(No Model.) 3 Sheets—Sheet 1.

R. H. BUCKINGHAM.

GAS METER.

No. 588,632. Patented Aug. 24, 1897.

Fig. 1.

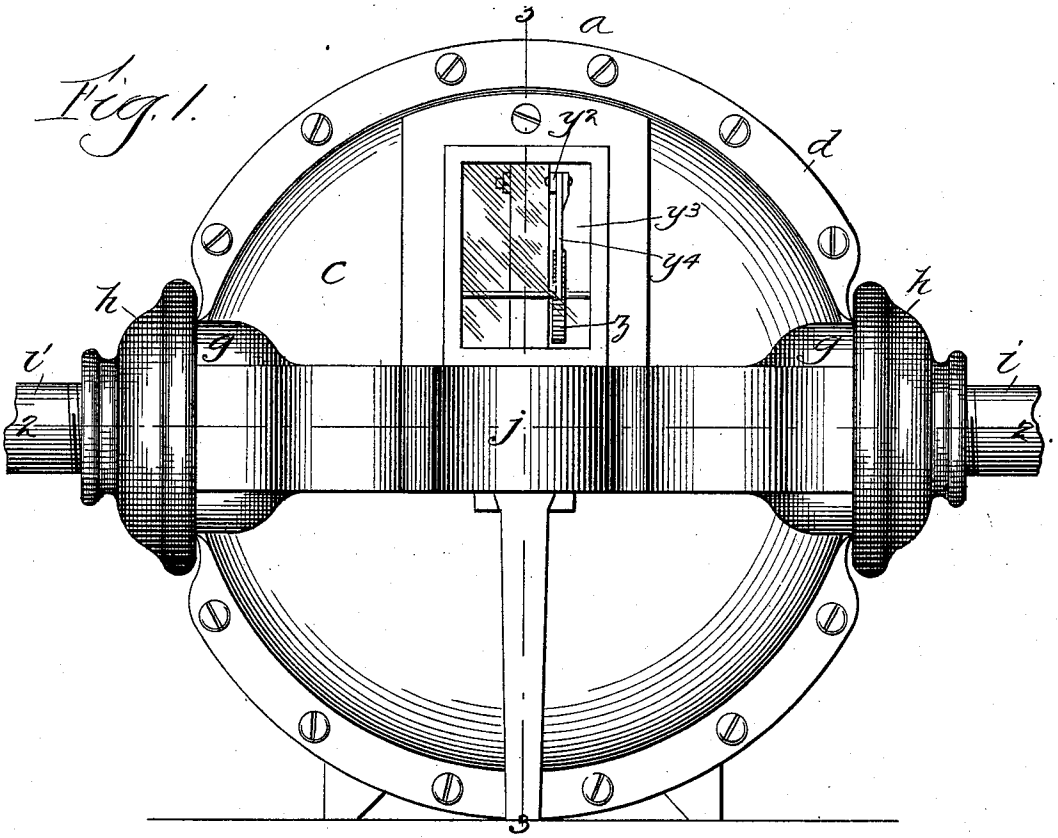
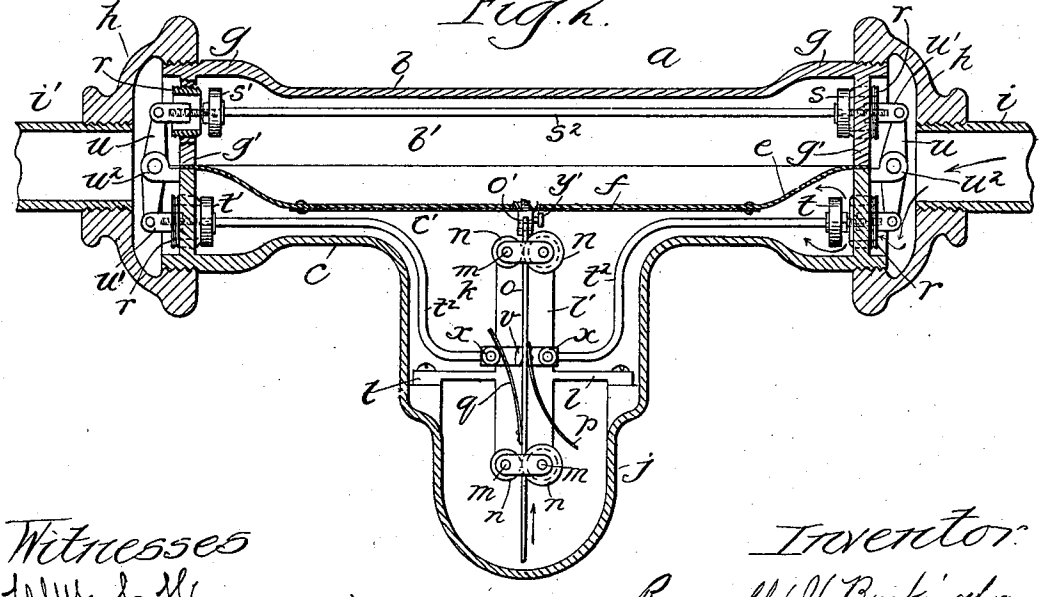


