No. 702,972. Patented June 24, 1902.

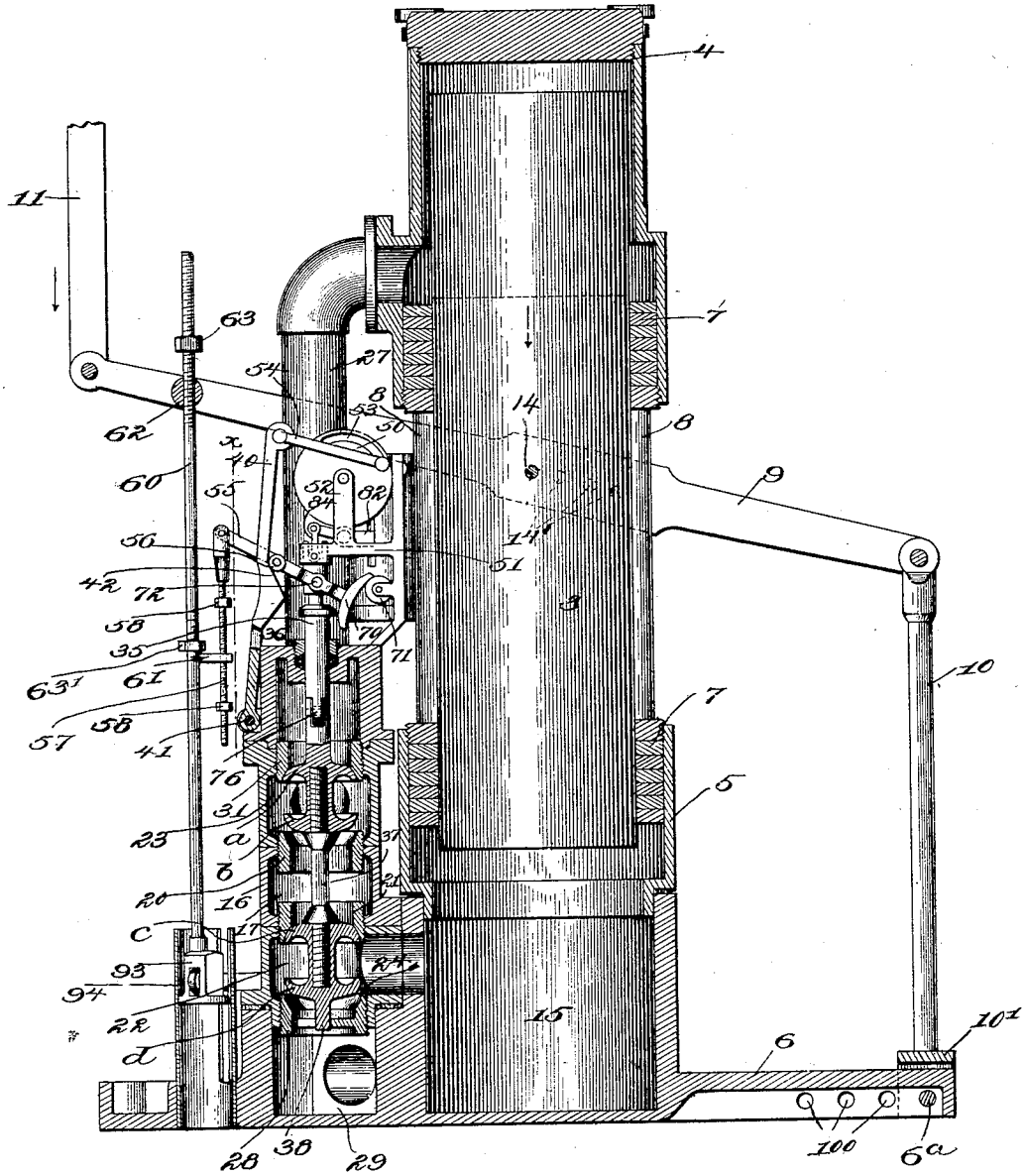
P. B. LASKEY.

MOTOR.

(Application filed May 23, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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No. 702,972

