Sept. 9, 1969 F. L. CARSON 3,465,647

ADJUSTABLE PRE-SET PRESSURE ACTUATED MECHANICAL PRIME MOVER

Filed Nov. 15, 1967 3 Sheets-Sheet 1

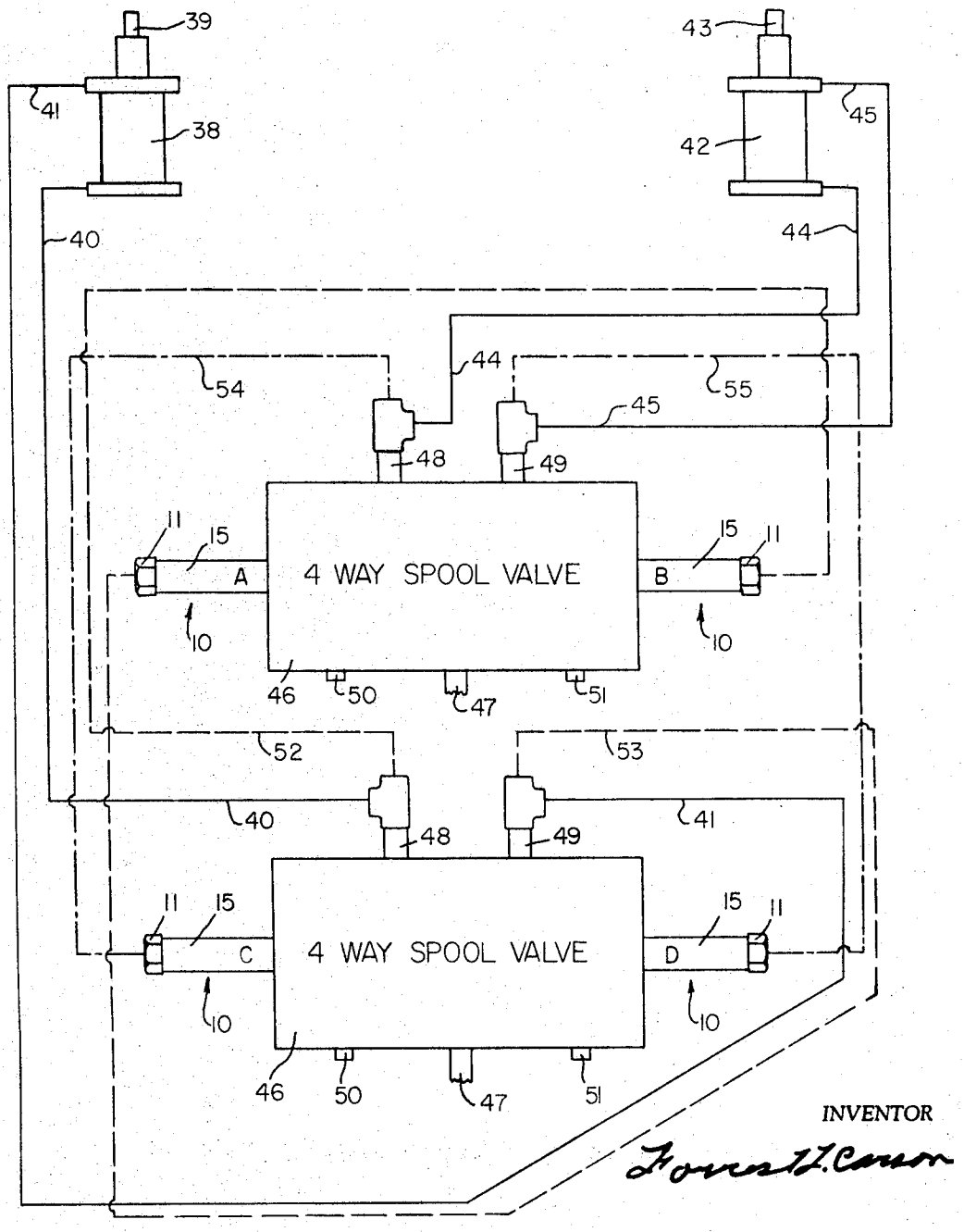


