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Newswanger

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[45] **Sept. 11, 1973**

[54] **AUTOMATIC VISE JAW**

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[21] Appl. No.: **158,550**

[52] **U.S. Cl.** **269/27,** 269/32, 269/229

[51] **Int. Cl.** **B25b 1/08,** B25b 1/18

[58] **Field of Search** 269/27, 28, 32, 228, 269/261, 283, 229

[56] **References Cited**

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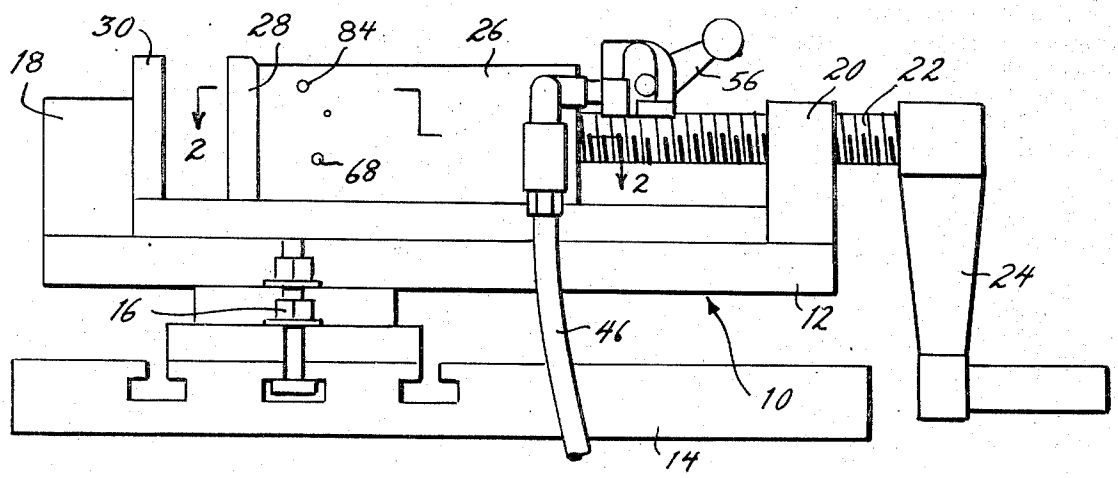
[57] **ABSTRACT**

An automatic vise jaw wherein a movable jaw is urged toward a fixed vise jaw by means of crank operated screw. The movable jaw is equipped with integral air cylinders to actuate a pressure plate for work holding purposes. The air cylinders function piston rods which operatively cooperate with the pressure plate by means of linkage interposed therebetween. By employing suitable leverage, the linkage serves to substantially increase the ratio of pressure applied at the air cylinders and to rapidly apply the increased pressure at the pressure plate.

9 Claims, 13 Drawing Figures



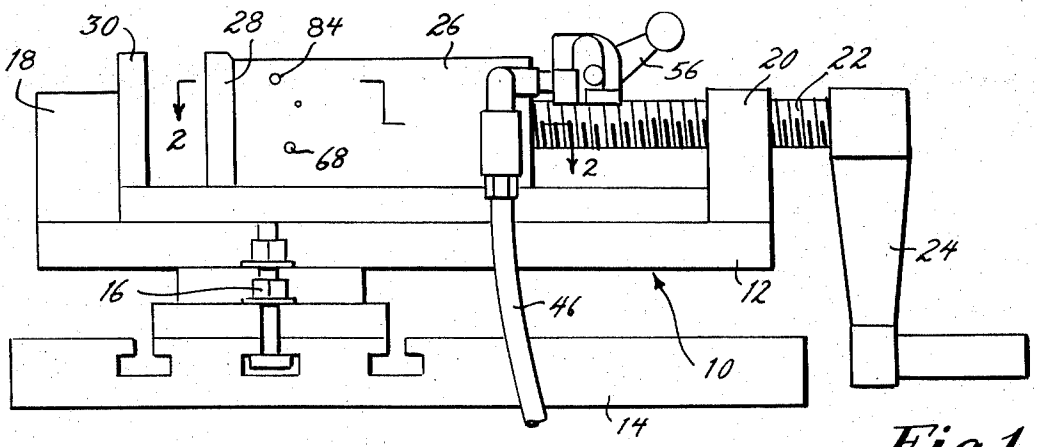


Fig. 1.

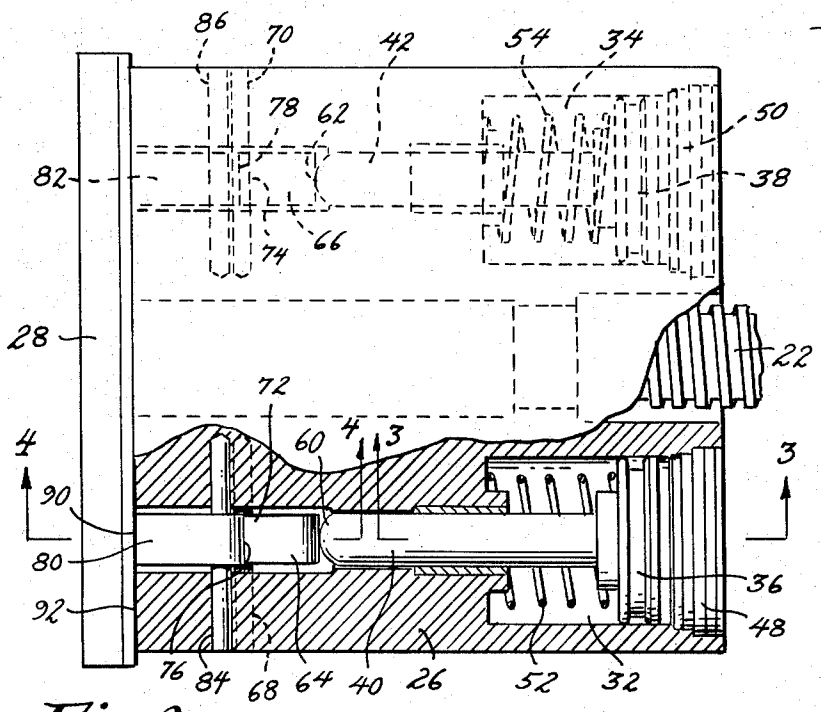


Fig. 2.

