Feb. 8, 1938. E. C. WELLS 2,107,970

HYDRAULIC VISE

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Fig. 1.

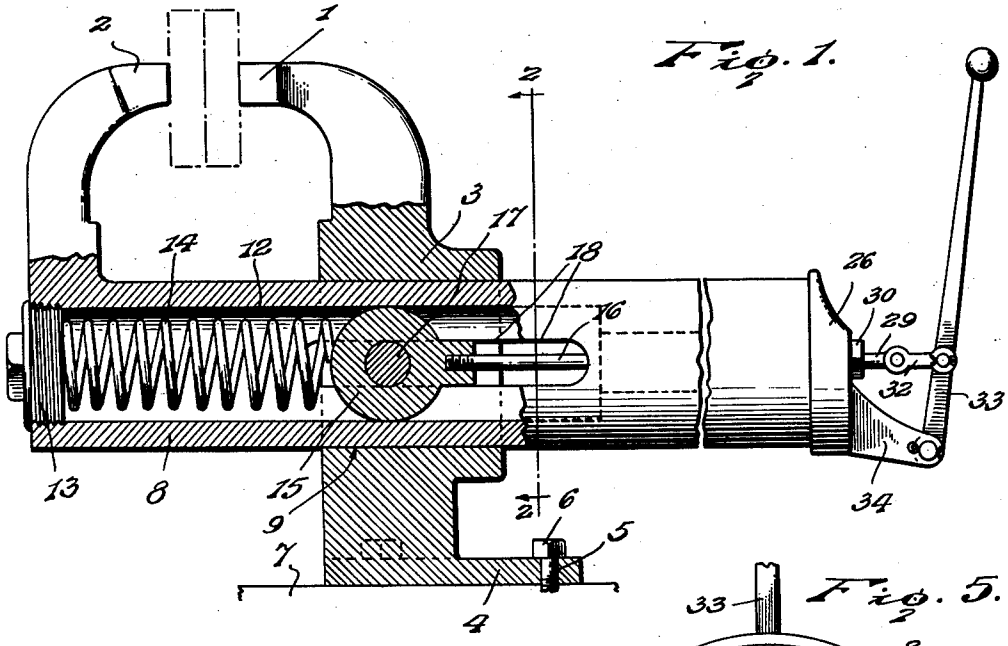


Fig. 2.

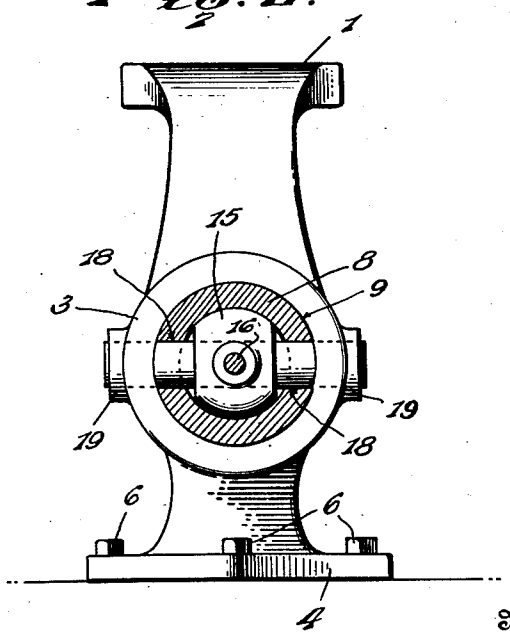
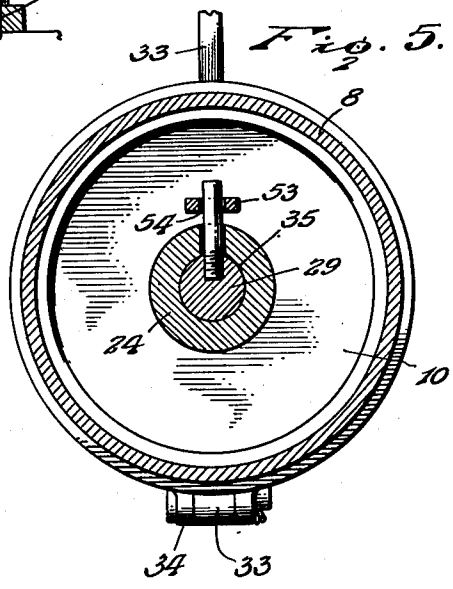


Fig. 5.



