July 14, 1942. J. L. SEAT 2,289,597

PNEUMATIC VISE

Filed April 24, 1940 2 Sheets-Sheet 1

FIG. 1.

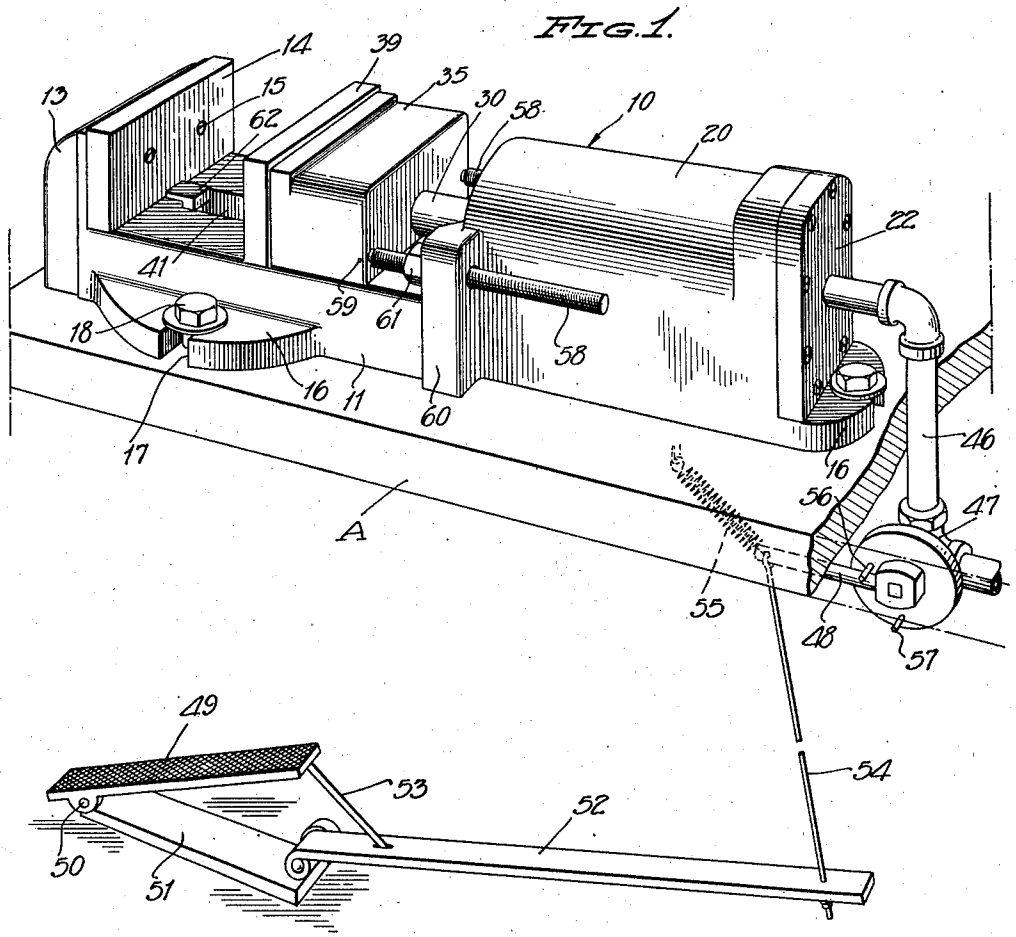
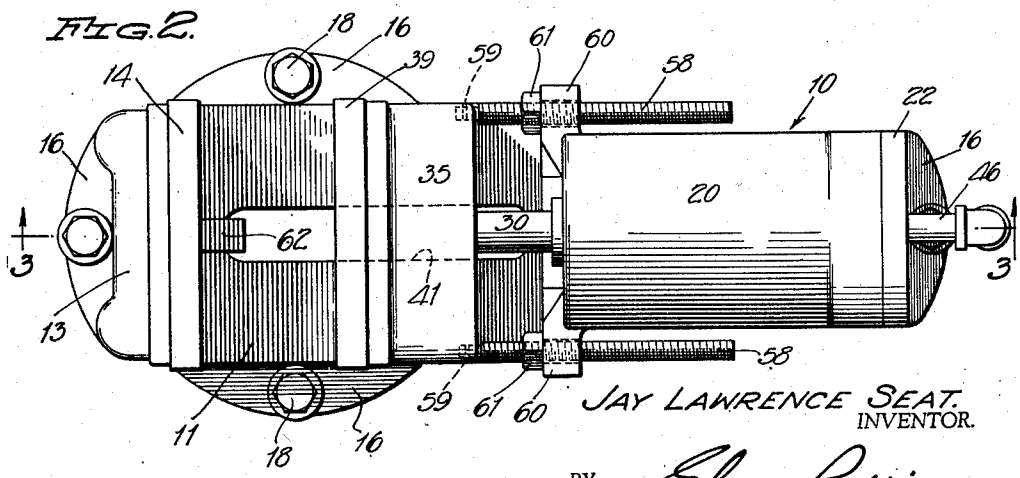


