July 28, 1959 H. T. SEALE 2,896,487

PRESSURE-FLUID-OPERATED VISE

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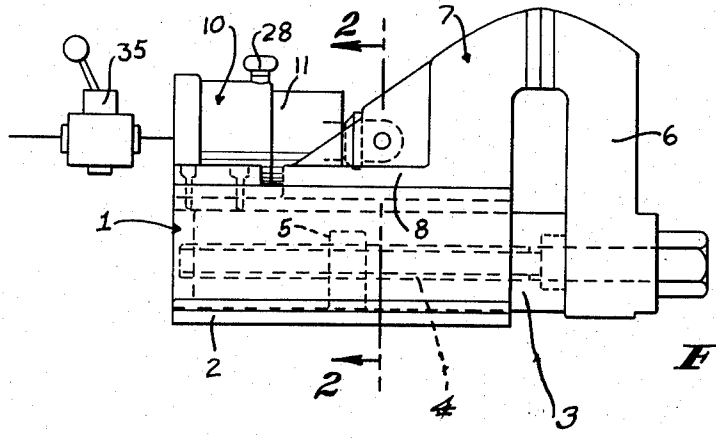


FIG. 1

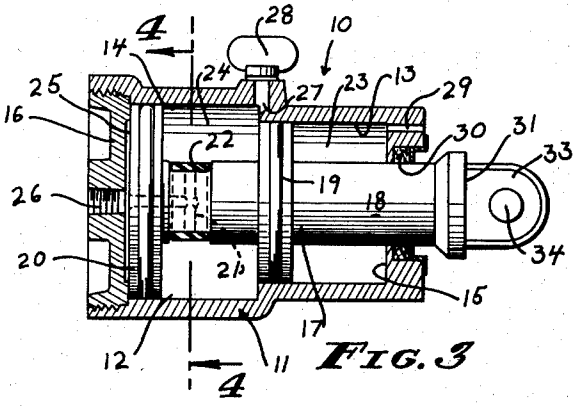


FIG. 3

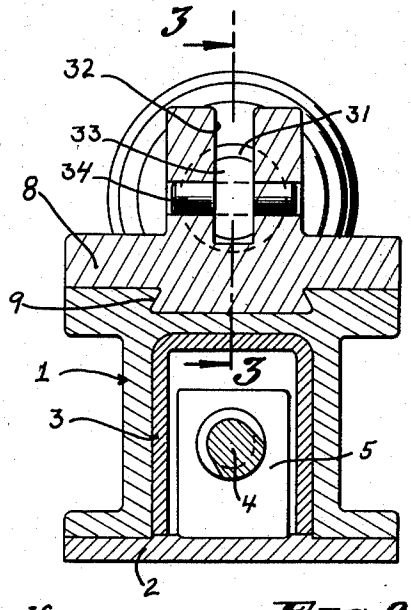


FIG. 2

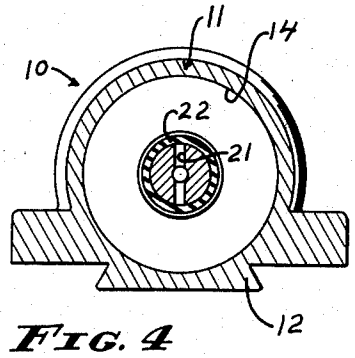


FIG. 4

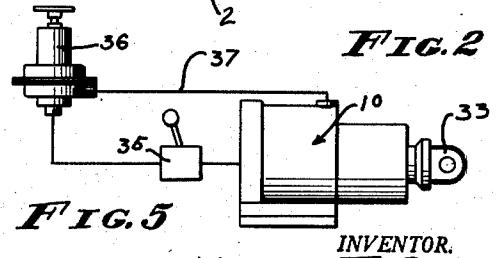


FIG. 5

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PRESSURE-FLUID-OPERATED VISE

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8 Claims. (Cl. 81—17.2)

This invention relates to pressure-fluid-operated vises. The principal object of this invention is to provide a pressure-fluid-operated vise which includes a novel fluid-power unit arranged to close the jaws in response to application of pressure, and simultaneously store fluid under pressure to open the jaws on release of the applied pressure.

A further object is to provide a fluid-power unit which does not require a spring return or applied pressure from a four-way control valve to opposite ends of the power unit in order to effect reciprocation of the plunger, but merely the application and release of fluid pressure.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a side view of a vise equipped with a pressure-fluid operating unit;

Figure 2 is an enlarged transverse sectional view through 2—2 of Figure 1;

Figure 3 is a longitudinal sectional view through 3—3 of Figure 2, showing the pressure-fluid unit;

Figure 4 is a transverse sectional view through 4—4 of Figure 3;

Figure 5 is a diagrammatical view illustrating the fluid operating unit in conjunction with a control valve and pressure regulator whereby the force exerted by the vise may be readily adjusted.