Fig. 2.



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Fig 3.

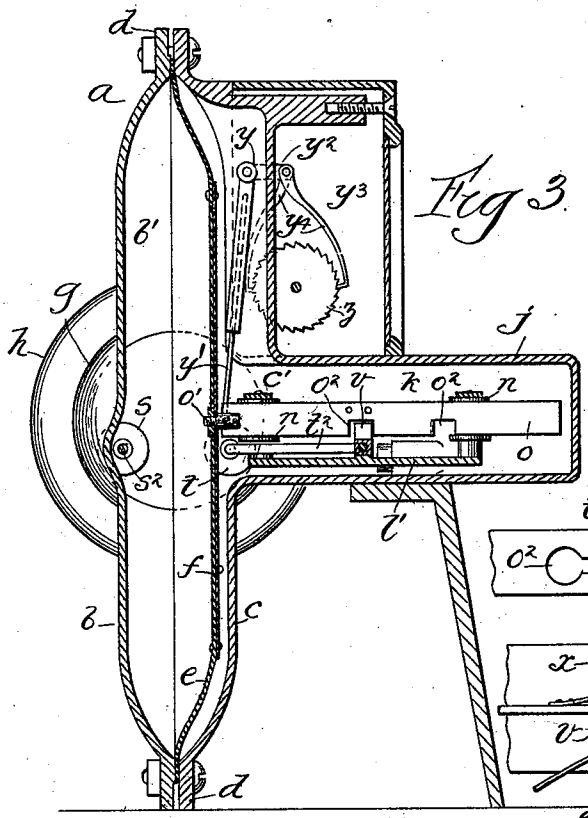


Fig 7.

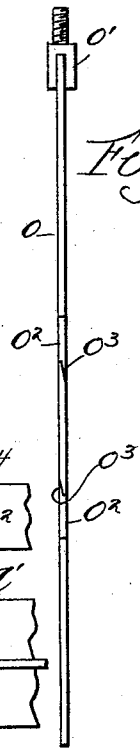


Fig 8.

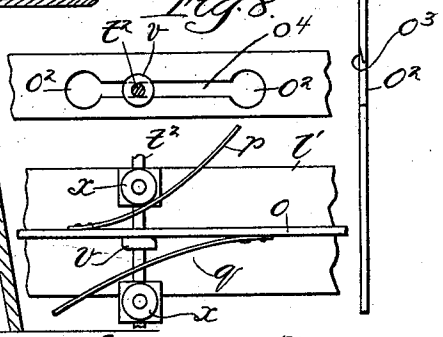


Fig 4.

