United States Patent

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[54] **FLUID-ACTUATED VISES**
1 Claim, 2 Drawing Figs.

[52] **U.S. Cl.** **269/28, 269/137**
[51] **Int. Cl.** **B25b 1/18**
[50] **Field of Search** 269/28, 27, 20, 137

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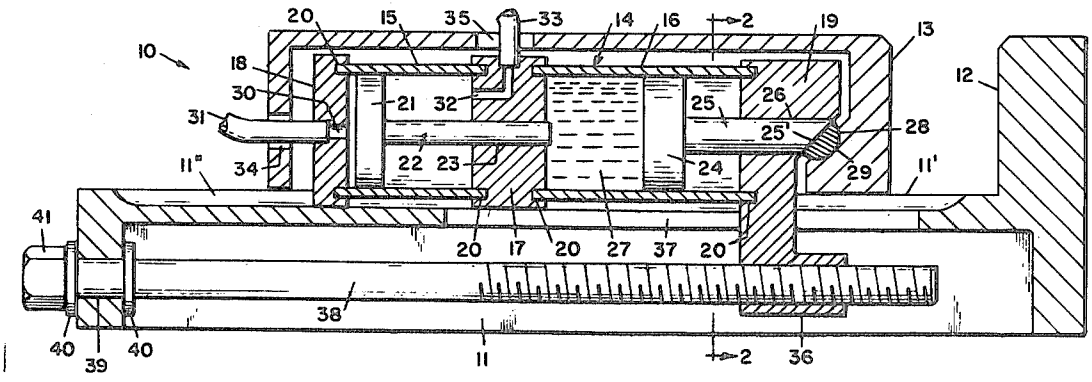
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ABSTRACT: An elongated base having a fixed jaw at one end thereof. A movable jaw and its fluid actuator are slidable as a unit on the base for prepositioning the movable jaw relative to the fixed jaw. The fluid actuator consists of an air cylinder and a hydraulic cylinder in tandem. A piston in the air cylinder has a plunger projectable into the hydraulic cylinder for actuating a piston in the latter with a multiplication of force. The hydraulic cylinder piston has a piston rod which slides the movable jaw relative to the fixed jaw while the fluid actuator remains relatively stationary in its preadjusted position on the base.



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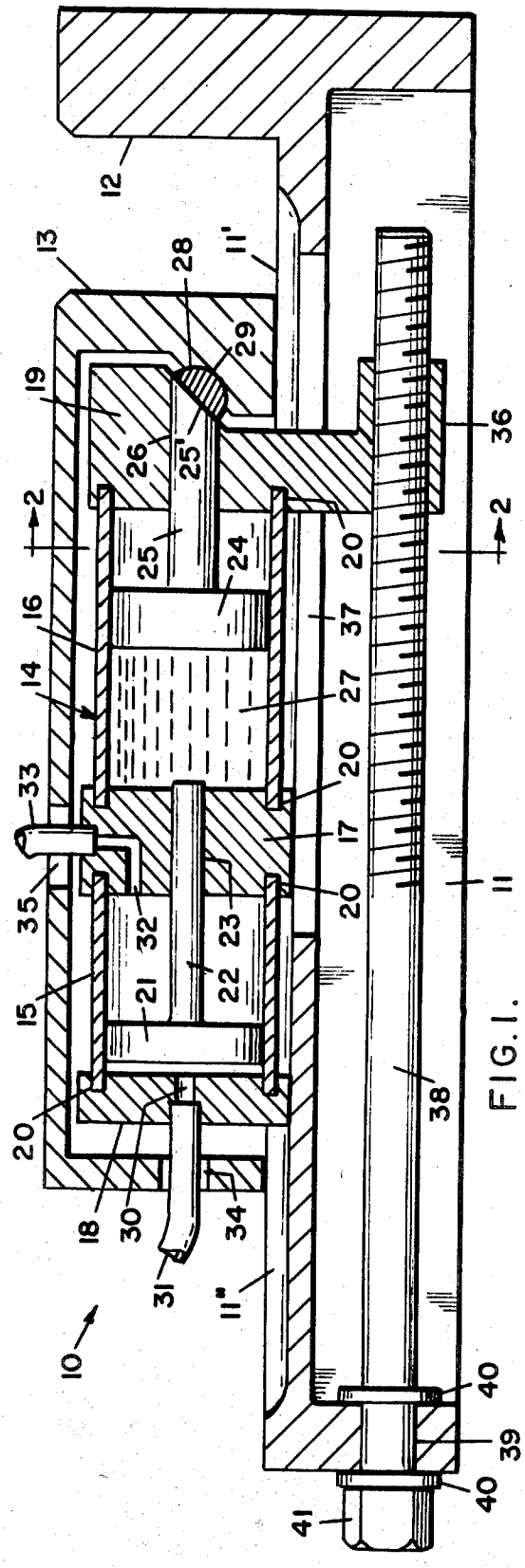