FIG. 1

ADJUSTABLE PRE-SET PRESSURE ACTUATED MECHANICAL PRIME MOVER

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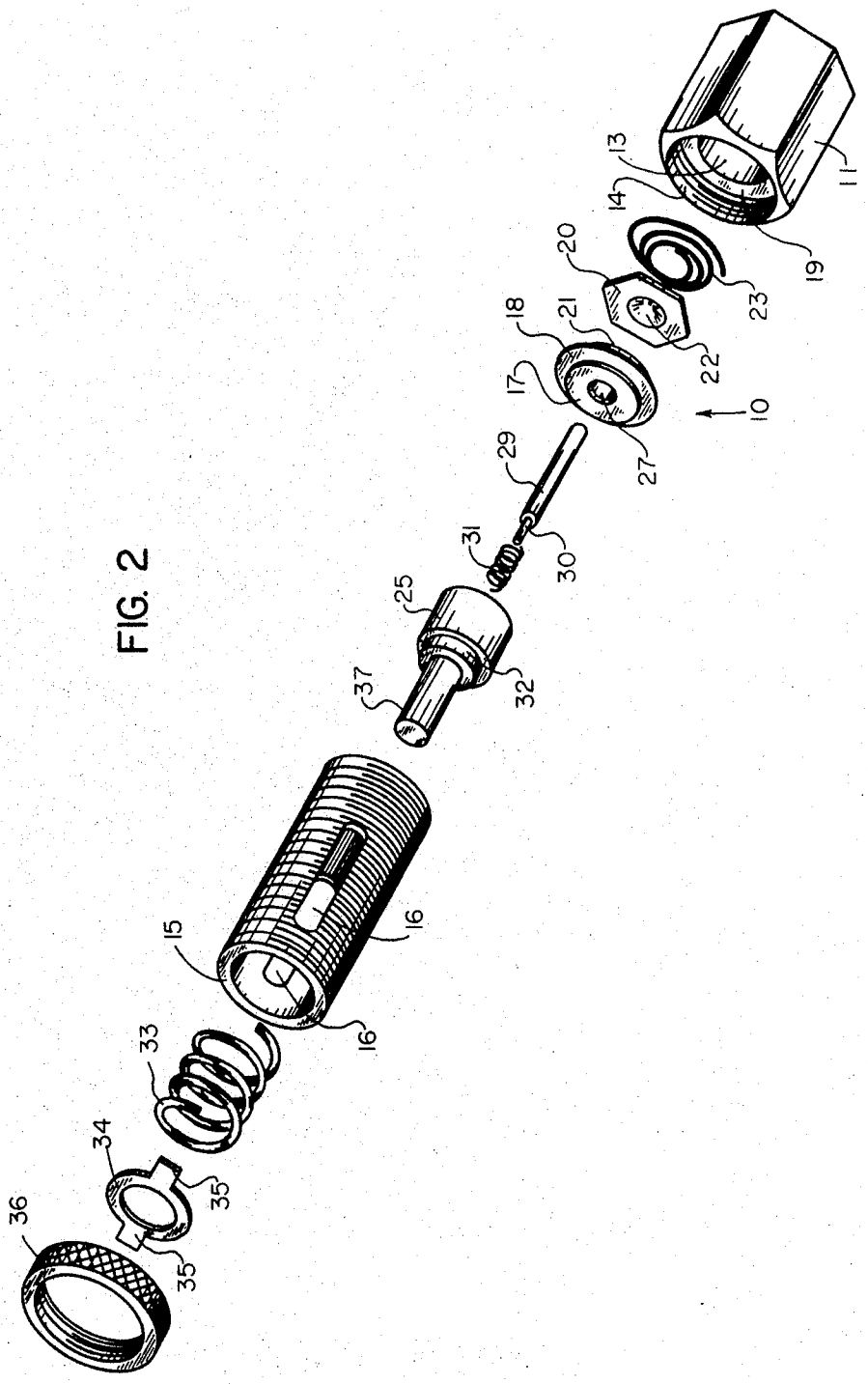


