Jan. 18, 1955 L. C. MILLER 2,699,756

RECIPROCATING PNEUMATIC ACTUATOR FOR TOOLS

Filed Sept. 15, 1950 2 Sheets-Sheet 1

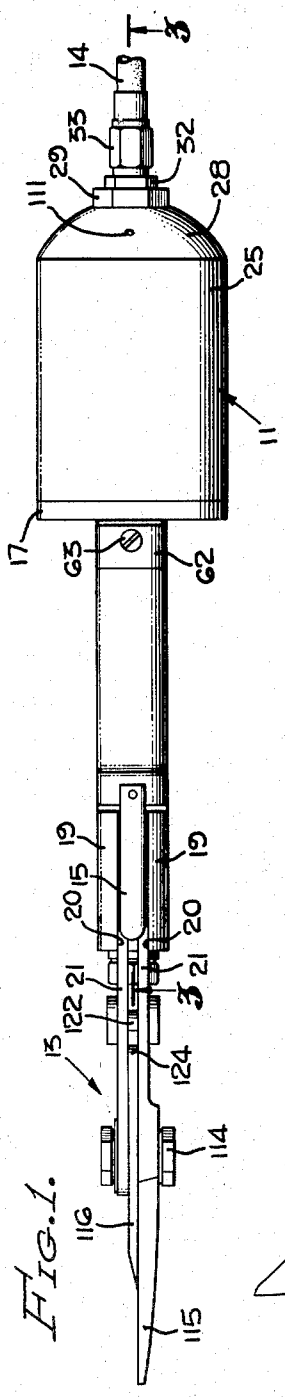


FIG. 1.

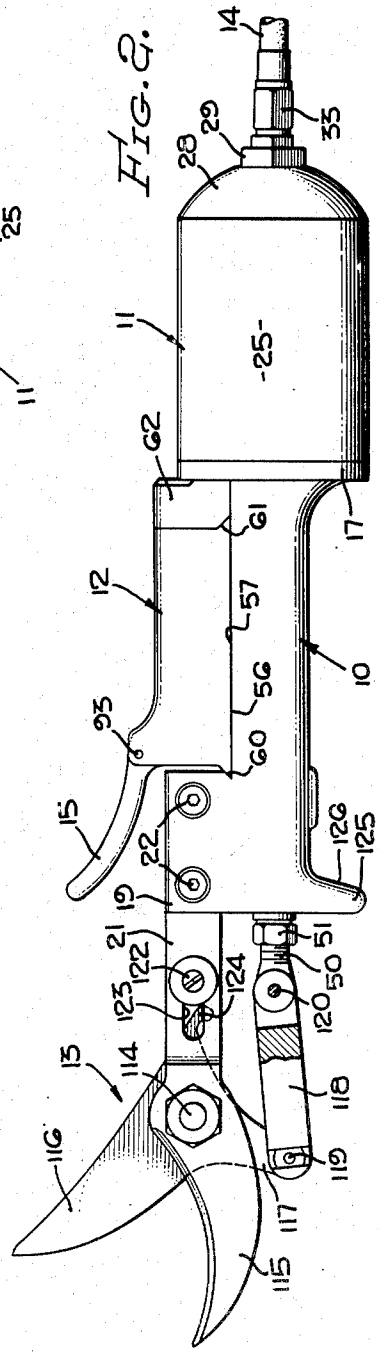


FIG. 2.

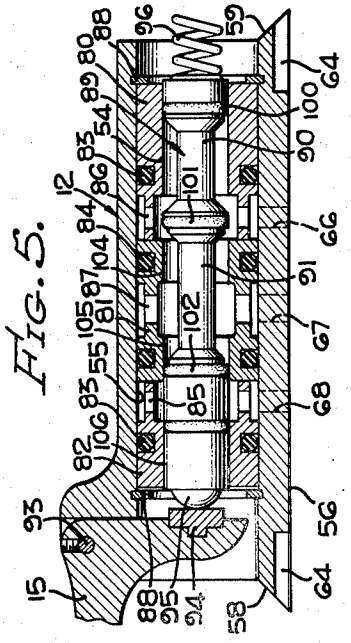


FIG. 5.

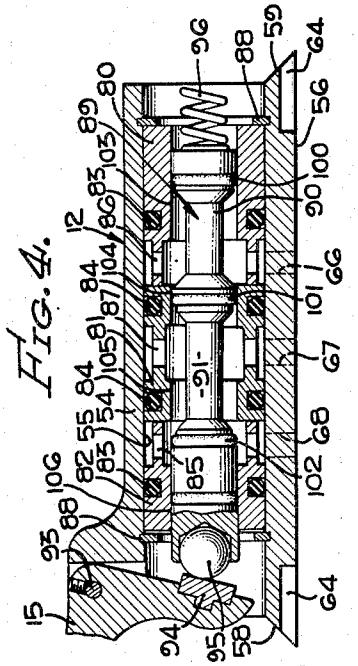


FIG. 4.