FIG. 1.

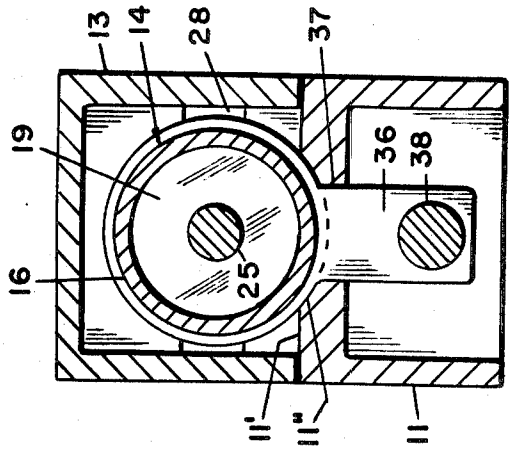


FIG. 2.

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FLUID-ACTUATED VISES

This invention relates to new and useful improvements in vises and other similar devices wherein work is to be held between a fixed jaw and a relatively movable jaw, and in particular the invention concerns itself with a fluid-actuated vise.

Although vises actuated by pneumatic or hydraulic pressure are well known, and although it is also old in the art to utilize pneumatic and hydraulic pressures jointly in vise actuation, the principle object of the invention is to provide an improved fluid actuator which embodies pneumatic and hydraulic cylinders in tandem for attaining a substantial multiplication of force for firmly clamping a piece of work between the vise jaws.

Another important object of the invention is to provide an improved vise structure wherein the aforementioned fluid actuator is slidable with the movable jaw of the vise relative to the fixed jaw so that the movable jaw may be adjustably prepositioned at some generally predetermined distance from the fixed jaw in order to accommodate a piece of work of a given size, whereupon the fluid actuator may be energized to slide the movable jaw toward the fixed jaw while the fluid actuator remains relatively stationary in predadjusted position.

Another object of the invention is to provide an improved vise structure wherein the fluid actuator is contained within the movable jaw while both the actuator and the movable jaw are slidable along the base of the vise for purposes of the aforementioned preadjustment, and wherein the operative connection of the actuator to the movable jaw is such as to positively urge the movable jaw into sliding engagement with the base of the vise.

The vise of the invention is simple in construction, efficient in operation, and lends itself to convenient and economical manufacture.

With the foregoing more important objects and features in view and such objects and features as may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawing wherein like characters of reference are used to designate like parts, and wherein:

FIG. 1 is a longitudinal sectional view of the vise according to the invention; and

FIG. 2 is a cross-sectional view, taken substantially in the plane of the line 2—2 in FIG. 1.

Referring now to the accompanying drawing in detail, the fluid actuated vise of the invention is designated generally by the reference numeral 10. The same comprises an elongated hollow base 11 which is provided at one end thereof with a fixed jaw 12 projecting upwardly from the base as shown. A movable jaw 13 is slidable on the upper surface 11' of the base 11 toward and away from the fixed jaw 12, so that a piece of work (not shown) may be received and clamped between the two jaws. Preferably, the movable jaw 13 has an inverted boxlike form and its interior accommodates a fluid actuator designated generally as 14, the arrangement being such that the actuator 14 is slidable along the base 11 with the movable jaw 13 toward and away from the fixed jaw 12, as will be hereinafter apparent.

