(No Model.)

3 Sheets—Sheet 1.

M. C. HENLEY & J. P. FULGHAM.

METER.

No. 527,979.

Patented Oct. 23, 1894.

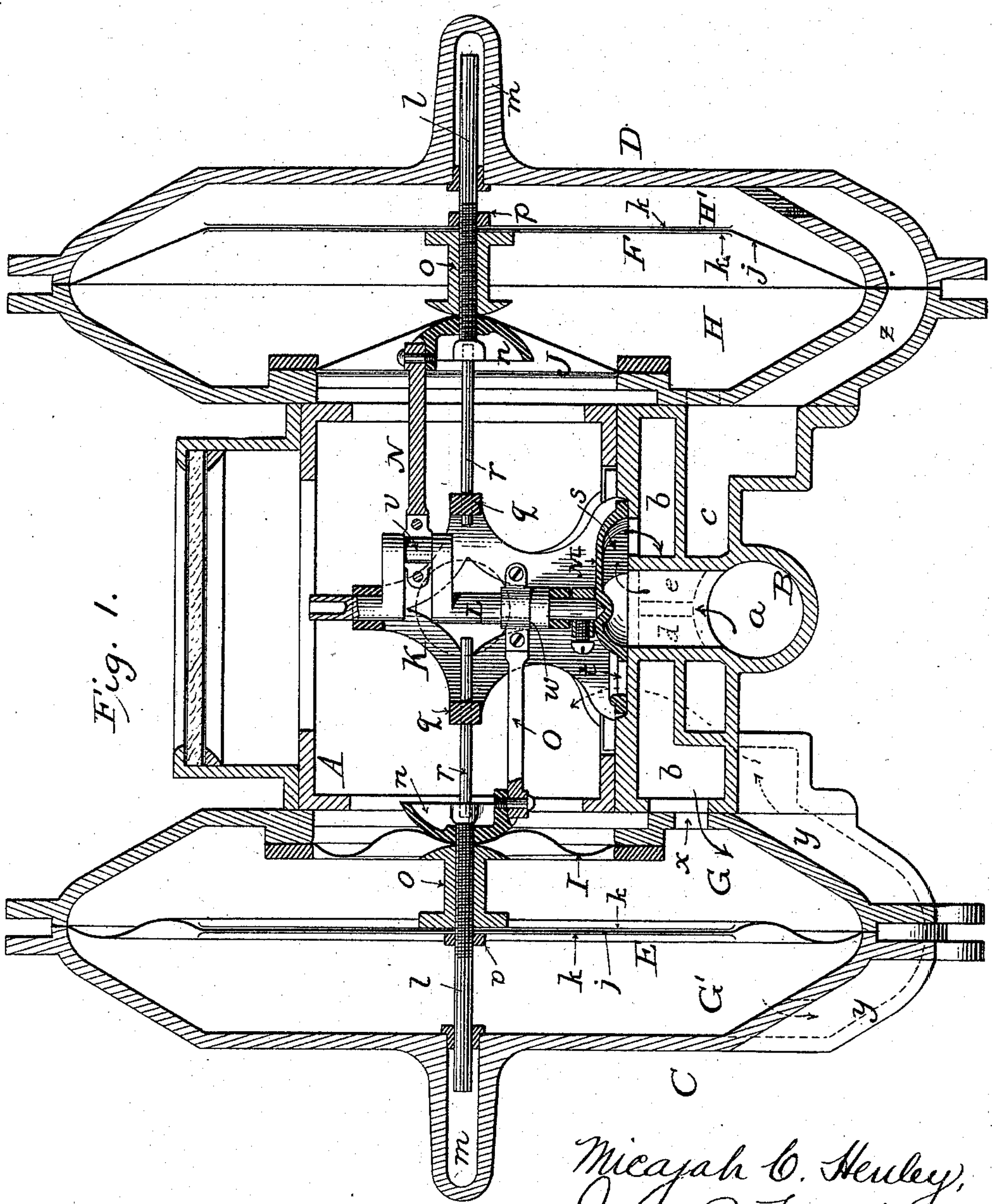


Fig. 1.

Witnesses
W. C. Burdine.
C. B. Bull.

Micajah C. Henley,
Jesse P. Fulgham
Inventors

by Dodge & Sons,
Attorneys

(No Model.) 3 Sheets—Sheet 2.

M. C. HENLEY & J. P. FULGHAM.

METER.

No. 527,979. Patented Oct. 23, 1894.

Fig. 2.

