(No Model.)

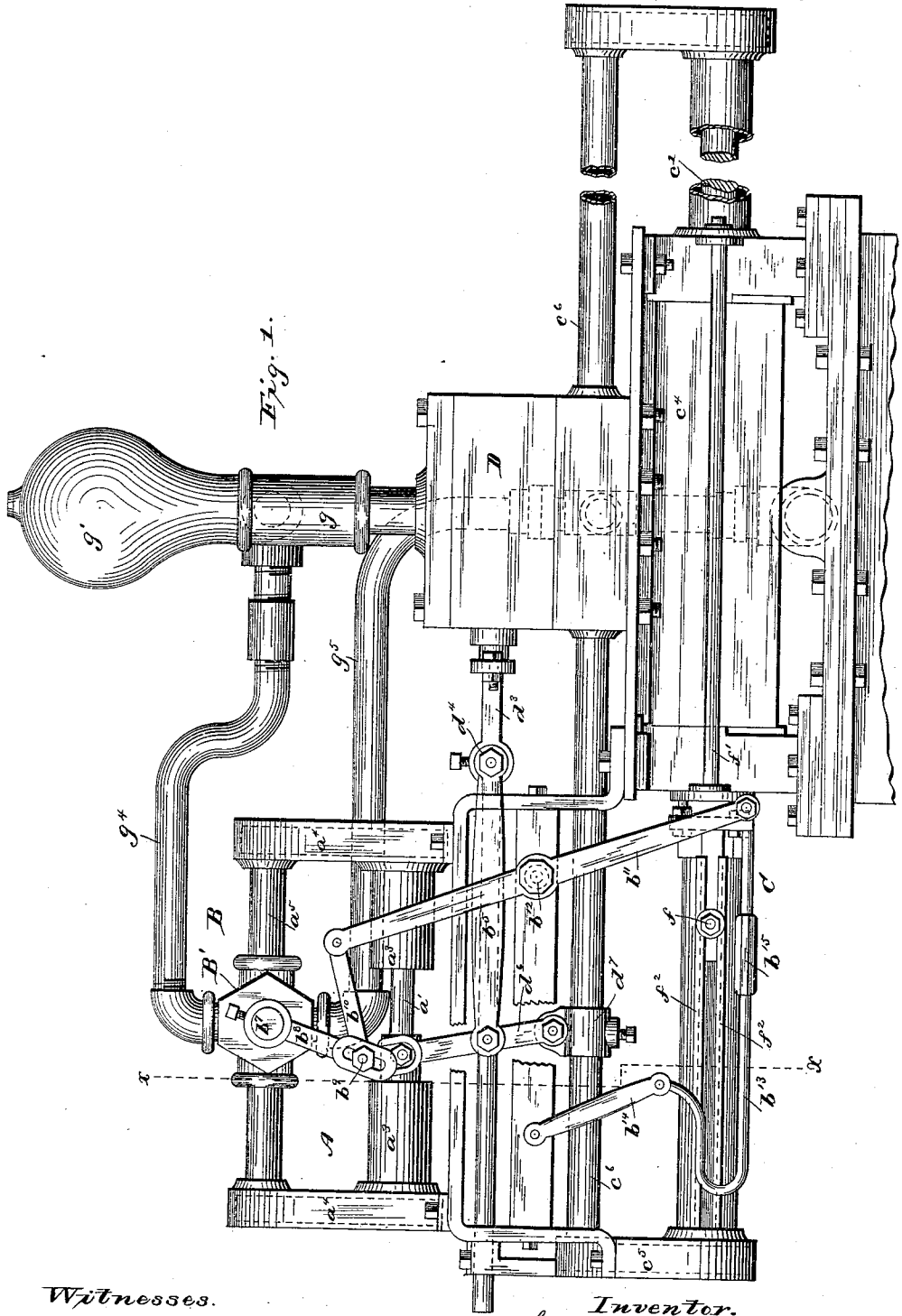
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L. B. TUBBS.

CUT-OFF FOR HYDRAULIC AND OTHER ENGINES.