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Filed Sept. 15, 1950 2 Sheets-Sheet 2

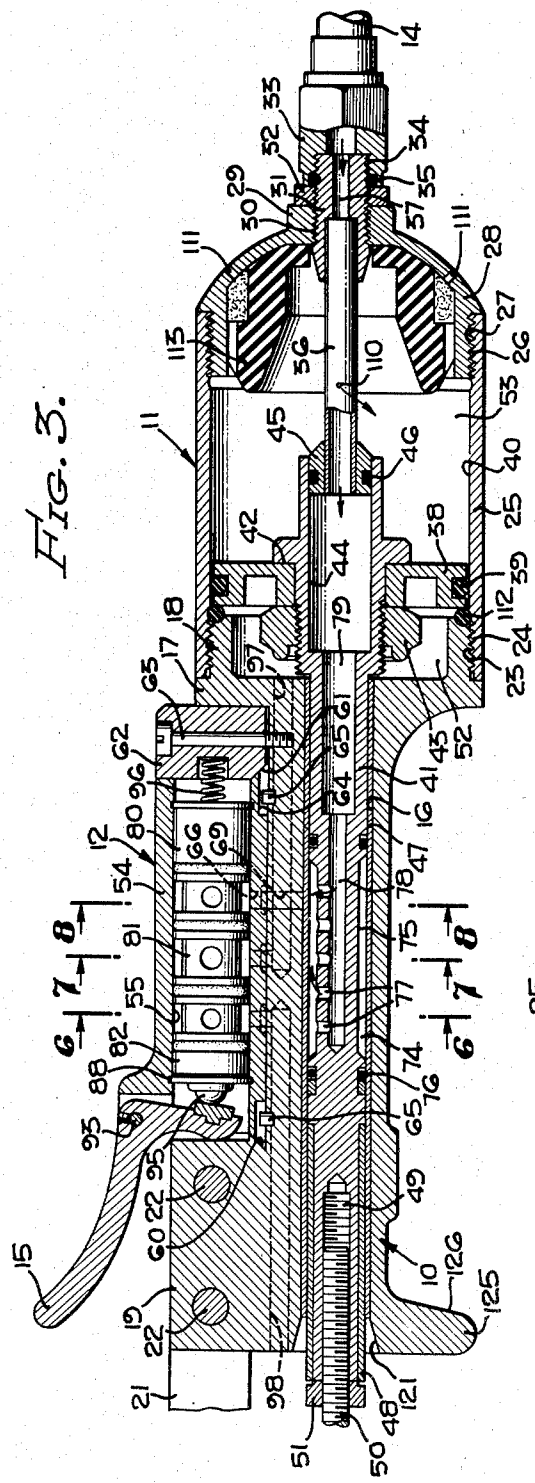


FIG. 5.

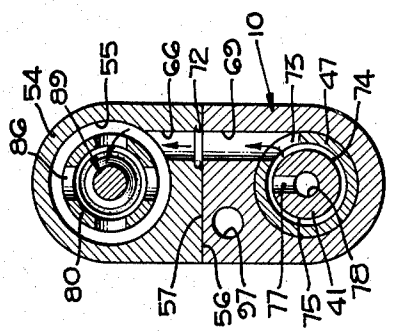


FIG. 8.

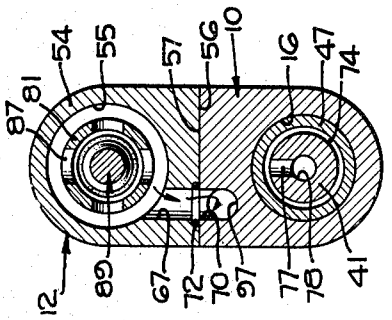


FIG. 7.

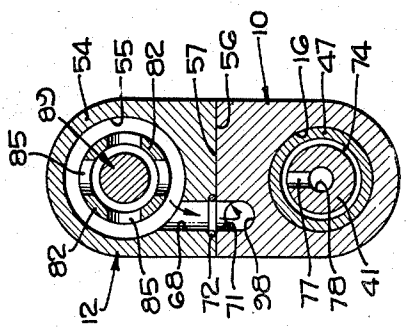


FIG. 6.

