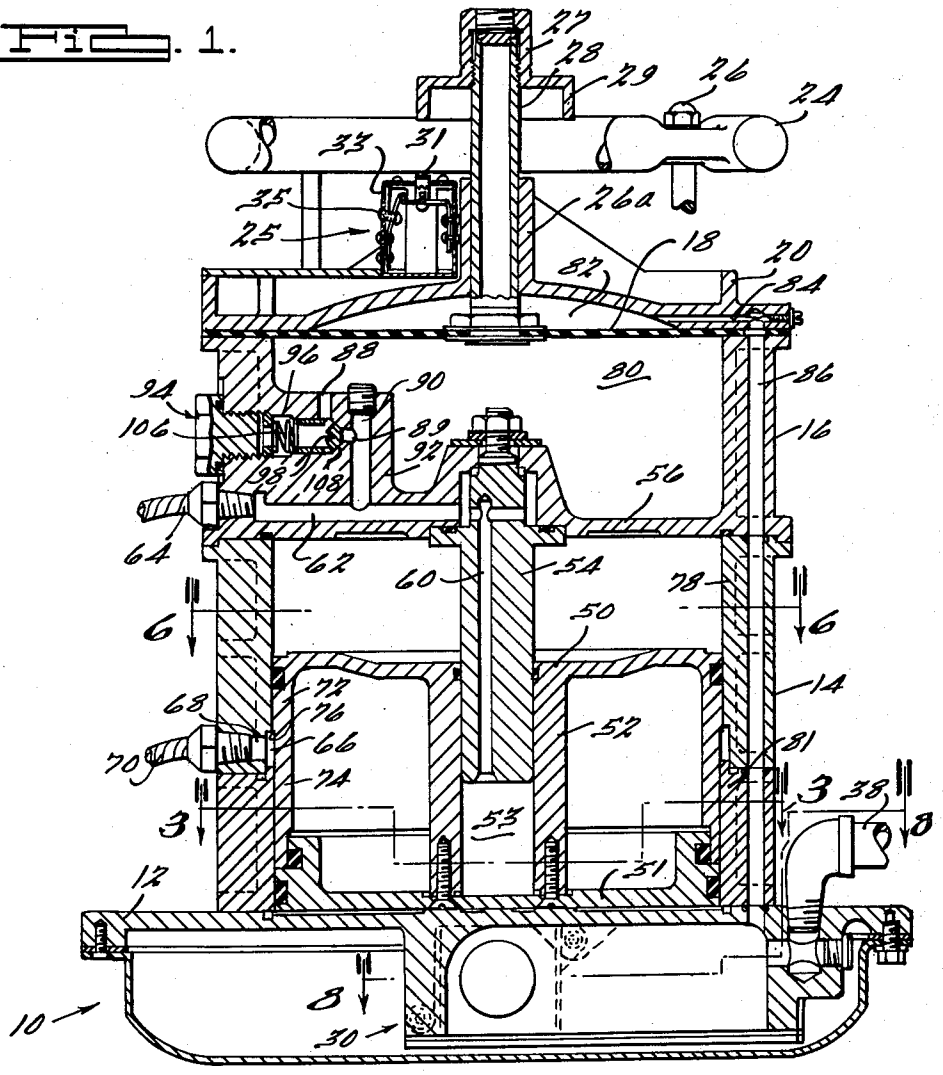
Dec. 31, 1963 G. J. VAN HECKE 3,115,752

FASTENER APPLYING TOOL AND POWER UNIT THEREFOR

Original Filed April 18, 1958 5 Sheets-Sheet 1

FIG. 1.



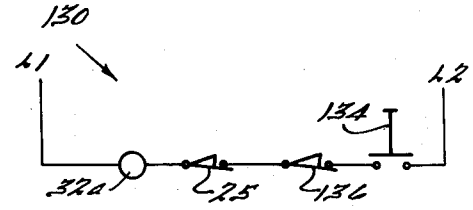


FIG. 11.

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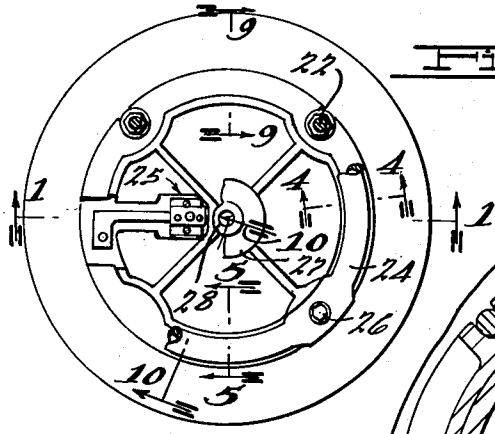


FIG. 2.

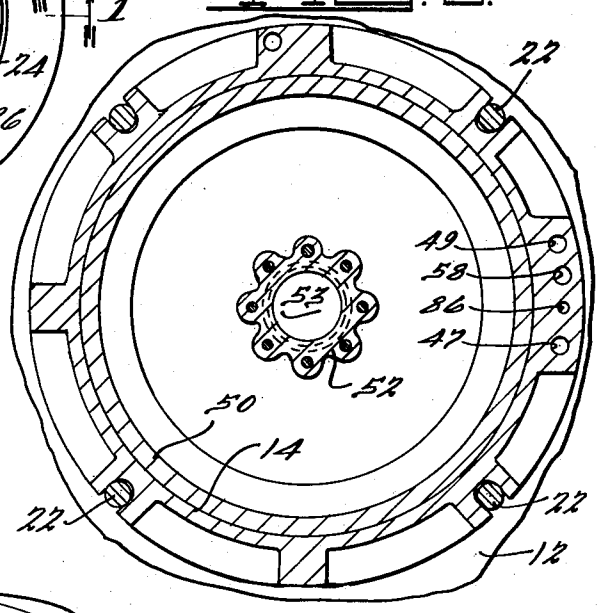


FIG. 3.

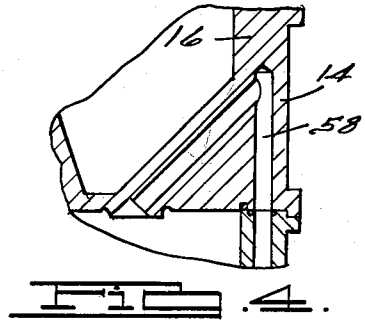


FIG. 4.