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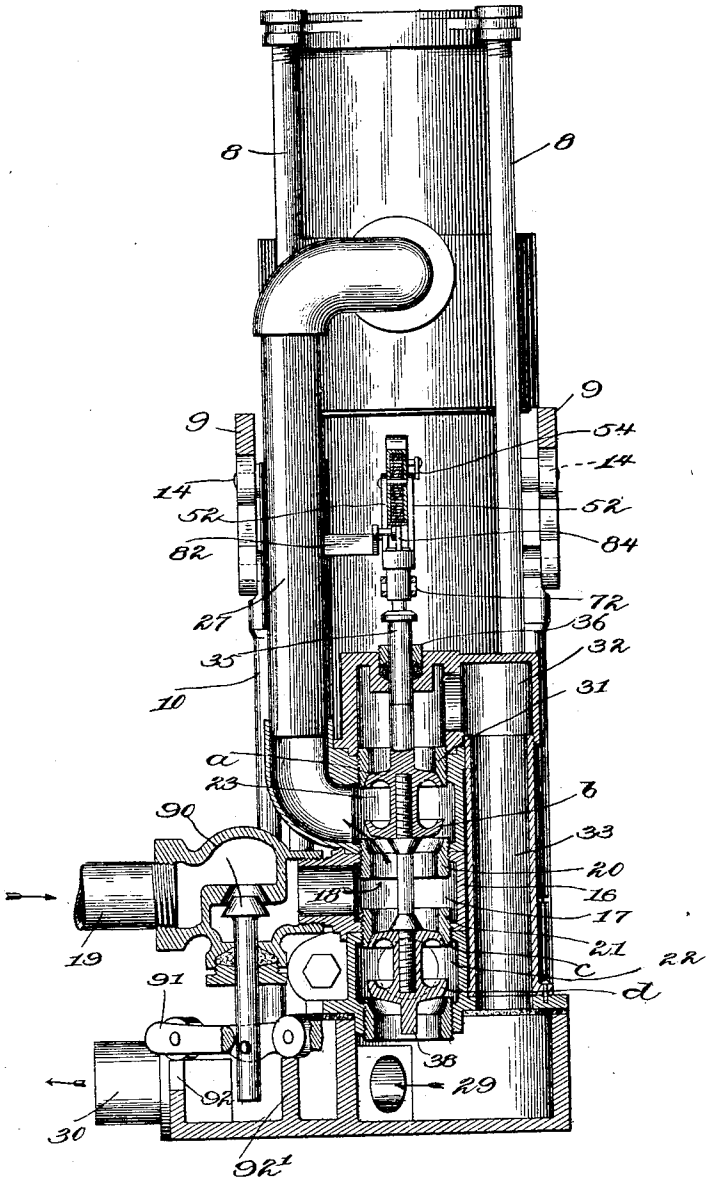
3 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 4.

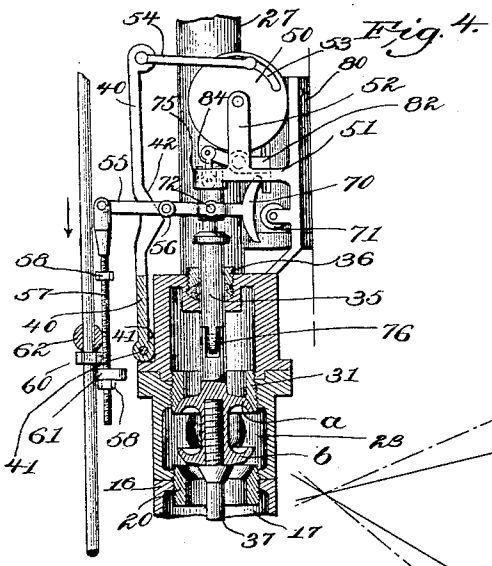


Fig. 9.

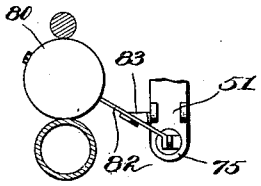
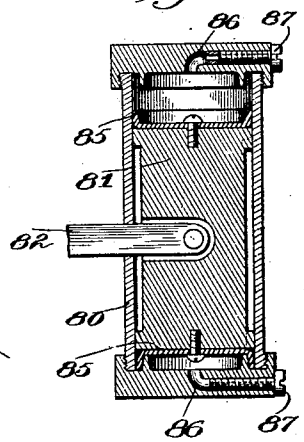


Fig. 8.



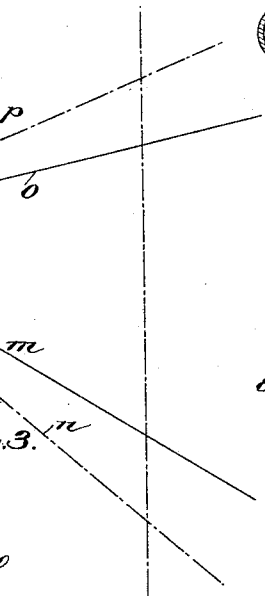


Fig. 7.

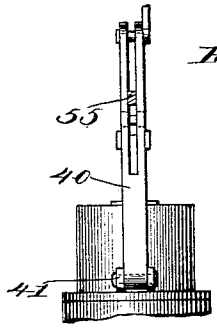


Fig. 3.

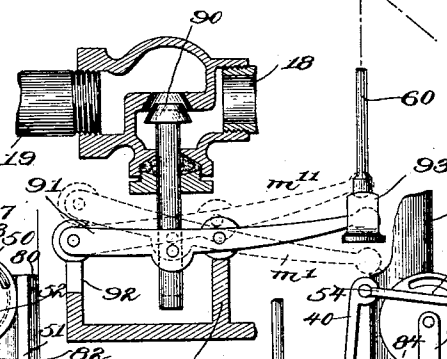


Fig. 5

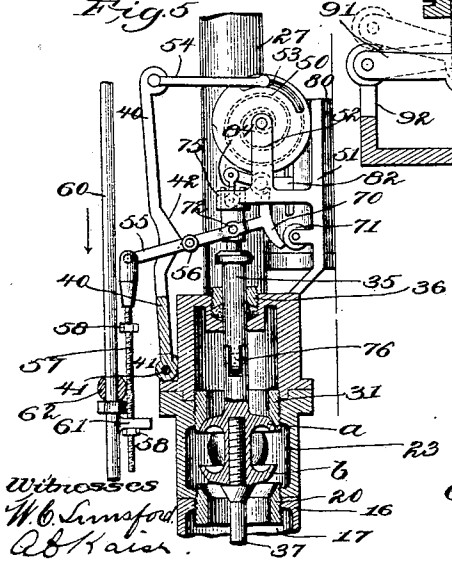
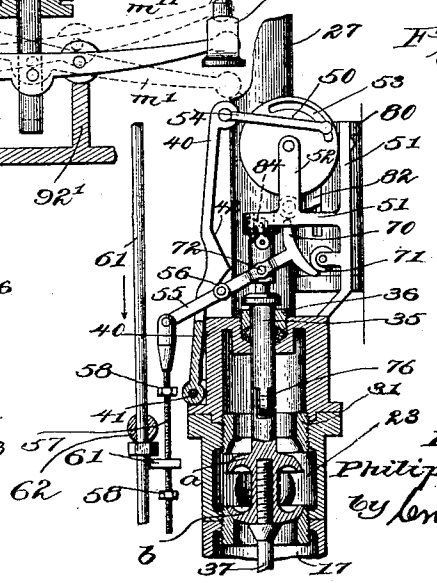


Fig. 6.



Witnesses
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UNITED STATES PATENT OFFICE.

PHILIP B. LASKEY, OF MARBLEHEAD, MASSACHUSETTS.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 702,972, dated June 24, 1902.

Application filed May 23, 1901. Serial No. 61,519. (No model.)

To all whom it may concern:

Be it known that I, PHILIP B. LASKEY, a citizen of the United States, and a resident of Marblehead, county of Essex, State of Massachusetts, have invented an Improvement in Motors, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to motors wherein a motive fluid under pressure is used, and especially to the valve and the actuating mechanism which operates the same to control the supply of motive fluid to the motor.

The motor used may be of any ordinary type, and the valve-actuating mechanism comprises a spring-controlled actuator, which is normally inactive, but which is rendered active periodically by mechanism operated by the motor, the actuator when active operating to shift the valve and change the direction of flow of the motive fluid. The actuator I preferably employ comprises an actuating-lever pivoted to a suitable fixed support and having thereon a double cam-surface, preferably of substantially V shape. The valve, which is a puppet-valve, has pivotally connected to its stem an operating-lever adapted to engage the cam-surface on the actuating-lever. The operating-lever is loosely connected to a reciprocating part of the motor in such a way that when the reciprocating member approaches the end of its stroke the operating-lever is turned about its pivot on the valve-stem against the action of the cam on the actuating-lever. This movement of the operating-lever operates both to hold the puppet-valve to its seat and to store up energy in the spring of the actuator. Just as the point of engagement between the operating-lever and actuating-lever passes the point or rise of the cam the opposite end of said operating-lever engages a fixed stop, thus limiting the turning movement of the operating-lever with reference to the valve-stem. The spring controlling the cam-lever or actuating-lever, which has been put under tension during the above operation, pulls the cam-lever to its normal position, and thereby turns the operating-lever about the fixed stop as a fulcrum, thus shifting the valve. The operating mechanism is so constructed that during the return movement of the reciprocating member the same operation is repeated. It will thus be seen that the reciprocating member does not operate to positively shift the valve, but that it merely operates to energize, so to speak, or render active the spring-controlled actuator, which when thus "energized" operates to shift the valve. The valve therefore will be positively shifted, even though the motor should stop immediately after the actuating mechanism has been rendered operative, and it will be impossible to stop the motor in such a position that it cannot be instantly started.

Where water is used as the motive fluid, it is found that the sudden shifting of the valve and changing of the direction of the motive fluid cause the same to hammer or pound, and to obviate this I prefer to employ in connection with my mechanism a throttle device which is automatically operated by the valve-actuating mechanism to throttle the supply of motive fluid just as the valve shifts.

My device is found to be especially useful as a motor for operating the bellows of pipe-organs, although it will be understood that the device may be put to a great variety of uses.

Figure 1 is a vertical longitudinal section of my apparatus. Fig. 2 is a front elevation thereof, showing the valve and supply-pipe in section. Fig. 3 is a diagram showing the operation of the throttle device. Figs. 4, 5, and 6 are views showing different positions of the valve-actuating mechanism. Fig. 7 is a section on the line $x\,x$, Fig. 1. Fig. 8 is a section of the cushioning-counterweight used in connection with the valve, and Fig. 9 is a detail hereinafter referred to.

The motor may be of any ordinary construction, either rotary or reciprocating, and as illustrating one convenient and practical type of motor I have shown the same as comprising the reciprocating plunger or piston 3, the ends of which are contained in the cylinders or casings 4 and 5, respectively, the casing 5 being supported on a suitable base 6, on which the motor is mounted. The cylinders 4 and 5 are provided with suitable packing means 7, surrounding the plunger, to form a tight joint therewith, as is usual in this class of devices. The cylinder 4 may be sup-

ported in any suitable way, and I have herein illustrated the same as connected to the cylinder 5 by means of suitable tie-rods 8. Each side of the piston has connected thereto centrally thereof by any suitable means, as a pin 14, an arm 9, which is pivoted at one end to a rocking support or standard 10, the other end thereof being connected to a pitman 11, which in turn will be connected to the device to be operated. The support 10 is mounted on a base 10′, which is pivoted to the base 6 of the motor by means of a pin 6^a, such pivotal connection between the standard and base 6 being necessary to accommodate the slight lateral movement of the pivotal end of the arms 9.

It will be obvious that by admitting the motive fluid alternately to the cylinder 4 and to the chamber 15, which communicates with the cylinder 5, the piston 3 will be reciprocated, and such motion will be communicated to the device to be operated through the oscillating arms 9. This type of motor has many advantages over the ordinary engine, for the length of the stroke of the end of the arms 9 is much greater than the stroke of the piston, and the only packing necessary is around the plunger. The device, too, is more compact than when the pitman is connected to the end of a piston-rod, as is the ordinary construction.

If it is desired to vary the effective stroke of the piston—that is, the stroke of the free end of the arms 9—I may adjust the support 10, which is pivoted to the base 6 and to which the arms 9 are pivoted, toward and from the piston, the base 6 being provided with series of holes 100 for this purpose. As the support 10 is adjusted toward or from the cylinder the point of connection between the arms and the piston 3 must be varied, and I therefore provide each of the arms with a series of apertures 14′, in any one of which the pin 14 may be placed. The valve mechanism for thus alternately admitting the motive fluid to the cylinders 4 and 5 and exhausting it therefrom will now be described. The valve-casing is designated by 16, and it comprises the central chamber 17, which is connected through the inlet 18 to the supply-pipe 19. The inlet-chamber 17 communicates through the oppositely-disposed valve-seats 20 21 with supplemental chambers 23 22, the chamber 22 communicating through the port 24 with the chamber 15 and the supplemental chamber 23 communicating with the pipe 27, which extends upwardly and into the cylinder 4. The supplemental chamber 22 has also a communication through the apertured valve-seat 28 with an exhaust-chamber 29 in the base 6 of the motor, which chamber is connected to a suitable exhaust-pipe 30. The upper supplemental chamber 23 communicates through the apertured valve-seat 31 with the chamber 32, which is in communication with the exhaust-chamber 29 by the pipe 33. The valve is of the puppet type and is in the nature of a double globe-valve, it comprising the valve-stem having the valve-sections *a b c d*, which are adapted to fit the valve-seats 31, 20, 21, and 28, respectively, the said valve-sections being so positioned on the stem that when the valve-section *c* is closed the valve-section *a* will also be closed, while the valve-sections *b* and *d* will be open, and when the valve-sections *b* and *d* are closed the valve-sections *a* and *c* are open. These valve-sections are mounted upon a reciprocating stem 35, which passes through a suitable stuffing-box 36 in the upper end of the valve-casing and is connected to the valve-actuating mechanism hereinafter described. Preferably the oppositely-disposed valve-sections *a* and *b* will be integral with each other and will be screwed upon the rod 37, and the oppositely-disposed valve-sections *c* and *d* will also be integral with each other and will be screwed upon the opposite end of the rod 37, the valve-section *d* having the stem 38, which passes through a suitable guide in the valve-seat 28.

The valve-seats 31, 20, 21, and 28 will preferably all be made adjustable in the valve-casing, so that they can be adjusted to compensate for wear and so that the valve-sections *a* and *c* or *b* and *d* will always seat together.

The valve which I have herein described and shown is, it will be seen, a balanced puppet-valve—that is, the pressure in the chamber 17 bears equally against the valve-sections *b* and *c*, so that the pressure on the valve is balanced and the valve may be moved with comparative ease, regardless of the amount of pressure of the motive fluid.

With the valve in the position illustrated in Fig. 1 it will be seen that the motive fluid from the chamber 17 passes through the open valve-section *b* to the supplemental chamber 23, from whence it passes by pipe 27 to the cylinder 4, thus forcing the piston 3 downward, while the supplemental chamber 22 is in communication with the exhaust-chamber 29 and the motive fluid in the cylinder 5 will be exhausted. The arrows in Figs. 1 and 2 indicate the direction in which the motive fluid is flowing at this point, and also the direction of movement of the parts. When the valve is reversed, so that the valve-sections *b* and *d* are seated, the motive fluid will be admitted from the central chamber 17 to the cylinder 5 and exhausted from the cylinder 4 through the pipe 27 and valve-section *a* to the exhaust-chamber 29.

The globe type of valve above described is preferable in many ways to a slide or piston valve, for in addition to its being a balanced valve, so that it may be moved easily, regardless of the pressure of the motive fluid, the shape of the valve is such that it cannot easily stick to its seat. The slightest movement of the valve unseats it, and a comparatively short stroke thereof completely opens it. Moreover, should wear occur the similarly-disposed valve-sections, as *a* and *c* or *b* and

d, may readily be ground to fit their seats. It will also be noted that the stem 35 of the valve device passes through the exhaust-chamber and through a stuffing-box, and since the pressure in the exhaust-chamber is very much less than the pressure of the supply of motive fluid it is unnecessary to pack the valve-stem very tightly, thus doing away with the friction caused by such a packing as would be necessary where the pressure is high.

The valve-actuating mechanism comprises a normally inactive actuator, which is rendered active when the piston 3 or the oscillating arm 9 approaches the end of its stroke, said actuator when active operating to quickly shift the valve from one extreme position to the other. One form of actuator is herein illustrated, it comprising an actuating-lever 40, pivoted, as at 41, to a suitable fixed support, preferably the valve-casing, and having thereon a double cam 42, preferably substantially V-shaped, the free end of said lever being connected to a suitable spring-controller. In this embodiment of my invention I have illustrated the spring-controller as including a convolute spring, said spring being sustained in a suitable casing 50, carried by a bracket 51, supported in any suitable way on the valve-casing, said bracket having the upright arm 52, to which the spring-casing 50 is attached. Any other suitable form of spring may be used instead of the one illustrated without in any way departing from the spirit of my invention. One end of the spring may be attached at one end to a fixed support 52, and the other end of said spring may have a pin projecting therefrom through a slot 53 in the casing and connected to a link 54, which in turn is pivoted to the free end of the actuator or cam-lever 40. The projecting end of the valve-stem 35 has pivoted thereto an operating-lever 55, said lever preferably passing through a slot in the cam-lever 40, as shown in Fig. 7, and being provided with a roll or projection 56, which engages the surface of the cam 42. The free end of the lever 55 has pivoted thereto a rod 57, carrying the adjustable stop-collars 58, which are preferably in the form of nuts threaded upon the rod. An actuating-rod 60 has a lug 61 projecting therefrom, through which the rod 57 slidably passes, the said lug playing between the adjustable stop-collars 58. The upper end of the actuating-rod 60 slidably passes through a cross-piece 62, connected to the two arms 9, and the upper end of the said rod has the adjustable stop-collar 63 thereon, and preferably a lower adjustable stop-collar 63′ will be used adjacent the lug 61.

Assuming the parts to be in the position shown in Fig. 1, in which position the piston 3 is just beginning its downstroke, it will be seen that the rod 60 and the valve-actuating device will remain in the position shown until the arms 9 have been depressed, so that the cross-piece 62 strikes the stop-collar 63′. When this occurs, the rod 60 is carried down with the arms 9 until the lug 61 strikes the lower stop-collar 58 on the rod 57, when the said rod is depressed, thus turning the operating-lever 55 about its pivot 72 on the valve-stem 35. The turning of the lever 55 about its pivot operates to force the cam-lever 40 to the left, as shown in Fig. 4, thus putting the spring-controller under tension, as will be obvious, and since the point of engagement of the operating-lever with the cam on the cam-lever 40 is between the point where pressure is applied to the operating-lever and its fulcrum 72 it will be obvious that the power exerted in forcing the cam-lever to the left, as in Fig. 4, will operate to hold the valve-sections *a* and *c* tightly to their seats and prevent the valve-stem from having any downward movement. Just as the roll 56 passes the point of the cam 42, which position of the parts is illustrated in Fig. 5, the head 70 at the opposite end of the lever 55 strikes a fixed stop, (shown in the nature of a roll 71,) thus limiting the turning movement of the operating-lever about its pivot 72. At this point the tension on the spring-controller is sufficient to force the cam-lever 40 to the right, when the lower portion of the V-shaped cam, engaging the roll 56, operates to turn the lever 55 about the stop 71 as a fulcrum, thereby moving the valve-stem downward and reversing the position of the valve.

The construction and disposition of the parts are such that if for any reason the valve should stick to its seat it is positively forced therefrom by the motor.

The arms 9 operate to positively turn the lever 55 about its pivot 72 until the head 70 strikes the stop 71, as above described, at which position of the lever the roll 56 has just passed the point or rise of the cam 42. If the pressure of the motive fluid is comparatively low, the spring-controller will be sufficient to shift the valve. If, however, the pressure of the motive fluid is very great or if the valve should stick to its seat for any reason, so that the tension on the spring-controller is insufficient to start the valve, the positive movement of the rod 60 will positively start the valve from its seat through the rod 57 and lever 55. As soon as the valve is once started from its seat the spring-controller is sufficient to shift it. It will thus be seen that the movement given to the valve is caused by the cam 42 operating against the operating-lever 55 and that the positive movement of the rod 60 only operates to energize the spring-controller and under certain conditions to start the valve from its seat. The tension of the spring is sufficient to throw the valve quickly to its seat, and the rod 57 will therefore move ahead of the rod 60, as shown in Fig. 6. As soon as the valve is reversed the piston 3 begins its movement in the opposite direction, and the same operation is repeated when the arms 9 are raised sufficiently to engage the upper stop-collar 63 and the rod 60, ex-

cept that in this instance the upward movement of the said arms causes the lug 61 to engage the upper stop-collar 58 when the operating-lever 55 will be turned about its pivot 72 until the roll 56 passes over the rise of the cam, when the spring-controller will operate to quickly raise the valve to the position shown in Fig. 1. The upper end of the valve-stem is shown as being guided in an arm 75, fast on the bracket 51, and in order that the valves may seat perfectly I prefer to provide the stem 35 of the valve with a loose joint, (shown at 76,) so that the valves may have a lateral movement in any direction relative to that part of the valve-stem which passes through the stuffing-box.

In order that the valve device may work easily, I prefer to counterbalance the same, this being advisable where the valves stand in a vertical position, as in this embodiment of my invention, and to prevent the valves from coming to their seats too suddenly I preferably provide a cushioning device in the form of a dash-pot.

Referring to Fig. 8, 80 is a suitable casing supported above the valve-casing at one side thereof and which contains a counterweight 81 in the nature of a piston, the said counterweight having pivoted thereto a lever 82, passing through a slot in the casing 80 and being fulcrumed upon an arm 83, carried by the bracket 51, as shown in Fig. 9, the opposite end of the arm being connected to the upper end of the valve-stem by means of a link 84. Either end of the weight 81 will preferably be provided with suitable packing 85, and the ends of the casing are provided with outlets 86, into which are screwed plugs or screws 87, said screws having tapering slots or cut-away portions, (not shown,) whereby by adjusting the screws the said outlets may be more or less closed. The weight 81 is just sufficient to counterbalance the weight of the valves and valve-stem, and as the valves are operated by the means above described the counterweight will be vibrated in its casing; but the throttle-ports 86 will prevent any sudden movement of the valves and cause the same to come to their seats easily.

When water is used for the motive fluid, it is very desirable to gradually throttle the supply of water to the valve mechanism just when the valves are being reversed, for otherwise the sudden changing of direction of the stream of water is liable to cause hammering. I have provided an automatic throttle device which operates to practically shut off the supply of motive fluid just as the valves are being reversed, such throttle device being operated by the valve-operating mechanism.

Referring to Fig. 2, the throttle device is shown as a valve 90 of ordinary construction, the stem of which is pivotally connected to the rocking member 91, said member bearing on the two supports 92 92′ either side of the valve-stem. One end of the rocking member is pivotally connected to the lower end of the actuating-rod 60, (see Fig. 1,) and preferably said rod will be provided with a head 93, playing in a suitable guide 94.

The diagram in Fig. 3 illustrates the operation of the throttle device, and in full lines is shown the normal position of the valve that is open. When the arms 9 reach the position shown by the full line m, Fig. 3, the cross-piece 62 engages the lower stop-collar 63′, thus moving the actuating-rod 60 downward, and thereby rocking the rocking member 91 into the dotted-line position m', Fig. 3. As this occurs the rocking member 91 fulcrums about the stop or support 92′, thereby raising the valve-stem and substantially closing the valve to practically shut off the supply of motive fluid. The dotted-line position n shows the position of the arms 9 at this point.

Preferably the device will be so constructed that the valve will not entirely close, but will allow sufficient water to pass therethrough to operate the motor. After the valve has been reversed and the piston starts on its return stroke the pressure of the water will operate to fully open the throttle-valve, leaving it in the full-line position, Fig. 3. The same operation is repeated when the arms 9 reach the upper limit of their stroke, for when they reach the full-line position o the cross-piece 62 engages the upper stop-collar 63 and raises said rod, turning the rocking member about the stop or fulcrum 92 into the dotted-line position m'', thereby again throttling the supply of fluid by substantially closing the valve 90. The upper dotted-line position p represents the extreme upper position of the arms 9. It will thus be seen that my automatic throttling device operates only as the valve is about to be reversed, and because the pressure of the motive fluid is cut down at this point the valve will work easier, and there is no hammering or pounding due to the sudden change of direction of the motive fluid.

While my motor is capable of a variety of uses, yet I have found it especially valuable in operating the bellows of a pipe-organ, an æolian, or a pianola or like instrument, for the valve device is of such a construction that the motor will start up regardless of the position of the parts. When used as a motor for working the bellows of an organ, I will preferably provide a suitable device connected to the bellows, which will operate the throttle-valve 90 when the bellows are full, so that so long as the bellows remain full the supply of motive fluid to the motor is nearly shut off. I also wish it understood that my particular valve and its operating mechanism may be used in connection with any other form of motor, if desired.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A motor, a valve for admitting the motive fluid thereto, a normally inoperative actuator for said valve, a valve-operating lever piv-

oted to the valve-stem and engaging said actuator, means operated by the motor to positively turn said lever about its pivot, a stop to limit such positive-turning movement of the lever, said positive turning movement of the lever operating to store up energy in the actuator and said lever being then operated on by the actuator to shift the valve.

2. A motor, a valve for admitting motive fluid thereto, an actuator for said valve including a normally inactive cam, a lever pivoted to the valve-stem and engaging said cam, means operated by the motor to positively turn said lever about its pivot, and a stop to limit such positive turning movement, the lever during such positive turning movement operating to render the cam active, and said cam when active engaging the lever and actuating the valves.

3. A motor, a puppet-valve for admitting the motive fluid thereto, a normally inoperative actuator for said valve, a valve-operating lever pivoted to the valve-stem, means operated by the motor to operate said lever, said lever operating through the first portion of its stroke to store up energy in said actuator and to hold the valve firmly to its seat, and being operated upon by the actuator during the latter portion of its stroke to shift the valve.

4. A motor, a puppet-valve for admitting motive fluid thereto, an actuator for said valve including a normally inactive actuating-cam, a lever pivoted to the valve-stem, and means connected to said lever and operated by the motor to render said cam active, said lever operating to hold the valve to its seat while the cam is being rendered active and said cam when active engaging the lever and actuating the valve-stem.

5. In a valve-operating mechanism, a spring-controlled cam-lever having a double cam-surface thereon, an operating-lever pivotally connected to the valve-stem, and engaging said cam-surface, means to turn said operating-lever about its pivotal point against the action of the cam-lever, said lever during such turning motion operating to hold the valve to its seat, and said cam-lever after the operating-lever has passed its rise giving to the same a movement to shift the valve.

6. In a puppet-valve-operating mechanism, a valve, a yieldingly-supported cam, an operating-lever connected to the valve and engaging said cam, means to positively operate one of said parts until the point of engagement between the lever and the cam passes the rise thereof, the lever during such positive movement operating to hold the valve to its seat and the cam then operating against the lever to shift the valve.

7. In a puppet-valve-operating mechanism, a valve, a yieldingly-supported cam, an operating-lever connected to the valve-stem, and engaging said cam, means to positively turn said lever until its point of engagement with the cam passes the rise thereof, the cam then operating to complete the stroke of the lever, and shift the valve, said lever during its initial turning movement operating to hold the valve to its seat.

8. In a valve-operating mechanism, a valve, a yieldingly-supported cam, an operating-lever pivoted to the valve-stem and engaging the cam, means to positively turn said lever and a stop to arrest the turning movement of said lever about its pivot as the point of engagement between said lever and the cam passes the rise of the cam, whereby said cam operates to move the lever about the stop as a fulcrum and thus shift the valve.

9. In a valve-operating mechanism, a valve, a spring-controlled actuating-lever having a cam thereon, an operating-lever pivoted to the valve-stem to engage the cam, means to positively turn said lever, and a stop to arrest the turning movement thereof as the point of engagement between the lever and cam passes the rise of the cam, whereby said cam operates to move the lever about the stop as a fulcrum, and thus shift the valve.

10. In a valve-operating mechanism, a valve, a yieldingly-supported cam, an operating-lever pivoted to the valve-stem and engaging said cam one side of the fulcrum thereof, means to positively turn the operating-lever about its fulcrum, a stop adapted to engage the opposite end of the lever as the point of engagement with the cam passes the rise thereof, whereby the yielding cam operates to turn the lever about the stop as a fulcrum and thus shift the valve.

11. In a valve-operating mechanism, a valve, a spring-controlled actuating-lever having a double cam thereon, an operating-lever pivoted to the valve-stem, one arm of said lever engaging said cam-surface, means to turn said lever about its fulcrum, a stop adapted to engage the other arm of said lever just as the point of engagement between the lever and the cam passes the rise of the cam, the lever-operating mechanism operating to positively lift the valve from its seat and the spring-controlled cam-lever operating to turn the operating-lever about the stop as a fulcrum and thus shift the valve.

12. In a valve-operating mechanism, a valve, a spring-controlled actuating-lever pivoted to a stationary support and having a substantially V-shaped cam-surface thereon, an operating-lever pivoted to the valve-stem and engaging the said cam-surface, a stop to limit the turning movement of the operating-lever about its pivotal point in either direction just as it passes the point of the cam, whereby the actuating-lever operates to turn the operating-lever about the stop as a fulcrum and thus shift the valve in either direction.

13. A motor including a reciprocating member, a valve for admitting motive fluid thereto, a spring-controlled cam-lever pivoted to a stationary support and having a substantially V-shaped cam-surface thereon, an operating-lever pivoted to the valve-stem and en-

gaging said cam-surface, means connected to the reciprocating member of the motor to turn said lever about its pivotal point against the action of the cam-lever, a stop to limit the turning movement of the operating-lever about its pivotal point in either direction just as it passes the point of said cam, whereby the cam-lever operates to turn the operating-lever about the stop as a fulcrum, and thus shift the valve in either direction.

14. A motor including a cylinder and a reciprocating piston therein, a valve to alternately admit motive fluid to opposite sides of the piston, a spring-controlled cam-lever having a substantially V-shaped cam-surface thereon, and an operating-lever pivoted to the valve-stem and engaging said cam-surface, means operated by the piston to turn the lever about its pivotal point, and a stop to limit the movement of the operating-lever relative to the valve-stem just as the point of engagement between said lever and cam-surface passes the point of rise of the cam, whereby the cam operates to turn the lever about the stop as a fulcrum and thus shift the valve.

15. A motor, a balanced puppet-valve device for admitting the motive fluid thereto, an actuator for said valve including a normally inactive actuating-cam, a lever pivoted to the valve-stem, and means connected to said lever and operated by the motor to render said cam active, said means also operating to hold the valve to its seat until the cam is rendered active and said cam when active engaging the lever and shifting the valve device.

16. In a valve-operating mechanism, a balanced reciprocating valve, a yieldingly-supported cam, an operating-lever pivoted to the valve-stem and engaging the cam, means to positively turn said lever, and a stop to arrest the turning movement of the lever relative to the valve-stem as the point of engagement between said lever and the cam passes the rise of said cam, whereby said cam operates to turn the lever about the stop as a fulcrum and thus shift the valve.

17. In a valve mechanism, a globe-valve, means to move the same toward and from its seat, and a cushioning-counterweight connected to the valve-stem and operating to retard the action of the valve in both directions, said counterweight having approximately the same weight as the valves.

18. In a valve mechanism, a globe-valve, means to move the same toward and from its seat, a casing, a piston in said casing and connected to said valve, said piston having substantially the same weight as the valve and serving as a counterweight therefor, and means to retard the movement of the piston in both directions, whereby the movement of the valve is cushioned.

19. In a valve mechanism, a globe-valve, means to move the same to and from its seat, a lever pivoted to the valve-stem, a counterweight connected to said lever and inclosed in a casing, and means to retard the movement of said counterweight in said casing in both directions, said counterweight having approximately the same weight as the valve.

20. A motor including a reciprocating piston, valve mechanism to admit motive fluid alternately to opposite sides of said piston, a single throttle-valve in the supply-pipe, and automatic mechanism to substantially close the same when the piston reaches each end of its stroke, said valve being automatically opened by the pressure of the motive fluid.

21. A motor including a reciprocating piston, a valve to admit motive fluid alternately to opposite sides thereof, a throttle-valve in the supply-pipe, a rocking lever to which said throttle-valve is attached, said lever having a fulcrum each side its point of attachment to said valve, and means operated by said piston as it reaches each end of its stroke to rock said lever whereby the throttle-valve is substantially closed.

22. A motor including a reciprocating piston, a valve to admit motive fluid alternately to opposite sides thereof, a throttle-valve in the supply-pipe, a rocking lever to which said throttle-valve is attached, said lever having a fulcrum each side of its point of attachment with the throttle-valve, and means operated by said piston when it reaches one end of its stroke to rock said lever about one fulcrum, and when it reaches the other end of its stroke to rock said lever about the other fulcrum, said lever in such rocking movement operating to substantially close the throttle-valve and said valve being automatically opened by the pressure of the motive fluid as the piston begins each return stroke.

23. In a motor, a reciprocating piston, a valve to supply motive fluid to said motor, valve-operating mechanism, a puppet throttle-valve in the supply-pipe, and means actuated by the piston as it reaches each end of its stroke to move said throttle-valve toward its seat to substantially close the same, the closing movement of the throttle-valve being always in the same direction regardless of the direction of movement of the piston.

24. A motor including a reciprocating piston, a valve to supply motive fluid to said motor, valve-operating mechanism rendered active when the piston reaches a predetermined point in its stroke in either direction, a puppet throttle-valve in the supply-pipe of the motor, and means operated by the valve-operating mechanism to substantially close the throttle-valve for an interval of time when the piston reaches each end of its stroke, said valve being opened by the pressure of the motive fluid.

25. A motor, including a reciprocating piston, a valve to supply motive fluid to said motor, valve-operating mechanism, a reciprocating throttle-valve in the supply-pipe, and a rocking member connected to the stem of said throttle-valve and actuated by the piston as it reaches each end of its stroke to

move said throttle-valve toward its seat to substantially close the same, the closing movement of the throttle-valve being always in the same direction, regardless of the direction of movement of the piston.

26. In a motor, two oppositely-disposed cylinders, a reciprocating piston at its ends inclosed in said cylinders, an arm adjustably connected intermediate its ends to the central portion of the piston, and an adjustable support to which one end of said arm is pivoted, the other end of said arm being connected to the mechanism to be operated, the construction being such that the length of the stroke of the arm may be adjusted.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PHILIP B. LASKEY.

Witnesses:
GEO. W. GREGORY,
LOUIS C. SMITH.