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RECIPROCATING PNEUMATIC ACTUATOR FOR TOOLS

Leonidas C. Miller, Los Angeles, Calif.

Application September 15, 1950, Serial No. 185,120

18 Claims. (Cl. 121—38)

This invention relates to a fluid driven actuator and is particularly directed to improvements in a pneumatic actuator for operating a tool such as, for example, a shear.

Among the objects of this invention are to provide a light-weight tool and actuator assembly adapted to be grasped in one hand and supported and operated thereby, to provide a device of this type in which a manually graspable section of the device is positioned between the tool support and the power cylinder, to provide a novel form of air system for applying power to one stroke of the tool and for returning the tool to its initial position without the use of springs, and to provide a novel form of valve assembly which is demountable as a unit from the manually graspable body portion of the device.

Other and more detailed objects and advantages will appear more fully hereinafter.

In the drawings:

Figure 1 is a plan view showing a preferred embodiment of my invention.

Figure 2 is a side elevation thereof partly broken away.

Figure 3 is a sectional elevation on an enlarged scale taken substantially on the line 3—3 as shown in Figure 1.

Figure 4 is a longitudinal sectional view partly broken away showing details of the valve assembly, the valve being in open position.

Figure 5 is a sectional view similar to Figure 4 showing the valve shifted to closed position.

Figures 6, 7 and 8 are transverse sectional views taken substantially on the lines 6—6, 7—7, and 8—8 respectively as shown in Figure 3.

Referring to the drawings, the device includes a manually graspable body portion 10, a power cylinder assembly 11, a control valve mechanism 12, and a power driven tool generally designated 13. The general plan of operation contemplates that fluid under pressure delivered by the supply line 14 causes a piston within the power cylinder assembly 11 to reciprocate and thereby operate the tool 13. This operation is under the control of the valve assembly 12 so that when the operating handle 15 is depressed the tool is actuated in one direction, and when the handle 15 is released the tool is actuated in the other direction.

The body 10 comprises an elongated section having an axial bore 16 extending longitudinally therethrough. One end of the body is formed with a circular flange 17 having a cylindrical projection 18 extending axially therefrom. The other end of the body is provided with a plurality of upstanding lugs 19 separated by a pair of axially extending slots 20. The tool 13 is provided with parallel support bars 21 which extend into the slots 20 between the lugs 19. These support bars 21 are fixed relative to the lugs 19 by means of clamping bolts 22. The cylindrical projection 18 is provided with external threads 23 to receive the internal threads 24 of the shell 25. The flange 17, projection 18 and shell 25 form a part of the power cylinder assembly 11.

The shell 25 is internally threaded at 26 to receive the external thread 27 on the end closure 28. The closure 28 is provided with a central boss 29 which is threaded at 30 to receive the threaded bushing 31. A lock nut 32 serves to anchor the bushing 31 with respect to the end closure 28. A fitting 33 serves to connect the pressure fluid supply line 14 with the bushing 31. This connection is accomplished by means of interengaging threads 34 and seal ring 35. A stationary tube 36 is fixed in the bushing 31 by any convenient means and extends axially of the power cylinder assembly 11. Fluid pressure supplied

from the line 14 passes directly into the interior of the tube 36 through the central passage 37 in the bushing 31.

A piston 38 is provided with a sealing ring 39 which slides in sealing engagement with the inner cylindrical surface 40 of the shell 25. The piston rod 41 is enlarged at one end and is provided with a shoulder 42. The piston 38 is fixed on the piston rod 41 and clamped against the shoulder 42 by means of a clamping nut 43.

The enlarged end of the piston rod 41 is provided with an axially extending cylindrical bore 44, and the annular seal plug 45 which is fixed on the end of the stationary tube 36 is slidably received within this bore 44. A seal ring 46 is provided to prevent leakage. The seal plug 45 acts as a piston within the cylindrical bore 44. The piston rod 41 reciprocates within the cylindrical bushing 47 which is fixed within the bore 16 in the body member. The forward end of the piston rod is provided with a hardened sleeve 48 which fits within the bushing 47. The piston rod is provided with internal threads 49 at its forward end to receive an externally threaded actuating rod 50. A lock nut 51 secures the actuating rod 50 in selected position with respect to the piston rod 41.

