

May 26, 1964

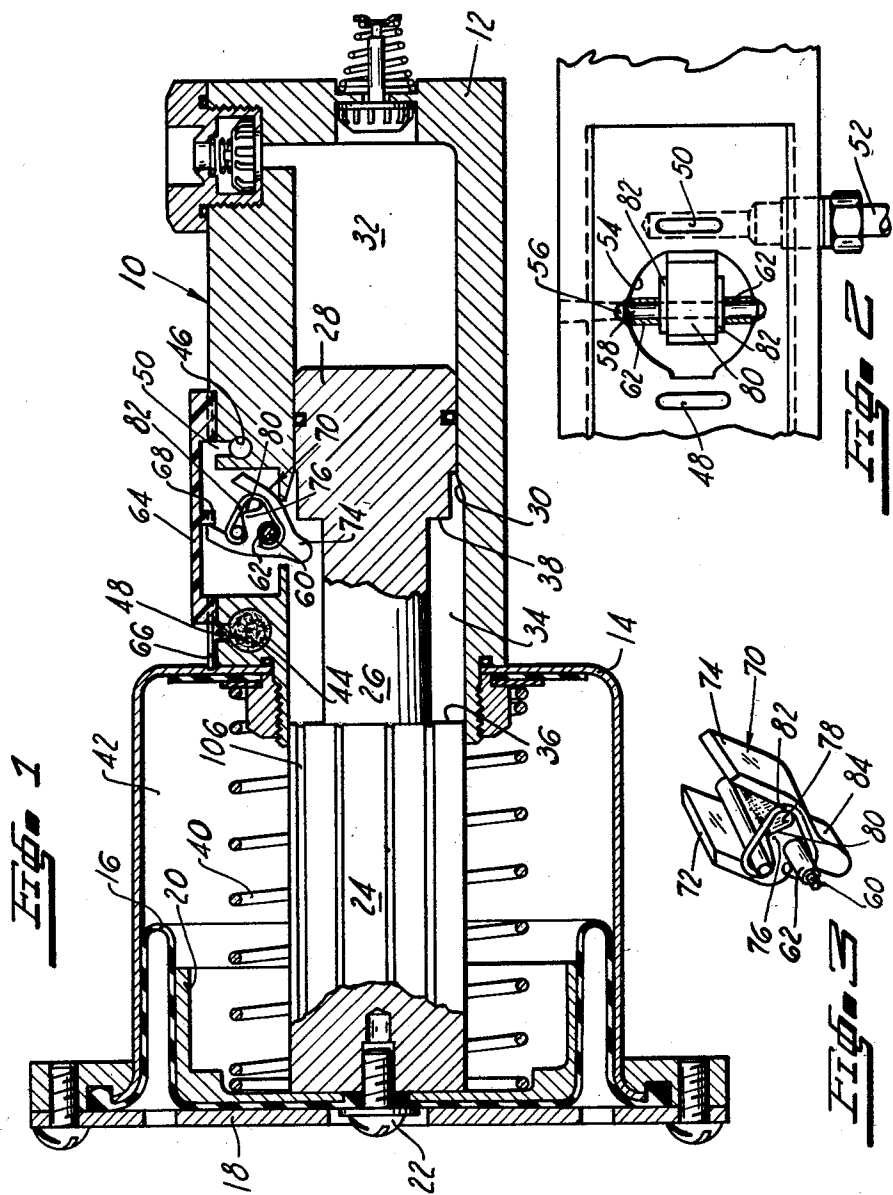
R. R. HAGER

3,134,304

PRESSURE OPERATED PUMP

Filed Oct. 15, 1962

2 Sheets-Sheet 1



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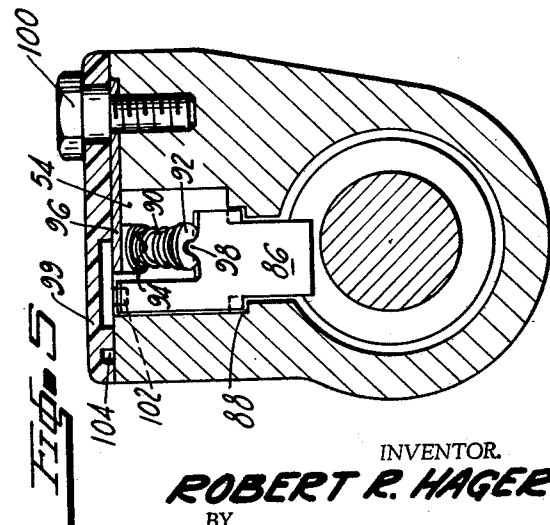
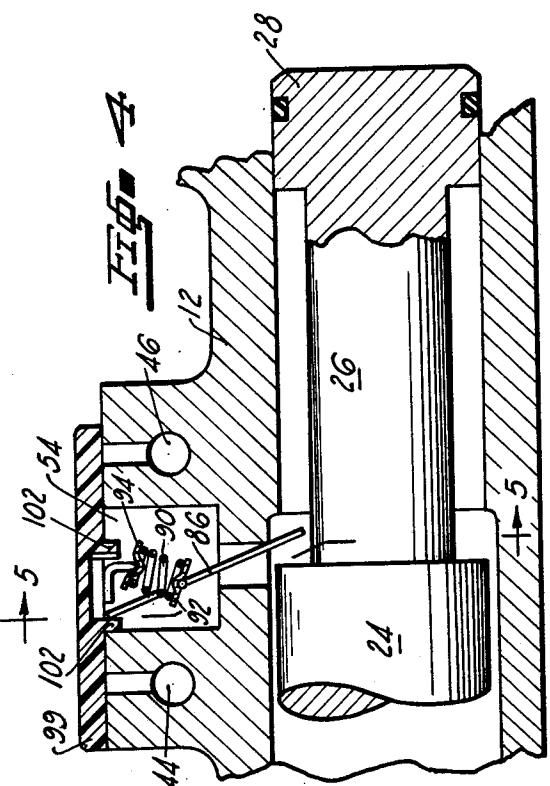
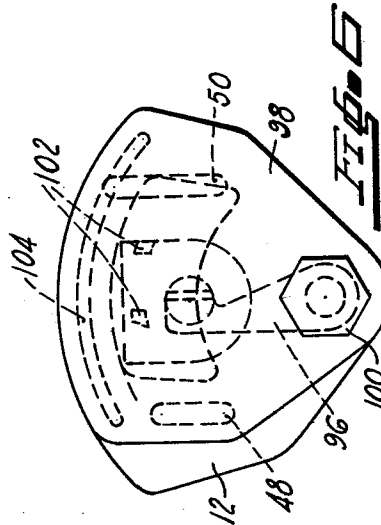
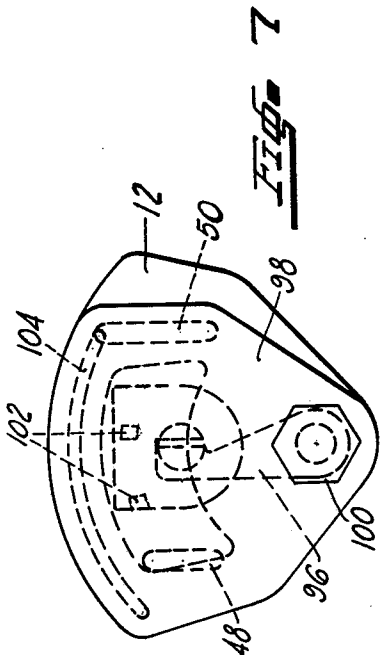
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2 Sheets-Sheet 2



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3,134,304

PRESSURE OPERATED PUMP

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4 Claims. (Cl. 91—341)

The present invention pertains to a novel means for controlling a pressure operated pump. More particularly, my invention concerns a means operated by a pressure responsive motor to selectively communicate inlet and exhaust ports to the motor.

While not necessarily limited to application in the automotive field, my invention finds a particular usefulness to such a field. For instance, with the rapid progress in varying types of power plants for automobiles it is almost impossible to think of other than air pressure power brake systems. However, with the more familiar internal combustion engine this would mean the addition of an air compressor.

Therefore, in order to seriously drain power from an already burdened engine, such as by driving an air compressor with the fan belt, it has become quite desirable to utilize a vacuum powered or air pressure driven pump. In the interest of brevity I will endeavor to explain my invention, as applied to a vacuum powered pump. However, as those skilled in the art may readily recognize, my invention can be of equal significance to air powered compressors and the like.