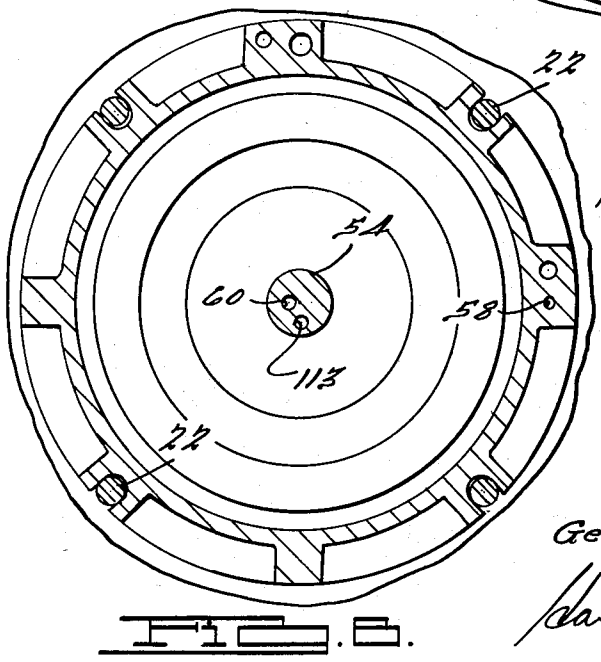
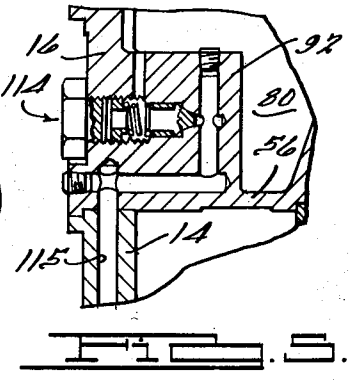


FIG. 5.



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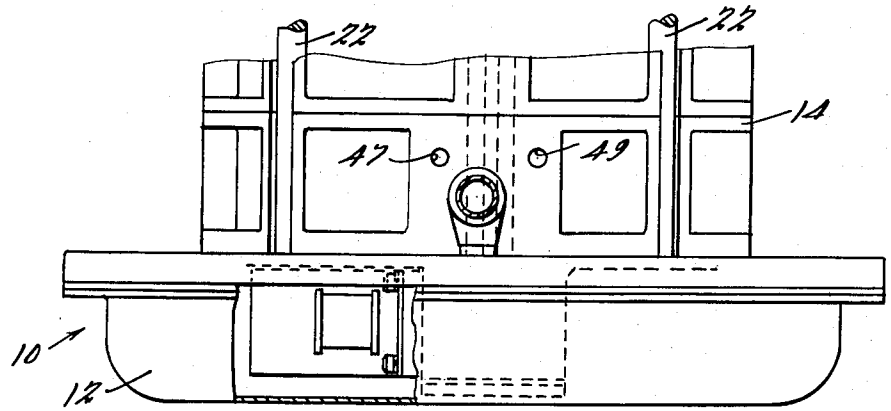

FIG. 7.

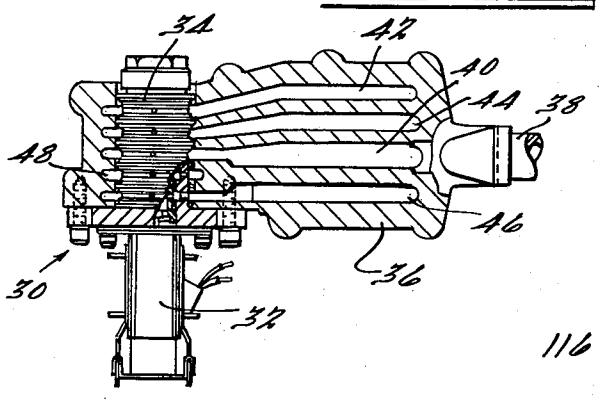

FIG. 8.

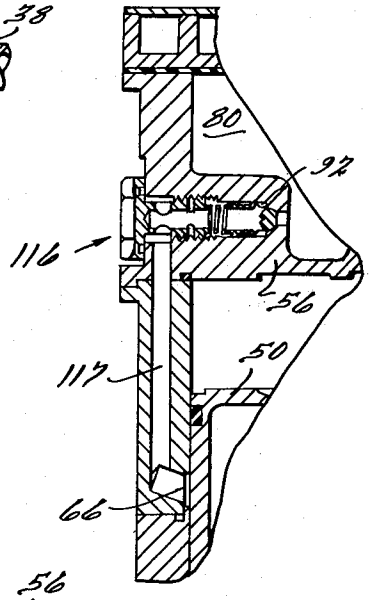

FIG. 9.

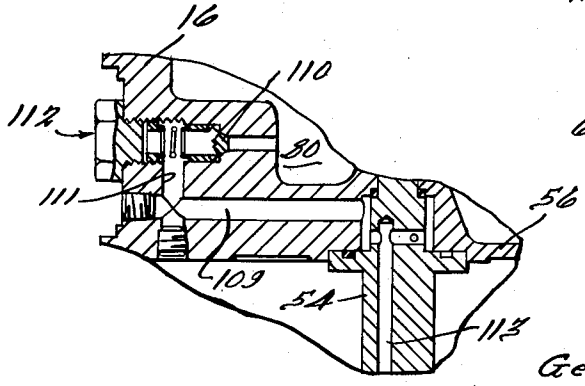

FIG. 10.

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Fig. 12

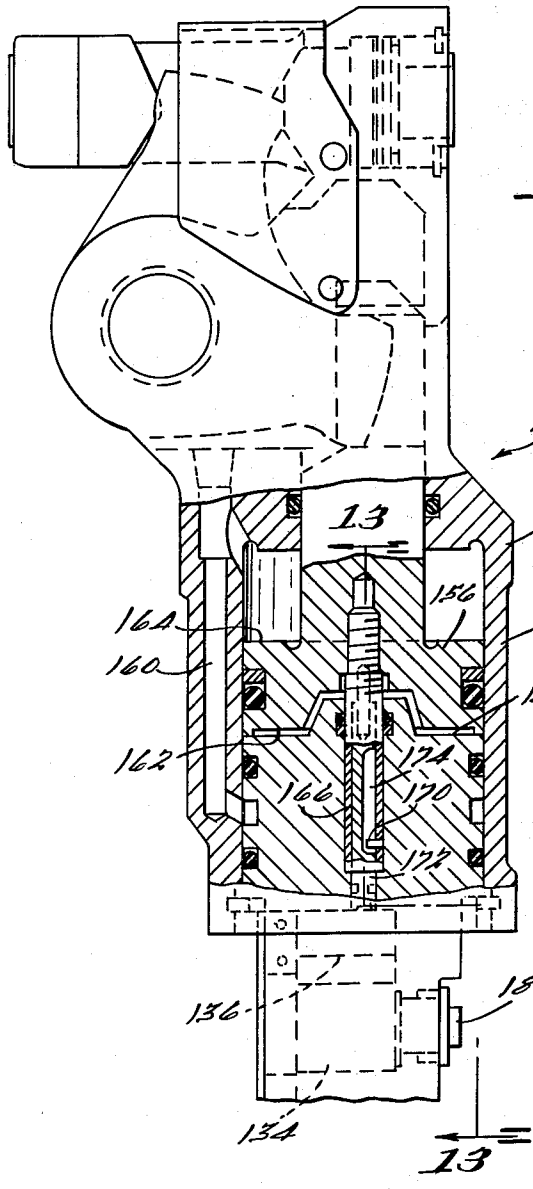
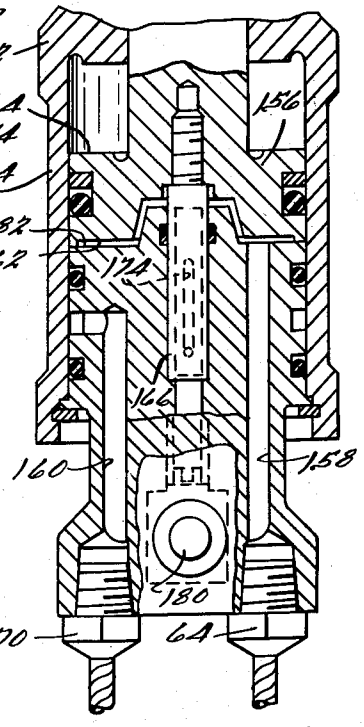


Fig. 13.



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FASTENER APPLYING TOOL AND POWER UNIT THEREFOR

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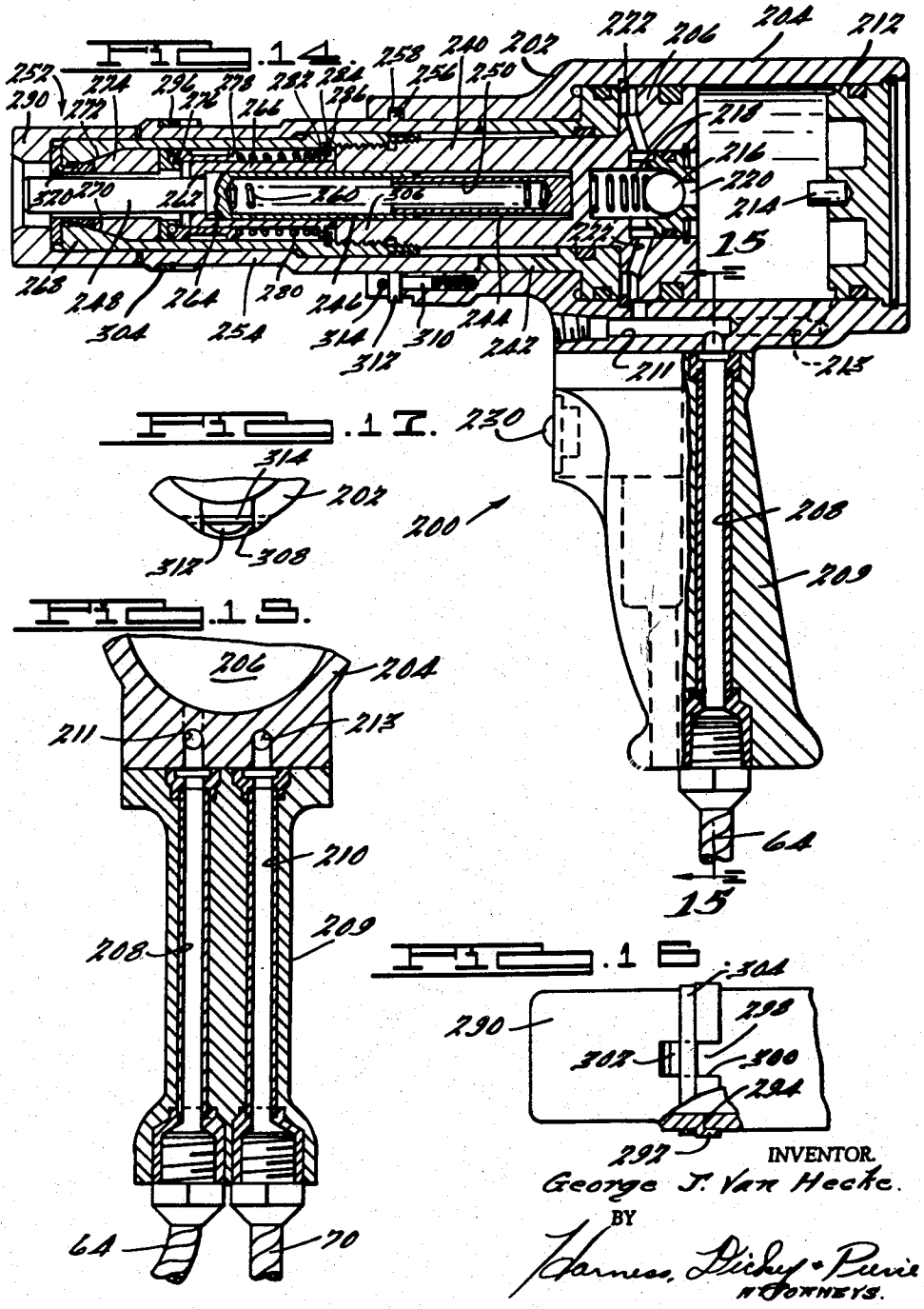

United States Patent Office

3,115,752

Patented Dec. 31, 1963

3,115,752
FASTENER APPLYING TOOL AND POWER UNIT THEREFOR

George J. Van Hecke, Detroit, Mich., assignor to Huck Manufacturing Company, Detroit, Mich., a corporation of Michigan

Original application Apr. 18, 1958, Ser. No. 729,349, now Patent No. 3,052,099, dated Sept. 4, 1962. Divided and this application Mar. 30, 1962, Ser. No. 192,300

10 Claims. (Cl. 60—54.5)

This invention relates generally to mechanisms for applying fasteners and more particularly to a fastener applying tool and a hydraulic power unit for a fastener driving tool.