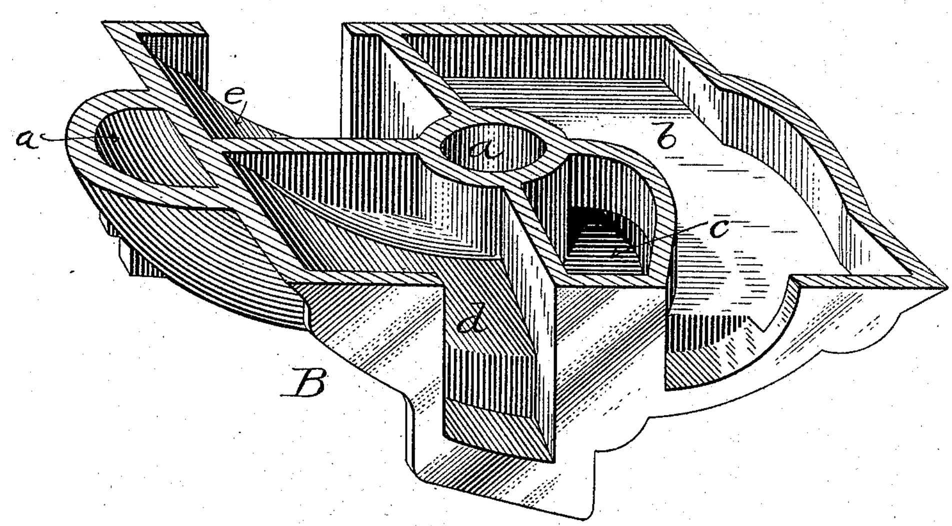
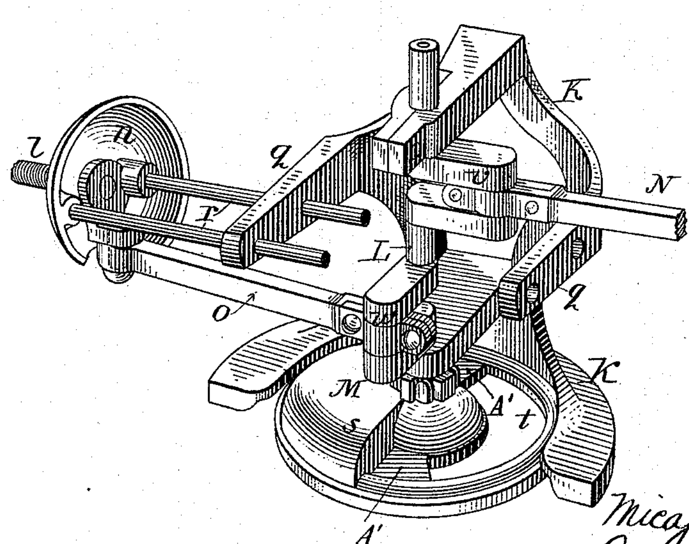


Fig. 3.



Witnesses
C. O. Burdine
C. B. Bull.

Micajah C. Henley
Jesse P. Fulgham
Inventors

by Dodge & Sons,
Attorneys.

(No Model.)

3 Sheets—Sheet 3.

M. C. HENLEY & J. P. FULGHAM.

METER.

No. 527,979. Patented Oct. 23, 1894.

Fig. 4.

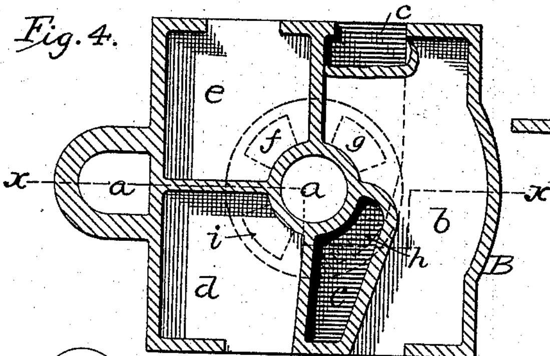


Fig. 5.

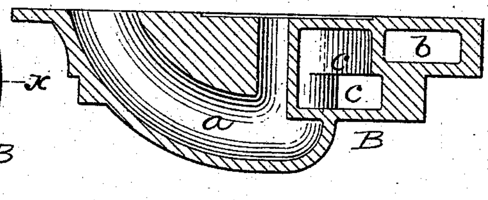


Fig. 6.