The pressure-fluid-operated vise includes a channel-shaped housing and guide structure 1, closed at its underside by a base plate 2 and arranged to receive a sliding beam 3. A screw shaft 4 extends through the sliding beam 3 and cooperates with a screw-threaded boss 5 secured to the base plate 2 so that the position of the sliding beam 3 may be adjusted. The extended end of the sliding beam 3 carries an adjustable jaw 6.

Slidably mounted on top of the housing 1 is a clamping jaw 7 which cooperates with the adjustable jaw 6. The clamping jaw 7 is provided with a base 8. The base 8 and housing 1 may be interconnected by dovetailed ways 9. Secured to the top of the housing 1, rearwardly of the clamping jaw 7, is a fluid-power unit 10.

The fluid-power unit 10 includes a shell 11, the underside of which may be flanged and provided with a dovetailed underside 12 which fits the ways of the housing 1. The shell 11 forms a minor cylinder 13 and a major cylinder 14 arranged in tandem. The minor cylinder is directed toward the clamping jaw 7 and is closed by an end wall 15. The major cylinder is closed by a cap 16.

Slidably mounted within the shell 11 is a plunger 17 which includes a stem 18, a minor piston 19 slidable in the minor cylinder 13, and a major piston 20 slidable in the major cylinder 14. A bypass 21 extends through the major piston 20 and communicates with the region between the major and minor pistons 19 and 20. The end of the bypass 21 between the pistons is covered by a check-valve collar 22 formed of rubber or other elastomer.

The minor cylinder 13, end wall 15, and minor piston 19 define a minor chamber 23. The minor piston 19 and major piston 20 define with the portion of the shell 11 therebetween an intermediate chamber 24. The major cylinder 14, major piston 20, and cap 16 define a major chamber 25.

The cap 16 is provided with an inlet port 26 communicating with the major chamber 25. The side wall of the shell 11 is provided with a bleed port 27 normally closed by a screw-threaded plug 28.

The end wall 15 is provided with a vent port 29 which remains open so that the minor chamber 23 is at all times exposed to atmospheric pressure. The plunger 17 extends through the end wall 15 and may be surrounded by a wiping gland 30.

Formed on the stem 18 is a shoulder flange 31 which is adapted to bear against a shoulder formed on the rearward portion of the clamping jaw 7. This portion of the clamping jaw may be provided with a slot 32, and the stem 18 may be provided with a tongue 33 extending into the slot and joined to the clamping jaw 7 by a cross pin 34.

The inlet port 26 is connected to a source of pressure fluid through a valve 35 which may be a simple three-way valve arranged to admit pressure fluid to the major chamber or to exhaust the pressure fluid therefrom.

Operation of the pressure-fluid-operated vise is as follows:

The adjustable jaw 6 is employed to set the spacing between the jaws to approximately the distance required to hold a workpiece so as to minimize the required length of travel of the clamping jaw 7. Upon application of pressure fluid to the major chamber 25, pressure fluid is also applied to the intermediate chamber 24; as a consequence, the effective unbalanced pressure area corresponds to the area of the minor chamber 23. The force of the pressure fluid corresponding to this area is therefore applied to the clamping jaw 7.

When the pressure fluid is released from the major chamber 25, the check valve collar 22 functions to retain the pressure fluid within the intermediate chamber 24 so that an unbalanced pressure area equal to the difference in diameters of the major and minor chambers 25 and 23 is effective to retract the plunger 17 and clamping jaw 7. Should leakage occur in the intermediate chamber 24, it is again pressurized upon pressurizing of the major chamber 25. If it is desired to relieve the pressure in the intermediate chamber 24, the plug 28 may be unscrewed. Inasmuch as the force required to retract the clamping jaw 7 need only be enough to overcome friction, it may be quite small, as compared to the force employed in the clamping movement of the jaw; consequently, the difference in diameters of the major and minor chambers 25 and 23 need not be great.

Reference is directed to Figure 5. In the arrangement here illustrated a pressure regulator 36 capable of manual adjustment is connected by an external bypass line 37 to the intermediate chamber port 27. In this arrangement the bypass 21 and check-valve collar 22 are omitted. By adjusting the pressure of the fluid supplied to the intermediate chamber, the effective force exerted on the plunger 17 to close the vise may be altered; that is, as the pressure in the intermediate chamber is reduced, the effective force is increased. Inasmuch as the maximum pressure in the intermediate chamber will not exceed the pressure in the major chamber (unless a second pressure regulator is provided in the control-valve line), the difference in diameters between the minor and major chambers may be increased to give a wider range of adjustment.

The arrangement shown in Figure 5 is particularly desirable where the force exerted by the vise must be held within close limits to prevent damage to fragile workpieces.

