March 2, 1954 T. ANDERSON ET AL 2,670,719

LUBRICANT PUMPING DEVICE

Filed Oct. 2, 1950

3 Sheets-Sheet 1

Fig. 1.

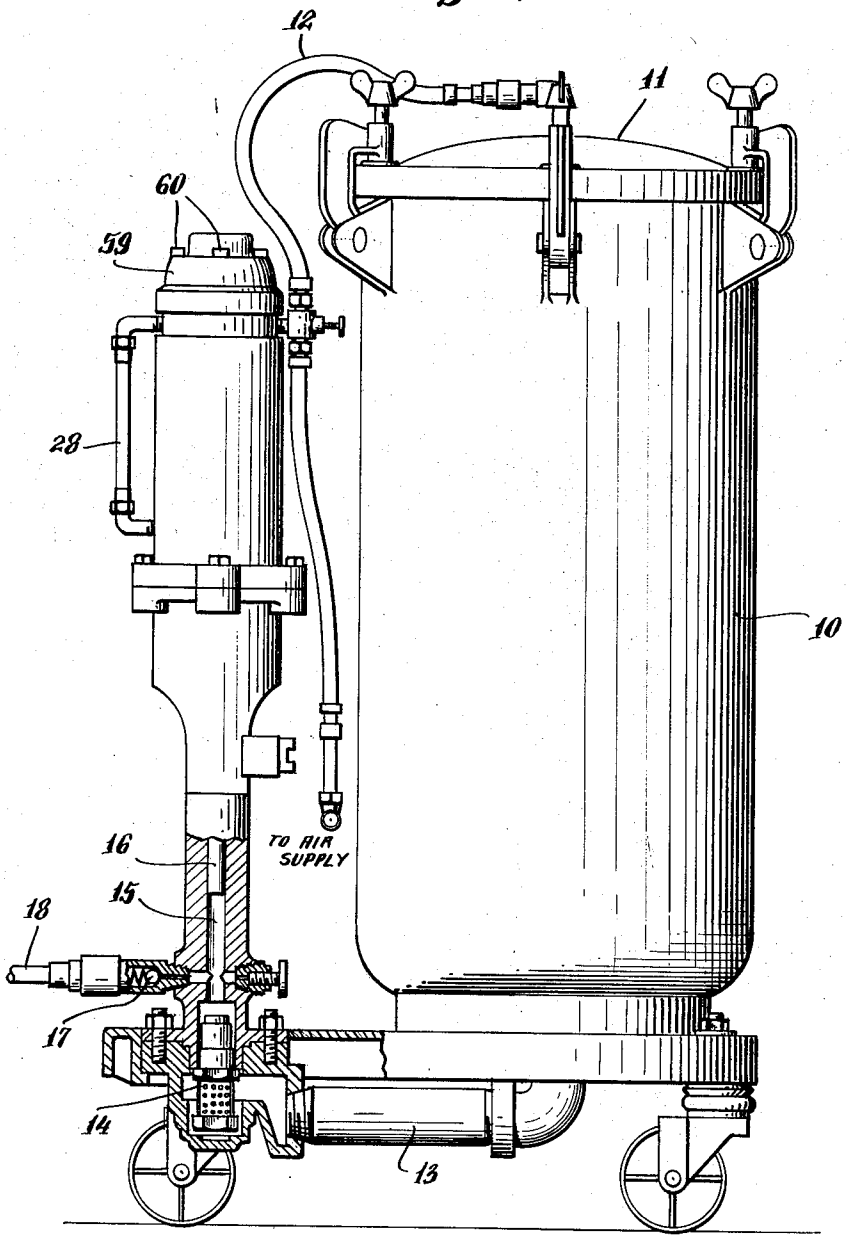

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Fig. 6.

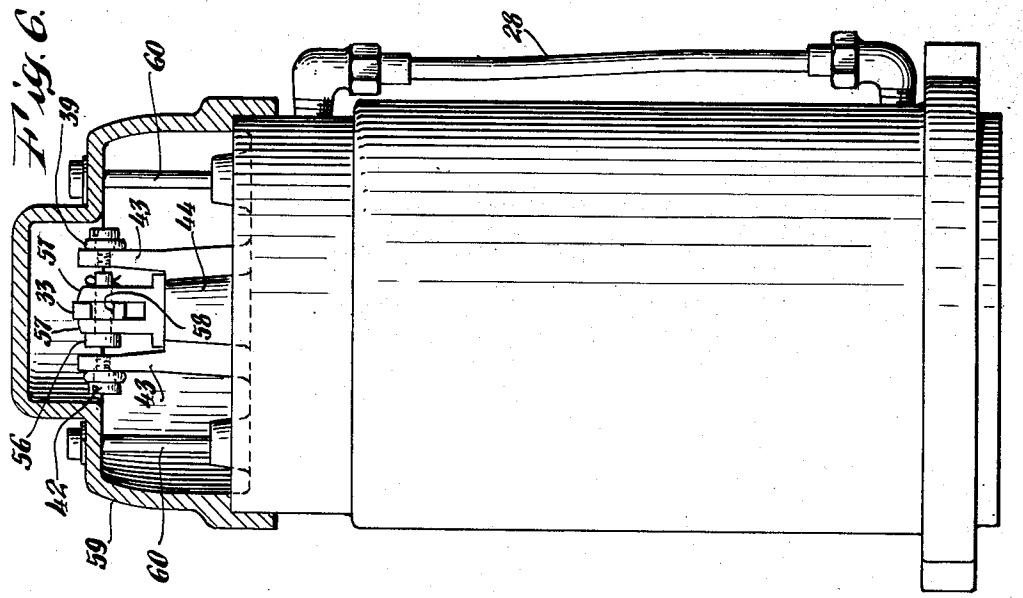

Fig. 2.

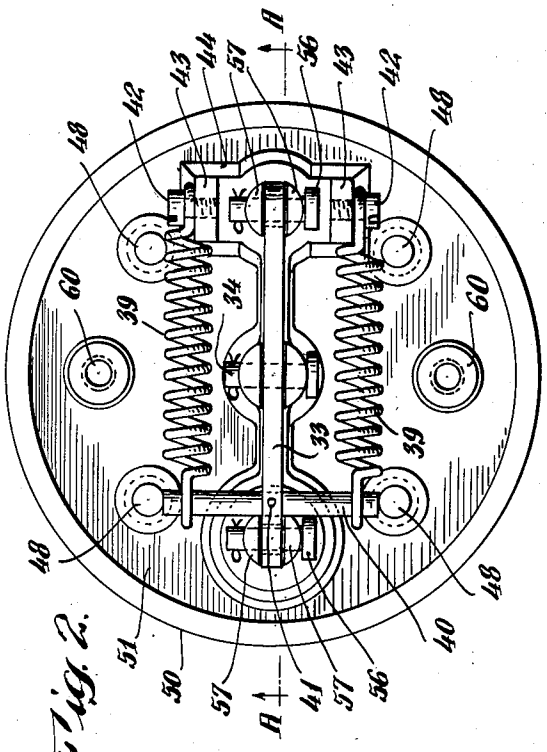

Fig. 3.

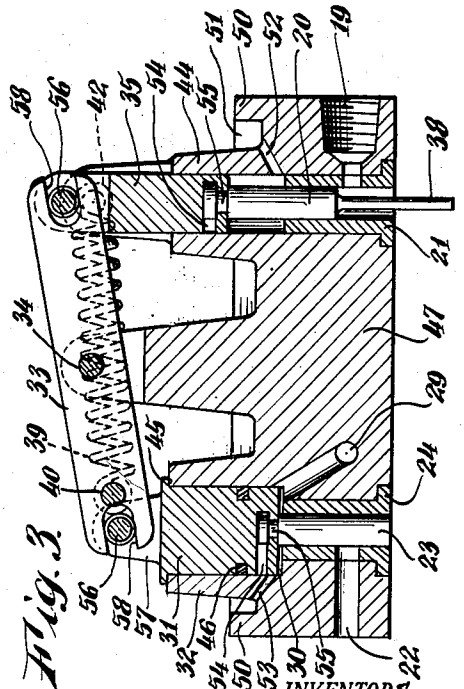

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Fig. 4.

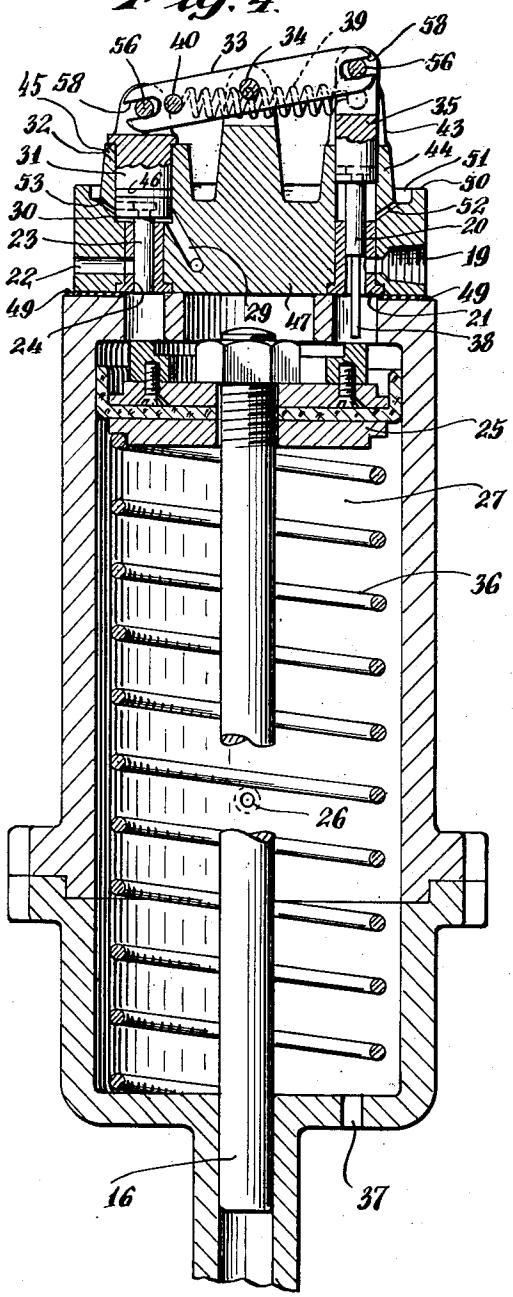
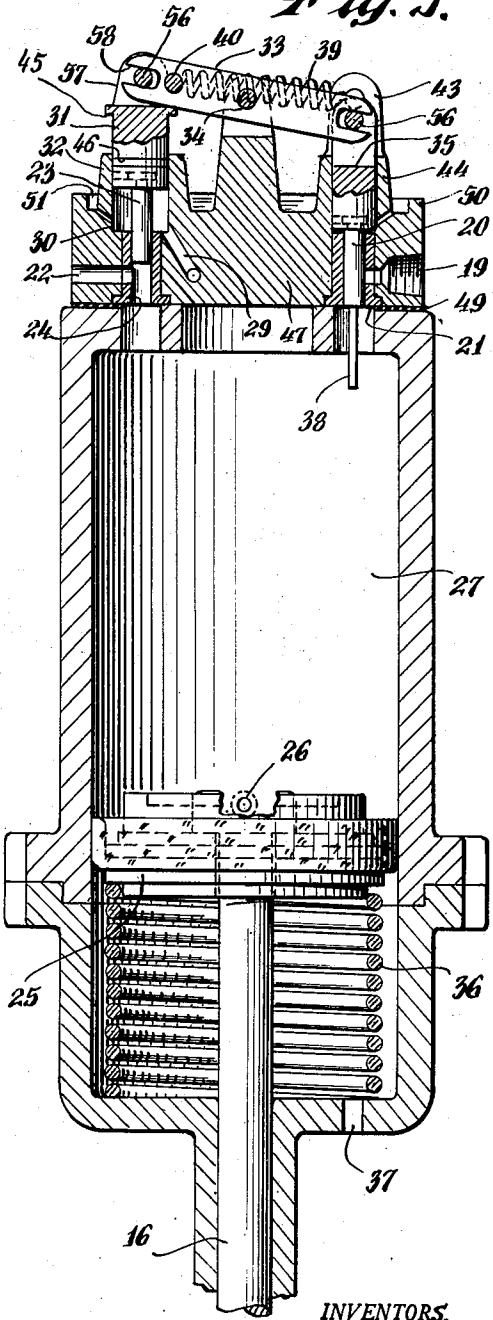


Fig. 5.



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LUBRICANT PUMPING DEVICE

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10 Claims. (Cl. 121—150)

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This invention relates to lubricant pumping devices and is more especially concerned with improvements in pneumatically driven pumps for handling greases and other thickened lubricants.

An object of the invention is to provide a pneumatically driven pumping mechanism which is adapted to deliver grease and other hard flowing lubricants under high pressure and at a high rate, and which is of such simple and rugged construction as to fit it for grease gun service.

It is a further and more specific object of the invention to provide an improved valve gear for a pneumatically actuated grease gun motor which gear is fully automatic in its action to reverse the flow of compressed air to and from the power cylinder responsive to changes in the position of the driving piston.

It is yet another object of the invention to provide a lubricant pumping mechanism in which all of the moving and operating parts may be completely enclosed to facilitate economical lubrication and to protect them against dust, dirt, and the normal hard knocks which are commonplace in conventional grease gun service.

Still another specific object of the invention is to provide a pneumatic valve gear in which the air inlet and outlet ports may be made of large cross-sectional area in comparison with the air power cylinder with which the gear is associated, whereby to facilitate the flow of air to and from the power cylinder in unobstructed streams, and accordingly to make possible a fast acting and efficient air motor.

In order that those skilled in the art may more fully appreciate the construction of my new valve mechanism and its manner of operation, it will be more fully described in connection with the accompanying drawings, in which

Fig. 1 is a view, partly in cross-section, of a grease dispensing apparatus of the type disclosed in U. S. Patent No. 2,007,113 and incorporating the improved valve mechanism of this invention,

Fig. 2 is a plan view of the principal operating parts of the valve mechanism as viewed from above,

Fig. 3 is a vertical cross-sectional view of the principal operating parts of the valve as they would appear when viewed along line A—A of Fig. 2,

Fig. 4 is a vertical cross-sectional view of the valve and air cylinder as it would appear when in a position to admit air to the cylinder,

Fig. 5 is a vertical cross-sectional view of the valve and air cylinder as it would appear when in position to exhaust air from the cylinder, and

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Fig. 6 is a vertical view partly in cross-section of the valve mechanism and air cylinder taken at a 90° angle from the view shown in Figs. 4 and 5.

In the drawings (Fig. 1), reference character 10 identifies a reservoir for lubricating material which is to be dispensed by the pumping mechanisms of the present invention. Where that material is a soft grease or semi-liquid compound which will flow under atmospheric pressure, cover 11 need only make a dust-tight fit on the top of the reservoir and be provided with suitable vent holes. In those cases where the device is used for dispensing hard greases, for which the illustrated mechanism is particularly designed, cover 11 must make an air-tight seal with the body of the reservoir so that compressed air delivered through line 12 will force the highly viscous and hard lubricant to flow through outlet line 13. In the latter case, it is usually desirable to provide a follower in the reservoir against which air under pressure can act to drive the grease in the desired manner without channeling, all as disclosed in the previously identified Staples patent.

It follows from the foregoing that grease is delivered from reservoir 10 under the influence of atmospheric or higher pressure through outlet line 13, past valve 14, and into cylinder 15 of the lubricant pump on each upward stroke of piston 16. When the piston is driven downwardly in a manner later to be described, valve 14 will close in the ordinary way so that grease may be delivered past check valve 17 and through line 18 to a point of usage. On the return stroke of the piston, valve 14 will again open, allowing grease to flow from the reservoir into cylinder 15 so that the action may be repeated, all in the conventional fashion.

Referring now to Fig. 4, which shows the valve mechanism at the beginning of a pumping stroke, it will be observed that an inlet port 19 which is tapped to receive a conventional threaded fitting, is in open position, its associated valve plunger 20 which moves slidably within a bushing 21, being at the extreme upper end of its stroke, while the exhaust air port 22 is closed by its associated valve plunger 23, which moves slidably within bushing 24, and is at the extreme lower end of its stroke. With the parts in these relative positions, compressed air may flow into the power cylinder to drive piston 25 and its associated plunger 16 downward, thereby discharging lubricant from cylinder 15 through line 18 as described above. As piston 25 nears the end of its downward stroke, it uncovers vent 26 thereby allowing air under pressure to flow from cylinder 27 through line 28

(Fig. 6) and passage 29 into the annular space 30 beneath piston 31. It should be noted that the latter element fits snugly within a small cylinder 32 formed in the head of the valve mechanism. The unit pressure of air thus confined beneath piston 31 is substantially identical with that acting on the under side of inlet valve plunger 20. Since the area of the former greatly exceeds that of the latter, piston 31 will be driven upwardly thereby lifting its associated exhaust valve plunger 23 and uncovering exhaust valve port 22. Simultaneously, piston 31 will rock arm 33 about its pivotal connection 34 with the base of the valve mechanism, thereby driving piston 35 and its associated inlet valve plunger 20 downwardly to close inlet port 19.

When the various parts reach the positions shown in Fig. 5 the supply of compressed air to cylinder 27 will be cut off, and air in the cylinder can freely escape through the unobstructed exhaust port 22 allowing piston 25 to rise under the urging of spring 36 which is compressed between the piston head and the base of the cylinder. In the course of its upward movement piston 25 will repass vent 26 thereby placing cylinder 32 in open communication with the atmosphere through passage 29 and line 28, and one or more vent holes 37 formed in the base of the cylinder.

As piston 25 approaches the top of its stroke it comes into contact with a pin 38 which may be formed separately or integrally with valve plunger 20 and which extends downwardly into cylinder 27. In the preferred arrangement as best seen in Fig. 4, a ring of cast iron or steel is secured to the head of the piston to engage the under side of the extension pin 38. Obviously, however, the piston head and its pin-engaging portion may be formed integrally or in any other satisfactory way.

Once contact is established between the piston and pin, further movement of the former element lifts the latter and begins to open inlet port 19. Simultaneously, motion is transmitted through piston 35 and rocker arm 33 to cause a downward movement of piston 31, air being vented from cylinder 32 through passage 29, line 28, vent 26 and vents 37, thus starting the closing of exhaust port 22. When the parts have been returned to the position shown in Fig. 4 compressed air is again delivered to cylinder 27 under full line pressure and, since it cannot escape through exhaust port 22, piston 25 will be driven downwardly to repeat the previously described action.

It will be apparent from the foregoing that the position of vent 26 in the side of cylinder 27 determines the lower end of the stroke of piston 25. Obviously, this port may be placed at any point along the length of the cylinder to increase or decrease the stroke as may be desired. Similarly, extension pin 38 serves to determine the limit of upward movement of the main power piston. Preferably, of course, the piston is permitted to rise as nearly to the top of the cylinder as is feasible with just that minimum of clearance which is necessary for satisfactory operation. If desired, however, the pin can readily be lengthened to establish a greater clearance and thus a shorter upward stroke.

While the valve may be operated as above described, its action tends to be sluggish and the pump to be consequently slow in action. In order to insure a rapid snapping of the valve parts from one position to another, and also to insure that the valve parts will remain in the same position during the upward and downward strokes of the piston, a snap action mechanism is provided. As illustrated in Figs. 2 and 3, the mechanism consists of a pair of springs 39 attached at one end to a rod 40 passing through rocker arm 33 near the point of its connection to piston 31, and secured thereto as by set screw 41. The other end of the springs 39 are attached, as by bolts 42, to a pair of lugs 43 rising out of boss 44, the point of attachment being at such a height that as the rocker arm 33 swings from one position to another, the center line of the springs 39 will pass the pivotal connection 34 of rocker arm 33, thereby causing an upward or downward resultant force to be applied to rod 40, depending on the position of arm 33.

Thus, when the rocker arm is in the position shown in Fig. 4, a downward resultant force will be applied by the springs 39 to rod 40, tending to hold the valve parts in the position shown. When, however, air under pressure is admitted to the annular space 30 under piston 31, the piston 31, together with the end of the rocker arm 33 to which it is connected, and rod 40, will be forced upward to a point at which the center line of the springs 39 will cross, in an upward direction, the pivotal connection 34. When this occurs, an upward resultant force will be applied to the rod 40, causing the rocker arm 33, together with the valve plungers and their associated elements connecting them with arm 33, to snap rapidly to the position shown in Fig. 5, where they are held during the upward stroke of piston 25, further movement of the rocker arm being inhibited by the impingement of the base of piston 35 against the bushing 21. Similarly, when valve plunger 20 and its associated piston 35 are forced in an upward direction by the action of the piston extension ring on the pin 38, the ensuing movement of rocker arm 33 will cause the center line of the springs 39 to pass, in a downward direction, the pivotal connection 34, causing a downward resultant force to be applied to rod 40, snapping the rocker arm rapidly back to the position shown in Fig. 4. As may be observed in the drawings, in this instance further movement of the rocker arm 33 is inhibited by an annular shoulder 45 near the top of piston 31, which makes contact with the top of cylinder 32. It will also be noted that the piston 31 is provided with an annular recess 46, in which packing may be placed to eliminate any blow-back of air from the annular space 30 when air under compression is admitted thereto.

It will be appreciated, of course, that the spring may be reversed, that is, one end may be connected to the rocker arm at a point near the inlet valve plunger, and the other connected to lugs rising out of cylinder 32. In either arrangement the functioning of the spring mechanism will be the same.

While in the foregoing description no particular method of attachment of the various bosses and lugs to the cylinder 27 has been given, it will be obvious to those skilled in the art that they may be formed integrally with the cylinder 27, or they may be separately fabricated and attached to the cylinder head in any conventional manner, as by bolting or welding. Likewise, the inlet and exhaust ports may be bored directly into the material of the cylinder head. However, for ease in servicing and replacement, the unitary valve construction illustrated in the drawings is preferred, in which the bosses and lugs are formed integrally with a base plate 47, which may be attached to the head of cylinder 27 as by bolts 48, a gasket 49 being interposed between the cylinder head and the base plate to eliminate air leakage. The base plate 47 preferably is sup-

plied with an upstanding rim **50**, defining an oil reservoir **51**, from which oil may flow through a hole **52** in boss **44** to lubricate valve plunger **20**, and through a capillary hole **53** in cylinder **32** to lubricate valve plunger **23**. Hole **52**, being of large enough diameter to permit oil to flow freely therethrough, also operates to relieve any vacuum tending to form under piston **35** during upward movement thereof, and also to relieve any pressure built up during its downward movement. The base plate **47** is preferably cast as one piece, and finished by conventional machining and boring operations.

Valve plungers **20** and **23** may also be attached to their associated pistons **31** and **35** in any conventional manner, but for ease of replacement in the event of wear or other damage, they are preferably held in slots **54** in the base of the valve pistons, the edges of the slots **54** engaging a neck portion **55** of reduced diameter near the upper end of the valve plungers.

Likewise, the valve pistons may be attached to the rocker arm **33** by any convenient means known to the art. A preferred method of attachment, as illustrated in the drawings, is by pins **56** passing through ears **57** on top of the plungers and through slots **58** in each end of the rocker arm **33**.

The entire valve assembly may be protected against dust and dirt by a cover plate **59**, secured to the base plate **47** as by bolts **60**.

It will be observed that the valve assembly described above is simple and sturdy, easily fabricated, and has a small number of moving parts. The valve stems, of course, may be widely varied in diameter, and may be of such size that the valve openings present a minimum of obstruction to the free entry and escape of air to and from the air cylinder of the pump. In addition, all moving parts of the assembly are completely enclosed; it is practically fool-proof in operation; and will operate at high speeds over long periods of time without requiring either lubrication or maintenance.

Having now described the invention, what is claimed is:

1. A motor assembly including in combination a pressure cylinder, an inlet port for the admission of gas under pressure to said cylinder, an exhaust port for exhausting gas from said cylinder, an inlet valve stem controlling the inlet port, an exhaust valve stem controlling the exhaust port, an exhaust valve piston slidably movable within a cylinder, and connected to the exhaust valve stem, said piston having a cross-sectional area greater than that of the exhaust valve stem, a pivotally mounted rocker arm connected at one end to the exhaust valve piston and at the other end to the inlet valve stem, and means for periodically admitting a gas under pressure to the base of the said piston, whereby to raise the said piston and exhaust valve stem to open said exhaust port and simultaneously lower the inlet valve stem to close the inlet port.

2. A motor assembly including in combination a pressure cylinder, an air inlet port for the admission of gas under pressure to said cylinder, an exhaust port for exhausting gas from said cylinder, an inlet valve stem controlling the inlet port, an exhaust valve stem controlling the exhaust port, an exhaust valve piston slidably movable within a cylinder and connected to the exhaust valve stem, the said piston having a cross-sectional area greater than that of the exhaust valve stem, a pivotally mounted rocker arm connected at one end to the exhaust valve piston and at the other end to the inlet valve stem, means for periodically admitting a gas under pressure to the base of the said valve piston, whereby to raise the said valve piston and exhaust valve stem to open said exhaust port and simultaneously lower the inlet valve stem to close the inlet port, and means for periodically raising the inlet valve stem whereby to open the inlet port and simultaneously lower the exhaust valve stem to close the exhaust port.

3. The motor assembly according to claim 2 including snap action means operably connected to one end of the rocker arm and conditioned during the first half of each movement of the rocker arm to complete the movement of the rocker arm and move the arm from one extreme position to the other.

4. A motor assembly including in combination a pressure cylinder, a motor piston movable reciprocally within the said cylinder, an inlet port, means for supplying gas under pressure to said inlet port, an inlet valve stem controlling the inlet port, an exhaust port, an exhaust valve stem controlling the said exhaust port, an exhaust valve piston slidably movable within a cylinder and connected to the said exhaust valve stem, the said valve piston having a cross-sectional area greater than that of the exhaust valve stem, a pivotally mounted rocker arm connected at one end to the exhaust valve piston, and at the other end to the inlet valve stem, means for admitting gas under pressure to the base of the said valve piston as the motor piston nears the end of the motor stroke, and means for raising the inlet valve stem as the motor piston nears the end of the return stroke.

5. The motor assembly according to claim 4 including snap action means operably connected to one end of the rocker arm and conditioned during the first half of each movement of the rocker arm to complete the movement of the rocker arm and move the said rocker arm from one extreme position to the other.

6. A motor assembly including in combination a pressure cylinder, a motor piston movable reciprocally within the said cylinder, an inlet port, means for supplying gas under pressure to the said inlet port, an inlet valve stem controlling the inlet port, an exhaust port, an exhaust valve stem controlling the said exhaust port, an exhaust valve piston slidably movable within a cylinder and connected to the said exhaust valve stem, the said valve piston having a cross-sectional area greater than that of the exhaust valve stem, a pivotally mounted rocker arm connected at one end to the exhaust valve piston, and at the other end to the inlet valve stem, a gas line connecting the base of the exhaust valve piston and the pressure cylinder, the said gas line entering the cylinder at a point such that it will be passed by the head of the motor piston near the end of its motor stroke, and means for raising the inlet valve stem as the motor piston nears the end of its return stroke.

7. The motor assembly according to claim 6 including snap action means operably connected to one end of the rocker arm and conditioned during the first half of each movement of the rocker arm to complete the movement of the rocker arm and move the said rocker arm from one extreme position to the other.

8. A motor assembly including in combination a pressure cylinder, a motor piston movable reciprocally within the said cylinder, an inlet port,

an inlet valve stem controlling the inlet port, means for supplying gas under pressure to the said inlet port, an exhaust port, an exhaust valve stem controlling the said exhaust port, an exhaust valve piston slidably movable within a cylinder and connected to the said exhaust valve stem, the said valve piston having a cross-sectional area greater than that of the exhaust valve stem, a pivotally mounted rocker arm connected at one end to the exhaust valve piston and at the other end to the inlet valve stem, a gas line connecting the base of the exhaust valve piston and the pressure cylinder, the said gas line entering the cylinder at a point such that it will be passed by the head of the motor piston near the end of its motor stroke, and a finger extension of the inlet valve stem extending into the interior of the pressure cylinder, and of a length such that the motor piston will contact the said finger extension near the end of its return stroke, whereby to raise the inlet valve stem to inlet port opening position during the remainder of the motor piston's return stroke.

9. The motor assembly according to claim 8 including means for relieving gas pressure against the base of the exhaust valve plunger during the piston return stroke.

10. The motor assembly according to claim 9 including snap action means operably connected to one end of the rocker arm and conditioned during the first half of each movement of the rocker arm to complete the movement of the rocker arm and move the rocker arm from one extreme position to the other.

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