FIG. 2

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ADJUSTABLE PRE-SET PRESSURE ACTUATED MECHANICAL PRIME MOVER

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FIG. 3

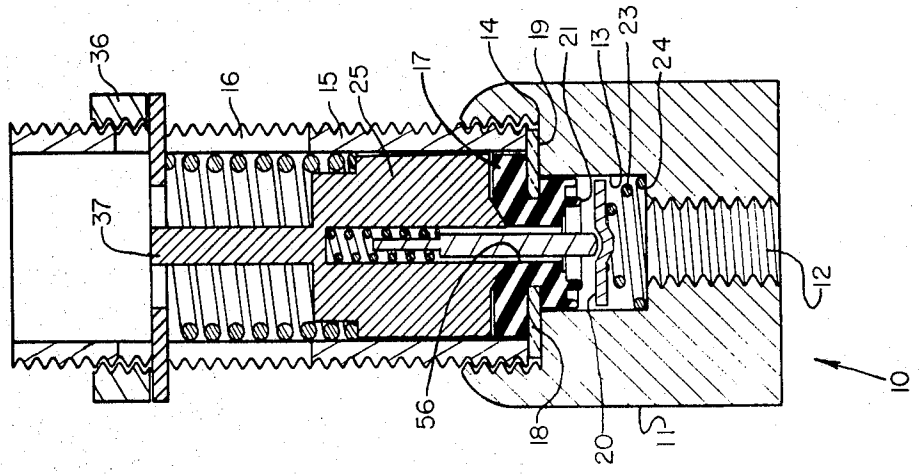


FIG. 4

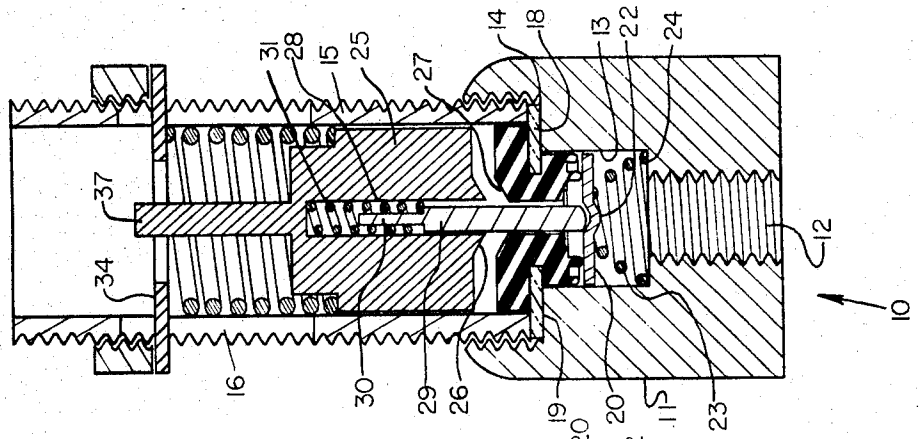
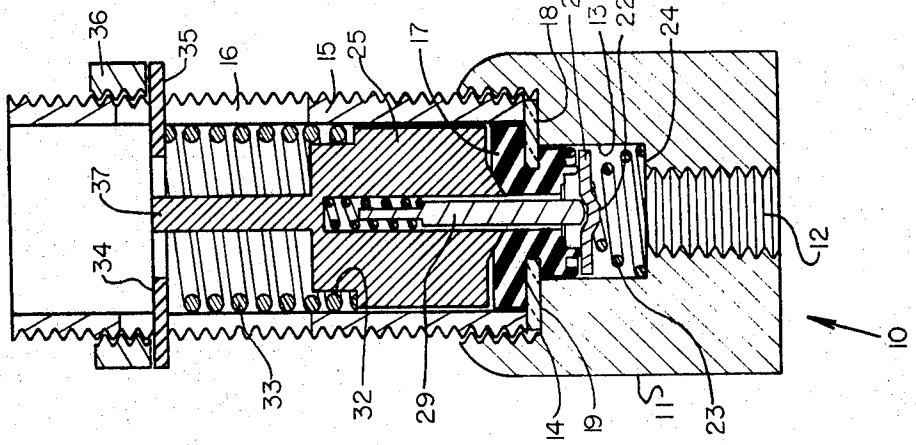


FIG. 5



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ADJUSTABLE PRE-SET PRESSURE ACTUATED MECHANICAL PRIME MOVER

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ABSTRACT OF THE DISCLOSURE

The disclosure involves a snap acting mechanical prime mover which is actuated by a pre-set fluid pressure and can be adjusted to be actuated by any desired pre-set pressure within the range of the prime mover. The prime mover actuator will move outwardly and return when the actuating pressure reaches a pre-set level, even though the actuating pressure is maintained. Upon release of the actuating pressure the prime mover resets for another cycle.