The piston 38 serves to divide the power cylinder assembly into a forward chamber 52 and a rear chamber 53. Means are provided for alternately pressurizing and venting the forward chamber 52, and as shown in the drawings this means includes the detachable valve assembly unit 12. This unit 12 includes a housing 54 provided with a cylindrical bore 55. The housing 54 is rounded on its upper portion, and its lower edge 56 is formed in an axially extending plane as shown clearly in Figures 6–8. The housing 54 and body 10 cooperate to provide a handle grip which may be grasped manually in one hand for supporting the device. The flat surface 56 on the housing is machined to fit the corresponding flat surface 57 provided on the body 10. The ends of the housing 54 adjacent the lower horizontal surface 56 are bevelled as shown at 58 and 59. The bevelled surface 58 is received within the corresponding notch 60 provided on the body 10 and the bevelled surface 59 is engaged by the corresponding bevelled surface 61 provided on the lug 62. The lug 62 is anchored to the body 10 by means of the threaded element 63. From this description it will be understood that the valve housing may be disassembled from the body by first removing the lug 62, sliding the valve assembly 12 toward the power cylinder assembly 11 to disconnect the bevelled surfaces 58 and 60, and then lifting the valve assembly 12 radially away from the body 10. Assembly of the parts is accomplished in the inverse order. The ends of the housing 54 may be grooved as shown at 64 for reception of the dowels 65 secured on the body 10.

A plurality of lateral ports are provided in the housing 54, and each of these ports extends from the axial bore 55 downward through the horizontal surface 56. The fluid inlet port is designated 66, the delivery port for delivering fluid to the chamber 52 is designated 67, and the vent port for exhausting fluid from the chamber 52 is designated 68. Each of these ports communicates with an aligned corresponding port provided in the body 10. Thus port 66 is aligned with port 69, port 67 is aligned with port 70, and port 68 is aligned with port 71. A seal ring 72 may be provided at the junction of each of the ports to prevent leakage.

The port 69 in the body 10 communicates with a lateral opening 73 provided in the guide bushing 47. The side opening 73 in turn communicates with the annular space 74 provided by the externally grooved portion 75 of the piston 41. Seal rings 76 are provided on the piston on opposite sides of the grooved portion 75 to prevent leakage. A plurality of lateral openings 77 are provided in the piston 41 establishing communication between the central bore 78 in the piston 41 and the annular space 74. The central bore 78 communicates with the bore 44 in the piston by way of the intermediate connecting bore 79. From this description it will be understood that fluid pressure delivered into the bore 44 by the stationary tube 36 passes inward through bores 79 and 78 and through lateral ports 77 into the annular space 74. The fluid pressure then passes outward through side opening 73 in guide bushing 77 and then passes through aligned ports 69 and 66 into the central bore 55 in the valve housing

54. Longitudinal passage 97 in the body 10 communicates between the chamber 52 and the lateral port 70. Longitudinal passage 98 in the body 10 connects the lateral vent port 71 to atmosphere.

A plurality of stationary annular elements is provided within the bore 55 of the valve housing 54. These elements preferably comprise three ported rings 80, 81 and 82. The inner and outer rings 80 and 82 are provided with a single sealing ring 83 engaging the bore 55, while the central sealing ring 81 is provided with axially spaced sealing rings 84 engaging the central bore 55. A lateral port 85 in the ring 82 communicates with the housing port 68. Similarly, a lateral port 86 in the ring 80 communicates with the housing port 66. A central port 87 in the central ring 81 communicates with the housing port 67. A pair of retainer rings 88 are mounted in grooves provided in the valve housing 54 and serve to prevent axial movement of the rings 80, 81 and 82.

An axially movable valve element 89 is positioned within the rings 80, 81 and 82. This element 89 comprises essentially a pair of spool portions 90 and 91 joined end-to-end and operable as a unit. Three spaced sealing rings 100, 101 and 102 are mounted on the movable element 89, and these sealing rings engage within cylindrical "land" portions 103, 104, 105 and 106 which are formed by the internal bores of the individual stationary rings 80, 81 and 82. When the movable valve element 89 is in the position shown in Figure 4 the delivery port 67 is placed in communication with the vent port 68, while the inlet port 66 is closed off by contact of the seals 100 and 101 with the lands 103 and 104 on the stationary annular rings 80 and 81. When the movable valve element 89 is shifted to the position shown in Figure 5 the inlet port 66 is placed in communication with the delivery port 67 while the vent port 68 is closed off by means of the contact of seals 102 and 92 with the lands 105 and 106 on the stationary rings 81 and 82.

Means are provided for shifting the valve element 89 axially between the position shown in Figure 4 and Figure 5. As shown in the drawings, this means includes the operating lever 15 which is connected to the valve housing 54 by means of pivot 93. A hardened insert 94 on the lever engages a steel ball 95 secured to one end of the element 89. A coil spring 96 is positioned between the other end of the element 89 and the lug 62. The spring 96 serves to return the element 89 to the open position shown in Figure 4 when the operator (not shown) releases the operating lever 15.