FIG. 2.



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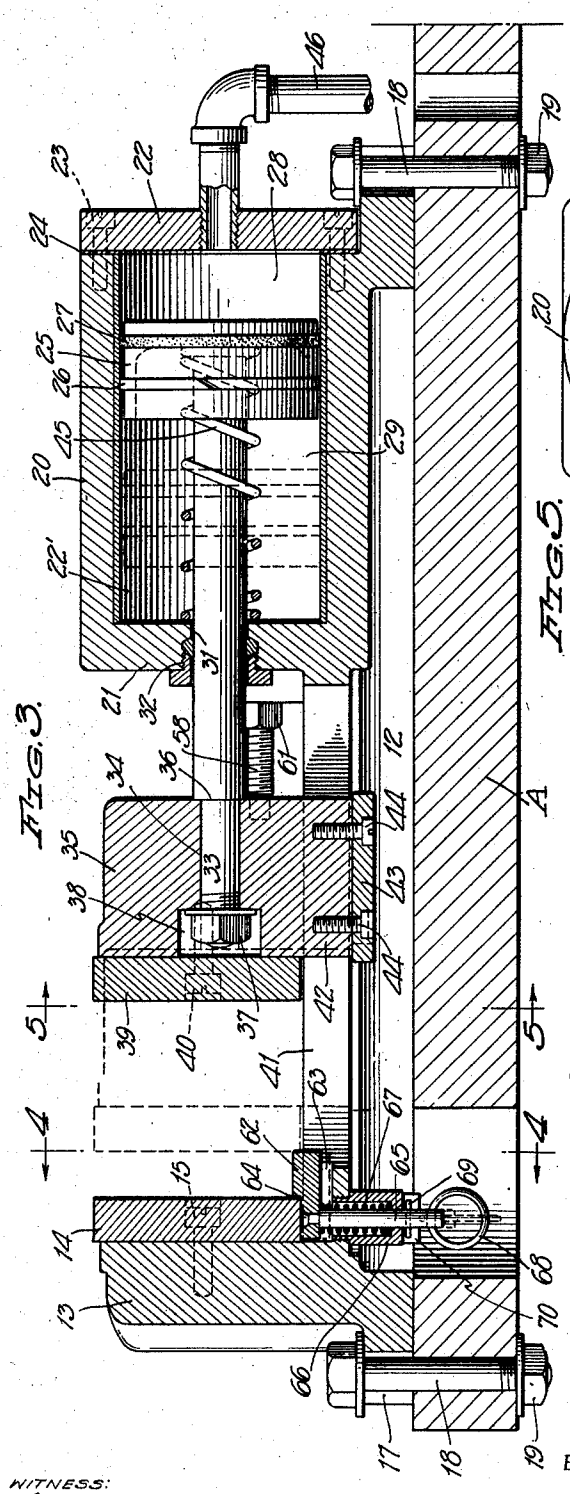


FIG. 3.