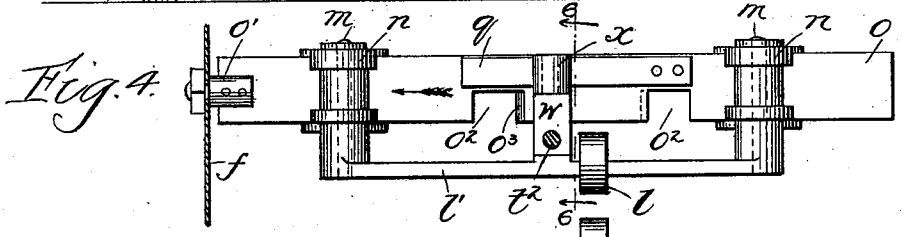


Fig 5

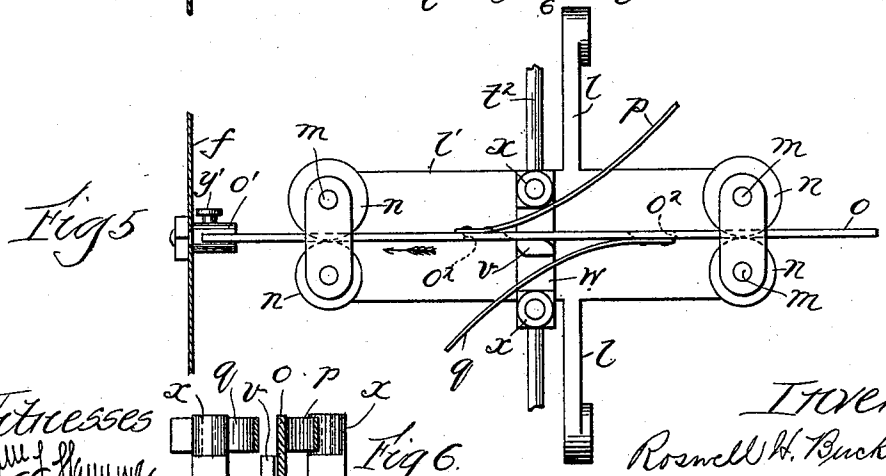


Fig 6.

