 12; the cam may be rotated by a lever 44. The conduit 36 is enlarged above the ball valve 38 and provides a seat for a ball valve 46, and above the ball valve a piston 48 is arranged to be a pressure tight fit in a bore 50 axially aligned with the enlarged passage 36. The piston is normally urged to exert a downward force on the ball valve 46 by means of a spring 52. A stem 54 connected to the piston 48 passes through a sealing gland 56 at the upper end of the bore 50 and is furnished with a head 58. A pawl or dog 60 mounted at the end of a pivoted lever 62 is arranged so that it may be caused to raise the piston 48 to remove downward pressure from the ball valve 46 but the lever is normally held to keep the dog 60 in inoperative position by means of a spring 64.

A rod 66 is arranged between ball valves 38 and 46 and when both valves are seated cannot interfere with the operation of either ball valve but when the ball valve 38 is raised by cam 42 through rod 40 the travel of the rod is sufficient to transmit movement through ball valve 38 and rod 66 to also raise the ball valve 46 off its seat.

An outlet port 68 for the cavity 12 is enlarged to provide a seat for a ball valve 70 and to form a passage 72. One end of a flexible conduit 74 is

connected in the end of passage 72, the other end of the flexible conduit being connected to the operating cylinder 76 or other device. The passageway 72 is connected by a passage 73 to the bore 50 below the lowermost position of the piston 48.

A piston 78 is arranged in the cylinder 76, and a piston rod 79 passes through the cylinder head 80, and stuffing gland 82. A compression spring 84 is arranged between the cylinder head and the piston.

The fluid pressure supplying device in this form of the invention is shown as being vertically arranged with the weight of the casing counterbalanced by spring 34 so that the spring 84 in the operative device may be relatively weak while serving to return the oil to the pressure supplying means when the vise jaws are to be opened.

The operation of this form of the device is as follows. At the commencement of the operation the casing 10 is at the upper end of its travel, as limited by the stop 86, the cavity 12 is full of hydraulic fluid together with conduit 36, cylinder 18 and all other passages in the casing 10, and the plunger 20 is in fully raised position, the levers 28 therefore being raised. The cam 42 is placed in the operating position, that is, with the low point of the cam under the rod 40 and ball valve 38, so that this valve is free from mechanical constraint.

The lever 28 is depressed, thereby forcing the plunger 20 downwardly in the cylinder 18. Downward movement of the plunger is transmitted to the casing 10 since the spring 52 loading valve 46 is sufficiently strong to prevent movement of this ball valve until the pressure in the system has been considerably increased. Downward movement of the casing forces oil through the outlet port 68 raising valve 70 off its seat and oil is forced through conduit 74 into cylinder 76, thereby commencing outward travel of the piston 78 against the resistance of spring 84. On allowing lever 28 to again move upwardly, raising the plunger 20 in the cylinder 18, a vacuum will be set up in this cylinder, atmospheric pressure acting on the casing 10 will force the casing downwardly and cause hydraulic fluid to flow out of cavity 12 through the conduit 36 to again fill cylinder 18.

Renewed downward pressure on the lever 28 will cause further hydraulic fluid to be forced into the cylinder of the operated device but the pressure of the fluid acting will be increased because of the increased compression of the spring 84. When the fluid pressure is sufficient to raise piston 48 sufficiently to remove pressure from the ball valve 46, the hydraulic fluid displaced from the cylinder 18 at each downward movement of the lever 28 will also pass around ball valve 46 and flow into the outlet passage 72.

If it is desired to render the quick contact feature temporarily inoperative, lever 62 can be rocked downwardly against the effort of the spring 64 and spring 52, bringing the dog 60 beyond dead center and raising piston 48 to remove downward pressure from the ball valve 46. With this setting of the valves fluid can be forced from the cylinder 18 into the outlet passage 72, resulting in a diminished flow of pressure fluid at the commencement of the operation; when the pressure in the system has risen sufficiently to raise the piston 48 and therefore to raise head 58 to free dog 60, spring 64 will remove this dog from operative position so that on recommencing the cycle of operations, the device will function as first described.