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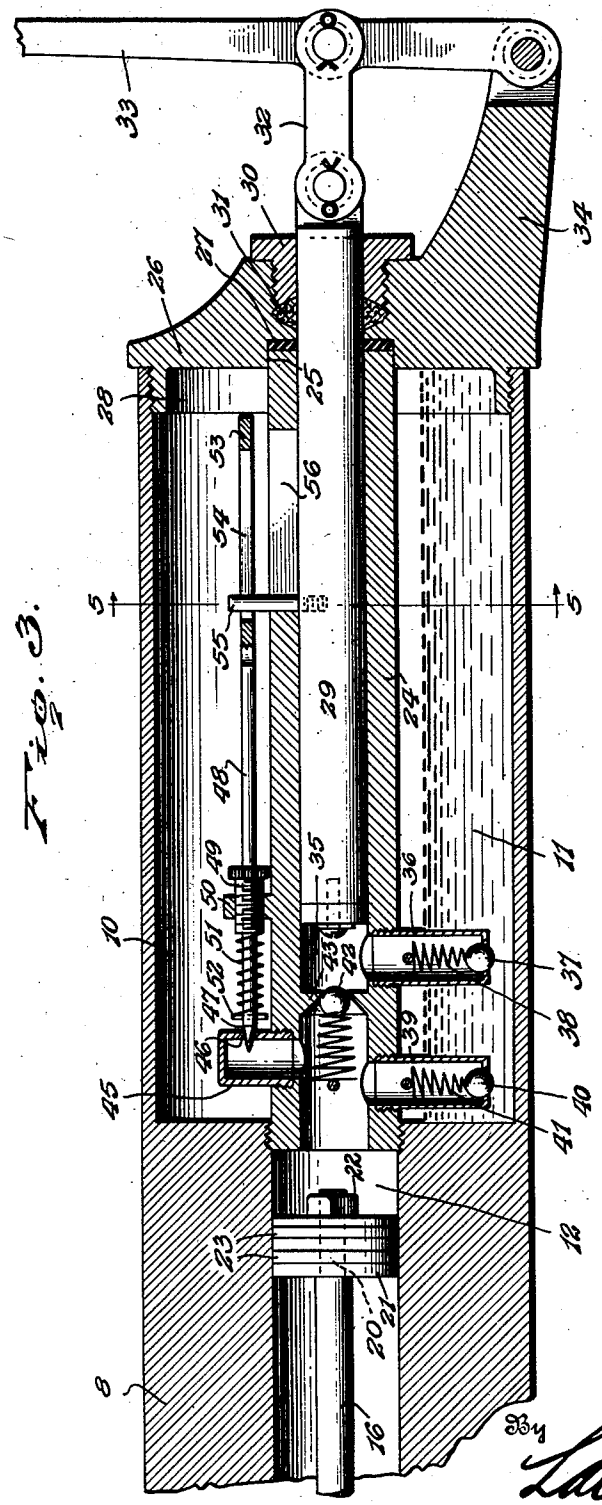


Fig. 3.

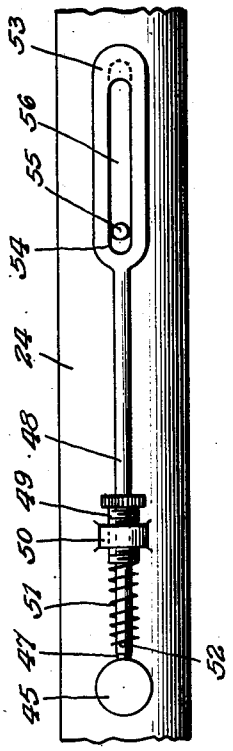


Fig. 4.

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HYDRAULIC VISE

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Application December 21, 1935, Serial No. 55,621

5 Claims. (Cl. 60—52)

This invention relates to a hydraulic vise and one object of the invention is to provide the vise with improved means for creating hydraulic pressure and forcing the movable jaw of the vise toward the stationary jaw so that an article disposed between the two jaws may be very firmly gripped.

Another object of the invention is to so construct the means for exerting hydraulic pressure that with a minimum amount of exertion by the operator, an article may be very firmly gripped between the movable jaw and the stationary jaw and prevented from slipping out of its proper position.

Another object of the invention is the provision of improved means for maintaining fluid under pressure when the movable jaw is shifted toward the stationary jaw for gripping an article between the jaws and at the same time to permit the fluid under pressure to escape when it is desired to shift the movable jaw away from the stationary jaw and release the article gripped between them.

Another object of the invention is to so construct the vise that when an article is first placed between the jaws, pressure may be directly applied to the two jaws to shift the movable jaw into position to bear against the article and the hydraulic pressure applying mechanism then operated to apply the desired pressure and maintain the movable jaw in a set position.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a view showing the improved vise partially in longitudinal section and partially in side elevation.

Figure 2 is a sectional view taken transversely through the vise along the line 2—2 of Figure 1.

Figure 3 is a sectional view upon an enlarged scale taken longitudinally through the portion of the vise shown in side elevation in Figure 1 and illustrating the construction of the hydraulic pressure applying mechanism.

Figure 4 is a fragmentary view showing a portion of the hydraulic pressure applying mechanism in top plan.

Figure 5 is a sectional view taken transversely through the vise along the line 5—5 of Figure 3.

This improved vise has a stationary jaw 1 and a movable jaw 2, the stationary jaw being carried by a base 3 formed at its lower end with an attaching flange or plate 4 through which openings 5 are formed to receive fasteners 6 by means of which it is secured against a work-bench or other support 7. The movable jaw 2 is disposed in opposed relation to the stationary jaw and rises from a shank or bar 8 which has been shown circular in cross section and is slidably engaged through an opening or bore 9 formed horizontally through the base 3 of the stationary jaw. One end portion of the shank 8 is hollow, as shown in Figure 3, to provide a chamber 10 which is to be partially filled with oil, as shown at 11, and from this chamber leads a cylindrical bore or passage 12 extending axially through the shank to the forward end thereof where it is closed by a threaded plug 13 which not only closes the forward end of the passage 12 but also serves to retain a spring 14 in the forward portion of the passage and maintain the spring under tension sufficient to urge the movable jaw away from the stationary jaw. The inner end of this spring bears against a coupling 15 carrying a piston rod 16 which extends rearwardly through the passage, and upon referring to Figures 1 and 2 it will be seen that the coupling 15 is mounted upon a pin 17 extending transversely through the shank or bar 8 with its end portions projecting from opposite sides of the shank through slots 18 formed longitudinally therein and mounted in opposed sockets 19 formed in the base 3 of the stationary jaw. The rear end portion of the piston rod is reduced, as shown at 20 in Figure 3, and upon this reduced end portion there is mounted a piston 21 which is held thereon by a securing nut 22 and carries piston rings 23 to form a tight joint between the piston and walls of the cylindrical passage. Therefore, when fluid under pressure acts against the rear face of the piston, the shank 8 may be shifted longitudinally in a direction to move the movable jaw toward the stationary jaw and during this movement the spring 14 will be compressed. When the fluid is released, the spring will then expand and serve to shift the movable jaw away from the stationary jaw. It will also be obvious that by grasping the two jaws and exerting pressure, the movable jaw may be shifted toward the stationary jaw as a preliminary operation in clamping an article between the two jaws, but unless fluid is drawn or forced into the passage 12 and held under pressure to act against the rear face of the piston, the spring will move the jaw 2 away from the stationary jaw 1 as soon as the operator releases the movable jaw.

In order to apply pressure to the piston, there has been provided a pump cylinder 24 which extends longitudinally through the chamber 10 in co-axial relation thereto and has its forward end portion screwed into the passage 12. The rear or outer end of the pump cylinder which is un-

threaded fits into a socket 25 formed in a head 26 serving as a closure for the rear end of the chamber 10 and a gasket 27 is disposed in the socket for engagement by the outer end of the pump cylinder so that when the flange 28 of the head is screwed into the chamber to tightly seat the head, oil will be prevented from escaping about the piston or plunger 29. This plunger extends outwardly through the head and as the head carries a packing gland 30 which, when tightened, causes packing 31 to be tightly compressed about the plunger, all danger of leakage will be eliminated. A link 32 connects the plunger with an operating lever 33 pivotally carried by an arm or bracket 34 extending rearwardly from the head 26 and from an inspection of Figure 3 it will be readily seen that when the lever is moved in a direction to draw the plunger outwardly, a vacuum will be created in the inner portion of the chamber 35 of the pump cylinder and oil will be drawn past the valve of inlet 36 extending transversely from the pump cylinder. The valve ball 37 which is yieldably held closed by a spring 38 and opens inwardly, permits the oil to be drawn into the pump cylinder but prevents the oil from returning to the chamber 10 through the inlet 36 when the plunger is forced inwardly. A second inlet 39 is carried by the pump cylinder closer to its inner end than the inlet 36 and this inlet also has a valve ball 40 which opens inwardly and is yieldably held closed by a spring 41. Therefore, when the movable jaw is forced toward the stationary jaw by the operator applying pressure directly to the movable jaw, oil will be drawn into the forward end of the pump cylinder and into the rear portion of the passage or chamber 12 and as this oil is prevented from returning to the chamber 10 through the inlet 39, the movable jaw will be maintained in position to exert slight gripping pressure against an article disposed between the two jaws. This pressure will not be sufficient to prevent the article from moving out of a desired position between the jaws when force is applied to the article by a workman but as soon as the lever is moved in a direction to force the plunger inwardly, oil which has been sucked into the chamber 35 by drawing the plunger outwardly, will be forced forwardly past the valve ball 42 which is yieldably held against the valve seat 43 by a spring 44 and opens forwardly so that oil may be forced into the forward end portion of the pump cylinder and rear portion of the chamber 12. Pressure applied to the oil will be regulated by the extent to which the plunger is forced forwardly and, therefore, the jaws may be caused to exert great gripping pressure upon the article to be held or only moderate pressure applied.

In order to permit the movable jaw to have movement away from the stationary jaw when an article gripped between the two jaws is to be released, oil under pressure must be allowed to escape from the forward or inner end portion of the pump cylinder. In order to do so, there has been provided an outlet neck 45 which projects upwardly from a port formed in the pump cylinder. This neck is closed at its outer end and in its side is formed with a discharge port 46 which tapers inwardly to provide a seat for the needle valve 47 formed at the front end of a rod 48. This valve rod 48 is slidably mounted through a bushing or nut 49 threaded into a bearing 50 carried by the pump cylinder and the nut or bushing serves not only as means to slidably mount the valve rod but also as an adjustable abutment for one end of a spring 51 coiled about the valve rod with its other end bearing against a pin 52 passed through the valve rod adjacent the forward end thereof. By turning the bushing, tension of the spring may be regulated. At its rear end the valve rod is widened to form a head 53 in which a longitudinally extending slot 54 is formed and through this slot extends a pin 55 carried by the plunger 29 and extending through a slot 56 formed longitudinally in the pump cylinder. From an inspection of Figure 3 it will be readily seen that by drawing the plunger outwardly, the pin 55 will eventually reach the end of the slot 54 and further movement of the plunger in this direction will cause the pin to exert pull upon the valve rod and shift the valve rod rearwardly against the action of the spring 51. The needle valve at the forward end of the valve rod will, therefore, be drawn out of the opening 46 in which it is normally tightly seated and the discharge opening will be cleared sufficiently to permit oil to escape from the outlet neck 45. Therefore, when the needle valve is open, oil confined in the forward portion of the pump cylinder and rear portion of the chamber 12 will be relieved of pressure and the spring 14 may force the movable jaw away from the stationary jaw. During this movement the shank 8 travels forwardly with the movable jaw and as the piston 21 approaches the rear end of the chamber 12, oil will be discharged through the outlet neck 45. This movement of the movable jaw away from the stationary jaw will continue until the piston 21 contacts with the forward end of the pump cylinder at which time the two jaws will be spaced from each other their greatest extent. If it is desired to stop movement of the movable jaw away from the stationary jaw before it reaches the limit of its movement in this direction, it is merely necessary to release the lever 33 and the spring 51 will move the needle valve to a closed position and as escape of oil through the discharge port will then be cut off, oil still remaining in the rear portion of the chamber 12 and forward end portion of the pump cylinder will act to prevent forward movement of the movable jaw under influence of the spring 14.

The operation of this device is as follows:

The article to be clamped is disposed between the stationary jaw and the movable jaw and the movable jaw can then be grasped and thrust toward the stationary jaw until it is brought into engagement with the article and sufficient pressure exerted to hold the article. During this movement, oil is sucked into the rear end portion of the chamber 12 through the inlet neck or valve casing 39 and as the valve 42 and the needle valve are closed, the oil will be confined and prevent the spring from moving the movable jaw out of the hand adjusted position in which it has light gripping engagement with the article. The lever 33 is now grasped and moved in a direction to draw the plunger outwardly and create a partial vacuum in the chamber 35 which will cause oil to be sucked into the pump cylinder through the inlet neck or valve 36. After the plunger has been drawn rearwardly to suck oil into the pump cylinder, the lever is moved in a direction to force the plunger inwardly and as the plunger moves toward the forward end of the pump cylinder, oil trapped in the chamber 35 of the pump cylinder will be forced forwardly and the valve 42 will be moved to an open position by pressure exerted so that oil under pressure may

enter the forward portion of the pump cylinder. The greater the distance the plunger is forced forwardly, the greater will be the pressure of the oil trapped in the forward portion of the pump cylinder and rear portion of the chamber 12. It will thus be seen that the pressure exerted by the movable jaw against an article gripped between the two jaws may be accurately controlled and the two jaws caused to very firmly grip the article without the operator expending a great deal of energy. If too much pressure is exerted, the valve 47 will open and, therefore, there will be no danger of crushing an article. By adjusting the bushing or sleeve 49, tension of the spring 51 may be regulated to control the amount of pressure the valve 47 will withstand before it opens and, therefore, the vise may be set according to the type of material to be gripped between the jaws. As soon as the lever 33 is released, pressure upon the oil between the inner end of the plunger and the valve seat 43 will be relieved but as the spring 44 will cause the valve ball 42 to immediately seat against the valve seat, there will be no loss of pressure upon the oil acting against the piston. Therefore, the movable jaw will remain in firm gripping engagement with the article until the operator desires to remove the article at which time it is merely necessary to draw the plunger outwardly a sufficient distance to cause the pin to move to the rear end of the slot 54 and shift the needle valve rearwardly to a position in which the outlet port 46 will be unobstructed and oil can flow from this passage as the spring moves the shank forwardly to shift the movable jaw away from the stationary jaw. A vise has, therefore, been provided which is so constructed that it will be very easy to operate and at the same time so constructed that hydraulic pressure may be employed as means for holding the movable jaw in gripping engagement with an article disposed between the two jaws. As the pins which connect the link 32 with the lever and the plunger 29 are held in place by cotter pins, these elements may be easily removed when so desired.

Having thus described the invention, what is claimed as new is:

1. In a device of the character described, a stationary support, a movable member having a portion slidable through the support and formed with a longitudinally extending bore and having longitudinally extending slots opening through opposite sides of the bore, a piston in the bore, an anchoring member for said piston extending transversely through the bore with portions extending outwardly through the side slots and connected with the stationary support, resilient means yieldably resisting movement of the movable member in one direction, and means for forcing fluid under pressure into the bore of the movable member to act against the piston and move the movable member in the said direction.

2. In a device of the character described, a stationary support having a transverse passage, a movable member having a shank slidably passed through the passage of the stationary support and formed with a longitudinally extending chamber and with a bore extending forwardly from the chamber, longitudinally extending slots being formed at opposite sides of the bore, a piston rod extending longitudinally in the bore, a piston carried by the rear end portion of the piston rod, a mounting for the forward end of the piston rod having portions extending through the longitudinally extending slots at opposite sides of the bore and engaged with the stationary support whereby the shank may have longitudinal movement relative to the piston and the support to shift the movable member, a spring in the bore having one end bearing against the mounting, a plug closing the forward end of the bore and engaging the spring to hold the spring under tension and yieldably resist movement of the shank in one direction, and means in said chamber to effect transfer of fluid under pressure into the rear portion of the bore to act against the piston and move the shank in the said direction against action of said spring.

3. In a device of the character described, a stationary support, a movable member having a shank slidably carried by the support and formed with a chamber and a bore extending from one end of the chamber, a piston in the bore connected with the support whereby the shank may have movement relative to the piston and the stationary support to shift the movable member, a pump cylinder in said chamber having one end communicating with the bore, said pump cylinder having an inlet and an inwardly opening check valve therefor and also having an outlet located forwardly of the inlet, a plunger slidable longitudinally in the pump cylinder for drawing fluid from the chamber into the cylinder and forcing the fluid under pressure into the bore to act against the piston and move the shank in one direction, a check valve in the pump cylinder between the inlet and the outlet thereof to maintain the fluid under pressure, and a normally closed valve for the outlet adapted to be moved to an open position to release the fluid when the movable member is moved in a direction opposite to the first mentioned direction.

4. In a device of the character described, a stationary support, a movable member slidably carried by said support and hydraulic means for actuating the movable member including a piston carried by the stationary support, a pump cylinder carried by the movable member in operative relation to the piston and having a valve controlled inlet and also having an outlet, a valve for the outlet yieldably held closed and having a stem extending longitudinally of the pump cylinder and formed with a longitudinally extending slot, and a pin carried by said plunger and extending through a slot formed longitudinally in the pump cylinder with its outer portion extending through the slot of the valve stem whereby the plunger may be reciprocated in the pump cylinder with the valve of the outlet remaining closed and the pin engaging the valve stem to move the valve of the outlet to an open position when the plunger is slid in one direction a predetermined extent.

5. In a device of the character described, a support, a body slidably carried by said support and formed with a bore, a piston carried by said support and operating in the bore, a pump cylinder carried by said body and having an end communicating with the bore in facing relation to the piston, said cylinder having a fluid inlet controlled by an inwardly opening check valve and also having a fluid outlet spaced from the inlet longitudinally of the cylinder, a check valve between the inlet and outlet opening toward the piston, a valve for the outlet yieldably held closed and having a stem extending longitudinally of the cylinder, the cylinder having a slot formed longitudinally therein and the valve stem being formed with a longitudinally extending slot extending longitudinally of the cylinder, a plunger

slidable longitudinally in said cylinder opposite the slot thereof for drawing fluid into the cylinder when moved in one direction and forcing the fluid past the check valve of the cylinder to act against the piston when slid in an opposite direction, and a pin carried by the plunger and extending through the slots of the cylinder and valve stem, the slot of the valve stem having its ends offset longitudinally relative to ends of the slot formed in the cylinder whereby when the plunger is moved longitudinally to draw fluid into the cylinder, the pin may reach the end of the slot in the valve stem before reaching the end of the slot in the cylinder and further movement of the plunger in the said direction causing the valve of the outlet to be moved to an opened position.

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