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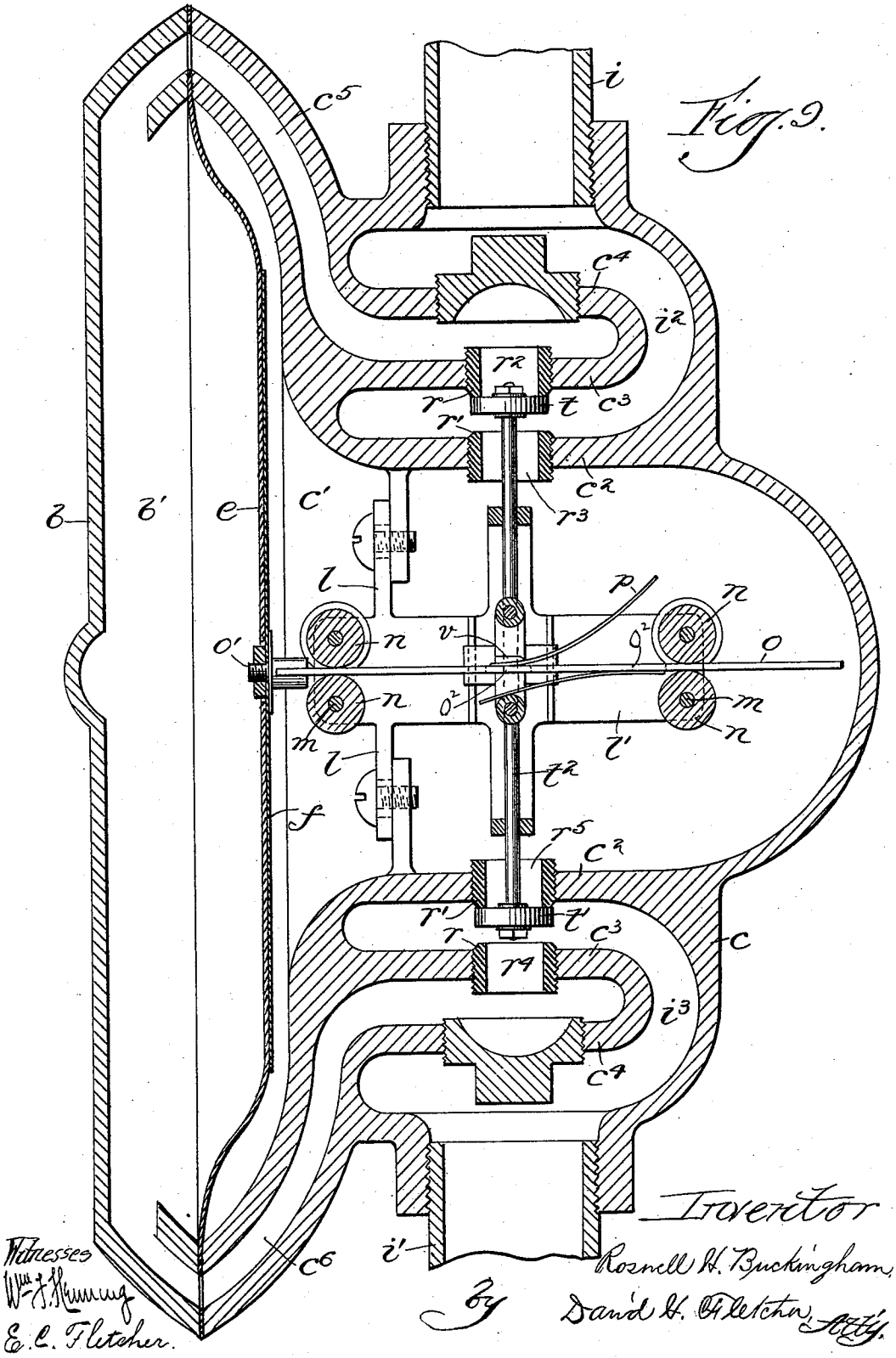
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R. H. BUCKINGHAM.

GAS METER.

No. 588,632. Patented Aug. 24, 1897.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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GAS-METER.

SPECIFICATION forming part of Letters Patent No. 588,632, dated August 24, 1897.

Application filed September 17, 1896. Serial No. 606,125. (No model.)

To all whom it may concern:

Be it known that I, ROSWELL H. BUCKINGHAM, of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Meters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which corresponding letters of reference in the different figures indicate like parts.

My invention relates to that class of gas-meters in which the initial action is obtained by the pressure of the gas acting alternately upon opposite sides of a movable diaphragm; and it consists more particularly in the valve-actuating mechanism, which may be utilized in connection with cases of varying construction, as well as in the peculiar form of case with which I have caused it to be combined.

The primary object of my invention is to combine with a valve-rod and diaphragm of a gas-meter of the class described a reciprocatory locking-bar having springs thereon in operative proximity to said valve-rod, the axis of which valve-rod is at right angles to that of the locking-bar, means upon said valve-rod for alternately compressing one or the other of said springs, a shoulder on said valve-rod for engaging said locking-bar and holding said valve-rod stationary while the locking-bar is being moved in a given direction, and openings in said locking-bar to permit the passage of said shoulder when one or the other of said openings is brought into registration therewith.