The fluid actuator 14 consists of a composite cylindrical body including a pneumatic cylinder 15 and a hydraulic cylinder 16 in tandem with the cylinder 15, the two cylinders being separated by an intermediate partition member 17 while caps or heads 18, 19 are provided at the outer ends of the respective cylinders 15, 16, as will be clearly understood. End portions of the cylinder walls 15, 16 are seated in annular grooves 20 formed in the heads 18, 19 and in the intermediate member 17, and the whole assembly of the parts 15, 16, 17, 18 and 19 is held together in any suitable conventional manner.

The pneumatic cylinder 15 accommodates a reciprocable piston 21 equipped with a piston rod constituting a plunger 22 which extends slidably through a bore 23 in the partition member 17 and is projectable into the hydraulic cylinder 16. The latter contains a reciprocable piston 24 having a piston rod 25 slidable through a bore 26 formed in the cylinder head 19. The portion of the cylinder 16 between the partition member 17 and the piston 24 contains hydraulic fluid as indicated at 27, and it will be apparent that when the piston 21 with its plunger 22 are slid to the right (as viewed in FIG. 1), the plunger 22 will enter the hydraulic cylinder 16 and will pressurize the hydraulic fluid 27 therein so as to slide the piston 24 with its piston rod 25 also to the right. However, since the diameter of the plunger 22 is considerably smaller than that of the piston 24, a substantial multiplication of force will be obtained. In other words, a given force applied to the piston 21 in the pneumatic cylinder 15 will be greatly multiplied at the hydraulic piston 24, although of course the extent of sliding movement of the piston 24 with respect to that of the piston 21 will be considerably smaller. However, as will hereinafter be apparent, only a small sliding movement of the piston 24 is needed for firmly clamping a piece of work between the jaws 12, 13, since the movable jaw 13 with the fluid actuator 14 therein, may be preadjusted on the base 11 with the fluid actuator 14 therein, may be preadjusted on the base 11 with respect to the fixed jaw 12 so as to accommodate work of various sizes between the jaws. When this preadjustment is made, it is then only necessary to slide the movable jaw 13 by the actuator 14 by a small amount in order to firmly clamp the work between the jaws.

It may be noted at this point that suitable sealing rings or gaskets maybe used at the seating of the cylinders 15, 16 in the grooves 20 of the partition member 17 and cylinder heads 18, 19, and also on the pistons 21, 24 and in the bore 23, as is customary in the art.

The piston rod 25 of the hydraulic piston 24 has an oblique end face 25' which operatively engages a complementally faced force transmitting element 29 seated inside the movable jaw 13, so that when the piston rod 25 is slid outwardly, that is, to the right as viewed in FIG. 1, it slides the entire movable jaw 13 in the same direction toward the fixed jaw 12 and, at the same time, the oblique face 25' coacts with the element 29 to urge the movable jaw 13 into sliding engagement with the upper surface 11' of the base 11, thus preventing the movable jaw from lifting off the base. Although the inverted box-shaped movable jaw 13 slides on the base surface 11', the components 18, 17 and 19 of the cylindrical actuator 14 are better slidably accommodated in a transversely concaved recess 11'' which extends longitudinally in the upper surface 11' of the base, as will be apparent from FIG. 2.

The head 18 of the pneumatic cylinder 15 is provided with a port 30 communicating with a flexible air hose 31 so that air under pressure may be delivered into that cylinder for sliding the piston 21 to the right, as viewed in FIG. 1 and, through the medium of the hydraulic cylinder piston 24, for sliding the movable jaw 13 toward the fixed jaw 12. Conversely, when the work is to be released from the jaws 12, 13, compressed air is supplied to the opposite side of the piston 21 in the pneumatic cylinder 15 through a port 32 in the partition member 17, the port 32 communicating with a flexible compressed airhose 33. The airhoses 31, 33 extend freely outwardly through suitable openings 34, 35, respectively, provided in the end and top of the movable jaw 13, as shown.