No. 329,417. Patented Oct. 27, 1885.

Fig. 1.



Witnesses.
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Inventor.
Lily B. Tubbs
by Church & Church
Her Attorneys.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

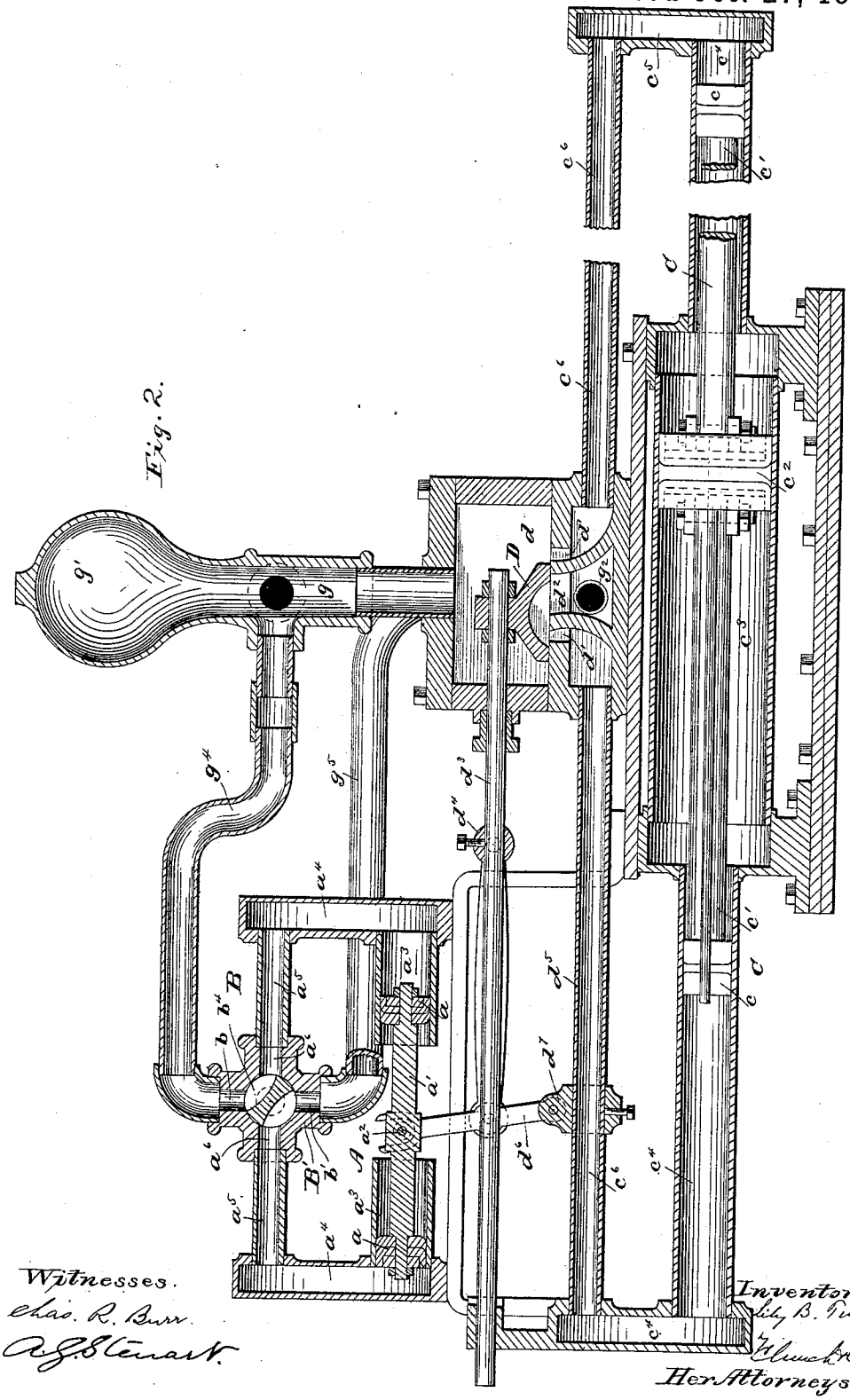
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L. B. TUBBS.