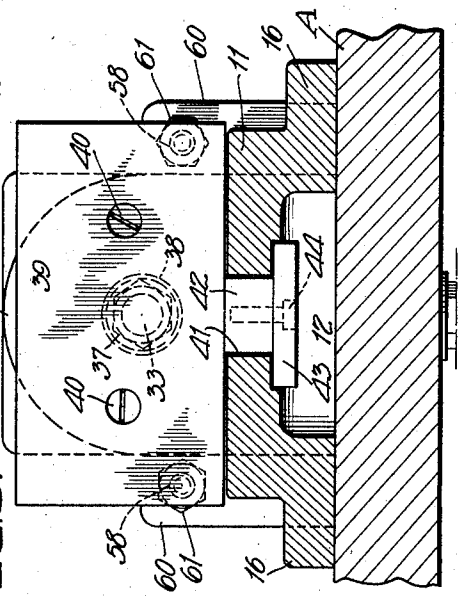


FIG. 5.

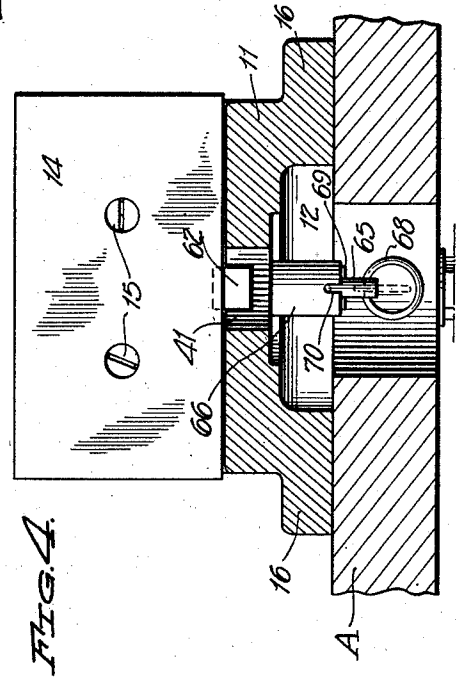


FIG. 4.

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PNEUMATIC VISE

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Application April 24, 1940, Serial No. 331,280

9 Claims. (Cl. 90—60)

This invention relates to improvements in vises and particularly to a vise operable to holding position by means of air pressure.

One of the important features of the invention resides in a pneumatic vise for use in the holding of work on benches, drill press tables, planers, milling machines, shapers, borers, and the like, and by which the actuation of the vise to holding and releasing positions may be expedited over the conventional screw action vise.

Another feature of the invention is to provide a quick action air vise which is equipped with a novel automatic safety catch which prevents the pneumatically actuated movable jaw from contacting the stationary jaw which assures safety to an operator against accidental crushing of the fingers during the setting up of a piece of work between the movable and stationary jaws.

Another important feature of the invention is to provide an adjustable stop means for limiting the opening movement of the movable jaw for a maximum return movement is not necessary when a relatively thin piece of work is being worked upon. The adjustment of the opening movement of the movable jaw expedites the operation of the movable jaw which effects a saving of the operator's time when a particular operation is to be performed by an operator during mass production of an article in its course of manufacture.

Other features of the invention will become apparent as the following specification is read in conjunction with the accompanying drawings, in which,

Figure 1 is a perspective view of the pneumatic vise with the movable jaw in open position.

Figure 2 is a top plan view.

Figure 3 is an enlarged vertical longitudinal sectional view on the line 3—3 of Figure 2, the movable jaw and its connected parts being illustrated in open position in full lines and in closed position in dotted lines.

Figure 4 is a vertical transverse sectional view on the line 4—4 of Figure 3 looking in the direction of the arrows and showing the safety stop in inoperative position in full lines and in operative position in dotted lines.

Figure 5 is a vertical transverse sectional view on the line 5—5 of Figure 3, looking in the direction of the arrows.