When the operating lever 15 is in the position shown in Figures 1–4, fluid pressure is blocked off by the engagement of the seals 100 and 101 with stationary contact rings 80 and 81 so that no pressure is applied to the chamber 62, but on the contrary this chamber is vented to atmosphere through passages 97 and 98.

When the operating lever 15 is manually depressed the movable valve element 89 is shifted to the right as viewed in the drawings to the position shown in Figure 5. In this position of the valve element, fluid under pressure passes through inlet port 66 and out through delivery port 67 into the aligned body port 70 and into the passageway 97 to the chamber 52. Fluid under pressure is thus applied against the left side of the piston 38 as viewed in Figure 3. A seal ring 112 may be provided to prevent escape of pressure along the threads 23—24. The piston 38 moves to the right because the effective area of the forward chamber 52 is greater than the effective cross-section area of the bore 44. The unit pressure within the bore 44 is approximately the same as the unit pressure within the forward chamber 52, but since the effective area of the latter is considerably greater the piston moves to the right on its power stroke. When the operating lever 15 of the control valve assembly 12 is released, the forward chamber 52 is vented to atmosphere through passageways 97 and 98. The same unit pressure within the bore 44 then moves the piston 38 back to its initial position on the return stroke.

In order to accomplish rapid venting of the rear chamber 53 and rapid repressuring to prevent sluggishness on the return stroke, I prefer to provide a small bleed port 110 extending through the wall of the stationary tube 36, and I further provide a plurality of ports 111 extending through the wall of the end closure 28. When the piston 38 moves to the right as viewed in Figure 3 air pressure within the rear chamber 53 is exhausted through the ports 111, and when the piston 38 is moved to the left the rear chamber 53 is repressurized by air passing inwardly through the ports 111 and by air supplied from the bleed port 110. The bleed port 110 is so small in comparison with the area of ports 111 that the pressure in the rear chamber 53 does not build up above atmospheric pressure except when the piston 38 moves to the right.

In the particular embodiment of my invention illustrated in the drawings the bore 44 is larger in diameter than the inner diameter of the bushing 47, but these relative dimensions are illustrative only and the bore 44 could be made smaller if desired.

A resilient cushion or bumper 113 may be provided within the power cylinder assembly 11 and mounted on the end closure 28. This bumper may be formed of natural or synthetic rubber and acts to cushion the deceleration of the piston 38 at the end of its power stroke. The piston 38 engages the rubber bumper 113 in direct contact.

While the pneumatic actuator as described above may be used in connection with any one of a number of different types of tools, I have chosen to illustrate it in connection with a pruning shear. This shear designated 13 includes the stationary bars 21 which carry the pivot bolt 114 at their outer ends. One of the bars 21 is provided with a stationary shear blade 115. A movable shear blade 116 is pivoted on the bolt 114 between the bars 21 and provided with a radially extending crank arm 117. A link 118 is pivotally connected to the crank arm 117 at 119 and is pivotally connected at 120 to the actuating rod 50. As described above this actuating rod 50 is directly connected to the piston rod 41. When the piston rod 41 is extended the movable shear blade 116 is moved to the position shown in Figure 2. When the piston rod is restricted on the power stroke the link 118 moves the blade 116 toward the blade 115, as will be readily understood. Since the movable shear blade 116 is located between the bars 21 it is centrally positioned with respect to the piston rod 41 and link 118. No offset is present and hence the force on the power stroke does not subject any of the parts to bending action. A counterbore 121 is provided at the forwerd end of the body 10 to provide clearance for the nut 51 on the power stroke.

A movable stop 122 may be mounted on the support bars 21 so as to limit the opening movement of the shear blade 116 when desired. This stop 122 may be moved along the horizontal slots 123 provided in the bars 21 so that in one position it is engaged by the lug 124 provided on the shear blade 116. If it is desired to have the movable shear blade 116 move through its maximum arc of travel the stop 122 is shifted to the position shown in Figure 2 so that it is clear of the path of travel of the lug 124.

The size and shape of the body 10 is such that it may be readily grasped in the palm of the hand of an operator, and so that the operating lever 15 may be moved by the index and medial fingers. A squeezing action of these fingers depresses the operating lever and causes the movable shear blade 116 to move through its power stroke. When the fingers of the operator are relaxed, the return spring 96 moves the operating lever back to its initial position and the movable shear blade 116 is returned to open position. A laterally extending lug 125 is provided on the forward end of the body 10 opposite the lugs 19, and this lug is proportioned so that the hand of the operator may rest against its surface 126.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, means at the other end of the body for connecting said body to a tool, the body having an axially extending central grip portion intermediate its ends shaped to be manually grasped by an operator whereby the actuator may be supported by one hand, a control valve assembly mounted on and forming a part of said central grip portion of the body and having an axially extending movable valve element mounted within the outer surface of the grip portion, the power cylinder assembly including a piston mounted for reciprocation within the shell and

having a piston rod extending axially through the body, means for connecting the piston rod to actuate the tool, means for delivering a fluid under pressure to the control valve assembly, and passage means in the body for delivering fluid under pressure from the control valve assembly to said power cylinder assembly.