BACKGROUND OF THE INVENTION

Field of the invention

The invention is directed to a snap acting fluid pressure mechanical prime mover for operating numerous devices such as valves, electric switches, triggers, pilot members, safety devices and the like.

Description of the prior art

Prior to the present invention pressure actuated mechanical prime movers were such that movement of the device was directly related to the working pressure and the device would remain in extended position until a drop in pressure was sufficient to permit the device to retract. Such devices were not capable of providing an instant recycling snap acting device such as the present invention. Other devices utilize an over dead center mechanical means to obtain a snap action, but these too fail to provide the instant recycling snap action of the present invention.

Brief description of the drawings

FIGURE 1 is a schematic view of a control system incorporating the pre-set pressure actuated mechanical prime mover of the present invention.

FIGURE 2 is an exploded perspective view of the invention.

FIGURE 3 is an enlarged vertical cross-section of the invention showing the parts in one operative position.

FIGURE 4 is a view similar to FIGURE 3 showing the parts in another operative position, and

FIGURE 5 is a view similar to FIGURES 3 and 4 with the parts in still another operative position.

Referring now to the drawings in detail wherein like reference characters indicate like parts throughout the several figures, the reference numeral **10** indicates generally a pre-set pressure actuated mechanical prime mover constructed in accordance with the invention.

The prime mover **10** includes a body **11** having a longitudinally extending threaded bore **12** opening inwardly from the outer end thereof. A cylindrical valve chamber **13** is formed centrally of the body **11** in communication with the bore **12** and having a diameter somewhat greater than that of the bore **12**. A second threaded bore **14** opens inwardly from the inner end of the body **11** and communicates with the chamber **13**. The second bore **14** has a diameter substantially greater than the diameter of the chamber **13** as can be clearly seen in FIGURES 3 through 5. The bore **12**, chamber **13**, and bore **14** are formed on a common axis.

An externally threaded cylinder **15** is threaded into the threaded bore **14** at one end and extends outwardly therefrom. The threaded cylinder **15** is provided with a pair of oppositely disposed elongated longitudinally extended slots **16** as can be seen in FIGURE 2.

A resilient double valve seat member **17** is molded onto a washer **18** and is positioned so as to extend into the chamber **13** in sealing engagement therewith and into the cylinder **15**, also in sealing engagement therewith. The washer **18** engages the shoulder **19** between the threaded bore **14** and the chamber **13** and is clamped thereto by the inner end of the cylinder **15**.

A generally flat valve **20** is positioned within the chamber **13** for reciprocal movement therein into and out of engagement with a valve seat **21** on the double valve seat member **17**. The valve **20** has a dimple formed centrally thereof at **22** for reasons to be assigned. A tapered coil spring **23** is positioned in the chamber **13** in engagement with the shoulder **24** at one end of the chamber **13**. The opposite end of the coil spring **23** engages the valve **20** with the dimple **22** serving to center the valve **20** with the upper end of the spring **23**. The lower end of the coil spring **23** has a diameter to snugly fit the wall of the chamber **13**.

A cylindrical piston **25** is positioned within the cylinder **15** and is adapted to reciprocate therein. The piston **25** has an outwardly extending conical valve **26** formed centrally of the lower end thereof adapted for engagement with a depressed conical valve seat **27** formed on the double valve seat member **17**. A central bore **28** is formed in the piston **25** opening through the valve **26** at the lower end thereof and terminating short of the opposite end of the piston **25**. A free valve stem **29** is mounted in the bore **28** for reciprocation therein and has at its upper end a reduced diameter guide pin **30** as can be seen in FIGURES 3 through 5. A coil spring **31** is mounted in the bore **28** in engagement with the upper end thereof with its lower end engaging over the guide pin **30** to resiliently bias the valve stem **29** into engagement with the valve **20**. The lower end of the valve stem **29** is centered in the recessed portion of the dimple **22** in the valve **20**. The upper end of the piston **25** has a reduced diameter spring guide portion **32** to receive the lower end of a coil spring **33** positioned in the cylinder **15**. A moveable spring seat **34** is in engagement with the upper end of the spring **33** and has a pair of oppositely extending ears **35** which project through the slots **16** outwardly of the cylinder **15**. An adjusting nut **36** is threaded onto the externally threaded cylinder **15** and is adapted to engage the ears **35** to move the moveable spring seat **34** longitudinally of the cylinder **15** to the extent permitted by the length of the slots **16**. An actuator pin **37** is integrally formed on the piston **25** and extends axially therefrom oppositely of the valve **26**.