Referring to the drawings by reference characters, the numeral 10 designates my pneumatic vise in its entirety and which includes a flat elongated base 11 having a longitudinally extending recess 12 in the under side thereof. Integral with the base 11 at one end thereof, is a stationary jaw 13 which has a hardened ground tool steel face plate 14 removably secured to the flat inner side thereof by machine screws 15, the heads of which are countersunk in the face plate 14. Extending outwardly from the ends of the base 11 and also from the sides thereof, are attaching flanges 16, each of which is provided with a bolt receiving notch 17. In the drawings, I have illustrated the base 10 as being fixedly mounted on a bench or table A, but the same may be used for holding work on drill press tables, planers, milling machines, shapers, borers, and other like machines on which a piece of work is to be held tightly clamped. Bolts 18 extend through the table A and through the notches 17 of the attaching flanges 16, the threaded shanks of the bolts receiving clamping nuts 19, whereby the vise may be rigidly secured to the table or support A.

Formed integral with the base 11 at that end opposite to that at which the stationary jaw is located, is a cylinder 20 which has an inner end wall 21, the other end of the cylinder being open. The cylinder 20 is bored from the open end and has an accurately ground sleeve 22 inserted and secured therein. The outer open end of the cylinder is closed by an end plate 22 which is fastened in position by machine screws 23, there being a gasket 24 interposed between the inner side of the plate 22 and the outer end of the cylinder 20. Slidably mounted in the cylinder 20 and extending through the end wall 21 is a piston assembly which includes a piston head 25 which is slidably mounted in the sleeve or lining 22' of the cylinder, the said head being provided with a metal piston ring 26 and with a leather piston ring 27 for the purpose of sealing the interior of the cylinder into an air chamber 28 and a spring chamber 29. Fixed to the piston head 25 is a piston rod 30 which extends through an opening 31 in the end wall 21, the said opening being sealed by a packing gland 32. The outer free end of the piston rod 30 is reduced in diameter as at 33 and this reduced end of the rod fits into a bore 34 in a movable jaw 35. The outer face of the jaw 35 seats against a shoulder 36 which is formed by the reduced extension 33 and the terminal end of the extension 33 is screw threaded and threadedly receives a nut 37 which is countersunk in a recess 38 provided in the movable jaw 35. Attached to the inner face of the movable jaw 35 is a hardened and ground tool steel face plate 39 which is secured in position by machine bolts 40, the said plate overlying the

recess 38. The base 11 intermediate the cylinder 20 and the stationary jaw 13, is provided with a keyway slot 41 into which a key lug 42 extends, the latter being integral with the movable jaw 35. A cross plate 43 is secured to the key lug 42 by machine screws 44 and the ends of the plate slidably engage the top wall of the recess 12. Thus it will be seen that the movable jaw is slidably mounted upon the base 11 for closing movement toward the stationary jaw 13 and for opening movement away from the jaw 13, and these movements are imparted to the movable jaw by means of the piston and piston actuating means now to be described.

The movable jaw 35 is normally held in open position, as illustrated in full lines in the drawings, and which condition exists by reason of an expansion spring 45 which is disposed within the chamber 29 of the cylinder and which is interposed between the end wall 21 and the piston head 25.