When it is desired to release the pressure of the device the lever 44 is moved downwardly to bring the high point of the cam 42 below the rod 40, thereby pushing ball valves 48 and 36 off their seats, whereupon spring 84 will return the hydraulic fluid in the cylinder 76 to the cavity 12, thereby raising the counterbalanced casing 10 to the upper limit of its travel.

The form of the invention shown in Figs. 5 and 6, which has elements generally similar to the corresponding parts described with reference to Figs. 1 to 4, differs from that shown in Figs. 1 to 4 in that the weight of the casing is not counterbalanced, the return spring in the cylinder 90 of the operated device being made sufficiently strong to raise the weight of the casing, but the operation of the device is in all respects the same as that previously described.

It will be noted that all working chambers of the device in both forms of the invention are continuously filled with oil so that no trouble due to leakage of air into the hydraulic system can occur.

The invention is hereinabove described and illustrated in preferred forms, but it is to be understood that the scope of the invention is not in any way limited by this illustrative showing but only as indicated by the scope of the appended claims.

I claim:

1. In a pressure actuated device having a work cylinder and a work piston reciprocally mounted therein; hydraulic pressure generating means comprising a body having a main cylinder providing a fluid reservoir, and a piston therein, said body being movable relative to the piston to vary the capacity of the reservoir, a check valve controlled passageway communicating at its inlet end with the reservoir and adapted for connection at its other end to said work cylinder whereby movement of the body in one direction relative to the piston forces fluid from the reservoir through said passageway, means for so moving the body including a pumping cylinder carried by the body parallel with said piston, a plunger reciprocally mounted therein, valve controlled means for supplying the pumping cylinder with hydraulic fluid in response to the suction stroke of the plunger, and means for trapping said fluid in the pumping cylinder whereby upon the pressure stroke of the plunger to cause movement of the body relative to the piston to force fluid from the reservoir through said passageway.

2. In a pressure actuated device having a work cylinder and a work piston reciprocally mounted therein; hydraulic pressure generating means comprising a body having a main cylinder providing a fluid reservoir, and a piston therein, said body being movable relative to the piston to vary the capacity of the reservoir, a check valve controlled passageway communicating at its inlet end with the reservoir and adapted for connection at its other end to said work cylinder whereby movement of the body in one direction relative to the piston forces fluid from the reservoir through said passageway, means for so moving the body including a pumping cylinder carried by the body parallel with said piston, a plunger reciprocally mounted therein, valve controlled means for supplying the pumping cylinder with hydraulic fluid in response to the suction stroke of the plunger, and second valve controlled means openable in response to predetermined

pressure in the pumping cylinder to pass fluid under pressure from the pumping cylinder to the said passageway at a point between its outlet and the check valve controlling said passageway.

3. In a pressure actuated device having a work cylinder and a work piston reciprocally mounted therein; hydraulic pressure generating means comprising a body providing a pumping cylinder and a main cylinder, a piston in the main cylinder and forming with the inner end thereof a fluid reservoir, means securing the piston against axial movement, said body being movable longitudinally of the piston to vary the capacity of the reservoir, a fluid passageway in the body communicating at one end with the reservoir and adapted at its other end for connection to the work cylinder, a check valve in said passageway seating towards the reservoir, a valve bore in the body communicating at its inlet end with the reservoir, a port providing communication

between the bore and the pumping cylinder, a conduit providing communication between said bore and said passageway, a first check valve in said bore between the reservoir and said port and seating towards the reservoir, a second check valve in said bore between said port and said passageway and seating towards said port, spring means urging said second check valve seated, a pressure generating plunger reciprocally mounted in the pumping cylinder, means for reciprocating the plunger and means for unseating said first and second check valves.

4. The pressure generating means of claim 3 which includes spring means urging the body and piston apart.

5. The pressure generating means of claim 3 which includes means for relieving the spring pressure on the second check valve.

HERBERT E. PAGE.