2. In a portable pneumatic actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, means at the other end of the body for releasably connecting said body to a tool, the body having an axially extending central grip portion intermediate its ends shaped to be manually grasped by an operator whereby the actuator may be supported by one hand, a control valve assembly removably mounted on and forming a part of said central grip portion of the body and having an axially extending movable valve element mounted within the outer surface of the grip portion, the power cylinder assembly including a piston mounted for reciprocation within the shell and having a piston rod extending axially through the body, means for connecting the piston rod to actuate the tool, means for delivering air pressure to the control valve assembly, and passage means in the body for delivering air pressure from the control valve assembly to said power cylinder assembly.

3. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, support lugs at the other end of the body, means for releasably connecting said support lugs to a tool, the body having an axially extending central grip portion intermediate the cylindrical extension and support lugs shaped to be manually grasped by an operator whereby the actuator may be supported by one hand, a control valve assembly removably mounted on and forming a part of said grip portion of the body, the power cylinder assembly including a piston mounted for reciprocation within the shell and having a piston rod extending axially through the body, the control valve assembly including a movable valve element mounted within the outer surface of the grip portion and extending parallel to the piston rod, means for connecting the piston rod to actuate the tool, means for delivering a fluid under pressure to the control valve assembly, and passage means in the body for delivering fluid under pressure from the control valve assembly to said power cylinder assembly.

4. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, support elements at the other end of the body for connecting said body to a tool, the body having an axially extending central grip portion intermediate the cylindrical extension and support elements whereby the operator may support the actuator with one hand, a control valve assembly removably mounted on and forming a part of said grip portion of the body, said control valve assembly including a movable valve element adapted to be actuated by the same hand the power cylinder assembly including a piston mounted for reciprocation within the shell and having a piston rod extending axially through the body to drive the tool, a fluid pressure inlet fitting fixed to an end of the power cylinder assembly remote from the body, means forming a passage for delivering a fluid under pressure from the inlet fitting to the control valve assembly, and the body having a passage for delivering fluid under pressure from the control valve assembly to said power cylinder assembly to drive the piston.

5. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, support elements at the other end of the body for connecting said body to a tool, the body having a central portion intermediate the cylindrical extension and support elements, a control valve assembly removably mounted on said intermediate portion of the body, the power cylinder assembly including a piston mounted for reciprocation within the shell and having a piston rod extending axially through the body to drive the tool, the piston rod having an axial opening therein, a stationary axial pressure supply tube on the power cylinder assembly forming a sliding seal with said piston rod opening, ports in the piston rod and body establishing communication between the piston rod opening and the control valve assembly, and the body having a passage for delivering fluid under pressure from the control valve assembly to said power cylinder assembly to drive the piston.

6. In a fluid-driven actuator, the combination of: a cylinder, a member comprising a piston reciprocable in said cylinder and a piston rod secured to the piston, the member defining within the cylinder a forward chamber and a rear chamber, the member having an axial bore, an axial tube secured against axial movement relative to the cylinder and projecting into the rear chamber, an element fixed on the tube slidably received in the said axial bore and forming a seal therewith, means for delivering a fluid under pressure into said axial tube, the piston rod having a longitudinal passage communicating with said axial bore and having a lateral port therein, and means for delivering pressure fluid from said lateral port to said forward chamber and for venting said forward chamber to atmosphere.

7. In a fluid-driven actuator, the combination of: a cylinder, a member comprising a piston reciprocable in said cylinder and a piston rod secured to the piston, the member defining within the cylinder a forward chamber and a rear chamber, the member having an axial bore, an axial tube secured against axial movement relative to the cylinder and projecting into the rear chamber, an element fixed on the tube slidably received in the said axial bore and forming a seal therewith, means for delivering a fluid under pressure into said axial tube, the piston rod having a longitudinal passage communicating with said axial bore and having a lateral port therein, and means including a valve assembly secured relative to the cylinder for delivering pressure fluid from said lateral port to said forward chamber and for venting said forward chamber to atmosphere, whereby the piston is moved in one direction by pressure in the forward chamber and is moved in the other direction by the pressure in said axial bore.

8. In a fluid-driven actuator, the combination of: a primary cylinder, a member comprising a primary piston reciprocable in said primary cylinder and a piston rod secured to the primary piston, the member defining within the primary cylinder a forward chamber and a rear chamber, the member having an axial bore forming a secondary cylinder, an axial tube secured against axial movement relative to the primary cylinder and projecting axially into the rear chamber, a secondary piston fixed on the tube slidably received in the secondary cylinder and forming a seal therewith, means for delivering a fluid under pressure into said axial tube, the piston rod having a longitudinal passage communicating with the secondary cylinder, means including valve means for delivering pressure fluid from said longitudinal passage to said forward chamber and for venting said forward chamber to atmosphere, whereby the primary piston is moved in one direction by pressure in the forward chamber and is moved in the other direction by the pressure in said secondary cylinder.

9. In a fluid-driven actuator, the combination of: a relatively large cylinder, a member comprising a large piston reciprocable in said large cylinder and a piston rod secured to the large piston, the member defining within the large cylinder a forward chamber and a rear chamber, the member having an axial bore forming a small cylinder, an axial tube secured against axial movement relative to the large cylinder and projecting axially into the rear chamber, a small piston fixed on the tube slidably received in the small cylinder and forming a seal therewith, means for delivering a fluid under pressure into said axial tube, the piston rod having a longitudinal passage communicating with the small cylinder, means including valve means for delivering pressure fluid from said longitudinal passage to said forward chamber whereby the large piston is moved in one direction by pressure in the forward chamber while opposed by pressure in the small cylinder, said means also acting to vent said forward chamber whereby the large piston is moved in the other direction by pressure in the small cylinder.

10. In a pneumatic actuator, the combination of: a power cylinder assembly, the assembly including a cylinder and a piston reciprocable in the cylinder and defining within the cylinder a forward chamber and a rear chamber, a hollow piston rod secured to the piston and extending through one end of the power cylinder assembly, the piston rod being closed at its extending end, axially extending telescoping parts on the piston

and cylinder for delivering pressure fluid into said hollow piston rod, one of said parts extending into the rear chamber, passage means including a lateral port in the hollow piston rod for delivering pressure fluid from the interior of the piston rod to said forward chamber, whereby the piston may be moved in one direction on a power stroke, the telescoping parts forming a smaller piston and cylinder assembly constantly acting to move the piston in the other direction, whereby the piston may be returned to its initial position upon blocking of the said passage means and venting of the forward chamber.

11. In a pneumatic actuator, the combination of: a power cylinder assembly, the assembly including a cylinder and a piston reciprocable in the cylinder and defining within the cylinder a forward chamber and a rear chamber, a hollow piston rod secured to the piston and extending through one end of the power cylinder assembly, the piston rod being closed at its extending end, axially extending telescopic parts on the piston and cylinder for delivering pressure fluid into said hollow piston rod, one of said parts extending into the rear chamber, a control valve assembly, passage means including a lateral port in the hollow piston rod for delivering pressure fluid from the interior of the piston rod to said control valve assembly, passage means establishing communication between the control valve assembly and the forward chamber, whereby the piston may be moved in one direction on a power stroke, one of the telescoping parts forming a smaller piston and cylinder assembly constantly acting to move the piston in the other direction, whereby the piston may be returned to its initial position upon blocking of the said passage means and venting of the forward chamber.

12. In a pneumatic actuator, the combination of: a power cylinder assembly, the assembly including a cylinder and a piston reciprocable in the cylinder and defining within the cylinder a forward chamber and a rear chamber, a hollow piston rod secured to the piston and extending through one end of the power cylinder assembly, the piston rod being closed at its extending end, an axially immovable tube extending axially into the rear chamber from the other end of the power cylinder assembly, an element fixed on the tube received within the hollow piston rod and forming a seal therewith, means for delivering pressure fluid into said tube and passage means including a lateral port in the hollow piston rod for delivering pressure fluid from the interior of the piston rod to said forward chamber.

13. In a pneumatic actuator, the combination of: a power cylinder assembly, the assembly including a cylinder and a piston reciprocable in the cylinder and defining within the cylinder a forward chamber and a rear chamber, a hollow piston rod secured to the piston and extending through one end of the power cylinder assembly, the piston rod being closed at its extending end, an axially immovable tube extending axially into the rear chamber from the other end of the power cylinder assembly, an element fixed on the tube received within the hollow piston rod and forming a seal therewith, means for delivering pressure fluid into said tube, a control valve assembly fixed relative to the cylinder, means including a lateral port in the hollow piston rod for delivering pressure fluid from the interior of the piston rod to said control valve assembly, and passage means establishing communication between the control valve assembly and the forward chamber.