As already stated, the movable jaw 13 together with its fluid actuator unit 14 may be prepositioned or preadjusted longitudinally on the base 11 in terms of distance of the jaw 13 from the fixed jaw 12, whereby the vise may be initially adjusted to receive work of different sizes between the two jaws, prior to actual clamping of the work. For this purpose the head 19 of the actuator 14 is provided with a depending lug 36 which projects downwardly through a longitudinal slot 37 formed in the base 11 and is internally screw threaded to operatively engage a screw shaft 28. The latter is rotatably journaled in a bearing 39 at the front end of the base 11 and is provided with shoulders 40 at the opposite sides of the bearing so that axial movement of the screw shaft is prevented. The forward end of the shaft 38 is provided with a polygonal portion 41 to which a wrench may be applied in order to rotate the shaft or, if

preferred, a suitable handle (not shown) may be provided on the shaft instead of the portion **41**.

In any event, it is to be noted that when the vise is used, it may be preadjusted to accommodate a piece of work of a given size by rotating the screw shaft **38** in one direction or the other. This rotation causes the lug **36** to travel along the shaft, thus correspondingly sliding the entire actuator unit **14** along the base **11**. Moreover, since the actuator unit **14** is contained within the box-shaped movable jaw **13**, the latter slides along the base **11** together with the unit **14** and accordingly, the jaw **13** may be spaced at a selected distance from the fixed jaw **12** for reception of a given piece of work between the jaws.

When this preliminary adjustment has been made and the work is positioned between the jaws, air under pressure is supplied to the pneumatic cylinder **15** through the hose **33**, causing the piston **21** and plunger **22** to move to the right (as in FIG. 1) and also causing correspondingly directional movement of the hydraulic piston **24** with its piston rod **25** under greatly multiplied force, as already explained. The piston rod **25**, with its end face **25'** acting against the force-transmitting element **29**, causes the movable jaw **13** to slide toward the fixed jaw **12**, thus firmly clamping the piece of work between the jaws. The work may be released from the jaws by simply reversing the procedure and admitting compressed air into the pneumatic cylinder through the hose **33**, so that the piston **21** is moved to the left and the plunger **22** is retracted from the hydraulic cylinder **16**.

It is to be noted that the longitudinal dimension of the movable jaw **13** with respect to the overall length of the actuator **14** is somewhat greater so as to provide clearance for a limited longitudinal movement of the jaw **13** under actuation by the actuator **14** while the latter remains relatively stationary in its preadjusted position on the base **11**, as initially preadjusted by means of the screw shaft **38**.

What I claim is:

1. In a fluid-actuated vise, the combination of a horizontally elongated hollow base having an upper surface provided with a longitudinally extending groove and with a longitudinal slot in the bottom of said groove, a fixed jaw projecting upwardly from one end of said base, an elongated inverted boxlike movable jaw slidable on said upper surface of the base toward and away from said fixed jaw, an elongated fluid actuator completely housed in said movable jaw and slidably engaging said groove in the upper surface of the base, said fluid actuator including a screw-threaded lug projecting downwardly through said slot into said base, a screw shaft rotatable in the base and engaging said lug whereby said fluid actuator and said movable jaw may be prepositioned on the base relative to the fixed jaw, said fluid actuator comprising a pneumatic cylinder and a hydraulic cylinder disposed in tandem, a pneumatic piston and a hydraulic piston slidable in the respective cylinders, a plunger connected to the pneumatic piston and projectable into the hydraulic cylinder for sliding the hydraulic piston with a multiplication of force, a piston rod connected to the hydraulic piston and operatively engaging an end wall of said movable jaw, and means for admitting compressed air into said pneumatic cylinder, the length of said fluid actuator being lesser than the length of said movable jaw whereby the movable jaw may be slid on said base by the fluid actuator while the latter remains relatively stationary on the base, said piston rod projecting outwardly from said hydraulic cylinder and having a downwardly inclined end surface, said end wall of said movable jaw having an upwardly inclined inner surface engaged by the downwardly inclined end surface of said piston rod, whereby to urge the movable jaw downwardly against the upper surface of said base.