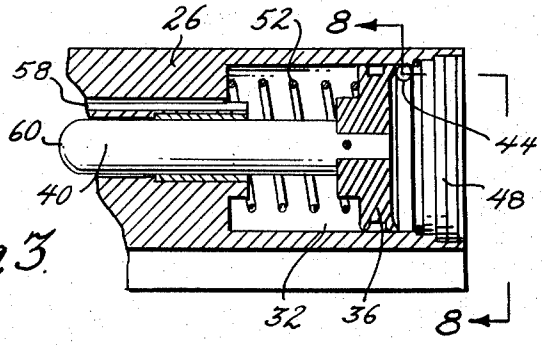


Fig. 3.

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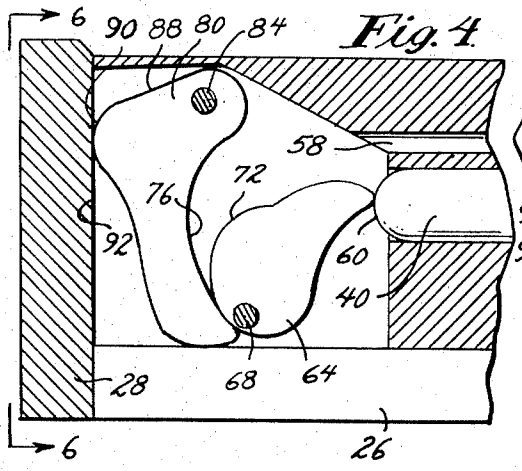

Fig. 4

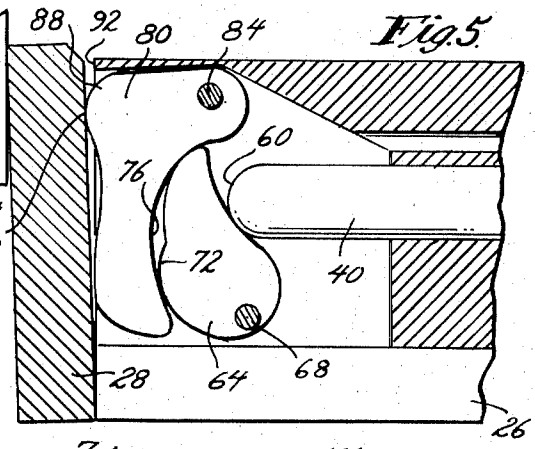

Fig. 5

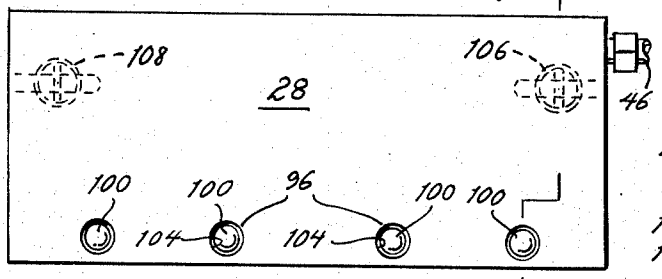

Fig. 6.

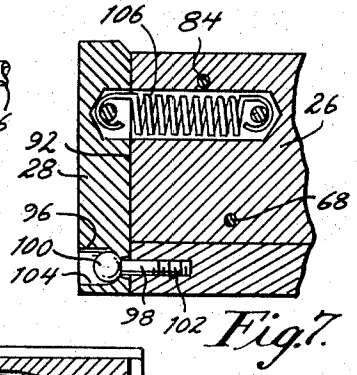

Fig. 7.

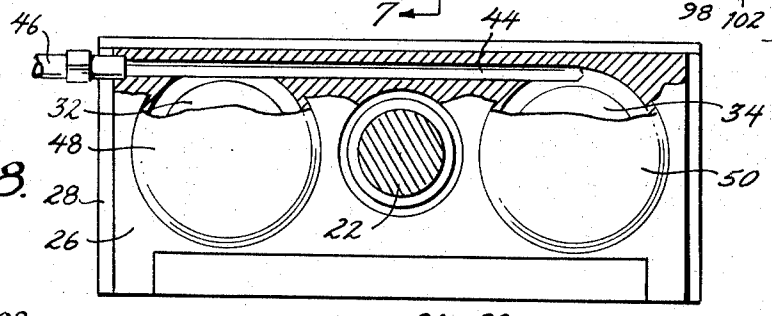

Fig. 8.