It is therefore a principal object to provide a control means for a pressure responsive motor operated compressor or pump, as it may be termed.

It is also an object of my invention to provide an over-center valve actuating mechanism for an air compressor.

A more particular object of my invention is to provide a lever actuated by shoulders on a compressor shaft to directly operate a valve mechanism.

A still further object of my invention is to utilize a lever actuated by a compressor or pump shaft to work a spring to an over-center position whereupon spring forces throw the lever completely over to operate a movable valve which is adapted to be controlled by the lever.

An additional object of this invention is to provide an improvement to the valve operating means for pumps of the type shown in United States Patent No. 2,630,102.

Other objects and advantages of this invention will become apparent from the following description and accompanying drawings in which:

FIGURE 1 is a side cross-sectional view of a vacuum operated compressor or pump assembly having my control valve incorporated therein;

FIGURE 2 is a plan view of a detail of FIGURE 1 showing the porting with my valve operating mechanism in the control port;

FIGURE 3 is an isometric of the pump control lever of my valve of FIGURE 1;

FIGURE 4 is a side sectional view of a modified valve operating mechanism in accordance with my invention;

FIGURE 5 is an end cross-section taken on line 5—5 of FIGURE 4 through the pump control port showing my modified valve operating mechanism;

FIGURE 6 is a plan view of a valve plate in accordance with my invention shown in a position where a vacuum or inlet port is in communication with the control port; and

FIGURE 7 is another plan view of my valve plate of FIGURE 6 with the exhaust or atmosphere port being connected to the control port.

With more particular regard to FIGURE 1, I have shown a simple vacuum operated pump 10 having a tubular housing 12 affixed to a cup-shaped housing 14

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that is closed by a diaphragm 16 and a rear limiting plate 18. A back-up structure 20 is positioned behind the diaphragm 16. A bolt 22 holds the diaphragm and back-up structure to a grooved rod end 24 that is of stepped construction to form a smaller diameter rod portion 26 terminating in a piston 28. As seen in FIGURE 1 the grooved rod end 24 and piston 28 are slidably mounted in a stepped bore 30 to form a pump or compressor chamber 32 ahead of the piston 28 and an annular control chamber 34 between the grooved rod end 24 and piston 28. The front of the grooved rod end 24 is formed as a shoulder 36, whereas the rear surface of piston 28 is formed as another shoulder 38. A spring 40 is incorporated into the cup-shaped housing 14 to urge the diaphragm and back-up structure into abutment with the plate 18 whereupon chamber 32 and chamber 42, the respective pump and motor chambers, are at their maximum volumetric capacity.

In order to reciprocate the piston 28, which could take the form of a diaphragm, I have provided an atmosphere passage 44 and a vacuum passage 46 in the housing 12 having respective ports 48 and 50. (See FIGURES 2 and 3.) A vacuum connection 52 is also provided to communicate passage 46 and port 50 to a vacuum source (not shown) such as an intake manifold of an internal combustion engine or a jet nozzle for a turbine engine.

Centrally of the above passages and ports, I show a control port 54 opening into the control chamber 34. The housing 12 surrounding this port, as seen in FIGURE 2, may be slotted, as at 56, to receive a pin 58. The housing is drilled to open to the bottom of the slot to fixedly hold a pin 60, which pin is press fitted within the housing and slides through bosses 62 arranged to provide bearing surfaces for a spring 82 and to fix a lever 84 between slots 56. Thus, pin 60 becomes a fixed pivot pin, whereas pin 58 may move vertically in slot 56.

In the motorized pump of FIGURES 1, 2 and 3, I have incorporated a slide valve 64 adapted to slide along a slot 66 in the upper portions of the housing 12 adjacent the aforementioned ports. The slide valve may be of a hard plastic construction which is shorter than the length of slot 66 and which can yield slightly for assembly with approximately formed flanges to slidably fit within slots 66. In its preferred form the valve could be constructed to have lubricant properties interspersed therein to reduce frictional forces whenever the valve is caused to move along the slots. Such lubricity can be acquired by interspersing polytetrafluoroethylene within the plastic during or prior to formation of my slide valve.