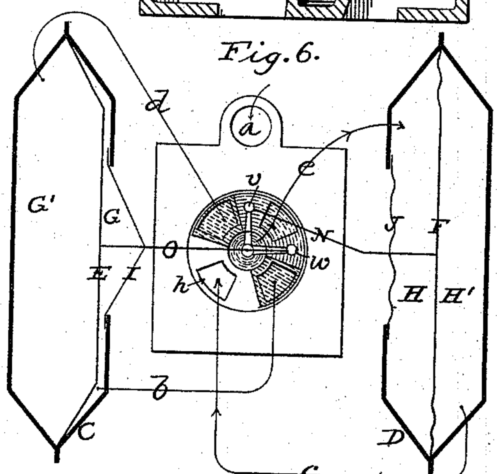


Fig. 7.

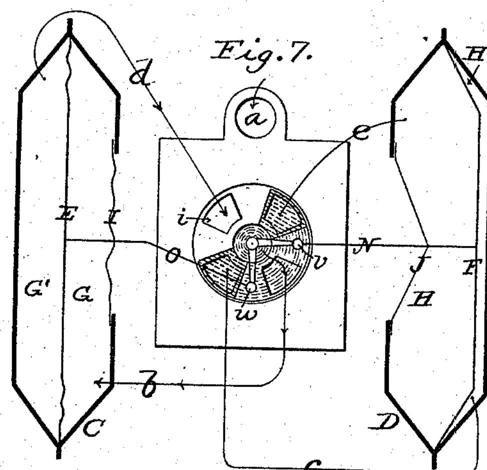


Fig. 8.

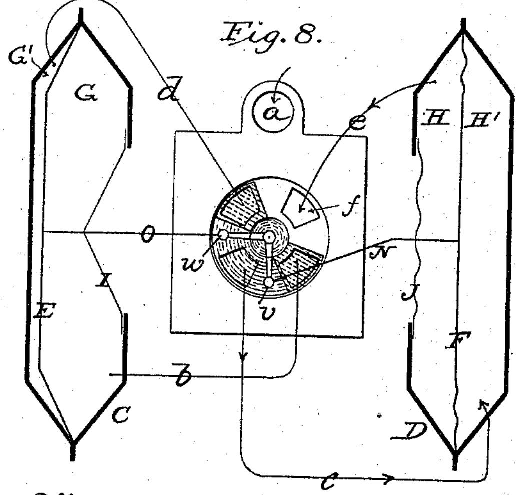
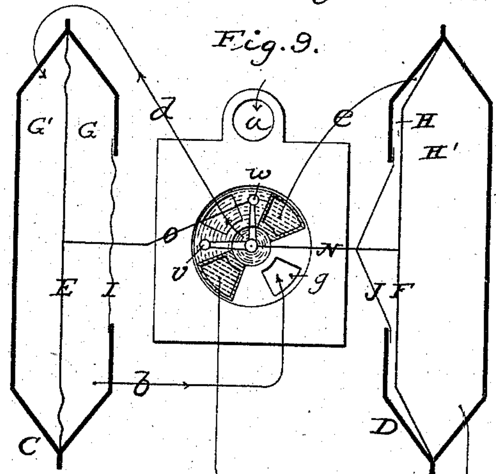


Fig. 9.



Witnesses
C. C. Burdine,
C. B. Bull.

Inventors
Micajah C. Henley
Jesse P. Fulgham
by Dodge & Sons
Attorneys.

UNITED STATES PATENT OFFICE.

MICAJAH C. HENLEY AND JESSE P. FULGHAM, OF RICHMOND, INDIANA; SAID FULGHAM ASSIGNOR TO EMMA R. FULGHAM, OF SAME PLACE.

METER.

SPECIFICATION forming part of Letters Patent No. 527,979, dated October 23, 1894.

Application filed March 9, 1894. Serial No. 502,991. (No model.)

To all whom it may concern:

Be it known that we, MICAJAH C. HENLEY and JESSE P. FULGHAM, citizens of the United States, residing at Richmond, in the county of Wayne and State of Indiana, have invented certain new and useful Improvements in Meters, of which the following is a specification.

Our invention relates to meters, and has reference more particularly to that class of meters in which the flow of fluid is controlled by means of a single rotary valve actuated by a pair of diaphragms. This valve is so arranged relatively to the passages opening into the diaphragm casings or chambers as to keep all of the said passages in action at all times, and as there are four of these passages,—two for each diaphragm chamber,—the flow of the fluid into and out of each chamber will be practically continuous, although the direction of flow will be reversed periodically.

An important feature of the present construction resides in the forming the whole or a portion of one of the side walls of the diaphragm-chamber, of a smaller diaphragm and connecting this flexible wall with the diaphragm which divides the measuring chamber into two compartments, thereby enabling us to dispense with packing glands or stuffing boxes to receive and support the main diaphragm stems, to lessen the cost of manufacture, and to render easier the operation of the meter.

In the drawings,—Figure 1 is a vertical longitudinal sectional view through our meter; Fig. 2, a perspective sectional view of the valve seat with its ducts; Fig. 3, a perspective view of the valve and its constructions; Fig. 4, a plan view, partly in section, of the valve seat; Fig. 5, a horizontal sectional view on the line x—x of Fig. 4; and Figs. 6, 7, 8 and 9, diagrammatic views, showing the parts in different positions.

A indicates a hollow frame of box-like casing open on all sides, and to the lower side of which is secured the block or casting B containing the valve seat, the central inlet a, the passages b, c, d and e through which the fluid flows to and from the diaphragm chambers C and D, and the ports f, g, h and i, as shown.

It will be noticed upon reference to Figs. 2, 4 and 5 that the passage c extends down below and under the passage b.

While the box A and the casting B are preferably made separate from each other, this is not essential. They form the shell or casing of the machine, and may be constructed of more than two parts if found advisable.

To two of the sides of the box A are secured the diaphragm chambers C and D which are, however, open on that side or face next to the box to which they are secured. Mounted within these chambers are the diaphragms E and F which will be held at their edges by the two parts of the casing, as usual, and thus divide the chambers, each into two compartments G G′ and H H′, as shown in Fig. 1. While, as before stated, the chambers proper are left open at one side, these openings are closed by means of smaller diaphragms I and J, Figs. 1 and 6 to 9, which thereby form respectively one wall of the compartments G H. Diaphragms E and F comprise, each, a flexible disk j of rubber, leather, or other suitable material, which is embraced between disks k of light sheet metal, as shown in Fig. 1. A stem l passes centrally through each of the diaphragms thus made up, and is supported at its outer end in a lateral axial extension m of the diaphragm chamber. The smaller diaphragms I and J are embraced between two blocks n and o secured upon the stem l, the opposing faces of the blocks being rounded or curved, as shown in Figs. 1 and 3, to prevent injury to the diaphragm. Stem l is threaded to receive the threaded block n, and a nut p between which the two diaphragms and the intervening spacing block o are clamped, and by which the parts are held in their proper relative positions.

K, Figs. 1 and 3, indicates an open frame or casting which fits within the box or frame A, and is provided at its upper and lower ends with bearings for the upright shaft L; and is further provided with perforated arms q q to receive and to guide and sustain rods r r projecting from the blocks n.

Shaft L is adapted to be connected, at its upper end, with a suitable registering mechanism, while its lower end is connected with the valve M having the closed port s, the open port t, and the solid portions A′ A′; the port

s always acting as an inlet and the port t always acting as an outlet.

It will be noticed upon reference to Figs. 1 and 7 that the frame K sets loosely upon the casting B, and may be readily removed when it is desired to disconnect the shaft.

The shaft L, Figs. 1 and 3, is provided with two cranks or cranked portions v and w at an angle of ninety degrees to each other, which are connected, respectively, by rods or pitmen N and O with the diaphragm blocks n, whereby the movement of the diaphragms E, F, will cause a rotary motion of the shaft and the valve attached thereto.

In the inner wall of diaphragm chamber C is an opening x which connects the chamber G with the passage b; while in the corresponding wall of chamber D is a similar opening (shown in dotted lines in Fig. 1) which connects the chamber H with the passage e.

The chamber G′ is connected with the passage d by a duct y, shown by dotted lines in Fig. 1, while the chamber H′ is connected with the passage c, by means of a similar duct z.

Passages b, c, d and e open, respectively, at their inner ends into the ports g, h, i and f, which, as shown in Figs. 4 and 6 to 9, are arranged around the central inlet or supply a and adapted to be covered and uncovered successively, in pairs by the valve M.

When the parts are in the position shown in Fig. 6, the gas will escape from compartment H′ through passage c and port h, the ports g and i being meanwhile covered by the solid parts A′ of the valve and thereby preventing any escape of gas from the compartments G′ and G. It will also be noted that the hollow closed port s of the valve covers the inlet a and the port f, thereby admitting gas under full head to go through passage e into the compartment H. As the diaphragm F is moved outward by the full pressure of the gas entering the compartment H, the shaft L is rotated and the valve turned slowly to the right, thus gradually uncovering the port i and also gradually connecting the port g with the supply port a. It will be noted, however, that the hollow valve port s is elongated so that even after the port g is partially open (or brought into connection with the said valve port s) the port f will remain wide open and in communication with the valve port s. By this means we insure the complete filling of the compartment H before the pressure of the gas in compartment G can interfere to reverse the motion or direction of movement of the diaphragm F. The full pressure of gas entering compartment H fills said compartment, and, acting through the diaphragm F, pitman N, and crank v, turns the shaft and the valve to the position shown in Fig. 7. When in the latter position gas enters through ports a g and passage b into compartment G, and escapes from compartment G′ through passage d and port i. The filling of compartment G gives to the shaft L and valve M another quarter revolution, and brings the latter to the position shown in Fig. 8, where it will be seen that gas is escaping from compartment H through passage e and port f, and entering compartment H′ through ports a h and passage c. A further rotation of shaft L and valve M, caused by the inward movement of diaphragm F, brings the valve to the position shown in Fig. 9, with the gas escaping from compartment G through passage b and port g, and entering compartment G′ through ports a i and passage d.

It is to be understood that the various parts do not rest in the positions in which they are represented in Figs. 6 to 9, such figures being merely intended to illustrate the positions the parts occupy relatively to each other at certain points in the rotation of the shaft. It will be noticed upon reference to all these figures there is an instant when only one port is filling and one emptying; but this occurs only for an instant, for as the valve rotates continuously an additional port begins to fill and an additional port begins to empty as soon as the valve moves to such a position that its hollow port s covers two of the ports f, g, h, i. As a matter of fact, therefore, there are two ports emptying and two ports filling, almost constantly. For example, when the valve moves to a position between the two positions represented in Figs. 6 and 7, the hollow port of the valve will connect the two ports f g with the supply a, while the ports h and i will be uncovered, thus allowing gas to enter the compartments G H and escape from the compartments G′ H′. As the valve continues to rotate, and before it reaches the position shown in Fig. 7, the ports h and f will begin to be closed, the parts being so proportioned that by the time they reach the position shown in Fig. 7, the compartment H will be completely filled, the compartment H′ completely emptied, the compartment G half filled, and the compartment G′ half emptied.

If desired, the port or passage a may be used as the outlet instead of the inlet, in which case the positions of the valve would be changed slightly and the gas would enter the measuring compartments through the open port t of the valve and pass out through the closed hollow port s.

The measuring chambers having one wall formed by the small diaphragms as described may obviously be used in connection with other forms of valves and valve-operating mechanism.

Having thus described our invention, what we claim is—

1. In a meter, the combination with a shell or casing comprising two diaphragm chambers; a diaphragm in each chamber dividing the latter into two compartments each; the supply a; the four inlet and outlet passages b, c, d, e, communicating with said compartments; a valve M provided with open outlet port t, elongated covered inlet port s, and solid portions A′; and connections between

the diaphragms and valve,—whereby the complete filling of one compartment is effected before the pressure in the opposite compartment can interfere to reverse the motion of the diaphragm in the first-mentioned compartment.

2. In a meter, the combination with the hollow box A having openings in two of its sides; of the diaphragm chambers C D each having an opening in one side and applied to the open sides of the box; the diaphragms E F mounted in the chambers C D; diaphragms I and J applied to the openings in the sides of the chambers and connected with the diaphragms E and F; supply *a;* suitable passages *b*, *c*, *d*, *e;* a valve M controlling the flow to and from the compartments; and connections between the diaphragms I and J, and the valve.

3. In a meter, a measuring chamber having one wall formed by a flexible diaphragm; in combination with a second diaphragm dividing the chamber into two compartments; and a connection between the two diaphragms.

4. In a meter, two measuring chambers each having one wall formed by a flexible diaphragm; in combination with a second set of diaphragms dividing each chamber into two compartments; a connection between the diaphragms of each chamber; a valve controlling the flow of gas to and from the separate compartments; a shaft for actuating the valve; and connections between the opposing diaphragms and the shaft.

5. In a meter, the combination with the chamber C having a flexible diaphragm I forming one wall thereof; the diaphragm E within the chamber thus formed; the rod or stem *l;* block *o* between the diaphragms; block *n* on the outside; and the nut *p*.

6. In combination with the chambers and the diaphragms therein; the intermediate cranked shaft L and valve M; the frame K provided with perforated arms *q q;* stems *l* provided with blocks *n;* rods *r* carried by the blocks and supported in the arms; pitmen N and O connecting the blocks with the shaft; and a shell or casing provided with suitable ports and passages.

In witness whereof we hereunto set our hands in the presence of two witnesses.

MICAJAH C. HENLEY.
JESSE P. FULGHAM.

Witnesses:
WILLIAM E. BELL,
FRANK. H. WILLIAMS.