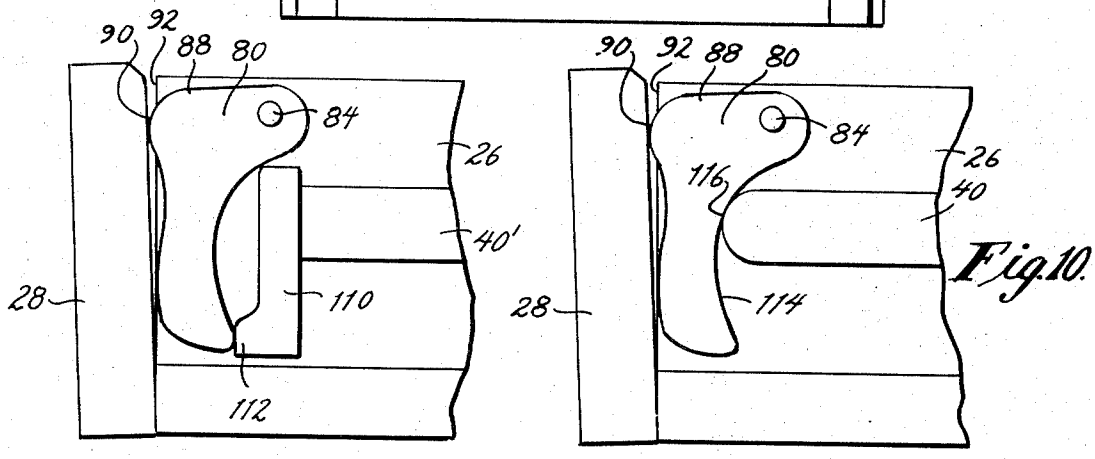

Fig. 9

Fig. 10.

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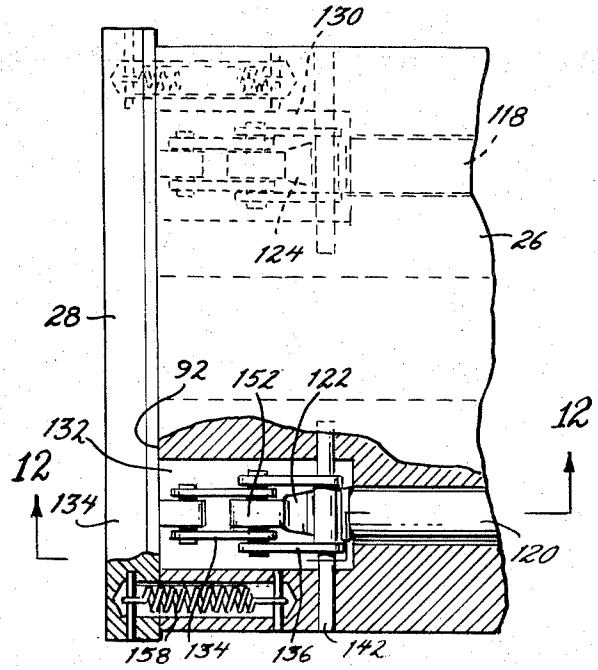

Fig. 11.

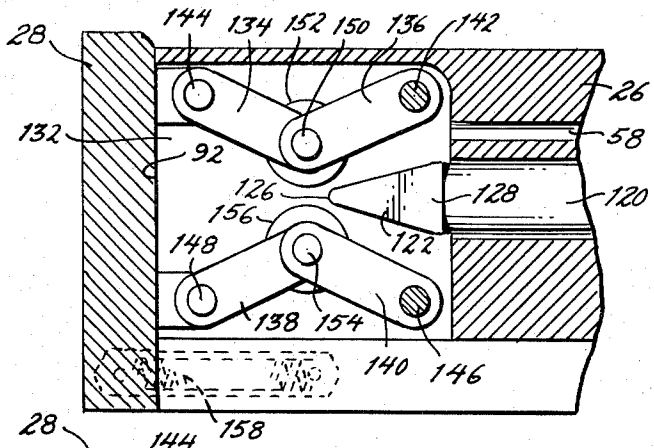

Fig. 12.

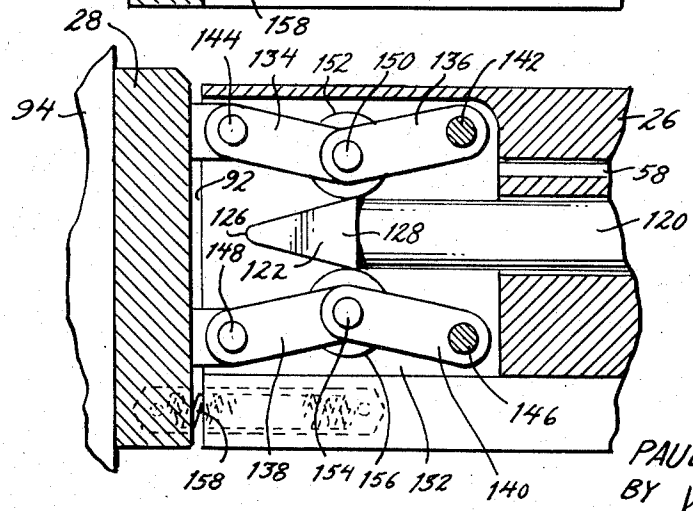

Fig. 13.

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AUTOMATIC VISE JAW

BACKGROUND OF THE INVENTION

The present invention relates generally to the field of machine tools, and more particularly, is directed to an automatic vise jaw for use in holding various work pieces for machining operations.

It is the common practice to employ work holding vises in conjunction with conventional machine tools such as drill presses, milling machines, grinders and similar metal working machinery. Most conventional vises include a stationary jaw and a movable jaw, the movable jaw being movable with respect to the fixed jaw by means of a crank and screw. By placing a work piece between the fixed and movable jaws and then turning the crank, a work piece could be tightly gripped for the machining operations.

The prior art vises of which I am familiar are relatively slow in operation in that the machine operator must manually turn the crank until sufficient pressures are built up to securely hold the work piece between the fixed and movable jaws. In thos instances wherein it is desired to machine a great number of pieces in a production run, the length of time required to alternately tighten and loosen work pieces in the vise by means of the hand operated crank greatly slows down the machining operations and thereby increases the final cost of the items so treated. Additionally, the pressure generated to tighten the work piece within the vise jaws was directly proportional to the pressure exerted by the machine operator on the crank handle. In order to tighten and loosen a number of pieces during a production run, considerable manual effort on the part of the operator was required. Accordingly, fatigue of the operator is an important consideration in production operation. The exertions required to alternately tighten and loosen the jaw vise manually by tightening and loosening the crank handle requires considerable exertion on the part of the operator and could result in noticeable slow down by the end of a busy day.