For actuating the piston against the tension of the spring 45 to effect a movement of the movable jaw 35 to a closed position, I provide a compressed air supply pipe 46 which communicates with the chamber 28 through the end plate 22. The air supply pipe 46 may lead to a compressed air storage tank, or other like source of compressed air supply, and arranged in the pipe 46 is a three-way valve 47 of the conventional type, whereby turning of the valve to an "on" position will permit compressed air to pass into the chamber 28 of the cylinder, and upon movement of the valve to a closed position will effect a shutting off of the air supply to the cylinder and permit the air from the chamber 28 to be bled or exhausted to the atmosphere. It is not beleived necessary to go into the detail constructioin of the three-way valve, other than to state that it includes a rotatable plug to which an actuating lever or arm 48 is fixedly attached. This valve might be located above the table A, but in Figure 1, I disclose the same beneath the table and connect the actuating lever 48 with a foot actuating mechanism. If the valve were above the table, it might be hand operated by the user of the vise, but such control would not give an operator the use of both hands in performing his operation upon the work held by the vise. Thus I have illustrated in the drawing a conventional foot actuating mechanism which includes a foot pedal 49 pivoted at 50 to a base 51, the latter resting upon the floor beneath the bench or table A. Also pivoted to the base 51 forward of the pedal 49 is an arm 52 which is operatively connected to the pedal 49 by a link connection 53. A rod 54 has one end connected to the outer end of the lever 48 and its other end connected to the arm 52. A contractile spring 55 has one of its ends connected to the arm 48 and its other end to the table A, and this spring tends to normally hold the lever 48 against a stop pin 56, at which time the three-way valve 47 is in closed position. By depressing the pedal 49, the arm 52 will be depressed, exerting a pull upon the rod 54 which swings the lever 48 to a position against a stop pin 57, at which time the three-way valve 47 is in open position. The pressure of the air entering the chamber 28 is of such force to rapidly actuate the piston against the tension of the spring 45, whereby the movable jaw 35 will slide to closing position in the direction of the stationary jaw 13. Upon shutting off of the air pressure and the bleeding of the air from the chamber 28, the spring 45 performs its function of returning the piston to its normal position, whereupon the movable jaw 35 is moved away from the stationary jaw 13 and assumes an open position.

The space between the jaws 13 and 35 may be varied when the jaw 35 is in open position whereby to regulate the stroke of the piston for it would not be necessary for the movable jaw to travel as far when a relatively thin piece of work is acted upon by the vise in the mass manufacture of an item, as when a relatively wide piece of work were passing through the vise. Thus I have provided a novel adjustable stop means to effect the limiting of the opening movement of the movable jaw. This means consists of a pair of screw threaded guide rods 58—58 which have their inner ends fixedly secured to the outer end of the movable jaw 35 as at 59. The guide rods 58 are connected to the movable jaw so that the rods extend parallel to and at opposite sides of the cylinder 20 and these rods freely slide through bearing ears 60 which are formed integral with the cylinder 20 and extend from opposite sides thereof. Threaded on the guide rods 58 intermediate the bearings 60 and the movable jaw 35, are stop nuts 61. Thus it will be seen that if the nuts 61 are turned to a set position upon the screw threaded guide rods 58, the said nuts will abut the bearing ears 60 on the return movement of the movable jaw to open position. In addition to acting as stops for limiting the opening movement of the movable jaw, these nuts may be turned so as to clampingly hold the movable jaw against the piece of work when no air is available, or when a piece of work may be set up in the vise and it is essential to hold the same clamped for a relatively long period of time.

In view of the danger which might be present in a vise of this kind by reason of an operator placing his fingers between the two jaws when the movable jaw is in open position and the fact that compressed air may be inadvertently admitted to the chamber 28 which would forcibly project the movable jaw in the direction of the stationary jaw, I have provided a novel safety catch which is normally disposed in the path of closing movement of the movable jaw 35 so that if no piece of work is present between the jaws, the movable jaw cannot contact the stationary jaw. This safety block comprises a block-like member 62, which is vertically slidable in a recess 63 formed in the base 11 adjacent the stationary jaw 13, and which opens through the top of the base. One end of the top face of the block 62 is recessed as at 64 to accommodate the bottom of the face plate 14 of the stationary jaw 13, whereby a portion of the block may be disposed above the plane of the top surface of the base 11. The recess 63 is of a depth which permits the block member 62 to be depressed to a position below the plane of the top of the base so as to move out of the path of the closing movement of the face plate 39 of the movable jaw 35. Swivelly connected to the block member 62 is the upper end of a pin 65, the said pin passing through a sleeve member 66 which is threaded into the top wall of the recess 12. Surrounding the pin 65 and interposed between the block member 62 and the lower end wall of the sleeve 66 is an expansion spring 67, which spring tends to normally urge the block member 62 into obstructing position, the upward movement being limited by engagement of the member 62 with the underside of the face plate 14. From the description thus far, it will be seen that if the