This application is a divisional application of the copending application of George J. Van Hecke, Serial No. 729,349, filed April 18, 1958, now Patent No. 3,052,099.

The fastener applying tools of the type to which this invention relates are fluid operated and are for driving fasteners of types such as the ones having a pin and a collar which is cold-swaged tightly into locking grooves in the pin. Each tool, therefore, includes an anvil engageable with the collar and a multiple jaw assembly engageable with pulling grooves on the pin. Either the anvil, the jaw assembly, or both parts, are moved so as to provide for a relative movement of the parts in opposite directions. The structure for accomplishing this relative movement includes a cylinder formed in the gun and a piston mounted in the cylinder for reciprocal movement. On movement of the piston in one direction, the tool anvil and jaw assembly are moved relative to each other to provide for driving of the fastener. The piston is then moved in an opposite direction to return the anvil and the jaw assembly to relative positions in which the tool is set for another driving operation.

In the tools now in use commercially, the structure for reversing the direction of travel of the piston consists of a valve mechanism assembled in the driving tool. Such a tool is, therefore, complex, heavy, and subject to mechanical mis-adjustments. Furthermore, since the operators of such tools are usually not capable of correctly adjusting the tools, additional difficulty is caused by unnecessary and improper operator adjustments.

An object of this invention, therefore, is to provide a power unit and driving tool assembly in which the necessary valve mechanism for reversing the direction of travel of the tool piston is incorporated in a unit which is remote from the tool so that the tool is of a simplified construction and is of light weight.

A further object of this invention is to provide an improved fastener applying tool which is of a simplified construction.

Another object of this invention is to provide a power unit which includes an auxiliary fluid chamber that is expansible for receiving additional fluid when the fluid pressure in the tool is above a predetermined pressure required for tool operation, with the auxiliary fluid chamber being also contractible to supply make-up fluid to these same passages when leakage has reduced the volume of fluid therein.

A further object of this invention is to provide a power unit for a fastener driving tool which is simple in construction, economical to manufacture, and efficient in

operation in providing the necessary fluid pressures for operating the tool.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawing in which:

FIGURE 1 is a vertical sectional view of the power unit of this invention, looking substantially along the line 1—1 in FIG. 2;

FIG. 2 is a top view of the power unit of this invention, with parts of the handle therefor broken away;

FIG. 3 is a horizontal sectional view looking substantially along the line 3—3 in FIG. 1;

FIGS. 4 and 5 are fragmentary enlarged sectional views looking along the lines 4—4 and 5—5 in FIG. 2;

FIG. 6 is a horizontal sectional view looking along the line 6—6 in FIG. 1;

FIG. 7 is a fragmentary side elevational view of a lower portion of the power unit of this invention;

FIG. 8 is a horizontal sectional view looking substantially along the line 8—8 in FIG. 1;

FIGS. 9 and 10 are enlarged fragmentary sectional views looking along the lines 9—9 and 10—10 in FIG. 2;

FIG. 11 is a wiring diagram showing the circuit for the switches and the valve operating solenoid in the power unit of this invention;

FIG. 12 is a side elevational view of a driving tool adapted to be used with the power unit shown in FIG. 1 with some parts broken away and other parts shown in section for the purpose of clarity;

FIG. 13 is a fragmentary sectional view looking along the line 13—13 in FIG. 12;

FIG. 14 is a side elevational view of another driving tool adapted to be used with the power unit shown in FIG. 1, with some parts broken away and other parts shown in section for the purpose of clarity;

FIG. 15 is a fragmentary sectional view as seen along the line 15—15 in FIG. 14.

FIG. 16 is a fragmentary plan view of the barrel portion of the tool shown in FIG. 14, with some parts broken away for the purpose of clarity; and

FIG. 17 is a fragmentary elevational view of a portion of the tool shown in FIG. 14.

With reference to the drawing, the power unit of this invention, indicated generally at 10, is illustrated in FIG. 1 as including a base 12 which carries an upwardly extending cylinder member 14. An upright reservoir member 16 is mounted on the upper end of the cylinder member 14. A cap or cover 20, for the reservoir 16, also acts to secure a horizontal flexible diaphragm 18 to the reservoir 16. Upright connecting bolts 22 extend between the base 12 and the cover 20 for holding the cylinder member 14, the reservoir member 16 and the cover member 20 in positions extending upwardly on the base 12. A tubular handle member 24, of circular shape, is secured by bolts 26 to the cover member 20 which has an upwardly extending bearing portion 26a which slidably supports a tubular stem 28 secured at its lower end to a central portion of the diaphragm 18. At its upper end the stem 28 carries a collar 27 having a depending annular flange 29 which has a radius equal to the distance a release button 31 for a safety switch unit 25 is spaced from the stem axis. The button 31 is mounted on a housing 33 which also supports a re-set

button 35 for the unit 25 which is circuit-connected in a manner to be hereinafter described.

The hollow base 12 functions as a housing for a valve assembly 30 (FIG. 8) which includes a solenoid 32*a* mounted in a casing 32 and a valve body 34 actuated in response to energization of the solenoid 32*a*. A stationary valve passage member 36 connected to a supply line 38 for air under pressure is formed with substantially parallel air passages 40, 42, 44, 46 and 48 for a purpose to appear presently.

Mounted for up and down reciprocation in the cylinder 14 is a hollow piston member 50 which has a tubular central portion 52 arranged for up and down sliding movement on an upright piston member 54 secured to and extending downwardly from the lower wall 56 for the reservoir member 16. The lower wall 51 for the piston 50 closes the lower end of the tubular portion 52 so as to form a fluid chamber 53 in the tubular portion between the lower end of the piston 54 and the lower wall 51 of the piston 50.