Prior workers in the art have attempted to introduce the advantages of hydraulic pressure in conjunction with vises to both speed up and to increase the available pressure for holding work pieces. For example, a device is disclosed in U.S. Pat. No. 2,803,157 which employs a screw thread and hydraulic pressure for exerting forces against a work piece. A hollow spindle is employed which is turned by a ratchet bolt to displace a spring pressed pawl. Another prior art device employs a power plunger which incorporates a lever and has a renewable bearing member for direct contact with the plunger as set forth in U.S. Pat. No. 2,052,976. In U.S. Pat. No. 2,656,820, a power operated vise includes a fixed jaw and a movable jaw which is movable by a screw in conventional manner. A piston axially aligns with the screw and employs a threaded sleeve nut. All of the prior art automatic vise jaws of which I am aware incorporate means to operate a movable jaw but are not equipped with linkage means to rapidly exert greatly multiplied forces upon a pressure plate to thereby allow rapid interchangeability of work pieces during production runs. Additionally, the prior art devices are relatively complicated in nature and in construction are not compatible for use with existing equipment.

SUMMARY OF THE INVENTION

The present invention relates to the field of automatic vise jaws, and more particularly, is directed to a cylinder operated movable jaw for rapidly exerting greatly multiplied forces upon a work piece.

The present invention is compatible with most vises presently utilized on existing equipment, such as those manufactured by Bridgeport Machine Tool Company. The fixed jaw construction and the usual vise screw are employed in well known manner and are re-used with the present invention. The movable jaw may be removed from the existing vise and replaced by a jaw which has been machined to accommodate two air cylinders for jaw actuation by air pressure. An axially aligned path is provided for each air cylinder piston actuated plunger which rapidly reciprocates forwardly for work holding purposes and rearwardly for work releasing. The plungers contact linkage which is suitably pivoted within the movable jaw construction to exert an increased ratio of pressure upon a work contacting pressure plate. The pressure plate forwardly connects to the movable jaw and in conjunction with the vise fixed jaw forms the work holding components. Activation of the air cylinders urges the plungers forwardly into contact with the operating linkage. The linkage in turn presses against the pressure plate to urge the pressure plate toward the fixed jaw for work holding purposes. By judiciously constructing the linkage to increase the pressure ratio, great pressures can be quickly and easily built up at the pressure plate to securely hold a work piece during any machining operation.

The operator can turn the conventional screw of the vise to move the movable jaw until the work piece is loosely held. Optimumly, the part to be machined is a free sliding fit between the fixed jaw and the pressure plate with a clearance of approximately one-sixty-fourth of an inch therebetween. Energization of the air cylinders causes the plungers to activate the linkage which forwardly press the pressure plate to securely hold the work piece between the fixed jaw and the pressure plate. Enormous pressures can be applied quickly and easily to the work piece by the leverage obtained at the operating linkage. After the maching operation is performed, the air switch is opened to rapidly reduce the pressure holding the work piece, thereby allowing the work piece to be easily removed from between the pressure plate and the fixed jaw without requiring any manual adjustment of the vise screw.

It should be noted that once the pressure plate is properly located by the screw of the vise for a production run of similar parts, the screw need not again be turned and all of the work clamping operations can be performed by the activation and de-activation of the air cylinders. It should be noted that the present invention completely eliminates the need for additional work clamps and accordingly, when the size of the work changes, the screw can be rotated until the movable jaw is brought to the new position for work holding purposes without loosening or tightening any clamps or similar devices.

It is therefore an object of the present invention to provide an improved automatic vise jaw of the type set forth.

It is another object of the present invention to provide a novel automatic vise jaw that incorporates exist-

ing vise components such as the base, the fixed jaw and the screw.

It is another object of the present invention to provide a novel automatic vise jaw that includes a pressure plate affixed to the movable vise jaw for work clamping purposes.

It is another object of the present invention to provide a novel automatic vise jaw wherein an air cylinder is employed with suitable linkage to increase the ratio of pressure available for work clamping purposes.

It is another object of the present invention to provide a novel automatic vise jaw that incorporates an air operated plunger which functions operating linkage to energize a work holding pressure plate.

It is another object of the present invention to provide a novel automatic vise jaw equipped with a pressure plate operable forwardly of the jaw and being activated by air cylinder operated linkage to increase the working pressure.

It is another object of the present invention while having all the above improvements and features, to incorporate safety features insuring the operator's safety. Because of the small amount of travel by the pressure plate forwardly from the moving jaw, a maximum travel of approximately one sixteenth of one inch makes it almost impossible for the operator to have his fingers caught and pinched.

It is another object of the present invention to provide a novel automatic vise jaw including a forwardly positioned pressure plate, the pressure plate being pivotal with respect to the jaw construction for work piece clamping purposes.

It is another object of the present invention to provide a novel automatic vise jaw that is compatible for use with existing machine tool work holding vises.

It is another object of the present invention to provide a novel automatic vise jaw that is inexpensive in manufacture, rugged in construction and trouble-free when in use.

Other objects and a fuller understanding of the invention will be had by referring to the following description and claims of a preferred embodiment thereof, taken in conjunction with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a vise assembly incorporating the present invention.

FIG. **2** is an enlarged, cross sectional view taken along Line **2—2** of FIG. **1**, looking in the direction of the arrows.

FIG. **3** is a cross sectional view taken along Line **3—3** of FIG. **2**, looking in the direction of the arrows.