CUT-OFF FOR HYDRAULIC AND OTHER ENGINES.

No. 329,417. Patented Oct. 27, 1885.

Fig. 2.



Witnesses.
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(No Model.)

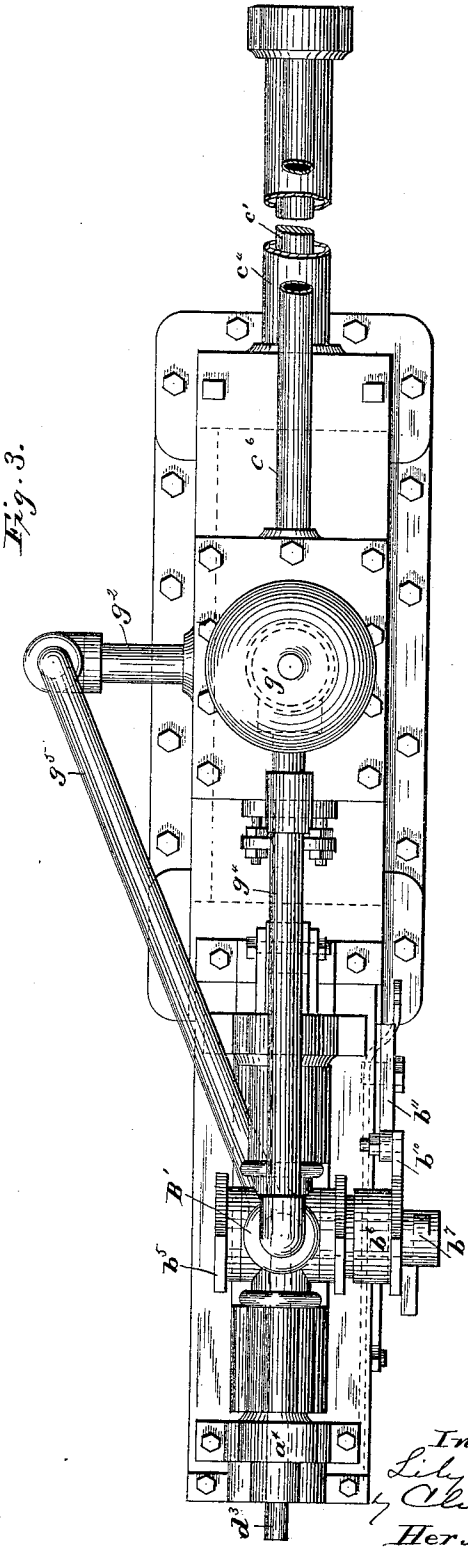
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L. B. TUBBS.

CUT-OFF FOR HYDRAULIC AND OTHER ENGINES.

No. 329,417. Patented Oct. 27, 1885.

Fig. 3.



Witnesses.
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(No Model.)

4 Sheets—Sheet 4.

L. B. TUBBS.

CUT-OFF FOR HYDRAULIC AND OTHER ENGINES.

No. 329,417. Patented Oct. 27, 1885.

Fig. 7.

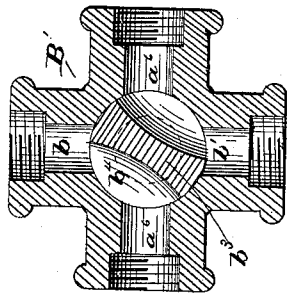


Fig. 5.

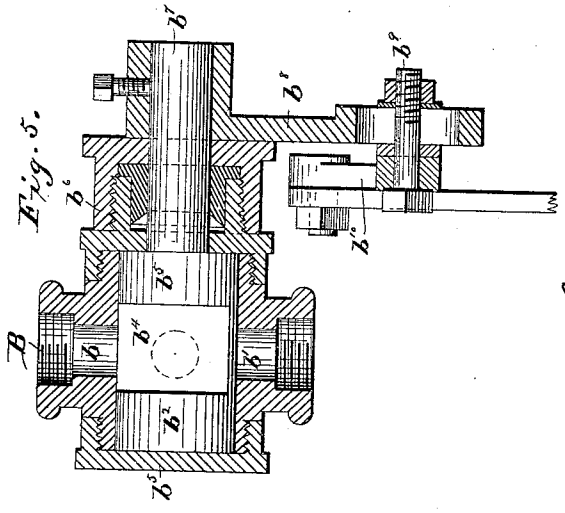


Fig. 6.

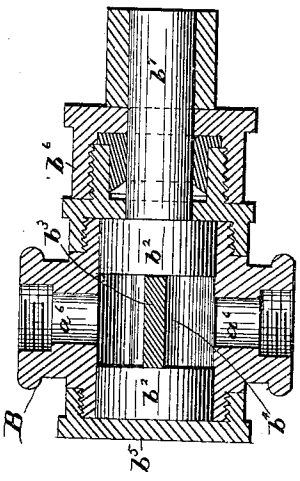
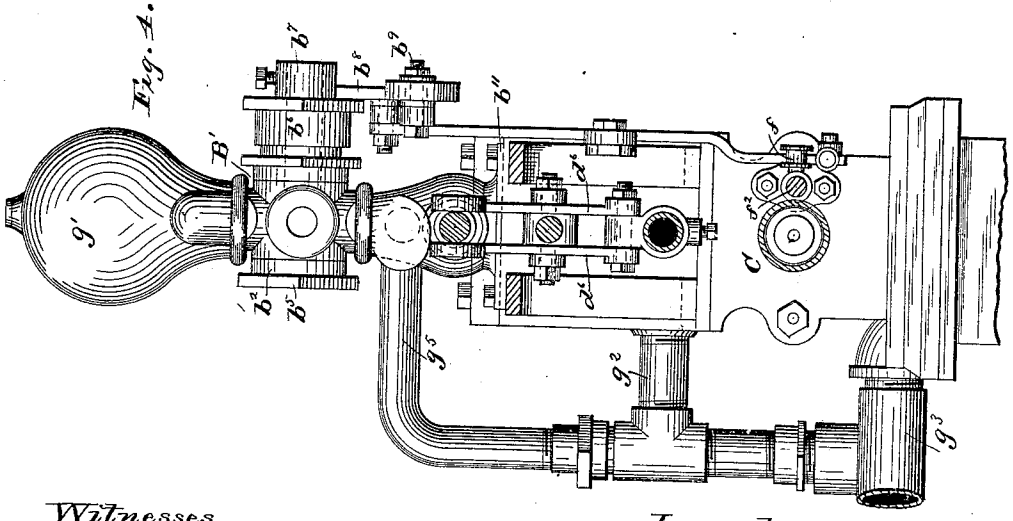


Fig. 4.



Witnesses.
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UNITED STATES PATENT OFFICE.

LILY B. TUBBS, OF PHILADELPHIA, PENNSYLVANIA.

CUT-OFF FOR HYDRAULIC AND OTHER ENGINES.

SPECIFICATION forming part of Letters Patent No. 329,417, dated October 27, 1885.

Application filed February 4, 1885. Serial No. 154,870. (No model.)

To all whom it may concern:

Be it known that I, LILY B. TUBBS, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Cut-Offs for Hydraulic and other Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

The present invention relates more especially to that class of hydraulic engines or motors wherein a column or body of liquid under pressure is caused to act intermittingly, or at predetermined intervals, upon a piston or series of pistons or analogous devices to effect the desired reciprocating motion of the driver or other part from whence the power is communicated to the mechanism as desired; and it consists, essentially, in a new system or combination and arrangement of mechanism for effecting automatically the movements of the valve for controlling the passage or delivery of the motive power to the operating piston or pistons, all as hereinafter more fully described, and pointed out in the claims.

As is well known to those familiar with the inelastic properties of liquids, it is impossible to employ any valve-operating mechanism in this class of motors which, being actuated by the piston either directly or indirectly, depends upon the prolonged or continued action of the fluid after the induction-passage has been closed, as is the case with most valve mechanisms used in connection with motors employing elastic fluids. Attempts have been made to overcome this difficulty by the interposition or addition of springs and weights at some point between the piston and valve, designed to furnish the requisite elasticity or prolonged action, and thereby in a measure compensate for or supply the place of the elasticity wanting in the motive fluid. This is necessary in order that the valve may at the proper time be given a quick movement in advance of the piston, and the means heretofore usually employed have been either springs or weights, which being connected in any suitable manner, as by an arm or lever acted upon by the piston during its stroke, are compressed or raised, and the power thus stored is at the proper time applied to the valve mechanism, causing a sudden shock and quick movement of the valve, whereby the supply of fluid is cut off from one side and admitted to the other side of the piston. The defects of such a system are both numerous and obvious.

The devices employed for producing the requisite throw of the valve are not only unreliable in themselves, involving the use of springs whose tension is weakened by use and varied by temperature, and which are liable to be clogged by rust and dirt and in various ways interfered with and rendered uncertain when delicacy and promptness of action are most essential, or weights whose connected parts are in like manner liable to be impeded or their action interfered with. In addition to these structural weaknesses, there are certain inherent defects common to both classes of valve-operating mechanisms, the one employing springs and the other weights, arising in part from the fact that the valve-actuating lever, or the part acted upon by the springs or weights, must at times be free to move independently of the driver, and when being moved from side to side is positively actuated in one direction only; hence the valve is not at all times under control, but is liable to become misplaced and be rendered inoperative, as by the rebound of the lever or the sticking of the parts, such as would prevent the valve from uncovering the inlet and outlet ports, and at the proper times.

Another defective feature of the systems heretofore in use is the absence of any means for automatically adjusting or controlling the power of the valve-operating mechanism relative to the pressure of the fluid as delivered to the motor. Thus where springs or weights are employed to throw the valve their force should be so adjusted as to overcome the friction of the parts and properly place and hold the valve; but if the pressure in the valve-chest varies and the friction is correspondingly increased or diminished it necessitates a readjustment of the parts. Otherwise the movement of the valve would become irregular and the action of the motor be correspondingly interferred with or interrupted altogether.

While the present invention is designed and calculated to overcome the defects enumerated and others apparent to the skilled mechanic, and may for that reason be properly classed as an improvement upon prior systems of valve-operating mechanisms for hydraulic motors, I do not wish to be limited to the particular embodiment shown, for the reason that I believe I have introduced a new and more perfect system of valve-regulation based upon the novel application of hydraulic pressure to the valve-operating mechanism.

In the accompanying drawings, Figure 1 is a side elevation, Fig. 2 a longitudinal section, and Fig. 3 a plan view, of a pump and hydraulic motor, showing the application of a valve-operating mechanism embodying my present invention. Fig. 4 is a transverse section on the line $x\ x$ of Fig. 1. Figs. 5, 6, and 7 are detail views of the valve for controlling the passages leading to the supplemental motor for actuating the valve.

Similar letters of reference in the several figures indicate like parts.

As shown in the drawings, my invention contemplates the use of a supplemental hydraulic motor, A, the admission and escape of the fluid being regulated or controlled by a valve, B, which latter is set by a part moving in unison with the piston of the prime motor C. The supplemental motor A is connected to and actuates the rod of the valve D, which latter governs the admission and escape of the liquid in the prime motor C. These four parts constitute in effect the essential elements of my improved valve-operating mechanism as applied to a reciprocating motor, and as is obvious the special form and construction of the several parts and their intermediate connections can be varied indefinitely.

Having thus outlined what I deem the essential features of my invention, I will proceed to describe in detail the mechanism in which I have illustrated its embodiment, said mechanism having been practically tested and found well adapted for the purposes. The prime motor C is in this instance provided with two pistons, $c\ c$, fastened to the opposite ends of a piston-rod, c', which latter carries a piston, c^2, working in a cylinder, c^3, the said piston and cylinder, with suitable valves and connections (not shown) constituting a force-pump, with which the prime motor C is shown connected, although, as is obvious, other mechanisms or devices or other kinds and constructions of pumps might be substituted for and arranged to be driven by the prime motor the special pump shown forming no part of my present invention, being in all material respects the same as that described in the application No. 101,427, filed by N. J. Tubbs, July 20, 1883. The pistons $c\ c$ work in cylinders $c^4\ c^4$, whose outer ends communicate through heads c^5 c^5 and pipes $c^6\ c^6$ with opposite ends of the valve-chest d. The valve-chest d is provided with ports $d'\ d'\ d^2$, the latter, d^2, communicating with the discharge-pipe. A slide-valve, D, controlling the ports $d'\ d'\ d^2$, is located within the valve-chest d, and is actuated through the medium of a rod, d^3, passing through a stuffing-box and supported in suitable guides. Adjustably secured to the rod d^3 is a collar, d^4, and to the latter is pivoted one end of a pair of links, b^5, the opposite ends being in like manner fastened to a pair of links or levers, d^6. The upper ends of these levers d^6 are slotted or furcated, and their lower ends are pivotally secured to a block or collar, d^7, adjustably fastened to one of the pipes c^6 or other part of the frame. The supplemental motor A is provided with the usual piston or pistons, a, and rod a', the latter carrying pins or studs a^2, engaging the slotted or furcated ends of the levers d^6. The pistons work in cylinders a^3, whose outer ends connect through heads a^4 and pipes a^5 with diametrically-opposite branches a^6 of the four-way coupling B', the remaining branches of said coupling being connected, the one, b, with the fluid-supply, and the other, b', with the eduction or exhaust pipe. Within the coupling B' is located an oscillating valve, B, having a cylindrical bearing, b^2, at either end, and a central longitudinal portion or web, b^3, whose outer surface is concentric with and fits accurately within the chamber b^4, extending transversely through the center of the coupling B'. One end of the valve-chamber b^4 is closed by a tight-fitting screw-cap, b^5, and the other end is provided with a stuffing-box, b^6, through which projects the valve-stem b^7. To this valve-stem b^7 is fastened an arm, b^8, provided with a slotted portion, in which is adjustably secured a pin or bolt, b^9, forming a pivot to receive the end of a link, b^{10}. The opposite end of this link is attached to a lever, b^{11}, pivoted to the frame, as at b^{12}, and connected at its lower end to an adjustable bar or link, b^{13}, whose other extremity is supported by a link, b^{14}. A roller or pin, f, connected to and moving in unison with the pistons of the prime motor C, (in the present instance this roller is carried by a rod, f', supported in guideways f^2, secured to the side of the cylinder c^4, and passing through a stuffing-box is attached to the pump-piston c^2,) reciprocates and alternately makes contact with the lever b^{11} and the opposite end of the bar or link b^{13}, thereby forcing the lever b^{11} first in one direction and then in the other to actuate the valve B.

The supply and discharge pipes for operating the prime motor and the mode of transmitting the power from the supply-station may be similar to that disclosed in the application of N. J. Tubbs, before referred to—that is to say, the fluid is delivered under pressure to the valve-chest of the prime motor by a pipe attached to the connection g above the valve-chest, an air-chamber, g', being preferably located at this point, the pressure being produced through the medium of an accumulator, an elevated reservoir, or a force-pump, termed

a "transmitter," while the exhaust from the prime motor may be by a pipe, g^2, connected to a return-pipe, or, as in the present instance, to the discharge-pipe g^3 of the pump. The supplemental motor A receives its supply from the same head as the prime motor through a branch-pipe, g^4, extending from the connection g to the induction-branch b of the valve-coupling B'; hence it follows that the pressure brought to bear upon the supplemental motor will at all times be the same as that within the valve-chest. The eduction or exhaust branch b' of the coupling B' may, if desired, be connected by a pipe, g^5, with the exhaust of the prime motor.

The operation of my improved valve mechanism is as follows: The bar or link b^{13} having been adjusted by means of the nut b^{15}, the said bar or link being made in two parts, screw-threaded into the nut b^{15}, as is well understood, and the pin or bolt b^9 set at the proper point, whereby the length of the stroke or point of cut-off is determined, the liquid is admitted under pressure through the main supply-pipe, and flowing into the valve-chest d makes its way through one of the induction-ports into cylinder c^4, where the pressure is applied to the piston c to drive the prime motor in one direction. The valve being connected directly to the piston of the supplemental motor, and being held thereby, must at all times retain a specific relation to the supplemental motor; hence the position of the valve D and the direction of the movement first given to the prime motor are determined by the position occupied at the time by the piston of the supplemental motor. In like manner the position of the supplemental motor is determined by the direction of the valve B, and the latter by the lever b^{11}. When, therefore, the prime motor is started, the direction of its movement is controlled by the position of the valve, and the position of the valve by that of the supplemental motor. It will be observed, moreover, that the position of the supplemental motor is governed by the valve B and the latter by the lever b^{11}. If, now, the prime motor when started is at the beginning of its stroke, the pin will be pressed against the lever b^{11} or (at the opposite end of the stroke) the bar b^{13}, thereby turning the valve B so as to admit the fluid to one end of the piston of the supplemental motor, forcing and holding the piston and the valve D connected thereto at the extreme end of its stroke. Just before the stroke of the piston of the prime motor is completed the pin strikes the lever (or the bar) and reverses the valve B. As soon as this is accomplished the supplemental motor is set in motion, carrying with it the valve D, and thereby reversing the direction of the prime motor, which operations are repeated at each end of the stroke, producing a regular, positive, and continuous motion of the prime motor.

It will be observed that the prime motor is merely utilized to set the valve for the supplemental motor, which operation in no wise interfers with or occasions an interruption in the movement of the former. Moreover, when the prime motor has once set the valve of the supplemental motor, the lattter is placed under the influence of the liquid-supply and continues its action entirely independent of the prime motor until the valve D has been properly placed. By adjusting the length of the connection b^{13} and the position of the pin b^9 on the valve-lever the valve B can be actuated at any point during the reciprocation of the prime motor.

Although the supplemental motor might be supplied with fluid from another source than that employed to drive the prime motor, I prefer that both said motors should be connected to the same supply, for the reason that the pressure is thereby equalized, the power of the supplemental motor being increased in the same ratio as the pressure upon the valve of the prime motor.

The action of this valve mechanism is simple, easy, positive, and reliable. It starts at any point, and is self setting and regulating. So long as a sufficient pressure is maintained in the supply-pipe to actuate the prime motor the valve mechanism will be set in motion and continue to act irrespective of any change in the pressure. There are no parts depending upon gravity or compression, and the valve for controlling the induction and exhaust ports of the prime motor is moved positively and held firmly in place, hence cannot be jolted or misplaced by the rebounding or failure to work of the actuating-lever.

As before mentioned, I do not desire to be limited to the precise form and construction of the valves, motors, and connections, except as specified in the claims, as other equivalent forms may be substituted in whole or in part for those herein described and illustrated without departing from the spirit of my present invention.

I claim—

1. In combination with the prime motor C, having pistons c, piston-rod c^3, and valve D, and the supplemental motor A, having pistons a and rod a', the levers d^6, connected at one end to the rod a', and links b^5, connected at opposite ends to the lever d^6 and valve-rod d^3, substantially as described.

2. In combination with the prime and supplemental motors C and A, the slide-valve D, controlling flow of liquid in prime motor, rod d^3, links b^5, levers d^6, oscillating valve B, controlling flow of liquid in supplemental motor, arm b^8, link b^{10}, lever b^{11}, bar b^{13}, link b^{14}, and pin f, carried by rod f', and actuated by piston of prime motor, substantially as described.

3. In combination with the cylinders and pistons of the prime motor C, the slide-valve D, supplemental motor A, and connections,

such as described, intermediate the supplemental motor and slide-valve, the oscillating valve B, actuated by the prime motor and governing the inlet and exhaust of the supplemental motor, said valves D and B being connected to the same supply-pipe, substantially as described, whereby when the valve B is reversed to admit the liquid to the supplemental motor the pressure on the valve D is temporarily relieved.

LILY B. TUBBS.

Witnesses:
THOMAS J. BEWLEY,
THOS. C. BARR.