A further object is to combine in a gas-meter a casing composed of two parts having a flexible diaphragm interposed and clamped between the two, induction and eduction valve-ports respectively communicating with the chamber formed between the diaphragm and each of said parts, valve-rods located upon opposite sides of said diaphragm and parallel with the plane thereof, having valves thereon for opening and closing said ports, and means for simultaneously actuating said rods in opposite directions, all of which is hereinafter more particularly described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a front elevation of a gas-meter embodying the features of my invention. Fig. 2 is a sectional view in plan, taken upon the line 2 2, Fig. 1. Fig. 3 is a vertical sectional view taken upon the line 3 3, Fig. 1. Fig. 4 is a side view in detail of the valve-controlling mechanism. Fig. 5 is a plan view thereof. Fig. 6 is a transverse sectional view taken upon the line 6 6, Fig. 4, viewed in the direction of the arrow there shown. Fig. 7 is a plan view in detail of the valve-locking bar. Fig. 8 represents a modification of said invention, being a side and plan view, respectively, of a modified form of said reciprocating bar and valve-rod; and Fig. 9 is a sectional view showing a modified form of case in which a single valve-rod is employed.

Referring to the drawings, *a* represents the case of my improved meter, which consists of a shell of cast metal formed in two parts *b c*. Said parts are provided with corresponding flanges *d*, which are bolted together, as shown, and between them is interposed a diaphragm consisting of a disk *e*, of leather or other suitable flexible material, reinforced by a central disk *f*, of tin or other sheet metal, which is riveted thereto. The diaphragm separates the shell into two compartments *b' c'*, Figs. 2 and 3.

At points diametrically opposite to each other upon a case *a* the flanges *d* are cut away and cylindrical extensions *g g* are formed upon said case, said extensions being threaded, as shown, for the reception of caps *h h*, into which are tapped induction and eduction service-pipes *i i'*.

A horizontal extension *j*, which is integral with the part *c*, forms a chamber *k*, Figs. 2 and 3, for the reception of valve-controlling mechanism. Attached by means of screws, as clearly shown in Fig. 2, is a cross-bar *l*, Figs. 2 to 5, inclusive, on which is cast a horizontal plate *l'*, having located thereon upwardly-projecting studs *m* for the reception of two pairs of antifriction guide-rollers *n*, between which is inserted a flat reciprocatory bar *o*, the axis of which is arranged at right angles to the plane of the diaphragm. One end of said bar, which I term the "locking-bar," is free, while the other is attached by means of a shank and nut, as shown at *o'*, to the center of the diaphragm. Upon opposite sides of the bar *o* I attach springs *p q*,

which are extended in opposite directions and bent outwardly, as shown.

Arranged within and near the outer ends of the cylindrical extensions g are partitions g', one-half of each being formed upon each part of the shell and between which a portion of the diaphragm is clamped, the caps $h\,h$ serving, when in position, to hold that portion of the shell together. Upon opposite sides of the diaphragm are openings or ports into which are preferably tapped adjustable cylindrical valve-seats r, adapted to receive valves s s' t t' in the order shown, the first pair being attached to opposite ends of a valve-rod s^2, while the others are secured to the ends of a valve-rod t^2. Said valve-rods are tapped into stub-couplings u' at their respective ends, which in turn are pivotally connected with the ends of cross-levers u u, pivoted upon stationary lugs u^2, formed upon the partitions g'. It will thus be seen that the valve-rods may be accurately adjusted to the requirements of the pivoted levers, while the valves themselves may be adjusted with the utmost accuracy by merely removing the unions h and turning the adjustable valve-seats r to the required positions.

The valve-rod s^2 is straight, while the valve-rod t^2 is bent, as shown in Fig. 2, to pass preferably beneath the locking-bar o. Upon the middle of the valve-rod t^2 is formed a shoulder or projection v, which is adjusted to engage with one or the other side of the bar o, and when the latter is in proper position to coincide with and pass through one or the other of two notches or openings o^2, formed in said bar. Said openings are beveled upon opposite sides of the bar with respect to each other, as shown at o^3, for the purpose hereinafter stated. I also prefer to bevel the opposite faces of the shoulder v for the like purpose.