FIG. **4** is an enlarged, cross sectional view taken along Line **4—4** of FIG. **2**, looking in the direction of the arrows, showing the pressure plate in initial position.

FIG. **5** is a view similar to FIG. **4**, but showing the parts in work clamping position.

FIG. **6** is an end elevational view on reduced scale, taken along Line **6—6** of FIG. **4**, looking in the direction of the arrows.

FIG. **7** is a partial, cross sectional view taken along Line **7—7** of FIG. **6**, looking in the direction of the arrows.

FIG. **8** is a sectional view taken along Line **8—8** of FIG. **3**, looking in the direction of the arrows.

FIG. **9** is a diagrammatic view similar to FIG. **4**, showing a modified plunger and linkage arrangement.

FIG. **10** is a diagrammatic view similar to FIG. **4**, showing a second modified plunger and linkage arrangement.

FIG. **11** is a sectional view similar to FIG. **2**, showing a modified linkage arrangement.

FIG. **12** is a cross sectional view taken along Line **12—12** of FIG. **11**, looking in the direction of the arrows, showing the pressure plate in initial position.

FIG. **13** is a view similar to FIG. **12** showing the parts in work clamping position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Although specific terms are used in the following description for the sake of clarity, these terms are intended to refer only to the particular structure of my invention selected for illustation in the drawings and are not intended to define or limit the scope of the invention.

Referring now to the drawings, I show in FIG. **1** a machine vise **10** which includes a stationary base **12** which is adaptable to be mounted upon the table **14** of a conventional machine tool such as a milling machine or a drill press (not shown). The stationary base **12** conventionally mounts upon the table **14** by utilizing mounting bolts **16** or other suitable fastening means in well known manner. The stationary base **12** forwardly supports the fixed vise jaw **18** and terminates rearwardly in a vertical flange **20** in the usual manner. The vertical flange **20** is provided with an internal screw thread which threadedly receives the vise screw **22** in conventional, threaded engagement therein. The vise screw **22** terminates rearwardly in a crank handle **24** and forwardly engages the movable vise jaw **26.** Thus, by rotating the crank handle **24** to turn the vise screw **22** within the threaded connection in the vertical flange **20,** the movable jaw **26** may be moved forwardly or rearwardly in conventional manner to thereby vary the spacing between the pressure plate **28** of the movable jaw **26** and the fixed plate **30** of the fixed vise jaw **18.**

As best seen in FIGS. **2, 3** and **8,** the movable vise jaw **26** is drilled or otherwise treated to provide a pair of spaced, longitudinally extending air cylinders **32, 34.** Pistons **36, 38** respectively reciprocate within the air cylinders **32, 34** to longitudinally reciprocate their associated piston rods **40, 42.** An air intake line **44** is conventionally energized by an air hose **46** and simultaneously introduces air under pressure into each air cylinder **32, 34** intermediate the heads of the pistons **36, 38** and the air cylinder seals **48, 50.** Energization of the air intake line **44** introduces line air pressure upon the heads of the pistons **36, 38** to forwardly urge the pistons **36, 38** and the affixed piston rods **40, 42.** Return springs **52, 54** bias between the forward ends of the air cylinders **32, 34** and the forward faces of the pistons **36, 38** to urge the pistons **36, 38** to return to their initial position once air pressure from the air intake line **44** has been interrupted such as by means of an air valve **56.** Air bleed lines **58** communicate with the air cylinders **33, 34** to bleed air from within the air cylinders **32, 34** in conventional manner to facilitate operation of the pistons **36, 38** upon energization of the air intake line **44.**

As best seen in FIGS. 2, 4 and 5, the forward ends 60, 62 of the respective piston rods 40, 42 contact the power cams 64, 66 to pivot the power cams 64, 66 in a counter clockwise direction about the jaw affixed pivot pins 68, 70. The cam surfaces 72, 74 of the power cams 64, 66 ride upon the cooperating cam surfaces 76, 78 of the jaw cams 80, 82 to cause the jaw cams 80, 82 to rotate in a clockwise direction about their respective movable jaw affixed pivot pins 84, 86. It will be observed that the jaw cams 80, 82 are machined to provide a crank arm 88 which swings from an angular position as in FIG. 4 when the air cylinders 32, 34 are de-energized to a generally horizontal position as in FIG. 5 when the air cylinders 32, 34 are activated. The forwardmost nose 90 of the crank arms 88 continuously contacts the rear surface of the pressure plate 28 during all periods of operation. When the air cylinders 32, 34 are de-activated and the jaw cams 80, 82 are disposed with the crank arms 88 in angular relation as in FIG. 4, the distance between the respective pivot pins 84, 86 and the forwardmost nose 90 is foreshortened to permit the upper portion of the pressure plate 28 to abut the face 92 of the movable vise jaw 26. When the power cams are rotated by activation of the air cylinders 32, 34 to clockwise rotate the jaw cams 80, 82 about their respective pivot pins 84, 86, the crank arms 88 dispose horizontally to increase the horizontal distance between the pivot pins 84, 86 and the noses 90 of the jaw cams 80, 82. This increase in horizontal distance of the noses 90 from the pivot pins 84, 86 exerts great pressure upon the upper portion of the pressure plate 28 to urge it forwardly from the face 92 of the movable vise jaw 26. It has been found that a forwardly urged movement of the upper portion of the pressure plate 28 of approximately one-sixteenth of an inch is sufficient to exert great holding forces upon a work piece 94 to secure it between the pressure plate 28 and the fixed plate 30 of the fixed vise jaw 18.