The valve body 34 is movable between a first spring-urged position and a second solenoid-moved position when the solenoid 32*a* is energized. The passage 40 in the valve passage member 36 connects the valve body 34 with the air inlet line 38 in both the positions of the body 34. In the spring-urged position of the body 34, the passage 44 communicates, by way of the body 34, with the air inlet passage 40 and, through a passage 58 (FIG. 4) in the walls of the cylinder member 14 and the reservoir member 16, with the interior of the cylinder member 14 on the top side of the piston 50. In this position of the body 34, the passage 46, which is connected to an outlet passage 47 in the cylinder wall, communicates with the cylinder 14 below the piston 50, and the passages 42 and 48 are closed at the body 34. The piston 50 is thus moved downwardly in the cylinder 14. In the solenoid actuated position of the body 34 the passages 44 and 46 are closed, the passage 42 communicates with the passage 58 and with an exhaust passage 49 in the cylinder wall, and the passage 48 is connected through the body 34 with the supply passage 40 for supplying air under pressure to the cylinder 14 below the piston 50, so that the piston 50 is moved upwardly in the cylinder 14.

The chamber 53 and communicating fluid passages are filled with a hydraulic fluid so that when air is supplied to the cylinder 14 below the piston bottom wall 51 and the piston member 50 moves upwardly in the cylinder 14, fluid is forced out of the chamber 53 through an upright passage 60 in the fixed piston 54, through a horizontal passage 62 in the reservoir lower wall 56 to a flexible high pressure conduit 64 on the reservoir member 16. The member 64 communicates with a driving tool such as those shown in FIGS. 12–15, inclusive, to be operated by the power unit 10.

When the circuit for the solenoid 32*a* is opened so that air under pressure is supplied to the cylinder member 14 on the top side of the piston 50, the piston member is forced downwardly in the cylinder 14 so that fluid in an annular chamber 66 which surrounds the piston member 50 is forced out of the chamber 66 through a horizontal passage 68 in the cylinder wall into a flexible conduit member 70 which also communicates with the driving tool. As shown in FIG. 1, the piston member 50 has an upper portion 72 and a lower portion 74 of a reduced diameter relative to the portion 72 with a horizontal shoulder 76 being formed at the juncture of the portions. The cylinder 14 has corresponding reduced and enlarged bore sections 78 and 81 for slidably supporting the piston sections 72 and 74. On downward movement of the piston member 50, the upper enlarged portion 72 thereof acts to displace fluid in the annular chamber 66 to raise the pressure of the fluid and force it out of the chamber 66 and the conduit member 70.

It can thus be seen that in the solenoid-moved position of the valve body 34, air under pressure is supplied

to the bottom side of the piston 50 and exhausted from the top side so as to force fluid under pressure into the conduit member 64. By virtue of the relative areas of the lower ends of the piston members 50 and 54, fluid is delivered to the conduit 64 at a substantial pressure. When the valve body 34 is returned to its spring-urged position, air under pressure is supplied to the top side of the piston 50 and exhausted from the bottom side. The piston 50 is thus moved downwardly to force fluid under pressure through the conduit member 70. This pressure in the conduit member 70 is reduced relative to the pressure in the conduit 64.

The higher pressure fluid in the conduit member 64 is used to move the piston in the driving tool in a direction to drive the fastener, as will be described in detail hereinafter. Fluid from the conduit member 70 returns the tool piston to a set position for the next driving operation.

A pair of driving tools 150 and 200 are shown in FIGS. 12 and 14, respectively, that are adapted to be used with the power unit 10. Since the tools 150 and 200 are conventional in the sense that they include the usual anvil, collet, and mechanical structure for moving these parts relative to each other, only the hydraulic mechanism and the control switches will be described in detail hereinafter. The tool 150 incldues a body 152 having a cylinder portion 154 in which a piston 156 is slidably mounted.

A pair of fluid passages 158 and 160 in the valve body 152 communicate with the cylinder 154 on what for convenience of description will be referred to as the bottom side 162 and top side 164, respectively, of the piston 156. The flexible conduits 64 and 70 are connected to the body 152 so that they communicate with the passages 158 and 160, respectively. As a result, when the piston 50 is moved upwardly to force fluid under pressure out of the unit 10 through the conduit member 64, this fluid is delivered to the cylinder 154 so as to exert an upward force on the piston 156 and in turn operate the tool 150 to drive the fastener to which the tool is applied.

A tubular member 166 carried by the piston 156 moves upwardly along with the piston. The tubular member 166 carries a radially inwardly projecting pin 170 which rides in a groove 174 formed in a switch actuating rod 172 that is slidably supported in the tubular member 166. When the piston 156 has traveled upwardly a distance necessary to move the pin 170 to the upper end of the groove 174, further upward movement of the piston causes upward movement of the rod 172 to open a switch 136 connected to the lower end of the rod. As shown in FIG. 11, the switch 136 is connected in a circuit indicated generally at 130 which includes the usual leads L1 and L2, the solenoid 32*a*, the reservoir safety switch 25, and a switch 134 operated by a trigger 180 on the tool 150.

In a fastener driving operation, the operator actuates the trigger 180 to close the trigger switch 134 and energize the solenoid 32*a* which in turn acts to move the valve body 34 as previously described so that the unit 10 operates to move the tool piston 156 in a driving direction. At the completion of the driving stroke of the piston 156, the switch 136 is opened by the actuating rod 172 so that the solenoid 32*a* is automatically de-energized. The valve body 34 returns and the power unit 10 operates to force fluid under pressure through the conduit 70 and piston 50 to return the tool piston 156 to a position in readiness for a subsequent gun operation. The trigger 180 is of course released by the operator when the switch 136 is opened since it is apparent that the movement of the tool 150 to drive a fastener has been completed. Return of the piston 156 to a position against the cylinder bottom wall 182 moves the pin 170 against the rod 172 at the lower end of the groove 174 and moves the rod 172 downwardly to again close the switch 136.

The driving tool 200 likewise includes a body 202 having a cylinder portion 204 in which a piston 206 is mounted for reciprocal movement. Passages 208 and 210 in

the tool handle 209 communicate through other passages 211 and 213, respectively, with opposite ends of the cylinder 204 and are connected to the conduits 64 and 70, respectively.

The piston 206 has a forwardly projecting extension 240 arranged concentrically within an annular seal 242 mounted in the body 202. An annular slideway 244 for the tubular inner end portion 246 of a pintail ejecting plunger 248 is formed in the extension 240 by inserting a smaller hollow cylinder 250 in an elongated opening in the extension 240. The plunger 248 is part of a nose attachment, indicated generally at 252, removably mounted on the tool 200 for setting fasteners and rivets of the type having a pull pin. The nose attachment 252 includes a barrel 254 having a radially extending ear 256 positioned in a groove 258 in the body 202.