movable jaw 35 is slid forwardly toward the stationary jaw 13, these two jaws will not meet for the face plate 39 of the jaw 35 will strike against the block member 62 as illustrated in dotted lines in Figure 3 of the drawings. If, however, a piece of work is placed between the jaws 13 and 35, and is permitted to rest upon the top of the base, it will strike the stop member 62 and the weight of the work will cause the block member to be depressed against the action of the spring 67. Should it be desired to clamp a piece of work between the jaws which is relatively thin and of less height than the height of the clamping jaws, that is, thinner than the distance between the clamping face of the face plate 14 and the inner end of the block member 62, it is possible to manually move the block member 62 out of obstructing position and to hold the same in an inoperative position. This is accomplished by connecting a finger ring 68 to the lower end of the pin 65 and imparting a turning movement to the pin to move the locking pin 69 which passes transversely through the pin 65 to a position out of the notches 70 provided in the lower end of the sleeve member 6. The sleeve and ring are disposed in an opening provided in the table A to make the ring accessible to an operator by reaching beneath the table. In Figure 4 of the drawings, I have illustrated the pin 65 as being pulled down so as to dispose the black member 62 out of the path of the face plate 39 of the movable jaw 35, the locking pin 69 resting upon the lower end of the sleeve-like member 66.

From the foregoing description, it will be seen that I have provided a vise in which the movable jaw may be expeditiously moved into clamping relation with respect to the stationary jaw, and may be rapidly returned to open position. I have also provided a novel stop means for limiting the return movement of the movable jaw whereby to control the length of the stroke of the piston and of the movable jaw. These features are inducive of expediting the operation of the vise which is desirable when an operator may be working on a job in which the parts to be held are of uniform thickness. Also, I have provided a novel safety block which prevents accidental crushing of the fingers of an operator should the movable jaw be actuated to closing position when a piece of work is not present between the jaws.

While I have shown and described what I consider to be the most practical embodiments of my invention, it will be understood that such changes in construction as come within the scope of the appended claims may be resorted to if desired.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. A vise comprising in combination, a stationary jaw, a movable jaw mounted for sliding movement toward and away from said stationary jaw to closed and open positions respectively, pneumatically operated means for sliding said movable jaw toward said stationary jaw to closing position, means for sliding the movable jaw away from said stationary jaw to open position, and adjustable stop means in the path of opening movement of the movable jaw for regulating the distance of the sliding movement of the movable jaw to open position to control the width of the work receiving opening between the jaws preparatory to the insertion of a piece of work thereto.

2. A vise comprising in combination, a stationary jaw, a movable jaw mounted for sliding movement toward and away from said stationary jaw, pneumatically operated means for sliding said movable jaw toward said stationary jaw to closing position, means for sliding the movable jaw away from said stationary jaw to open position, and a retractable safety stop means adjacent said stationary jaw and normally disposed in the path of closing movement of the movable jaw for preventing said movable jaw from engaging said stationary jaw should the pneumatically operated means be accidentally actuated preparatory to the insertion of a piece of work in the space between the jaws when the movable jaw is in open position.

3. A vise comprising in combination, a stationary jaw, a movable jaw mounted for sliding movement toward and away from said stationary jaw, means acting to normally hold said movable jaw in an open position away from said stationary jaw, pneumatically operated means for rapidly sliding said movable jaw toward said stationary jaw to a closed position and for forcibly holding said movable jaw against a piece of work inserted between the jaws for clamping thereby, a retractable safety stop member mounted inwardly of said stationary jaw and normally disposed in the path of closing movement of said movable jaw for preventing the movable jaw from contacting the stationary jaw to prevent the accidental crushing of the fingers of an operator therebetween should the pneumatically operated means be actuated prior to the positioning of a piece of work between said jaws and means for holding said stop member out of the path of movement of the movable jaw.

4. A vise having a stationary jaw and a movable jaw mounted for horizontal sliding movement toward said stationary jaw to a closed position and for movement away from said stationary jaw to open position, a safety stop device comprising a vertically movable block member mounted inwardly of and adjacent the bottom of said stationary jaw, and means biased to normally hold said block member in the path of closing movement of the movable jaw to prevent the latter from striking engagement with the stationary jaw, said block member being arranged to be engaged and depressed by a piece of work when placed between the jaws and thereby moved out of the path of closing movement of the movable jaw.