As best observed in FIGS. 6 and 7, the pressure plate 28 pivotally connects to the movable vise jaw 26 by employing a plurality of bottomly positioned ball and socket junctions 96. A plurality of connectors 98 each threadedly engage into the bottom of the movable vise jaw 26 and terminate forwardly in a ball head 100 which is preferably integrally formed with the threaded shank portions 102 of the connectors 98. The pressure plate 28 is drilled or otherwise machined to provide a plurality of circular sockets 104 of dimensions suitable to receive the ball heads 100 in a ball and socket joint. Thus, when the air cylinders 32, 34 are activated to forwardly push the piston rods 40, 42 which in turn rotate the power cams 64, 66 and the jaw cams 80, 82, the movement of the crank arms 88 to the horizontal position of FIG. 5 serves to pivot the top of the pressure plate 28 outwardly by swivelling the bottom of the pressure plate about the ball and socket junctions 96. A pair of return coil springs 106, 108 have their ends respectively pinned to the upper portion of the pressure plate 28 and to the interior of the movable vise jaw 26 in a manner to continuously bias the upper portion of the pressure plate against the face 92 of the movable vise jaw 26. Accordingly, after the air cylinders 32, 34 are energized and de-energized, the return coil springs 106, 108 serve to return the pressure plate 28 to the unloaded initial position as illustrated in FIG. 4.

Referring now to FIG. 9, I show a first modified jaw cam operating mechanism which includes a modified piston rod 40' which is reciprocal within the movable vise jaw body 26 in the manner hereinbefore described. The modified piston rod 40' terminates forwardly in a power ram 110 which has its forward action arm 112 in contact with the bottom end of the jaw cam 80 in a manner to pivot the cam about its movable jaw affixed pivot pin 84 when the ram 110 is forwardly urged by the piston rod 40'. Clockwise rotation of the jaw cam 80 about its pivot pin 84 causes the crank arm 88 to rotate to a generally horizontal position whereby the nose 90 rides against the upper portion of the pressure plate 28 to force it outwardly away from the face 92 of the movable jaw 26 in the manner hereinbefore described. De-energization of the air cylinders 32, 34 will cause the piston rod 40' to reciprocate rearwardly, pulling the rod affixed power ram 110 also rearwardly to thereby permit the jaw cam 80 to rotate counterclockwise about its pivot pin 84. The return coil springs 106, 108 (not illustrated in FIG. 9) will then pull the upper portion of the pressure plate 28 against the face 92 of the movable vise jaw so that the pressure plate 28 is vertically disposed in unloaded position in the manner hereinbefore illustrated. By varying the leverage distance between the pivot pin 84 and the contact area with the forward action arm 112, the power multiplication available at the pressure plate 28 can be readily designed.

In a second modification, the piston rod 40 may be employed directly against the interior cam face 114 of the jaw cam 80 to urge it in clockwise rotation about the jaw cam pivot pin 84 to thereby rotate the crank arm 88 into a generally horizontal position as illustrated. The cam nose 90 will co-act with the upper portion of the pressure plate 28 in the manner hereinbefore described to pivot the pressure plate 28 about its bottom ball and socket junction 96 for work holding purposes. It will be appreciated that the distance between the pivot pin 84 and the forward action arm 112 as in FIG. 9 is greater than the distance between the pivot pin 84 and the point of contact 116 between the end of the piston rod 40 and the interior cam face 114 as in FIG. 10. Accordingly, because of the greater leverage available, a greater pressure can be imposed upon the pressure plate 28 by the construction illustrated in FIG. 9. By varying the distance between the point of application of pressure upon the jaw cam 80 and the pivot pin 84, the available pressure for work holding purposes may be readily controlled in accordance with usual power crank and arm calculations.

By employing the constructions illustrated in FIGS. 2, 9 or 10, great pressures may be made available at the pressure plate 28 for work holding purposes. For example, by providing air cylinders 32, 34 of one and one-half inches in diameter, each piston 36, 38 will have a face area of 1.767 square inches or a total of 3,53 square inches. Applying air pressure at the air intake line 44 of for example, one hundred pounds per square inch will generate a force of three hundred and fifty-three pounds per square inch in the cylinders 32, 34. Should the leverage ratio between the power cams 64, 66 and jaw cams 80, 82 as in FIG. 2, or between the power ram 110 and the jaw cam 80 as in FIG. 9 or the piston rod 40 and the jaw cam 80 as in FIG. 10 be designed to produce an eight to one ratio, for example, nearly one and one-half tons of pressure will then be available on the work. By varying parameters such as the line air pressure, the size of the cylinders or the le-

verage ratio between the operating parts, the available pressure at the pressure plate **28** may be widely varied within desired limits to produce any required work holding pressure.

It will be appreciated that the pressure plate **28** pivots near its bottom about the ball and socket junctions **96** and it is therefore the tendency of the pressure plate **28** to force a work piece **94** downwardly towards the bottom of the vise construction. The pivotal arrangement completely eliminates any tendency of the applied pressure to squeeze the work upwardly between the pressure plate **28** and the fixed plate **30** and therefore, an extremely reliable, work clamping arrangement can be provided.