While particular embodiments of this invention have been shown and described, it is not intended to limit the same to the exact details of the constructions set forth, and it embraces such changes, modifications, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. A pressure-fluid-operated vise, comprising: a vise structure including a pair of jaws, and means for slidably mounting at least one of the jaws; a shell forming a minor cylinder and a major cylinder and secured to said vise structure; a plunger having a minor piston, a major piston, and a stem extending from the minor piston and connected to said slidably mounted jaw; said shell and plunger defining a minor chamber open to atmospheric pressure, an intermediate chamber between said pistons, and a major chamber; a check-valve-controlled bypass from said major chamber to said intermediate chamber to admit pressure fluid to said intermediate chamber but prevent backflow therefrom; means for applying pressure fluid to said major chamber to move said plunger in one direction and to release pressure fluid therefrom, whereby pressure fluid in said intermediate chamber causes return movement of said plunger.

2. A pressure-fluid-operated vise, comprising: a vise structure including a pair of jaws, and means for slidably mounting at least one of the jaws; a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem extending through said minor chamber and attached to said slidably mounted jaw; means for simultaneously applying pressure fluid at substantially equal pressure to said major and intermediate chambers whereby a pressure area corresponding to the area of said minor chamber is effective to extend said stem and said vise jaw; means for entrapping the pressure fluid in said intermediate chamber whereby on release of the pressure fluid in said major chamber a pressure area corresponding to the difference in areas of said movable walls is effective to retract said stem and said vise jaw.

3. A pressure-fluid-power unit, comprising: a shell forming a minor cylinder and a major cylinder and secured to said vise structure; a plunger having a minor piston, a major piston, and a stem protruding axially from said shell; said shell and plunger defining a minor chamber open to atmospheric pressure, an intermediate chamber between said pistons, and a major chamber; a check-valve-controlled bypass from said major chamber to said intermediate chamber to admit pressure fluid to said intermediate chamber but prevent backflow therefrom; means for applying pressure fluid to said major chamber to move said plunger in one direction and to release pressure fluid therefrom, whereby pressure fluid in said intermediate chamber causes return movement of said plunger.

4. A pressure-fluid-power unit, comprising: a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem protruding axially from said shell; means for simultaneously applying pressure fluid at substantially equal pressure to said major and intermediate chambers whereby a pressure area corresponding to the area of said minor chamber is effective to extend said stem; means for entrapping the pressure fluid in said intermediate chamber whereby on release of the pressure fluid in said major chamber a pressure area corresponding to the difference in areas of said movable walls is effective to retract said stem.

5. A pressure-fluid-operated vise, comprising: a vise structure including a pair of jaws, and means for slidably mounting at least one of the jaws; a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem extending through said minor chamber and attached to said slidably mounted jaw; means for applying a pressure fluid to said major chamber to drive said stem in a direction to close said vise; and means for maintaining a back pressure in said intermediate chamber tending to reduce the effective drive on said stem and vise jaw, and operable on release of pressure in said major chamber to cause return movement of said stem to open said vise.

6. A pressure-fluid-operated vise, comprising: a vise structure including a pair of jaws, and means for slidably mounting at least one of the jaws; a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem extending through said minor chamber and attached to said slidably mounted jaw; means for applying a pressure fluid to said major chamber to drive said stem in a direction to close said vise; means for maintaining a back pressure in said intermediate chamber tending to reduce the effective drive on said stem and vise jaw, and operable on release of pressure in said major chamber to cause return movement of said stem to open said vise; and means for regulating the back pressure in said intermediate chamber thereby to control the effective drive force on said stem and clamping force exerted by said vise jaw.

7. A pressure-fluid-power unit, comprising: a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem protruding axially from said shell; means for applying pressure fluid to said major chamber to exert a drive force in a direction to extend said stem; and means for maintaining a back pressure in said intermediate chamber tending to reduce the effective drive force on said stem, and operable on release of pressure in said major chamber to cause return movement of said stem.

8. A pessure-fluid-power unit, comprising: a plunger and shell means defining a vented minor chamber having a minor movable wall, a major chamber having a major movable wall, and an intermediate chamber between said movable walls; said plunger including a stem protruding axially from said shell; means for applying pressure fluid to said major chamber to exert a drive force in a direction to extend said stem; means for maintaining a back pressure in said intermediate chamber tending to reduce the effective drive force on said stem, and operable on release of pressure in said major chamber to cause return movement of said stem; and means for regulating the back pressure in said intermediate chamber thereby to control the effective drive force on said stem.

References Cited in the file of this patent

UNITED STATES PATENTS

1,816,677 Hanna ---------- July 28, 1931

FOREIGN PATENTS

(1st addition to No. 60,819) France -- July 21, 1954