As seen in FIGURE 1, the slide valve 64 is formed with a depending projection or extension 68 which extends into the control port 54. Within the control port a lever 70 is mounted on pin 60 for oscillatory movement, which lever is bifurcated at one end to form two legs 72 and 74. A cam surface 76 is formed between the legs having valleys 78 adjacent each leg and a crown or peak 80 between the valleys. The cam surface receives pin 58, and a spring or springs 82 is adapted to urge the pin 58 to a position closest to pin 60. Thus, as pin 58 is moved to the peak 80, as by striking a lower leg 84 of the lever 70 with either shoulder 36 or shoulder 38, the spring exerts a compressive force to pull the pin 58 off the peak towards one or the other valley. The legs 72 and 74 are dimensioned to abut the projection or extension 68 so that, as the lever 70 is oscillated the legs 72 or 74 force the slide valve to move to a position where the vacuum port and control port are in communication, as shown, or to another position where the atmosphere port is communicated to the control port.

I have also found that the valve operating mechanism may utilize simpler structure such as the plate lever 86 which may be biased to pivot in notches 88 by a coil

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spring 90, as seen in FIGURE 4. As seen the spring and lever are arranged so that the spring is in a relieved condition whenever the lever 86 is at an angle with an axis of the control port 54. This enables the spring to actually snap the lever whenever the shoulder of piston 28 forces the lever to a vertical position where the spring exerts a maximum force. As seen a pair of plates 92 and 94 pivotally position the spring between a spring bearing plate 96 and a rounded projection 99 on lever 86.

In addition, I show a modified valve plate 99 with the motorized pump of FIGURES 4 and 5, which valve plate is oscillatory about a shoulder bolt 100. As with the sliding valve, valve plate 99 is provided with depending members (extensions) 102 arranged, however, for arcuate travel in control port 54. Thus, the lever 86, as it is designed to contact members 102, causes the valve plate to move from the position shown in FIGURE 7 to the position shown in FIGURE 6.

As seen in FIGURES 6 and 7, I have provided a passage 104 in the valve plate which is always in communication with the vacuum port 50. This provides a vacuum holddown for the valve plate to maintain the necessary seal between the housing 12 and the valve plate.

In any event, whenever vacuum is communicated to chamber 54, it passes to chamber 34 and through the grooves 106 into chamber 42 to pull the diaphragm 16 to the right as viewed in FIGURE 1. This forces piston 28 to discharge a pressure fluid from chamber 32 until shoulder 36 impinges on either the lever 70 or 86 depending on which is utilized, to snap the valve over to communicate atmosphere to chamber 42 to assist spring 40 in restoring the diaphragm to the position shown in FIGURE 1, or until shoulder 38 strikes the lever to again connect the vacuum supply.

It will thus be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiments have been shown and described for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. For use in a pump having a housing with a pressure

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responsive motor controlling a pressure developing chamber, which housing has an actuated member supported for sliding movement, a valve operating means comprising:

a pair of generally parallel pins, one of which is fixed to said housing while the other is arranged to move toward and away from said fixed pin;

a lever pivotally mounted on said fixed pin, said lever being bifurcated into a pair of legs at one end having a rising and falling cam surface with a center high point formed between the pair of legs, which cam surface engages said movable pin; and

at least one spring biasing said movable pin towards said fixed pin to effect snap action of said lever whenever said movable pin reaches the center high point on said cam surface.

2. A valve operating means in accordance with claim 1 and further comprising:

a first driving connection between said pressure responsive motor and said lever for oscillating said lever; and

a second driving connection between said lever and said actuated member.

3. A valve operating means in accordance with claim 2 wherein said actuated member is further characterized as being a plate operatively connected to said housing, which plate is provided with a first passage arranged for selective lapping of either a vacuum port in said housing or an atmosphere port in said housing with a control port in said housing, said plate also having a second passage in continuous communication with said vacuum port for creating a suction between said plate and said housing to hold said plate in sealed relationship with said housing.

4. A valve operating means in accordance with claim 3 wherein said second driving connection includes a downwardly extending means mounted to said plate and projecting into said control port.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,134,304

May 26, 1964

Robert R. Hager

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 42, for "approximately" read
-- appropriately --.

Signed and sealed this 8th day of December 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents