

Aug. 7, 1928.

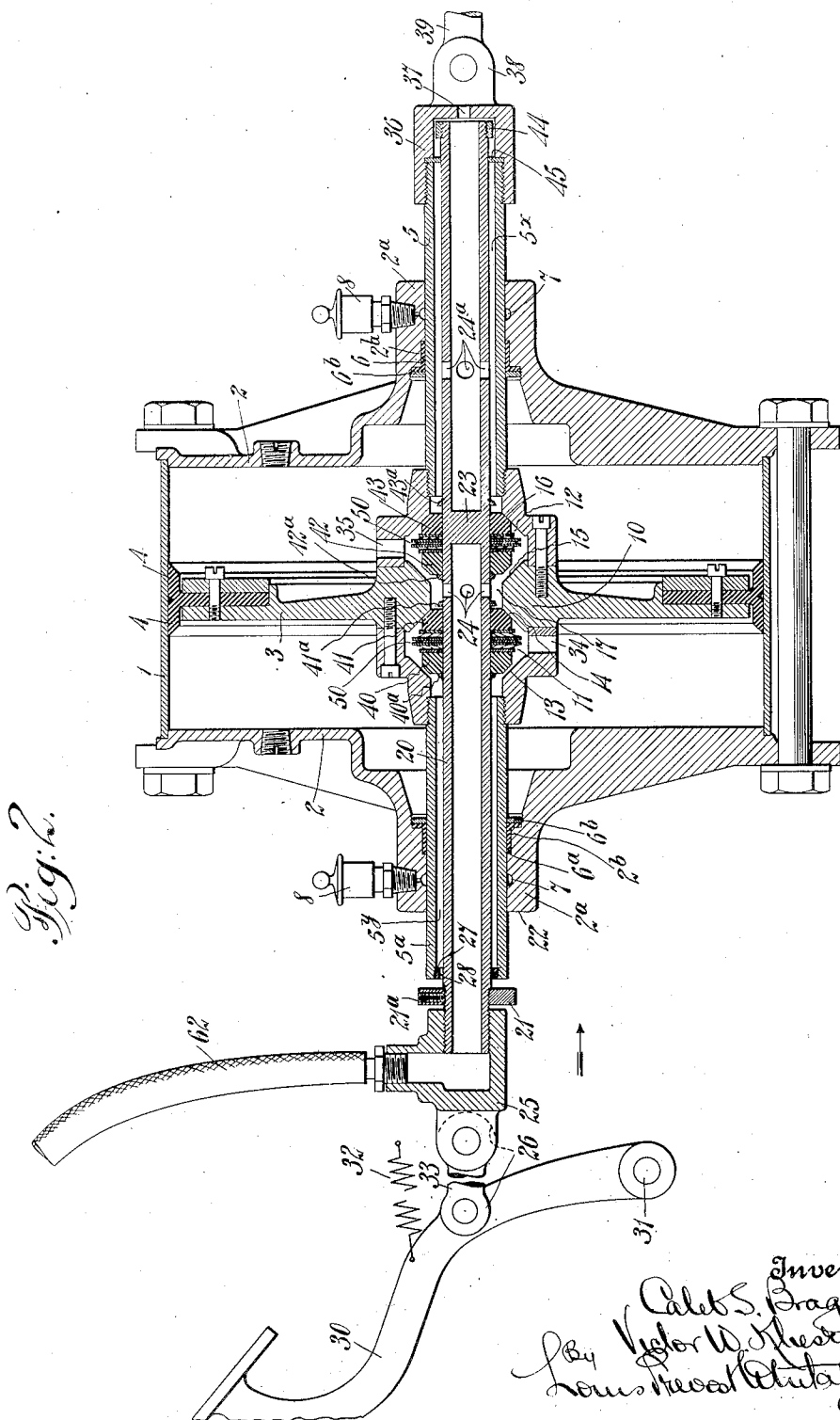
1,679,762

C. S. BRAGG ET AL

POPPET VALVE MECHANISM FOR POWER ACTUATORS AND THE LIKE

Original Filed Oct. 20, 1925

2 Sheets-Sheet 2



Patented Aug. 7, 1928.

1,679,762

UNITED STATES PATENT OFFICE.

CALEB S. BRAGG, OF PALM BEACH, FLORIDA, AND VICTOR W. KLIESRATH, OF PORT WASHINGTON, NEW YORK, ASSIGNORS TO BRAGG-KLIESRATH CORPORATION, OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF NEW YORK.

POPPET-VALVE MECHANISM FOR POWER ACTUATORS AND THE LIKE.

Application filed October 20, 1925, Serial No. 63,697. Renewed June 22, 1927.

Our invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one embodiment of the same, selected by us for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

Our present invention consists in an improved power actuator of the type shown in our former application for Letters Patent of the United States filed December 22, 1923, Serial No. 682,346, said actuator comprising a cylinder, closed at both ends, a double acting piston in the cylinder, means for subjecting the piston to differential pressures on its opposite faces, preferably by providing the cylinder with a connection leading to a suction device, which is usually and conveniently the intake manifold of an internal combustion engine, and providing the cylinder also with means for admitting higher pressure fluid, as atmospheric air, the differential pressures being controlled by reversing valve mechanism, preferably located in the hub of the piston and operated by a foot lever, or other operator operated part. These actuators are especially adapted to the operation of brake mechanism or other devices to be operated on an automotive vehicle propelled by the internal combustion engine and operating on land, in or upon water, or in the air. Our present invention consists in certain novel features embodied in the actuator, by means of which the reversing valve mechanism is connected directly with the atmosphere in such manner as to avoid the use of by-passes, whereby the piston is guided in its movements more efficiently, and positively preventing from cocking or in other words, getting out of coaxial relation with the cylinder, and whereby the apparatus within the cylinder is protected from dirt and water. Our invention also comprises certain other novel features hereinafter described and fully pointed out in the claims.

Referring to the accompanying drawings, which illustrate one embodiment of our invention, selected by us for purposes of illustration,

Fig. 1, is a sectional view of one form of our improved actuator embodying our present invention, and illustrating in connection therewith, an operator operated part for

controlling the reversing valve mechanism, which is shown in its normal retracted or off position in this figure.

Fig. 2 is a similar view showing the position of the apparatus after the piston has been actuated and the valve mechanism has been operated to effect the return of the piston to normal position.

In the accompanying drawings, 1, represents the cylinder of our improved actuator provided with heads, 2, each of which has a sleeve portion, 2^a, having an aperture therethrough for guiding a piston rod, and a stuffing box, indicated at 2^b, for the same. 3, represents the double acting piston provided with oppositely disposed gaskets, 4, 4, the said piston having a hub, 10, in which the reversing valve mechanism, hereinafter described, is located, and being provided at each end with a hollow piston rod, indicated at 5, 5^a, respectively, rigidly secured to the hub in any usual or desired manner, and extending through the guiding apertures in the sleeves, 2^a, of the head. Each of the stuffing boxes, 2^b, in the heads is provided with a flanged packing sleeve, indicated at 6, 6^a, respectively, and held in place by a follower, 6^b, said packing sleeves being preferably formed of molded rubber and adapted to make air tight joints between the ends of the cylinder and the adjacent piston rods, while permitting the piston rods to move therethrough. By providing the piston with two piston rods, in the manner shown and described, the piston will be guided in its movements by the engagement of each piston rod with its bearing aperture in the adjacent head of the cylinder, thus preventing cocking of the piston, and insuring the accurate movement of the same within the cylinder at all times. The sleeve portions, 2^a, of the cylinder are preferably provided with oil grooves, indicated at 7, and oil cups, 8, connected therewith, which are preferably filled with a suitable lubricant, as castor oil, to facilitate the movement of the piston rods, and assist in forming an air tight connection, and the prevention of leakage of air into the cylinder. This is important as a state of rarification is preferably maintained within the cylinder on both sides of the piston when the latter is in its normal or "off" position, as hereinafter described. The piston hub, 10, is preferably provided

centrally thereof with a suction, or outlet chamber, 17, communicating with valve chambers, 11 and 12, located on opposite sides of the suction chamber, and each of these valve chambers communicates with the interior of the adjacent hollow piston rod, 5, or 5^a, as the case may be. Each of the valve chambers, 11 and 12, is provided with a pair of oppositely disposed valve seats preferably conical, one adjacent to the piston rod, and the other adjacent to the suction chamber. The chamber, 11, is provided with the air inlet valve seat, 13, and suction valve seat, 14, while the chamber, 12, is provided with the air inlet valve seat, 16, and the suction valve seat, 15. 20 represents a valve actuating sleeve, which extends through the cylinder, the hollow piston rod, and the hub, 10, of the piston, and is provided within each of the valve chambers, 11 and 12, with oppositely disposed air inlet and suction valves, coaxial with respect to the sleeve, 20, and provided with central apertures through which the sleeve passes, means being provided to make this central aperture air tight, while permitting the sleeve to move longitudinally through the valves. Within the valve chamber, 11, the valve sleeve is provided with an inlet valve, 40, for engaging seat, 13, and a suction valve, 41, for engaging seat, 14. Within the valve chamber, 12, the sleeve is provided with a suction valve, 42, engaging seat, 15, and an air inlet valve, 43, engaging seat, 16. We prefer to make these valves of molded rubber, having their central apertures so formed as to fit the exterior of the sleeve air tight, while permitting the valve sleeve to move longitudinally with respect to the valve. The pair of valves in each chamber is provided with means for yieldingly pressing each valve in a direction toward its seat. In this instance we have illustrated the spring washers, 50, interposed between the valves, 40 and 41, and between the valves, 42 and 43, for elastically pressing them towards their seats, said spring washers as shown being of the kind shown in our former application for Letters Patent filed October 2, 1925, in which they are specifically claimed. The specific construction of these spring washers has no bearing on our present invention. The valve sleeve is provided, also, with collars, one adjacent to each of said valves, for unseating it by longitudinal movement of the sleeve, said collars being indicated respectively at 40^a, 41^a, 42^a, and 43^a. In practice, we prefer to provide means for limiting the extent to which the valve actuating sleeve, 20, may project into the cylinder, which consists in this instance of a stop collar, 21, adjustably secured to the sleeve, in this instance being threaded thereon, and held in adjusted position by a set screw, 21^a, the said sleeve being adapted to strike against the outer end, or shoulder, 22, of the sleeve, 2^a, of the adjacent head of the cylinder, when the piston is in its retracted position, as shown in Fig. 1, at which time the piston rod, 5^a, will be withdrawn entirely within the sleeve, 2^a, as therein shown, and the collars for actuating the valves are so located that when the sleeve and piston are in this position, the suction valves 41 and 42 will be held off of their respective seats, while the valves 40 and 43 will be seated, and the collars, 40^a, and 43^a, are located a little distance away from the corresponding valves, so that the valve sleeve may be moved far enough to permit the corresponding suction valve to seat fully before either of these collars will engage an air inlet valve. The valve chamber, 11, is connected with the cylinder on one face of the piston, by a port, or ports, 34, and the valve chamber, 12, is similarly connected with the cylinder on the other face of the piston, by a port, or ports, 35, and therefore in the normal or off position of the piston, the cylinder will be connected at both sides of the piston with the suction chamber, and will therefore be immersed or submerged in vacuum. For conveniently connecting the suction chamber, 17, with the source of vacuum, the valve sleeve is provided, internally, with a plug or partition, 23, just beyond the suction chamber, and with lateral openings, 24, communicating directly with the suction chamber, the adjacent portion of the sleeve, 20, extending outside of the cylinder, and being connected with a suction pipe, 62, leading to a source of suction. We conveniently provide the outer extremity of the sleeve, 20, with a fitting, 25, communicating with the interior of the sleeve, and the suction chamber, and provide means for connecting it with the suction pipe, 62, a portion of which at least is flexible tubing, so as to permit the longitudinal movement of the sleeve, and the said fitting is also provided with perforated lugs, indicated at 25, for conveniently connecting the valve actuating sleeve with an operator operated part. In order to facilitate an understanding of the operation of the device, we have shown a foot lever, 30, pivoted at 31, provided with a retracting spring, 32, and connected by a link, 33, (shown broken away) with the lug, or lugs, 26. The suction pipe, 62, is preferably connected to the intake manifold of the internal combustion engine, used for propelling the vehicle, on which the actuator is employed, as this forms a convenient source of suction.

Air is admitted to the air inlet controlled by the valve, 43, through an aperture at the outer end of the hollow piston rod, 5. In this instance we have shown the piston rod, 5, provided at its outer end with a cap, or fitting, 36, enclosing it, provided with

an air inlet aperture, 37, and also provided with lugs, 38, for convenience of attaching the piston rod, 5, to the part to be actuated, as the brake mechanism of an automotive vehicle, by means of a link, indicated at 39. As the valve actuating sleeve conveniently extends through the hollow piston rod, for a reason hereinafter explained, it is convenient to permit the air which enters through the aperture, 37, to pass through the end of the sleeve, 20, beyond the partition, 23, which separates it from the suction portion of the sleeve, and to pass through lateral apertures, 24^a, in the sleeve, into the space between the sleeve and the hollow piston rod, 5, indicated at 5^x, through which annular passage it passes to the valve chamber, 12, when the valve, 43, is opened. Atmospheric air is admitted to the valve chamber, 11, through the annular space, indicated at 5^v, between the hollow piston rod, 5^a, and the valve actuating sleeve, 20. At the outer end of the piston rod, 5^a, it is preferably provided interiorly with a guiding collar, 27, engaging the sleeve, 20, and provided with one or more air inlet openings, 28. The valve, 40, controlling the admission of air to valve chamber, 11, is never opened, except for the purpose of returning the piston to normal position, at which time the valve sleeve has moved in the direction of the arrow in Fig. 1, so as to remove the collar, 21, from the end face or shoulder, 22, of the cylinder head, and the piston rod, 5^a, will have been projected from the cylinder head so that air may readily enter through the apertures, 28, at such times.

Means are also provided for limiting the longitudinal movement of the valve actuating sleeve, 20, with respect to the piston in both directions, so that after the sleeve has been moved in either direction beyond the point necessary to effect the operation of the valve mechanism, the piston itself can be operated directly by the operator operated device, as in case of failure of power, or where the operator desires to add his physical force to the power of the actuator in the application of brakes or other devices. In this instance the interior end of the valve sleeve projects into a recess in the cap or fitting, 36, and is provided with a collar, 44, adapted to be brought into engagement with an interior collar, 45, secured to the hollow piston rod, 5, to limit the movement of the valve in the direction of the arrow, Fig. 1, and its movement in the opposite direction may be limited when the device is in use by the engagement of the end of the sleeve with the end of the collar, 36. This mechanism, however, forms no part of our present invention, and will not be further described or claimed herein.

The parts being in the positions indicated in Fig. 1, the suction pipe, 62, being

connected with the source of suction, as the intake manifold (a check valve, not shown, being preferably employed in said pipe to insure the maximum degree of rarification with the cylinder, which is obtained in the manifold between operations of the actuator) it will be seen that, assuming the engine to be running, air will be exhausted from the cylinder on both sides of the piston, leaving it submerged in vacuum, ready for instant operation. To effect the operation of the device in the arrangement shown, the foot lever, 30, is depressed or moved in the direction of the arrow, Fig. 1, thereby moving the valve sleeve, 20, longitudinally in the same direction. The first effect will be to open the suction valve, 41, further, continuing the connection of the portion of the cylinder forward of the piston (at the left in Fig. 1) with the suction, and to permit the suction valve, 42, to close upon its seat and thereafter to open the air inlet valve, 43, to admit atmospheric air to the cylinder in rear of the piston. The piston moves forward together with the valve actuating sleeve, and the movement of the piston will continue so long as the movement of the valve sleeve continues. When the operator stops the movement of the brake pedal, a slight continued movement of the piston engages the air inlet valve, 43, with its seat, 16, and shuts off the source of pressure, whereupon the movement of the piston ceases. The further movement of the piston, forward, may be obtained by the further forward movement of the valve sleeve, again opening the valve, 43. If it is desired to slightly release and reapply the brakes, as in continued braking on long grades, or in traffic, a slight release of pressure on the foot lever will cause a slight movement of the valve sleeve, 20, in a direction opposite that indicated by the arrow in Fig. 1, and will restore the valve mechanism to the position indicated in Fig. 1, although the piston will be further advanced in the cylinder, thereby permitting an equalization of pressures within the cylinder on opposite faces of the piston, and connecting both ends of the cylinder with the suction means, permitting the load of the applied brake bands to move the piston slightly rearwardly and relieve the brakes, which can be instantly reapplied by a forward movement of the pedal, effecting the closing of valve, 42, and a slight opening of the valve, 43. When it is desired to return the parts to their normal position, the operator will release the foot lever completely, usually by removing his foot from it, and permitting it to be retracted by its retracting spring, as indicated in Fig. 2. This will effect a quick movement of the sleeve, 20, in the direction of the arrow in that figure, closing the valve, 41, opening the valve, 42 further, closing the valve, 43, and opening

the valve, 40, thereby admitting atmospheric air through the annular passage between the piston rod, 5^a, and the sleeve to the cylinder on the forward face of the piston, and continuing communication between the cylinder 5 on the rear face of the piston and the suction chamber, thus moving the piston backward in the direction of the arrow, Fig. 2, until it is arrested by the engagement of its 10 hub with the head of the cylinder, and thereby withdrawing the piston rod, 5^a, into the sleeve, 2^a, of the piston head. Just before the piston is so arrested, the stop collar, 21, on the valve actuating sleeve, 20, engages the 15 end face, 22, of the adjacent cylinder head, arresting the movement of the valve head in the direction of the arrow, Fig. 2, permitting the air inlet valve, 40, to seat, cutting off further admission of higher pressure 20 fluid, and slightly opening the valve, 41, thereby permitting equalization of pressures on both sides of the piston, and establishing the communication between the cylinder on both sides of the piston, and the suction 25 chamber, and exhausting the higher pressure fluid, i. e., atmospheric air introduced for the return movement of the piston. The parts will then be in the position indicated in Fig. 1, and ready for another operation.

30 It will be seen that the stop collar, 21, closes the aperture at the end of the sleeve, 2^a, of the adjacent cylinder head, and thereby in effect closes the air inlet aperture, 28, when the parts are in normal or "off" position. This end of the cylinder will be ordi- 35 narily particularly subject to dirt and water, and this is normally prevented from entering the space between the hollow piston rod, 5^a, and the valve actuating sleeve, 20, thus protecting the valve mechanism there- 40 from. The air inlet passage, 5^x, at the opposite end of the cylinder between the hollow piston rod, 5, and valve sleeve, 20, is also protected from dirt and water by the 45 enclosing cap, 36, on the end of the piston rod, and the inlet aperture, 37, therein, is preferably located in a vertical face of the cap, as shown, to more effectually keep out moisture and foreign matter, although this 50 end of the apparatus is ordinarily not in a position to receive so much of the splash when the device is installed in an automobile, as is the opposite end of the apparatus.

It will be seen that atmospheric air may 55 be directly admitted from either end of the cylinder, to the adjacent valve chamber when required, through the annular passages between the hollow piston rods and the co-axial valve actuating sleeve, without the use 60 of by-passes in the hub from one side of the piston to the other, which would otherwise be required if the air was admitted at one end only of the cylinder. These air inlet passages are kept perfectly tight by means 65 of the valves, 40, and 43, and extraneous

packing is therefore unnecessary. The provision of the two piston rods extending in opposite directions through the head of the cylinder, also prevents any tendency of the piston to cock or twist in the cylinder, and 70 renders the operation of the piston true and uniform at all times, and the construction further provides for the prevention of the admission of dirt or water to the interior of the apparatus. 75

What we claim and desire to secure by Letters Patent is:—

1. A power actuator comprising among its members, a cylinder closed at each end by a head provided with a guiding aperture 80 a double acting piston in the cylinder, reversing valve mechanism located in the piston, a hollow piston rod connected to the piston and extending through the guiding 85 aperture in each of the cylinder heads, each of said hollow piston rods being provided with means for conducting air under atmospheric pressure to the reversing valve mechanism, one of said piston rods being constructed so as to be withdrawn within the 90 bearing aperture of the cylinder head through which it passes, when the piston is in "off" position, a hollow valve actuating member extending through said hollow piston rod and operatively connected with the 95 reversing valve mechanism for actuating the same, means for connecting said hollow valve actuating member with a source of suction, and a part carried by said hollow valve actuating part for engaging the adjacent cylinder 100 head when the piston is in "off" position, to limit the return movement of said valve actuating part, and to close the outer end of the bearing aperture in the cylinder head, and prevent access of water and dirt to the 105 hollow piston rod engaging the said bearing aperture.

2. A power actuator comprising among its members a cylinder having its opposite ends closed by heads provided with bearing aper- 110 tures, a double acting piston in said cylinder, reversing valve mechanism including normally closed air inlet valves each constructed to admit air on one side of the piston when 115 in open position, and a pair of suction valves each constructed to connect the cylinder on one side of the piston with a source of suction when in open position, a hollow piston rod extending from opposite sides of said piston in opposite directions, each having a 120 sliding engagement in the bearing aperture of one of said cylinder heads, means for admitting atmospheric air through each of said hollow piston rods to one of said air inlet valves, and a longitudinally-movable 125 valve actuating sleeve extending through at least one of said hollow piston rods operatively connected with said suction and air valves, and with means for connecting the cylinder with a source of suction under the 130

control of said suction valves, means for connecting one of said hollow piston rods with a part to be operated, and means for connecting said valve actuating sleeve with an operator operated part.

3. A power actuator comprising among its members a cylinder having its opposite ends closed by heads provided with bearing apertures, a double acting piston in said cylinder, reversing valve mechanism, including normally closed air inlet valves each constructed to admit air on one side of the piston when in open position, and a pair of suction valves each constructed to connect the cylinder on one side of the piston with a source of suction when in open position, hollow piston rods extending from said piston in opposite directions, each having a sliding engagement in the bearing aperture of one of said cylinder heads, means for admitting atmospheric air through each of said hollow piston rods to one of said air inlet valves, and a longitudinally movable valve actuating sleeve extending through at least one of said hollow piston rods operatively connected with said suction and air valve, and with means for connecting the cylinder with a source of suction under the control of said suction valve, means for connecting one of said hollow piston rods with a part to be operated, the other of said hollow piston rods being constructed to be withdrawn within its bearing aperture in the adjacent cylinder head, when the piston is in "off" position, a collar on the valve actuating sleeve for closing said bearing aperture when the parts are in "off" position, and means for connecting said valve actuating sleeve with an operator operated part.

4. A power actuator comprising among its members a cylinder having its opposite ends closed by heads provided with bearing apertures, a double acting piston in said cylinder, reversing valve mechanism, including normally closed air inlet valves each constructed to admit air on one side of the piston when in open position, and a pair of suction valves each constructed to connect the cylinder on one side of the piston with a source of suction when in open position, hollow piston rods extending from said piston in opposite directions, each having a sliding engagement in the bearing aperture of one of said cylinder heads, means for admitting atmospheric air through each of said hollow piston rods to one of said air inlet valves, and a longitudinally movable valve actuating sleeve extending through at least one of said hollow piston rods operatively connected with said suction and air valve, and with means for connecting the cylinder with a source of suction under the control of said suction valve, means for connecting one of said hollow piston rods with a part to be operated, the other hollow piston

rod being constructed to be withdrawn within its bearing aperture in the adjacent cylinder head when the parts are in "off" position, a collar on the valve actuating sleeve for engaging the adjacent cylinder head and closing said bearing aperture therein, said collar being constructed and arranged to limit the return movement of said sleeve and hold both suction valves in open position when the piston is in the "off" position, and means for connecting said sleeve with an operator operated part.

5. A power actuator comprising among its members a cylinder closed at each end by a head provided with a bearing aperture therein, a double acting piston in the cylinder having its central portion provided with two valve chambers each communicating with the cylinder on one side of the piston only, and a centrally located suction chamber, reversing valve mechanism including oppositely disposed air inlet and suction valves in each of said valve chambers, two hollow piston rods connected with said piston, each extending through the bearing aperture of one of the cylinder heads, one of said piston rods being provided with means for supplying atmospheric air to one of said valve chambers, and with means for attaching it to a part to be operated, the other of said piston rods being provided at its outer end with a guiding aperture and with air inlet apertures for supplying air to the other of said valve chambers, and being constructed to be withdrawn within its bearing aperture in the adjacent cylinder head when the piston is in "off" position, a hollow valve actuating sleeve extending through the said bearing aperture in the outer end of said hollow piston rod and being operatively connected with said air inlet and suction valve, said sleeve being provided with means for connecting said suction chamber to a source of suction, and with means for connecting said sleeve with an operator operated part, and a collar on said sleeve for closing the bearing aperture in the adjacent cylinder head when the parts are in "off" position.

6. A power actuator comprising among its members a cylinder closed at each end by a head provided with a bearing aperture therein, a double acting piston in the cylinder having its central portion provided with two valve chambers each communicating with the cylinder on one side of the piston only, and a centrally located suction chamber, reversing valve mechanism including oppositely disposed air inlet and suction valves in each of said valve chambers, two hollow piston rods connected with said piston, each extending through the bearing aperture of one of the cylinder heads, one of said piston rods being provided with means for supplying atmospheric air to one

of said valve chambers, and with means for attaching it to a part to be operated, the other of said piston rods being provided at its outer end with a guiding aperture and
5 with air inlet apertures for supplying air to the other of said valve chambers, and being constructed to be withdrawn within its bearing aperture in the adjacent cylinder head when the piston is in "off" position, a
10 hollow valve actuating sleeve extending through said bearing aperture in the outer end of said hollow piston rod, operatively connected with said inlet and suction valves, and provided with means for connecting said
15 suction chamber with a source of suction, and means for connecting said sleeve with an operator operated part, retracting means for said sleeve, and a stop collar on said sleeve adapted to engage the adjacent cylinder
20 head and arrest said sleeve in position to hold both of said suction valves in slightly opened position, and to close the bearing aperture and protect the air inlet in the adjacent hollow piston rod.
25 7. A power actuator comprising among its members a cylinder having its opposite ends closed by heads provided with bearing apertures, a double acting piston in said cylinder, reversing valve mechanism, including
30 normally closed air inlet valves each con-

structed to admit air on one side of the piston when in open position, and a pair of suction valves each constructed to connect the cylinder on one side of the piston with a source of suction when in open position, 35
piston rods extending from said piston in opposite directions, each having a sliding engagement in the bearing aperture of one of said cylinder heads, means for admitting atmospheric air to one of said air inlet valves, 40
and a longitudinally movable valve actuating member operatively connected with said suction and air valve, and with means for connecting the cylinder with a source of suction under the control of said suction 45
valve, means for connecting one of said piston rods with a part to be operated, the other of said piston rods being constructed to be withdrawn within its bearing aperture in the adjacent cylinder head, when the piston is in "off" position, a collar on the valve 50
actuating member for closing said bearing aperture when the parts are in "off" position, and means for connecting said valve actuating member with an operator operated part. 55
In testimony whereof we affix our signatures.

CALEB S. BRAGG.
VICTOR W. KLIESRATH.