14. In a pneumatic actuator, the combination of: a power cylinder assembly, the assembly including a cylinder having an end closure, the assembly also including a piston reciprocable in the cylinder and defining within the cylinder a forward chamber and a rear chamber, a hollow piston rod member secured to the piston and extending through the forward end of the power cylinder assembly, the piston rod being closed at its extending end, an axially immovable tube member extending axially into the rear chamber through said end closure, an element fixed on the tube member and received within the hollow piston rod member to form a sliding seal therewith, means for delivering pressure fluid into said tube member, means including a lateral port in the hollow piston rod for delivering pressure fluid from the interior of the piston rod to said forward chamber, whereby the piston may be moved in one direction on a power stroke, and an annular distortable bumper carried upon the end closure encircling the stationary tube and engaged by the piston at the end of its power stroke.

15. In a device of the class described, a body, a power cylinder assembly secured to the body at one end, a central opening extending axially through the body, the power cylinder assembly including a reciprocable piston, a piston rod secured to the piston and extending through said central opening in the body, means for delivering a fluid under pressure into said power cylinder assembly to move the piston axially, said means including a unitary control valve assembly, said assembly including an axially extending housing having a longitudinally extending side surface, the body having a complementary axially extending side surface to receive the housing, the body and housing cooperating to provide a handle grip which may be grasped manually in one hand for supporting the device, means for detachably securing the housing on the body with said housing surface and body face in mutual contact, a plurality of ports in the housing extending to said flat surface, a plurality of corresponding ports in the body extending to said face and each aligned with one of said housing ports, a movable valve element mounted within said housing, a valve operating lever movably mounted on the housing at a location remote from said power cylinder for actuating the valve element, passage means including one of said pair of aligned ports for delivering fluid under pressure from the control valve assembly to the power cylinder assembly, and passage means including another pair of aligned ports for venting the power cylinder assembly to atmosphere.

16. In a device of the class described, a body, a power cylinder assembly secured to the body at one end, a central opening extending axially through the body, the power cylinder assembly including a reciprocable piston, a piston rod secured to the piston and extending through said central opening in the body, means for delivering a fluid under pressure into said power cylinder assembly to move the piston axially, said means including a unitary control valve assembly, said assembly including an axially extending housing having a substantially flat surface, the body having a complementary axially extending flat face to receive the housing, the body and housing cooperating to provide a handle grip which may be grasped manually in one hand for supporting the device, wedge means for securing the housing relative to the body, a plurality of ports in the housing extending to said flat surface, a plurality of corresponding ports in the body extending to said flat face and each aligned with one of said housing ports, an axially movable valve element mounted within said housing, a valve operating lever movably mounted on the housing at a location remote from said power cylinder for actuating the valve element, passage means including one of said pair of aligned ports for delivering fluid under pressure from the control valve assembly to the power cylinder assembly, and passage means including another pair of aligned ports for venting the power cylinder assembly to atmosphere.

17. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly connected to one end of the body, means at the other end of the body for connecting said body to a tool, the body having an axially extending central portion intermediate at its ends shaped to be manually grasped by an operator whereby the actuator may be supported by one hand, a control valve assembly mounted on said intermediate portion of the body and having a part manually operable by the same hand, the power cylinder assembly including a piston rod extending axially through the body for operating the tool, a fluid inlet fitting mounted centrally on an end of the power cylinder assembly remote from the body, passage means extending centrally of the power cylinder assembly for delivering fluid from the inlet fitting to the control valve assembly, and means for delivering fluid from the control valve assembly to the power cylinder assembly.

18. In a portable fluid-driven actuator for a tool, the combination of: a body, a power cylinder assembly including a cylindrical shell, a cylindrical extension at one end of the body for connecting the body to the shell, support elements at the other end of the body for connecting said body to a tool, the body having an axially extending central grip portion intermediate the cylindrical extension and support elements whereby the operator may support the actuator with one hand, a control valve

assembly removably mounted on and forming a part of said grip portion of the body, said control valve assembly including a movable valve element adapted to be actuated by the same hand, the power cylinder assembly including a piston mounted for reciprocation within the shell and having a piston rod extending axially through the body to drive the tool, a fluid pressure inlet fitting fixed to an end of the power cylinder assembly remote from the body, means forming a passage extending centrally of the shell and piston for delivering a fluid under pressure from the inlet fitting to the control valve assembly, and the body having a passage for delivering fluid under pressure from the control valve assembly to said power cylinder assembly to drive the piston.

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