Referring now to FIGS. **11, 12** and **13,** I show a third modified construction which may be employed to function the pressure plate **28** in a vertical plane for clamping a work piece **94.** In this embodiment, the movable vise jaw **26** is equipped with air cylinders, air intake lines, air cylinder seals, pistons and return springs in the manner hereinbefore fully described for the embodiment illustrated in FIG. **2.** The pistons (not shown) function modified piston rods **118, 120** which reciprocate within the movable vise jaw body in response to activation of the air cylinders in the manner hereinbefore described. The piston rods **118, 120** forwardly carry angular cam operators **122, 124** which each terminate forwardly in a relatively narrow nose **126** and rearwardly in a widened shoulder **128.** The movable vise jaw body is forwardly machined to provide a pair of right and left operating cavities **130, 132** of necessary size to receive the upper and lower pressure plate operating linkage **134, 136, 138** and **140** therein for pressure plate operating purposes. The rearwardly positioned upper link arms **136** rearwardly pivotally connect to the movable vise jaw **26** about the upper pivot pins **142.** The forward upper link arms **134** forwardly pivotally connect to the pressure plate **28** at the forward pivot pins **144.** Similarly, the lower linkage arms **140** rearwardly connect to the movable vise jaw **26** through the lower pivot pins **146** and the lower forward linkage arms **138** forwardly pivotally affix to the pressure plate **28** at the lower pivotal connections **148.** The upper linkage arms **134, 136** pivotally respectively interconnect at the pivot pins **150** which also carries the upper cam follower **152.** Similarly, the lower linkage arms **138, 140** medially pivotally interconnect at the lower pivot pin **154** which also carries the lower cam follower **156.**

A plurality of corner positioned springs **158** bias between the pressure plate **28** and the movable vise jaw body to continuously bias the pressure plate **28** against the face **92** of the movable jaw **26.** Thus, when the air cylinders **32, 34** are de-energized, the plurality of springs **158** will pull the pressure plate **28** into vertical contact with the forward face **92** of the movable vise jaw **26.** See FIG. **12.** It will be noted that the upper and lower linkage arms **134, 136, 138, 140** are fabricated of substantially identical size. As best seen in FIG. **12,** the combined length of the upper linkage arms **134, 136** is greater than the distance between the upper pivot pin **142** and the pivotal connection **144** when the pressure plate **28** contacts the vise jaw forward face **92.** Similarly, the lower linkage arms **138, 140** are fabricated to a combined length that is greater than the distance between the lower pivot pin **146** and the lower pivotal connection **148** when the pressure plate **28** connects the forward face **92.** The upper and lower linkage arms **134, 136** and **138, 140** thus serve as crank arms and are arranged with the respective upper and lower pivot pins **150, 154** in close proximity so that the upper cam follower **152** and the lower cam follower **156** are urged toward each other. The piston rod cam operators **122, 124** align between the respective upper and lower cam followers **152, 156** in a manner to force the noses **126** between the upper and lower cam followers **152, 156** when the piston rods **118, 120** are forwardly urged by activation of the air cylinders **32, 34.**

As best seen in FIG. **13,** activation of the air cylinders **32, 34** urges the piston rods **118, 120** forwardly within the respective operating cavities **130, 132** to force the respective noses **126** of the cam operators **122, 124** between the upper and lower cam followers **152, 156.** Continued forward movement of the piston rods **118, 120** causes the cam followers **152, 156** to respectively ride up the inclined widened surfaces of the cam operators **122, 124** toward the widened shoulders **128.** The movement of the cam operators **122, 124** forwardly with respect to the cam followers **152, 156** causes the cam followers **152, 156** to separate and to tend to increase the distance between the upper and lower movable vise jaw affixed pivot pins **142, 146** and the respective upper and lower pivotal connections **144, 148** to the pressure plate **28** to thereby force the pressure plate **28** forwardly with respect to the forward face **92** of the movable vise jaw **26** for work piece **94** securing purposes. The pressure plate **28** will continue to exert pressure forces against the work piece **94** as long as the air cylinders **32, 34** are activated to thereby continuously urge the respective piston rods **118, 120** to the forward position as in FIG. **13.** De-energization of the air cylinders **32, 34** will cause the piston rods **118, 120** to be pulled rearwardly by the return springs **52, 54** in the manner hereinbefore described to withdraw the cam operators **122, 124** from contact with the upper and lower cam followers **152, 154** respectively. With the piston rods **118, 120** pulled to their rearward position, the plurality of corner positioned springs **158** pull the pressure plate **28** into vertical contact with the forward face **92** of the movable jaw **26** as in FIG. **12.** Thus, the upper and lower linkage arms **134, 136, 138, 140,** the cam followers **152, 156** and the cam operators **122, 124** all cooperate to function the pressure plate **28** forwardly and rearwardly in continuous vertical alignment.

In order to operate the device, the screw **22** of the vise is turned by means of the crank handle **24** until the work piece **94** is a sliding fit between the pressure plate **28** which is affixed to the movable jaw **26** and the fixed plate **30** which connects to the fixed vise jaw **18.** Optimumly, the distance between the pressure plate **28** and the fixed plate **30** is approximately one sixty-fourth of an inch greater than the width of the work piece **94** to be machined. The work piece **94** is then placed between the vise jaws **18, 26** in position for the desired machining operation. The air valve **56** which is of conventional construction of suitable design to control the air intake hose line **46** is then pivoted to energize the air intake line **44** and the air cylinders **32, 34.** Activation of the air cylinders **32, 34** causes the pressure plate **28** to press against the work piece **94** with great pressure due to the leverage action in the manner hereinbefore described in detail to permit the work piece to be firmly held during the machining operations. After

completion of the machining operations, the air valve **56** is closed, thereby de-activating the air cylinders **32, 34.** This retracts the pressure plate **28** to thereby allow the work piece **94** to be readily lifted clear from between the vise jaws **18, 26.** Because of the rapid action of the air cylinders **32, 34** in response to operation of the air valve **56,** considerable time may be saved in securing and removing work pieces from between the jaws of a vise as compared to the former method of turning the crank handle **24** for work tightening and loosening purposes for each work piece thus treated. It will be noted that by employing the air vise jaw of the present invention, once the screw **22** has been turned to properly position the jaws for a given size work piece, production runs of similar pieces may be made without again turning the crank handle **24.** The movable pressure plate **28** and its air activated operating mechanism cooperate for work securing purposes.

