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2,863,290

PNEUMATIC CLAMPING DEVICE WITH MECHANICAL ADVANTAGE

Filed April 26, 1952

3 Sheets-Sheet 1

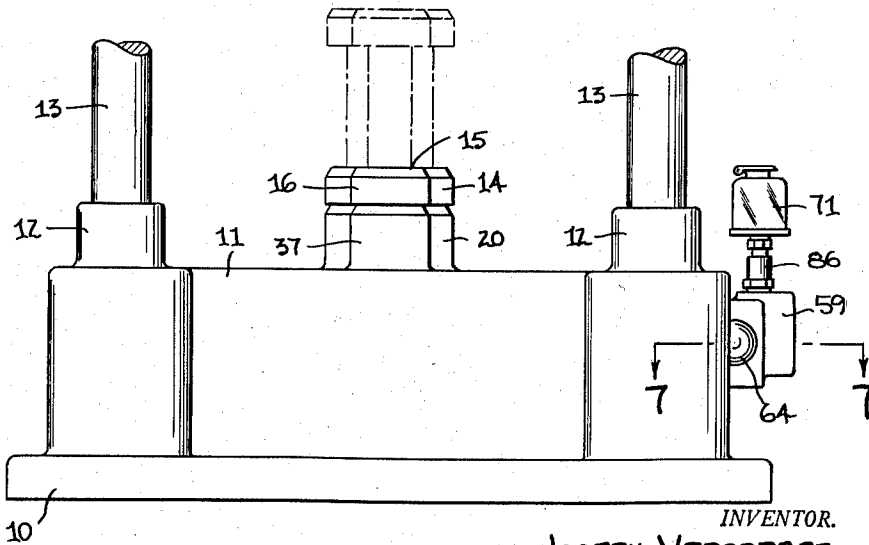
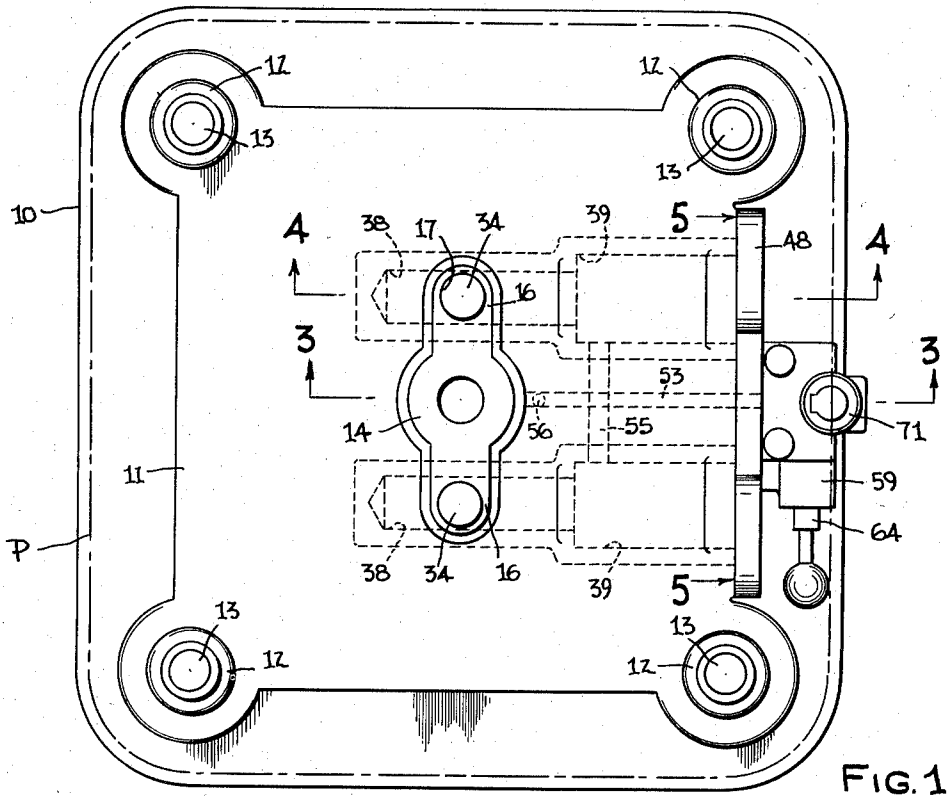


FIG. 2

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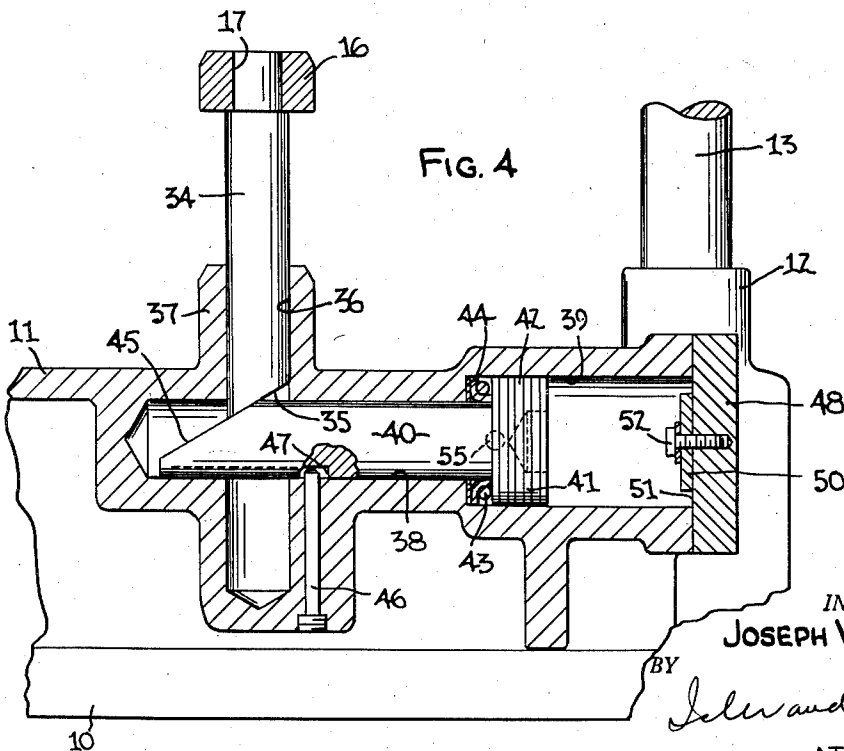
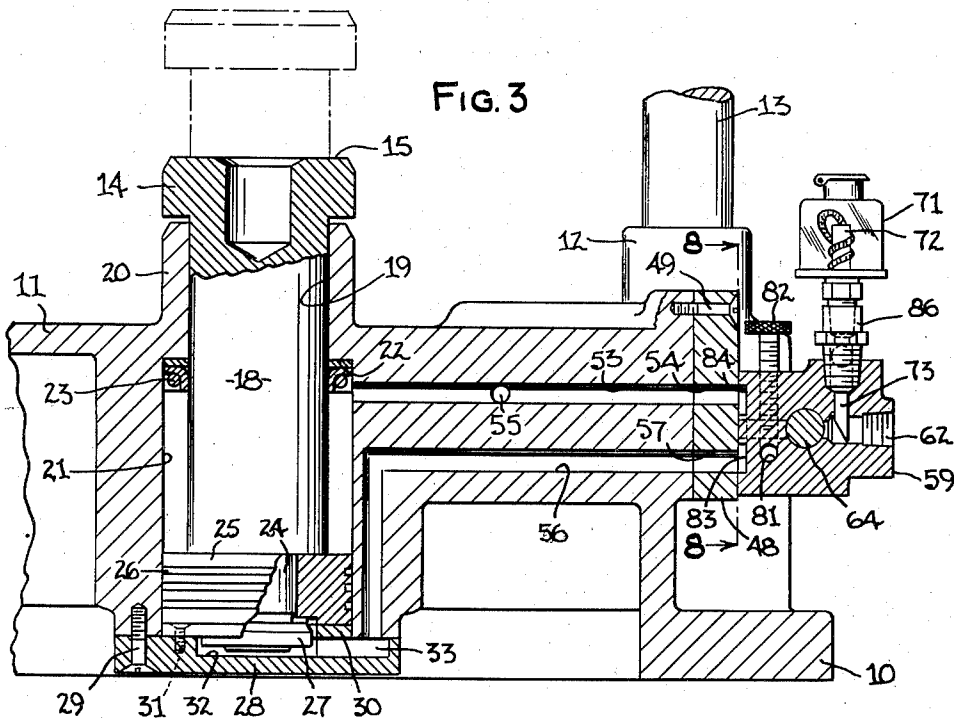
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PNEUMATIC CLAMPING DEVICE WITH MECHANICAL ADVANTAGE

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

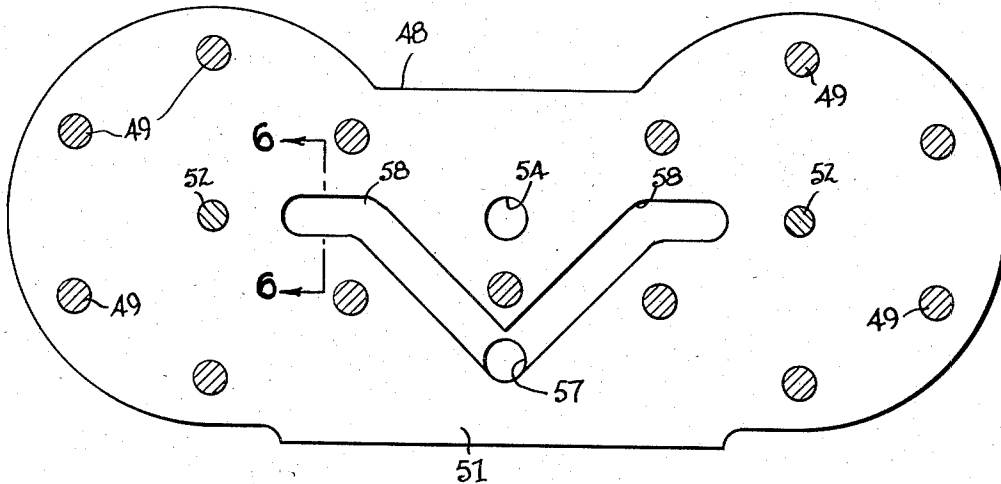


FIG. 5

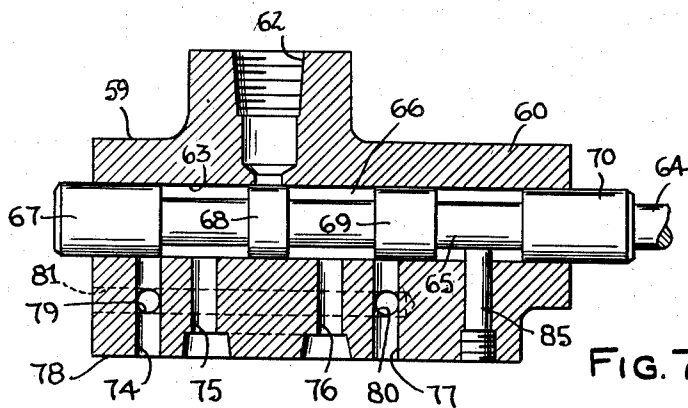


FIG. 7

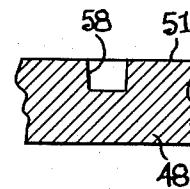


FIG. 6

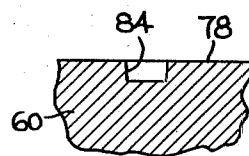


FIG. 9

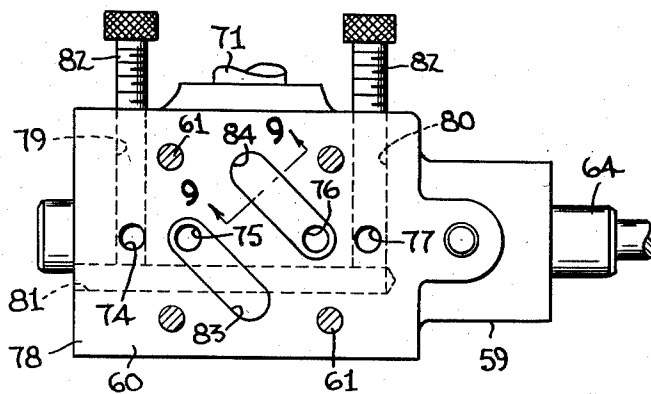


FIG. 8

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PNEUMATIC CLAMPING DEVICE WITH MECHANICAL ADVANTAGE

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2 Claims. (Cl. 60—97)

The present invention relates to clamping devices and more particularly to an air operated clamping device such as a jig for holding work pieces during machining operations.

It is the primary object of my invention to provide a quick-acting clamping device which in addition to utilizing a compressed fluid, such as air, for its clamping effect, also utilizes a mechanical advantage.

Other objects and advantages of my invention will be apparent during the course of the following description. In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a top plan view of a jig embodying the features of my invention;

Fig. 2 is a front elevation of the same;

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1 and showing the elevating piston structure;

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 1 and showing the mechanical elevating means;

Fig. 5 is a detail of the inner face of the cylinder head as taken on line 5—5 of Fig. 1;

Fig. 6 is a fragmentary cross-section taken on line 6—6 of Fig. 5;

Fig. 7 is a cross-sectional view of the control valve taken on line 7—7 of Fig. 2;

Fig. 8 is a detail view of the mounting face of the control valve taken as indicated by line 8—8 of Fig. 3, and

Fig. 9 is a fragmentary cross-section taken on line 9—9 of Fig. 8.

Referring more particularly to the drawings, the clamping device is seen to comprise a heavy cast iron base 10, having integrally formed therewith a cylinder block or body 11 of generally square contour.

The four corners of the block 11 are provided with cylindrical embossments 12 in which are secured heavy studs 13 which serve to support a top plate P shown in dotted outline in Fig. 1.

Located centrally of the block 11 is a clamping block 14 having a flat face 15 and having two diametrically opposed laterally extending ears 16 which are apertured as at 17.

The clamping block 14 is integral with an elevating bar 18 which is cylindrical in form and which depends vertically from the block 14 centrally thereof. The bar 18 is received in a bore 19 of the body 11 which extends through an embossment 20 on the body.

The bore 19 is counterbored to provide a cylinder 21 which forms an annular shoulder 22 against which is seated an oil seal 23 which embraces the bar 18. The elevating bar 18 has a lower threaded portion 24 of reduced diameter on which is mounted a piston assembly 25 having rings 26 which have wiping engagement with the wall of the bore 21. The piston assembly is secured to the bar 18 by means of a lock nut 27 which is threaded onto the portion 24 of the bar.

The lower open end of the bore 21 is closed by means

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of a cap 28 which is secured to the body 11 by fastening means such as screws 29. A leather gasket 30 is interposed between the cap 28 and the piston assembly 24 so as to provide a cushion for piston 25, the gasket being secured to the cap by means of screws 31. A circular recess 32 is provided in the cap 28 so as to provide a clearance for the lower end of the bar extension 24, this recess having a lateral extension 33 whose function will be described hereinafter.

To each ear 16 of the clamping block 14 is secured an elevating rod 34 which depends vertically from the ear 16. The lower end of the rod 34 is formed to provide an inclined or camming surface 35.

Each rod 34 is slidably received in a vertically extending bore 36 which is formed in an embossment 37 on the body 11 and which is bottomed within the body.

A horizontally extending bore 38 intersects the bore 36, the bore 38 being counterbored to provide a cylinder 39. A locking rod 40 is slidably received in the bore 38, and has integrally formed thereon a piston 41 having rings 42 which have wiping engagement with the wall of cylinder 39. An oil seal 43 is mounted on the rod 40 and seats against the shoulder 44 of the bore 39.

The end of the locking rod 40 is provided with an inclined or camming surface 45 which is parallel with surface 35 of elevating rod 34. In order to maintain the rod 40 in an operative position and prevent any angular rotation thereof, a guide pin 46 is secured to the body 11 so as to project into the bore 38 and lie in a longitudinal recess 47 formed on the underside of the rod 40. The pin 46 thereby prevents axial rotation of the rod 40.

The open ends of cylinders 39 are closed by means of a unitary cylinder head 48 which is secured to the body 11 by screws 49. Leather washers 50 are secured to the inner face 51 of the head 48 by means of screws 52 and these washers serve as cushions or shock absorbers for the pistons 41.

A fluid passageway or channel 53 extends horizontally from the cylinder wall 21 centrally through the body 11 to the face 51 of the cylinder head 48. An opening 54 is provided in the cylinder head in registry with channel 53.

Another horizontal passageway or channel 55 traverses the body from the wall of the other cylinder 39 and intersects the channel 53 at right angles thereto.

Immediately below channel 53 and extending parallel thereto is a channel 56 which extends horizontally from the face 51 of head 48 for a predetermined distance and then extends downward vertically into communication with the extension 33 of the recess 32 in the cap 28. An opening 57 is provided in the cylinder head 48 in registry with the channel 56. As best seen in Fig. 5, the face 51 of the cylinder head 48 is provided with recesses or grooves 58 which lead from aperture 57 to the cylinders 39.

For the purpose of controlling the operation of the clamping device, a control valve 59 is mounted on the cylinder head 48. As best seen in Figs. 3, 7 and 8, the valve consists of a valve body 60 which is secured to the head 48 by means of screws 61 which extend through the valve body.

The body 60 has a horizontally disposed threaded opening 62 which communicates with a bore 63 which extends at right angles thereto. The opening 62 is adapted to communicate with a source of compressed air or the like.

A cylindrical valve stem 64 is slidably received in the bore 63, the stem having portions 65 of reduced diameter which form an annular passageway 66 within the bore 63. Adjacent the portions 65 are the bearing portions 67, 68, 69 and 70.

A wick feed oiler 71 is mounted on the top of body 60 and communicates through tubes 72 and 73 with the opening 62.

The valve body 60 has formed therein four parallel horizontally extending passageways or channels 74, 75, 76 and 77 which extend from the mounting face 78 of the valve body 60 to the bore 63. The channel 74 communicates with a vertical channel 79, the channel 77 communicates with a vertical channel 80, and the channels 79 and 80 have a common outlet passageway 81.

Thumb screws 82 threadedly engage channels 79 and 80 and serve to control or limit the flow of fluid through channels 74 and 77 respectively.

As best seen in Fig. 8, the channel 75 communicates with a recess or groove 83 which, in turn, communicates with opening 57 in cylinder head 48. Likewise channel 76 intersects a groove 84 which communicates with aperture 54 in head 48.

In order to restrict the linear movement of the valve stem 64, a pin 85 is threadedly secured in valve body 60 and projects into bore 63 intermediate the stem portions 69 and 70.

The operation of the device will now be described.

By pulling valve stem 64 forward (to the right as seen in Fig. 7) compressed air, which has previously been blocked by portion 68, is permitted to flow around the annular space 66 in bore 63 and into channel 75. In this position of the valve stem the portion 67 blocks channel 74 and the portion 68 prevents the air from entering channel 76.

From 75 the air flows through groove 83 and aperture 57 into channel 56. The air flows through recess 33 in cap 28 and exerts pressure on piston 25, thereby causing elevating bar 18 to rise. When bar 18 rises, as shown in dotted lines in Fig. 3, it carries with it the rods 34 (as shown in dotted lines in Fig. 2).

Concurrently with the action of the air on bar 18, the grooves 58 in cylinder head 48 have permitted air to flow into bores 39 and thus urge pistons 41 to the left as seen in Fig. 4.

As soon as the bar 18 has elevated rods 34 to a point where the camming surfaces 35 and 45 can engage, the rod 40 moves the rod 34 mechanically and serves to supplement the fluid action as well as to prevent any retraction of the device. It will be apparent that the mechanical advantage obtained through the camming action, when added to the hydraulic or pneumatic forces present, exerts a tremendous clamping action.

It will be noted that during the process of elevation, the entrapped air in cylinders 39 exhausts through channel 55 which communicates with 53. The entrapped air in cylinder 21 exhausts through channel 53, aperture 54, groove 84 in the valve, channel 76 to bore area 66, channel 77, channel 80 and channel 81. The rate at which the clamping action proceeds can thus be controlled by manipulation of thumb screw 82.

To release the clamp, the valve stem 64 is pushed rearwardly (to the left in Fig. 7) thus exposing channels 74 and 76 and blocking channels 75 and 77. The compressed air then flows from 76 through groove 84 into aperture 54, channel 53 and channel 55. From channel 55 the air flows into cylinders 39 causing retraction of pistons 41. From channel 53 air flows into cylinder 21 retracting piston 25. The entrapped air in cylinders 21 and 39 reverses the inward flow previously described and exhausts through channels 75, 74, 79 and 81 in the valve 59. Again, by manipulation of thumb screw 82 the rate of release of the clamping device can be controlled.

During the operation of the clamping device, as described above, the pistons are automatically lubricated by means of the oiler 71. As the air surges through opening 62 in the valve 59, it has an aspirating effect on oiler tube 73 which is disposed in the path of the air. A fine mist of lubricant is thus carried by the air into the several

cylinders of the device. A check valve 86, which is interposed between oiler 71 and tube 73, serves to prevent the compressed air from backing up into the oiler. Thus each time that the clamping device is operated, the pistons and cylinder walls are coated with a thin film of finely dispersed lubricant.

Thus the foregoing structure not only develops great compressive strength due to the combination of pneumatic action and mechanical advantage, but, in addition, can easily be set to operate in any one of the following sequences:

- (a) Quick clamp-quick release,
- (b) Quick clamp-slow release,
- (c) Slow clamp-slow release, and
- (d) Slow clamp-quick release.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In a fluid-actuated device, the combination of a fluid motor including a piston, a load-engaging member fixedly connected to said piston for movement therewith, a second fluid motor including a second piston, control means for selectively actuating both said fluid motors, and a linearly movable camming element connected to said second piston for movement in a direction which traverses the path of movement of said load engaging member, said camming element being movable into motion-producing engagement with said load-engaging member in response to predetermined movement of said first-named piston toward load-engaging position.

2. In a fluid actuated device, the combination of a fluid motor including a piston, a load-engaging member fixedly connected to said piston for movement therewith, a second fluid motor including a second piston, means for selectively actuating both said fluid motors, a mechanical force-compounding member fixedly secured to said second piston for movement into the path of movement of said load-engaging member, and means provided on said load-engaging member and operatively engaged by said force-compounding member in response to predetermined movement of said load-engaging member toward load-engaging position, whereby said load-engaging member is driven into load-engaging position.

References Cited in the file of this patent

UNITED STATES PATENTS

492,931	Baird	Mar. 7, 1893
763,311	Mundy	June 21, 1904
770,270	Dehn	Sept. 20, 1904
1,164,519	Hill	Dec. 14, 1915
1,324,327	Turner	Dec. 9, 1919
1,430,359	Canion	Sept. 26, 1922
1,865,105	Houplain	June 28, 1932
2,130,618	Gnavi	Sept. 20, 1938
2,260,662	Farrell	Oct. 28, 1941
2,261,829	Cross	Nov. 4, 1941
2,365,148	Clark	Dec. 12, 1944
2,437,115	Muller	Mar. 2, 1948
2,443,775	Olson	June 22, 1948
2,560,283	Giesey	July 10, 1951
2,568,228	Forse	Sept. 18, 1951
2,573,333	Hillix	Oct. 30, 1951
2,597,126	Paterson	May 20, 1952
2,701,448	Johnson	Feb. 8, 1955