5. In a vise, an elongated base, a stationary jaw mounted on said base, a movable jaw slidably mounted on said base for horizontal movement toward and away from said stationary jaw to closing and opening positions, a safety stop member mounted for vertical sliding movement in said base and disposed inwardly of said stationary jaw, spring means acting upon said stop member to normally position the same in the path of closing movement of the movable jaw to prevent contacting engagement of the movable jaw with the stationary jaw, finger actuated means for manually depressing the stop member to a position out of the path of sliding movement of the movable jaw to closing position, and releasable latch means for holding the stop member in a depressed position.

6. A vise comprising in combination, an elongated base, a stationary jaw at one end of said base, a cylinder at the other end of said base in

spaced relation to said stationary jaw, a movable jaw, means for mounting said movable jaw on said base for sliding movement between said stationary jaw and said cylinder, a piston having a head slidably mounted in said cylinder, a rod connecting the piston to said movable jaw, a spring arranged for normally holding the piston in a retracted position, an air pressure supply pipe connected to the outer end of said cylinder whereby air pressure therefrom will force the piston to an extended position against the tension of said spring to cause the movable jaw to move into clamping relation with said stationary jaw, and adjustable stop means in the path of sliding movement of the movable jaw in a direction away from the stationary jaw for limiting the return sliding movement of the piston and movable jaw whereby the working strokes of the piston and movable jaw as a unit may be regulated in accordance with the width of the work to be clamped between the movable and stationary jaws.

7. A vise comprising in combination, an elongated base, a stationary jaw at one end of said base, a cylinder at the other end of said base in spaced relation to said stationary jaw, a movable jaw, means for mounting said movable jaw on said base for sliding movement between said stationary jaw and said cylinder, a piston having a head slidably mounted in said cylinder, a rod connecting the piston to said movable jaw, a spring for normally holding the piston in a retracted position, an air pressure supply pipe connected to the outer end of said cylinder whereby air pressure therefrom will force the piston to an extended position against the tension of said spring to cause the movable jaw to move into clamping relation with said stationary jaw, a threaded guide rod having one end connected to the movable jaw, a bearing at one side of the cylinder through which the guide rod freely passes, and a stop nut threaded on said guide rod between the bearing and the movable jaw, said nut being arranged [illegible] bearing and limit the working stroke of the piston and movable jaw.

8. A vise comprising in combination, an elongated base having a longitudinal recess in the underside thereof and an elongated slot opening into said recess, a stationary jaw at one end of said base, a cylinder at the other end of said base in spaced relation to said stationary jaw, a movable jaw, means for mounting said movable jaw on said base for sliding movement between said stationary jaw and said cylinder, said means including a lug integral with said movable jaw and extending through said slot, a cross piece secured to said lug and disposed within said recess and bridging said slot, a piston having a head slidably mounted in said cylinder, a rod slidably extending through the inner end of said cylinder and connected to said movable jaw, a spring interposed between said head and the inner end wall of said cylinder for normally holding the piston in a retracted position, and an air pressure supply pipe connected to the outer end of said cylinder whereby air pressure therefrom will force the piston to an extended position against the action of said spring to cause the movable jaw to move into clamping relation with respect to said stationary jaw.

9. A vise comprising a stationary jaw, a movable jaw mounted for sliding movement toward and away from said stationary jaw, means acting to normally move said movable jaw to an open position away from said stationary jaw, pneumatically operated means for sliding said movable jaw toward said stationary jaw to a closed position and for forcibly holding said movable jaw against a piece of work inserted between the jaws for clamping thereby, means including an adjustable stop for limiting the outward sliding movement of the movable jaw to a predetermined but variable position and means including a movable safety stop for limiting the movement of the movable jaw towards the other jaw.

JAY LAWRENCE SEAT.