I claim:

1. In an automatic operating vise of the type incorporating a fixed jaw and an adjustable jaw movable with respect to the fixed jaw to secure a work piece therebetween, the combination of

A. cylinder means provided in one said jaw,
  1. said cylinder means having a piston reciprocal therein,
  2. said cylinder means receiving activating forces to push the piston from a first position to a second position within the cylinder means,
    a. said piston moving a piston rod within the said jaw in response to the activating forces,
    b. said cylinder means including means to return the piston to its said first position upon removal of the activating forces;

B. linkage means in contact with the said piston rod,
  1. said linkage means having an initial position when the said cylinder is de-activated and having a pressure position when the activating forces push the piston to its said second position; and

C. pressure plate means connected to one said vise jaw,
  1. said pressure plate means having an initial position in overall contact with its associated vise jaw when the cylinder means is de-activated and being urged to a pressure position by the activating forces,
    a. said linkage means pushing at least a portion of the pressure plate means out of contact with its associated vise jaw when the piston is pushed to its said second position,
  2. the said pressure plate means being connected to the one said vise jaw by means of ball and socket junctions.

2. The invention of claim **1** wherein the ball and socket junctions permit pivotal movement of the pressure plate means with regard to the associated vise jaw.

3. In an automatic vise of the type incorporating a fixed jaw and an adjustable jaw movable with respect to the fixed jaw to secure a workpiece therebetween, the combination of

A. cylinder means provided in one said jaw,
  1. said cylinder means having a piston reciprocal therein,
  2. said cylinder means receiving activating forces to push the piston from a first position to a second position within the cylinder means,
    a. said piston moving a piston rod within the said jaw in response to the activating forces,
    b. said cylinder means including means to return the piston to its said first position upon removal of the activating forces,
  3. the one said jaw being the adjustable jaw;

B. linkage means in contact with the said piston rod,
  1. said linkage means having an initial position when the said cylinder is de-activated and having a pressure position when the activating forces push the piston to its said second position,
  2. said linkage means comprising a power cam and a jaw cam pivotally connected to the adjustable jaw,
    a. the said piston rod pivoting the power cam upon function of the cylinder means and the said power cam pivoting the jaw cam to urge the pressure plate means outwardly from the adjustable jaw; and

C. pressure plate means connected to one said vise jaw,
  1. said pressure plate means having an initial position in overall contact with its associated vise jaw when the cylinder means is de-activated and being urged to a pressure position by the activating forces,
    a. said linkage means pushing at least a portion of the pressure plate means out of contact with its associated vise jaw when the piston is pushed to its said second position,
  2. the pressure plate means moving outwardly from the adjustable jaw in a pivotal movement.

4. The invention of claim **3** wherein the said power cam and jaw cam have combined leverage about their respective pivotal connections when urged to the said pressure position to increase the pressures exerted by the piston rod.

5. The invention of claim **4** wherein the pressures exerted by the piston rod are increased substantially by the linkage means.

6. The invention of claim **5** wherein the pressures are increased by a ratio of at least eight to one.

7. In an automatic operating vise of the type incorporating a fixed jaw and an adjustable jaw movable with respect to the fixed jaw to secure a work piece therebetween, the combination of

A. cylinder means provided in the adjustable jaw,
  1. said cylinder means having a piston reciprocal therein,
  2. said cylinder means receiving activating forces to push the piston from a first position to a second position within the cylinder means,
    a. said piston moving a piston rod within the said jaw in response to the activating forces,
    b. said cylinder means including means to return the piston to its said first position upon removal of the activating forces;

B. linkage means in contact with the said piston rod,
  1. said linkage means having an initial position when the said cylinder is de-activated and having a pressure position when the activating forces push the piston to its said second position,
  2. the linkage means comprising a jaw cam pivotally connected to the adjustable jaw, wherein the jaw cam has a crank arm and wherein the piston rod contacts a portion of the jaw cam to rotate the jaw cam about its pivotal connections, the

crank arm functioning to push a portion of the pressure plate means out of contact with the adjustable jaw when the linkage means are urged to the said pressure position;

C. pressure plate means connected to the adjustable vise jaw,

1. said pressure plate means having an initial position in overall contact with its associated vise jaw when the cylinder means are de-activated and being urged to a pressure position by the activating forces,

a. said linkage means pushing at least a portion of the pressure plate means out of contact with its associated vise jaw when the piston is pushed to its said second position.

8. In an automatic operating vise of the type incorporating a fixed jaw and an adjustable jaw movable with respect to the fixed jaw to secure a work piece therebetween, the combination of

A. cylinder means provided in the adjustable jaw,

1. said cylinder means having a piston reciprocal therein,

2. said cylinder means receiving activating forces to push the piston from a first position to a second position within the cylinder means,

a. said piston moving a piston rod within the said jaw in response to the activating forces,

b. said cylinder means including means to return the piston to its said first position upon removal of the activating forces;

B. linkage means in contact with the said piston rod,

1. said linkage means having an initial position when the said cylinder is de-activated and having a pressure position when the activating forces push the piston to its said second position,

2. the linkage means including upper and lower pressure plate operating linkage rearwardly pivotally connected to the adjustable vise jaw and forwardly pivotally connected to the pressure plate means, the said piston rod terminating forwardly in angular cam operators which contact portions of the upper and lower pressure plate operating linkage when the piston is pushed to its second position to urge the pressure plate means to its said pressure position;

C. pressure plate means connected to the adjustable vise jaw,

1. said pressure plate means having an initial position in overall contact with its associated vise jaw when the cylinder means are de-activated and being urged to a pressure position by the activating forces,

a. said linkage means pushing at least a portion of the pressure plate means out of contact with its associated vise jaw when the piston is pushed to its said second position.

9. The invention of claim **8** wherein the pressure plate means move outwardly from the adjustable jaw in continuous vertical alignment.

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