A spring 260 in the cylinder 250 engages the plunger 248 at the forward end of the tubular portion 246 and urges the plunger 248 in a direction outwardly of the tool to a stop position in which a shoulder 262 on the plunger engages a shoulder 264 on a tubular slide support 266 for the plunger 248. The slide support 266 is positioned within an actuating sleeve 268 having a tapered annular surface 270 at its forward or outer end which engages a similar surface 272 on an expandable and contractible annular jaw assembly 274. A ring 278 supports the outer end of the slide support 266 and engages the inner end of the jaw assembly 274. A spring 280 extends between the ring 278 and annular ears 282 on the inner end of the slide support 266 and urges the jaw assembly 274 axially outwardly of the sleeve 268 to maintain the inclined surfaces 270 and 272 in engagement. A retainer ring 284 in a groove 286 formed in the inner surface of the sleeve 268 maintains the jaw assembly 274, the ring 278 and its associated spring 280, and the slide support 266 in an assembled position within the sleeve 268 so that all of these parts can be handled as a unit when the nose assembly 252 is detached from the tool body 202.

The barrel 254 has a detachable anvil 290 at its forward or outer end which is replaceable when it becomes worn or damaged. The anvil 290 has a longitudinally extending flange 292 at its rear end which fits about the barrel 254 and a shoulder 294 which abuts the outer end of the barrel 254. The flange 292 is radially offset from the anvil 290 so as to form a shoulder 296 which extends radially outwardly from the outer surface of the anvil 290 for a purpose to appear presently. Longitudinally extending ears 298 on the outer end of the barrel 254 fit in slots 300 in the anvil 290 in a position of the barrel within the anvil flange 292. The ears 300 terminate at their outer ends in radially outwardly extending projections 302. To retain the anvil 290 on the barrel 254, a removable retaining ring 304 is extended about the anvil 290 between the shoulder 296 on the anvil and the projections 302 on the barrel. To remove the anvil 290 for replacement, it is only necessary to remove the ring 302 and withdraw the anvil from the barrel.

In the assembly of the nose attachment 252 and the tool body 202, the inner end of the actuating sleeve 266 is threaded onto an outer end portion 306 of the piston extension 240. The barrel 254 is extended into the tool body 202 to a position against the outer end of the seal 242 with the ear 256 on the barrel located in a slot 308 in the lower side of the barrel 254. On rotation of the barrel, the retaining ear 256 slides into the groove 258, which terminates at its ends at the slot 308, and prevents the barrel from being removed from the body 202. A spring-pressed pin 310 has an enlarged head 312 which engages a pin 314 extending across the slot 308 at a position radially outwardly of the ear 256 to position the head 312 at the ends of the groove 258 and in the path of the ear 256 so that the ear cannot be accidentally positioned in the slot 308 to permit removal of the barrel 254. In order to remove the nose attachment 252, it is necessary to first manually depress the pin 310 to a position in which the head 312 is out of the path of movement of the ear 256.

In the operation of the tool 200, when fluid under pressure is delivered through the conduit 64 to the passage 208, the piston 206 is moved rearwardly toward a cylinder end wall 212 which carries a pin 214 projected toward a ball member 216 carried on the piston 206. A spring 218 urges the ball member 216 to a seated position at one end of an axial fluid passage 220 in the piston 206. The passage 220 communicates with the passage 208 through inclined piston passages 222 when the ball 216 is moved off its seat against the pressure of the spring 218. As a result, when the piston 206 has been moved to a position in which the pin 214 unseats the ball 216, the driving operation of the tool is completed because fluid from the conduit member 208 is merely dumped through the piston passages 220 and 222 into the passage 210 for return to the power unit 10. The operator then releases the tool trigger 230, which actuates a switch like the switch 134 connected in series with the solenoid 32*a*, so that the switch is opened and the solenoid 32*a* is deenergized and the power unit 10 is operated to force fluid under pressure through the conduit 70. In the event the full stroke of the piston 206 is not required to set the fastener, the trigger 230 is of course released as soon as the fastener is set.

Prior to actuation of the trigger 230, the nose attachment 252 is assembled with a fastener to be applied in the usual manner so that the fastener stem or pin extends axially through the contractible jaw assembly 274 and the ejector plunger 248 is forced inwardly to compress the spring 260. The sleeve 268 and the jaw assembly 274 cooperate in the manner described in patent No. 2,114,493 to effect first a gripping and then a pulling of the fastener pin as the piston 206 travels toward the cylinder wall 212. The reaction to the pulling force exerted on the fastener pin is applied through the anvil 290 to the fastener collar or sleeve. When the pin is fractured, the plunger 248 ejects the pin tail and the piston 206 moves the jaw assembly 274 and the sleeve 268 to positions in readiness for the next fastener setting operation. A spacer ring 320 on the outer end of the sleeve 268 prevents the jaw assembly 274 from being contracted on the plunger 248.

In the tool 200, the piston actuated switch 136 required in the tool 150 is dispensed with and the tool 200 utilizes instead the ball valve 216 in the piston 206.

The chamber 80 (FIG. 1) formed in the reservoir member 16 between the diaphragm 18 and the bottom wall 56 is filled with fluid. A chamber 82 formed between the cover 20 and the top side of the diaphragm 18 communicates through a horizontal passage 84 in the cover member 20 with an upright passage 86 extended through the walls of the cylinder member 14 and the reservoir member 16 and communicating at its lower end with the air inlet line 38. Consequently, the diaphragm 18 is subjected to a relatively constant air pressure which provides for a predetermined pressure of the diaphragm 18 on the fluid in the chamber 80 so as to likewise maintain this fluid at a predetermined constant pressure.

The chamber 80 communicates with the horizontal passage 62 in the reservoir member 16 through a pair of upright passages 88 and 90 and a horizontal passage 89 in an enlarged outer portion 92 of the reservoir lower wall 56. The passage 89 is aligned with an enlarged horizontal cavity in the reservoir in which a check valve unit 94 of conventional construction is disposed. The unit 94 includes a valve body 98 which is normally held against a seat 108 in the passage 89. When the pressure in the passage 90 is above a predetermined limit the body 98 moves inwardly to admit fluid from the passage 89 to the passage 88 and thence in the chamber 80. This flow continues until the pressure in the passage 89 has been reduced to a lower limit.