Preferably attached to the valve-rod t^2 is a block w, upon which the shoulder v is preferably formed and upon the ends of which are upwardly-projecting studs for the reception of antifriction-rollers x x, which are adapted to alternately engage the springs p q, according as the bar o is reciprocated.

Any well-known form of registering mechanism may be used in connection with my device; but as such forms no part of my invention I have not shown it, but have merely indicated suitable means by which it may be actuated. Pivotally mounted upon a suitable bearing attached to the case is an elbow-lever y, Fig. 3, one arm of which is bored out to receive a rod y', which is loosely inserted therein, the lower end being pivotally attached to the part o', connecting the bar o with the diaphragm, as shown in Figs. 2 and 3. The other arm y^2 of said elbow-lever is extended through a casing having a packed joint into a chamber y^3, (also indicated in Fig. 1,) in which the registering mechanism is located, and is loosely connected with pawls y^4, adapted to engage with and actuate an escapement-wheel z, mounted upon a suitable shaft, by which the usual train of gears connected with the registering mechanism may be driven.

Having thus described the various parts of my improved device, I will now explain its operation.

Referring to Fig. 2 and assuming the valves and diaphragm to be in the respective positions there shown, the gas enters through the induction-pipe i and port controlled by the valve t to the chamber c'. The valve t' being then closed, the inflowing gas presses against the diaphragm and moves it toward the chamber b', thus forcing out the gas in that chamber through the port controlled by the valve s' into the eduction-pipe i', the valve s meanwhile being closed against the back pressure of the gas from said chamber and also from that in the induction-pipe. The vibration of the diaphragm reciprocates the locking-bar, causing the compression of one or the other of the springs p q by drawing the spring against the antifriction-roller x, which causes the shoulder v to press against the bar o upon the opposite side from that of the spring under compression, as shown in Figs. 4, 5, and 6. When the diaphragm has attained its full movement and the spring is under complete compression, one of the openings o^2 is brought into registration with the shoulder v, which instantly releases the valve-rod by permitting the shoulder to pass through said opening, thereby reversing the position of the valve-rod, shifting the valve, and causing the inflowing gas to pass to the opposite side of the diaphragm, while that upon the side to which it had previously flowed is permitted to escape through the eduction-pipe.

In Fig. 2 I have shown the position of the respective parts at the instant the valve-rod is shifted past the locking-bar. The spring q is still under compression while the movement of the locking-bar is initiated in the direction indicated by the arrow. This causes the beveled portion o^3 to be brought into contact with the shoulder v, thus supplementing the action of the spring q and pressing the valves t' s more firmly upon their respective seats. The valves are thus locked in position as a result of the contact of the locking-bar with the shoulder v until the locking-bar has reached the limit of its opposite movement, when the spring q is removed from the stud by which it is engaged and the spring p is compressed sufficiently to again draw the shoulder v through the opening and reverse the position of the valve-rod.

Instead of passing the valve-rod beneath the locking-bar, as I prefer to do, it is obvious that it may be passed through said bar without departing from the principle involved.

In Fig. 8 I have shown a modified construction in which the valve-rod is passed through a slot o^4, terminating in enlarged openings at the respective ends of a size to permit the shoulder v, which may be in the form of a

collar, to pass through when in registration therewith.

It is manifest that my improved valve-controlling mechanism may be employed in connection with a single valve-rod having valves upon opposite ends adapted to close double ports arranged to communicate alternately with chambers located upon opposite sides of the diaphragm.