Referring now to FIGURE 1 a system is illustrated utilizing the prime mover **10** as a bleeder control for each end of a pair of four-way spool valves in turn controlling the movement of fluid power cylinders.

The fluid cylinder **38** has a piston rod **39** extending therefrom. A fluid supply line **40** extends to the lower end of the cylinder **38** and a second fluid supply line **41** extends to the upper end of the cylinder **38**. A second cylinder **42** has a piston rod **43** and is further provided with a fluid supply line **44** extending to the lower end of the cylinder **42** and a fluid supply line **45** extending to the upper end of the cylinder **42**.

A four-way spool valve **46** is provided with a conventional reciprocating spool (not shown). Fluid under pressure is fed to the four-way spool valve through an inlet conduit **47** and depending upon the setting of the spool is fed outwardly through outlet port **48** or outlet port **49**.

Exhaust ports **50** and **51** are adapted to be connected to the outlet ports **48** and **49** when the opposite outlet ports **48**, **49** are connected to the source of fluid under pressure **47**.

A prime mover **10** is connected to each end of the four-way spool valve **46** with its actuator **37** arranged to operate a bleed valve at each end of the four-way spool valve. The spool is moved conventionally by fluid pressure from the pressure conduit **47** in the direction of the open vent valve. A pilot pressure line **52** extends from the outlet port **48** and is pressured simultaneously with the pressuring of the outlet port **48** and the fluid supply line **40**. A pilot pressure line **53** extends from the outlet port **49** and is pressured simultaneously with the fluid supply line **41**.

A second four-way spool valve **46'** is identical in every respect to the four-way spool valve **46** having an inlet pressure conduit **47'**, outlet ports **48'** and **49'**, exhaust ports **50'** and **51'**, and a pair of prime movers **10** connected to opposite ends thereof. A fluid supply line **44** extends to the outlet port **48'** and a second fluid supply line **45** extends to the outlet port **49'**. A pilot pressure line **54** extends from the outlet port **48'** and a pilot pressure line **55** extends from the outlet port **49'**. The pilot pressure lines **52**, **53**, **54** and **55** each extend to a separate one of the prime movers **10** and are adapted to actuate the respective prime mover **10** when pressure in the lines **52**, **53**, **54** or **55** reach a pre-set point.

The operation of the control system in FIGURE 1 is a sequential operation in which the piston rod **39** is first extended, then the piston rod **43** is extended, then the piston rod **39** is retracted and finally the piston rod **43** is retracted to form a cycle which is continuously repeated so long as fluid pressure is fed through the conduits **47**, **47'**.

In order to start the operation it is assumed that pressure is in the line **41** actuating the prime mover D which causes the spool to move toward the prime mover D shifting pressure into the fluid supply line **40** and simultaneously into the pilot pressure line **52**. Pressure in the line **40** causes the piston rod **39** to be extended out of the cylinder **38**. Pressure in the pilot pressure line **52** actuates the prime mover B so that pressure is fed from the conduit **47'** to the fluid supply line **44** and simultaneously to the pilot pressure line **54**. Pressure in the line **44** causes the piston rod **43** to be extended from the cylinder **42**. Pressure in the pilot pressure line **54** actuates the prime mover C moving the spool valve spool to the left and connecting the fluid pressure from the supply conduit **47** to the fluid supply line **41** and simultaneously provides pressure in the pilot pressure line **53**. Pressure in the supply line **41** causes the piston rod **39** to be retracted into the cylinder **38** while the pressure in the pilot pressure line **53** causes the prime mover A to be actuated causing the spool to move to the left connecting the fluid pressure conduit **47'** to the fluid supply line **45** and the pilot pressure line **55**. Pressure in the fluid supply line **45** causes the piston rod **43** to be retracted in the cylinder **42** and the pressure in the pilot pressure line **55** actuates the prime mover D to start a second cycle of operation.