It is seen, therefore, that in the event fluid in the

passage 90, which in turn communicates with fluid in the chamber 53, is raised above a predetermined pressure, the one-way check valve unit 94 acts to provide for a flow of fluid into the chamber 80 which expands to accommodate this extra fluid and relieves the pressure in the chamber 53 and communicating fluid passages.

Conversely, in the event the total fluid volume in the chamber 53 and the communicating fluid passages which deliver high pressure fluid to the tool piston is reduced, the pressure of this fluid on a second check valve unit 112 (FIG. 10) mounted on the reservoir member 16 is reduced when the piston 50 is in the position shown in FIG. 1. The pressure of the fluid in the chamber 80 which is substantially constant acts on a valve body 110 for the one-way check valve 112 to move the body 110 inwardly when the pressure is reduced in the chamber 53 to provide for a flow of fluid through an upright passage 111 and a horizontal passage 109 in the reservoir lower wall 56 to an upright passage 113 in the fixed piston 54. The passage 113 communicates at its lower end with the chamber 53. The chamber 80 and the check valve unit 112 thus act to continually provide make-up fluid to the chamber 53 to provide for a volume make-up and for a minimum pressure therein for operating the driving tool 150 or 200.

A similar pair of check valve units 114 and 116 (FIGS. 5 and 9) are installed in the reservoir wall portion 92 and communicate through passages 115 and 117, respectively, with the chamber 66 to provide for a pressure relief and a volume make-up, respectively, for the annular chamber 66. The chamber 80 thus constitutes a fluid source for maintaining a constant volume of operating fluid in the power unit 10 and the tool 150 or 200 connected thereto. The chamber 80 also acts to accommodate extra fluid in the event the pressure in either of the chambers 53 or 66 becomes excessive. The check valve units 94 and 114 are adjustable to determine the pressures at which the valve units will open to provide the desired pressure relief, and the valve units 112 and 116 are likewise adjustable to determine the lower pressure limits in the chambers 53 and 66.

As fluid is moved out of the chamber 80, the diaphragm moves toward the reservoir bottom wall 56. The stem 28 and the collar flange 29 are correspondingly moved toward the cover 20 until the flange 29 engages the switch release button 31 and opens the switch 25. The chamber 80 must then be re-filled and the switch 25 reset with the button 35 before the power unit 10 can be operated.

From the above description it can be seen that when the power unit 10 is used, the fastener applying tool, such as one of the tools illustrated, is of a simplified construction without bulky and heavy valve mechanisms. Furthermore, the unit 10 provides for a continued supply of the necessary high pressure fluid to the driving tool while minimizing the danger of fluid leakage.

It will be understood that the specific construction of the improved power unit which is herein disclosed and described is presented for purposes of explanation and illustration and is not intended to indicate limits of the invention, the scope of which is defined by the following claims.

What is claimed is:

1. A power unit for operating a hydraulically operable fastener applying tool, said unit comprising a casing adapted to be located remote from and connected to said tool, a cylinder located in said casing and having first and second cylinder portions, said cylinder portions being of different sizes and means in said casing for supplying fluid under pressure to said tool, said means comprising a piston completely located in said cylinder, said piston having first and second portions of different sizes matably located in said first and second cylinder portions, respectively, an annular cavity for holding fluid defined by the smaller of said piston portions when located in the larger of said cylinder portions, and passage means in communication with said annular cavity for providing a passage for the fluid to and from said cavity.

2. In a power unit for fastener applying tool, a chamber having a first fluid therein, means located in said chamber and actuable by a source of a second fluid under pressure for subjecting said first fluid to a working pressure, a fluid reservoir of said first fluid having a diaphragm therein, means in communication with the source of said second fluid for applying a pressure to the diaphragm for applying a corresponding pressure to said first flund in said reservoir, and automatic valve means communicating with said chamber and said reservoir and operable to maintain a predetermined relation of said chamber and reservoir pressures.

3. A power unit for a fastener applying tool having a cylinder portion and a piston mounted for reciprocal movement therein, said unit comprising a hollow base member, a cylinder member mounted on said base member, a reservoir member mounted on said cylinder member, a first piston member mounted for reciprocation in said cylinder member and having a tubular portion closed at one end, a second piston member arranged in a fixed position in said cylinder member in a coaxial relation with said tubular portion for reciprocating movement of the tubular portion along said second piston member during reciprocation of said first piston member, said second piston member having a fluid passage therein, a pair of conduit members on said unit connectible with said tool cylinder portion on opposite sides of the piston therein, fluid passage means in said unit connecting said piston fluid passage with one of said conduit members, means forming an annular fluid chamber extending about said first piston and communicating with said other conduit member, means on the first piston for displacing fluid in said chamber on movement of said first piston in a direction to withdraw said tubular portion from said second piston, said reservoir member having a chamber therein for fluid and a flexible wall for maintaining the fluid at a predetermined pressure, fluid passage means extending between said reservoir chamber and said fluid passage in the second piston, first valve means in said fluid passage means for communicating said reservoir chamber and said fluid passage when the pressure in the reservoir chamber exceeds the pressure in the fluid passage by a predetermined amount, second valve means in said fluid passage means for communicating said reservoir chamber and said fluid passage when the pressure in the reservoir chamber exceeds the pressure in the fluid passage by a predetermined amount, fluid passage means extending between said reservoir chamber and said annular chamber, third valve means in said last mentioned fluid passage means for communicating said reservoir chamber and said annular chamber when the pressure in the reservoir chamber exceeds the pressure in the annular chamber by a predetermined amount, and fourth valve means in said last mentioned fluid passage means for communicating said reservoir chamber and said annular chamber when the pressure in the annular chamber exceeds the pressure in the reservoir chamber by a predetermined amount.

4. In a power unit which includes a chamber for a liquid, drive means located in said chamber and actuable by a source of air under pressure for placing said liquid in said chamber under pressure, means for maintaining the pressure in said chamber between predetermined high and low limits, said means comprising a reservoir member having a diaphragm disposed therein and a fluid chamber for the liquid on one side of the diaphragm, means in communication with the source of air for applying a predetermined pressure to the opposite side of the diaphragm for in turn applying a pressure to the liquid in said reservoir chamber, first passage means connecting said chambers, first one-way valve means in said first

passage means for communicating said chambers only when the pressure in the first mentioned chamber exceeds the pressure in said reservoir chamber by a predetermined amount, second passage means connecting said chambers, and second one-way valve means in said second passage means for communicating said chambers only when the pressure in the first mentioned chamber is below the pressure in said reservoir chamber by a predetermined amount.

5. For use with a fastener applying tool having a cylinder portion and a tool operating piston in the cylinder portion, a power unit separate from said tool, said unit comprising a casing adapted to be connected to said tool for supplying fluid to said cylinder portion on opposite sides of said piston, a piston mounted in a stationary position in said casing, a second piston mounted in the casing for reciprocal movement, said second piston having a tubular portion arranged in axial alignment with said stationary piston so that on movement in one direction of the second piston, fluid is forced out of said tubular portion to said tool cylinder portion on one side of said piston and on movement of said second piston in the opposite direction fluid is returned from said tool cylinder portion, a cylinder located in said casing and having first and second cylinder portions, said cylinder portions being of different sizes, said second piston being located completely in said cylinder and having first and second portions of different sizes matably located in said first and second cylinder portions, respectively, an annular cavity for holding fluid defined by the smaller of said piston portions when located in the larger of said cylinder portions, and passage means for communicating said annular cavity with the opposite side of said tool cylinder portion, the fluid in said annular cavity being placed under pressure as said second piston moves in said opposite direction to thereby move said tool piston in an opposite direction.

6. A power unit for a fastener applying tool having a cylinder portion and a piston mounted for reciprocal movement therein, said unit comprising a hollow base member, a cylinder member mounted on said base member and defining a cylinder, a reservoir member mounted on said cylinder member and defining a fluid reservoir, a first piston member mounted for reciprocation in said cylinder and having a tubular portion closed at one end, a second piston member arranged in a fixed position in said cylinder member and extending inwardly into said cylinder in a coaxial relation with said tubular portion for reciprocating movement of the tubular portion along said second piston member during reciprocation of said first piston member, said second piston member having a fluid passage therein, a pair of conduit members on said unit connectible with said tool cylinder portion on opposite sides of the piston therein, fluid passage means in said unit connecting said piston fluid passage with one of said conduit members, means forming an annular fluid chamber extending about said first piston and communicating with said other conduit member, and means on the first piston for displacing fluid in said chamber on movement of said first piston in a direction to withdraw said tubular portion from said second piston, fluid passage means extending between said reservoir and said fluid chamber and between said reservoir and said cylinder, and valve means in said passage means for maintaining the pressures in said fluid chamber and said cylinder between predetermined high and low limits.

7. In a power unit for a fastener applying tool, fluid chamber means adapted to supply a first fluid under pressure to said tool means located in said chamber and actuable by a source of second fluid under pressure for subjecting said first fluid to a working pressure, a fluid reservoir having said first fluid at a predetermined pressure disposed therein, means in communication with the source of said second fluid and operative with said reservoir for placing said first fluid therein at a predetermined pressure, passage means in said unit communicating said reservoir with said chamber means, and valve means in said passage means arranged for opening movement when the fluid pressure in said chamber means is below a predetermined pressure.

8. In a power unit for a fastener applying tool, fluid chamber means adapted to supply a first fluid under pressure to said tool, means located in said chamber and actuable by a source of second fluid under pressure for subjecting said first fluid to a working pressure, a fluid reservoir having said first fluid at a predetermined pressure disposed therein, means in communication with the source of said second fluid and operative with said reservoir for placing said first fluid therein at a predetermined pressure, passage means in said unit communicating said reservoir with said chamber means, valve means in said passage means arranged for opening movement when the fluid pressure in said chamber means is below a predetermined pressure, switch means actuable for deactuating said fluid chamber means, and means for actuating said switch means responsively to the level of said first fluid in said fluid reservoir dropping to a preselected level.

9. In a power unit which includes a chamber for a liquid, drive means located in said chamber and actuable by a source of air under pressure for placing said liquid in said chamber under pressure, means for maintaining the pressure in said chamber between predetermined high and low limits, said means comprising a reservoir member having a diaphragm disposed therein and a fluid chamber for the liquid on one side of the diaphragm, means in communication with the source of air for applying a predetermined pressure to the opposite side of the diaphragm for in turn applying a pressure to the liquid in said reservoir chamber, first passage means connecting said chambers, first one-way valve means in said first passage means for communicating said chambers only when the pressure in the first mentioned chamber exceeds the pressure in said reservoir chamber by a predetermined amount, second passage means connecting said chambers, second one-way valve means in said second passage means for communicating said chambers only when the pressure in the first mentioned chamber is below the pressure in said reservoir chamber by a predetermined amount, switch means actuable for deactuating said drive means from the source of air, and means for actuating said switch means responsively to the level of said liquid in said fluid reservoir dropping to a preselected level.

10. A power unit for a fastener applying tool having a cylinder portion and a piston mounted for reciprocal movement therein, said unit comprising a hollow base member, a cylinder member mounted on said base member and defining a cylinder, a reservoir member mounted on said cylinder member and defining a fluid reservoir, a first piston member mounted for reciprocation in said cylinder and having a tubular portion closed at one end, a second piston member arranged in a fixed position in said cylinder member and extending inwardly into said cylinder in a coaxial relation with said tubular portion for reciprocating movement of the tubular portion along said second piston member during reciprocation of said first piston member, said second piston member having a fluid passage therein, a pair of conduit members on said unit connectible with said tool cylinder portion on opposite sides of the piston therein, fluid passage means in said unit connecting said piston fluid passage with one of said conduit members, means forming an annular fluid chamber extending about said first piston and communicating with said other conduit member, and means on the first piston for displacing fluid in said chamber on movement of said first piston in a direction to withdraw said tubular portion from said second piston, fluid passage means extending between said reservoir and said fluid

chamber and between said reservoir and said cylinder, valve means in said passage means for maintaining the pressures in said fluid chamber and said cylinder between predetermined high and low limits, a diaphragm disposed over said reservoir member for substantially sealing one end of said reservoir, and a cap member disposable on said reservoir member and having a cavity therein, said diaphragm and said cavity defining a volume for receiving fluid under pressure for maintaining the fluid in said reservoir under pressure, and automatic valve means communicating with said chamber and said cylinder with said reservoir and operable to maintain a predetermined relation of said chamber, cylinder and reservoir pressures.

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