In Fig. 9 I have shown a modification of said invention in which such a valve-rod is employed. In the part *c* of the case are formed three partitions c^2 c^3 c^4 at each end of the valve-rod c^2. A curved way i^2 forms a recess between the partitions c^2 c^3 and permits of communication from the pipe *i* through the port r^3, when the valve *t* is removed therefrom, with the chamber *c'*, or through the port r^2 to the by-pass c^5, which communicates with the chamber *b'*. A similar way i^3 at the opposite end of the valve-rod communicates alternately with the chamber *b'* through the by-pass c^6 and port r^4, or with the chamber *c'* through the port r^5. Assuming the diaphragm to be in the position shown, the gas enters through the passage i^2 and port r^3 to the chamber *c'*, the valve *t* being upon the seat *r* and the valve *t'* upon the seat *r'*. The gas is therefore free to escape from the chamber *b'* through the by-pass c^6, port r^4, and passage i^3 to the eduction-pipe. The reversal of the valve-rod opens the induction by-pass to the chamber *b'*, closes the eduction by-pass to that chamber, closes the induction-port to the chamber *c'*, and opens the eduction-port therefrom.

While it is apparent that my improved valve-controlling mechanism may be advantageously employed either with one or two valve-rods, yet I prefer the latter in that it greatly simplifies the form of the case and lessens the cost of construction.

A case like that first above described may be cast without cores, while the placing of the valves at the ends of the cylindrical extensions and the employment of removable caps renders the valves accessible at all times and readily permits their adjustment or repair. A further and obvious advantage of this construction, which I believe I am the first to employ, is that it permits the gas to flow directly through the meter in lines parallel with the plane of the diaphragm.

It is apparent that either notches or openings may be employed in the locking-bar, and where one of said terms is employed in the claims it is intended to cover both. It is further manifest that the wedge-like action described between the locking-bar and shoulder may be produced by either beveling the openings or the faces of the shoulder, or both, and hence I do not confine myself to either construction.

Having thus described my invention, I claim—

1. The combination with a valve-rod and diaphragm of a gas-meter, of a reciprocatory locking-bar in operative connection with the diaphragm, springs thereon in operative proximity to a valve-rod having its axis at right angles to that of the locking-bar, means upon said valve-rod for alternately compressing one or the other of said springs, a shoulder on said valve-rod for engaging said locking-bar and holding said valve-rod stationary while the locking-bar is being moved in a given direction, and openings in said locking-bar to permit the passage of said shoulder when one or the other of said openings is brought into registration therewith, substantially as described.

2. In a valve-controlling mechanism for gas-meters, the combination with a movable diaphragm of a locking-bar having one end attached to said diaphragm and arranged to move longitudinally between suitable guides, a reciprocatory valve-rod arranged at right angles to said bar, valves upon said bar adapted to alternately open and close induction and eduction ports communicating with the opposite sides of the diaphragm, a shoulder or projection upon said valve-rod adapted to engage with said locking-bar, openings in said bar at points corresponding to its extreme opposite movement to permit the passage of said shoulder when said extreme movement is reached in either direction, springs attached to opposite sides of said locking-bar, and studs attached to the valve-rod upon opposite sides of said bar in position to be engaged by or disengaged from said springs as said bar is reciprocated, substantially as described.

3. In a valve-controlling mechanism for gas-meters, the combination with a movable diaphragm of a reciprocatory locking-bar arranged in guides, a reciprocatory valve-rod arranged at right angles thereto and provided with valves upon its ends adapted to control the admission of gas to induction and eduction ports communicating with the opposite sides of the diaphragm, springs attached to said bar for reversing the movement of said valve-rod, studs upon said valve-rod for alternately engaging one or the other of said springs, a shoulder or projection upon said valve-rod for engaging said locking-bar and locking said valve-rod in an extreme position pending the movement of the diaphragm, and openings or notches in said bar in alinement with said projection to permit the passage of the latter therethrough when the extreme movement of the diaphragm is reached, substantially as described.

4. In a gas-meter, the combination of a reciprocatory valve-rod having valves thereon for controlling the admission of gas to induction and eduction ports communicating with the opposite sides of the diaphragm, of a reciprocatory locking-bar arranged at right angles to the axis of said valve-rod, springs upon opposite sides of said bar for alternately reciprocating said valve-rod, means upon said