Referring now to FIGURES 3 through 5 the operation of the prime mover **10** will now be explained. The threaded bore **12** is connected to a source of fluid pressure either hydraulic or pneumatic, and with the pressure at zero the parts of the prime mover will be in the position as shown in FIGURE 3. As the pressure develops in the system the fluid flows into the valve chamber **13**, around the valve **20**, through a central port **56** in the double valve seat **17** and is prevented from flowing further by contact of the valve **26** with the valve seat **27**. As the pressure increases to the pre-set point the piston **25** remains in its lowermost position with the valve **26** sealed to the seat **27**. As the pressure reaches the pre-set point the fluid will lift the piston slightly off of the valve seat **27** against the pressure of the spring **33**, exposing the whole lower end of the piston **25** to the pressure. As soon as the whole lower end of the piston **25** is exposed to the pressure the piston **25** snaps upwardly in the cylinder **15** until the valve **20** comes in contact with the valve seat **21** sealing the fluid pressure against further passage through the central port **56**. This position of the parts is illustrated in FIGURE 4. The valve **20**, sealing against the valve seat **21** prevents further passage of the fluid into the cylinder **15** and the fluid already therein now bleeds past the piston **25** and the piston **25** is snapped downwardly by the spring **33** to the position illustrated in FIGURE 5. Even though pressure is maintained on the system the valve **20** will remain in sealed position against the valve seat **21** and all of the remaining parts of the prime mover **10** will remain in the position illustrated in FIGURE 5 until the pressure is released from the system, whereupon the valve **20** will move to the position illustrated in FIGURE 3, resetting the parts for another cycle. The adjusting nut **36** can be moved on the cylinder **15** to increase or decrease the spring pressure brought to bear on the piston **25** so as to adjust the point in pressure at which the piston **25** will be cracked from the valve seat **27**. The floating valve stem **29** and the spring **31** are capable of keeping the valve **20** spaced from the seat **21** against the pressure of the spring **23** as illustrated in FIGURE 3. However, the spring **31** is insufficient to move the valve **20** away from the seat **21** so long as pressure in the system is bearing there against.

I claim:

1. A snap acting adjustable pre-set pressure actuated prime mover comprising a cylinder, a piston mounted for reciprocation in said cylinder, a valve seat at one end of said cylinder, said valve seat having a central port extending therethrough and communicating with a source of fluid pressure, a valve on said piston engageable with said valve seat and sealing said central port against the passage of fluid, resilient means biasing said piston and said valve into sealing engagement with said valve seat to maintain said valve in engagement with said valve seat until the fluid pressure exceeds a pre-set point, said valve haviing an area exposed to the pressure substantially less than the cross sectional area of said piston, valve means for closing the pressure side of said central port upon movement of said piston in said cylinder away from said valve seat, and resilient means on said piston for opening said valve means upon movement of said piston in said cylinder toward said valve seat.

2. A prime mover as claimed in claim **1** wherein means are provided on said cylinder for adjusting the tension of said resilient biasing means and thereby adjusting the pressure necessary to move said piston.

3. A prime mover as claimed in claim **1** wherein means are provided on said cylinder for adjusting the tension of said resilient biasing means and thereby adjusting the pressure necessary to move said piston, and spring means supporting said valve means in balanced relation in said prime mover.

4. A prime mover as claimed in claim **1** wherein said last named resilient means includes a free valve stem resiliently mounted in said piston in engagement with said valve means and resilient means biases said valve means toward said piston maintaining said valve means in engagemnt with said free valve stem.

References Cited

UNITED STATES PATENTS

1,781,563	11/1930	Walter	91—410
2,649,076	8/1953	Dupre	91—410
3,040,711	6/1962	Townshend	91—410
3,334,545	8/1967	Houser	91—49
3,347,135	10/1967	Ahlbeck et al.	91—392

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U.S. Cl. X.R.

91—410; 92—86, 169