(No Model.) 4 Sheets—Sheet 1.

L. H. NASH.

OSCILLATING METER.

No. 336,423. Patented Feb. 16, 1886.

Fig. 1.

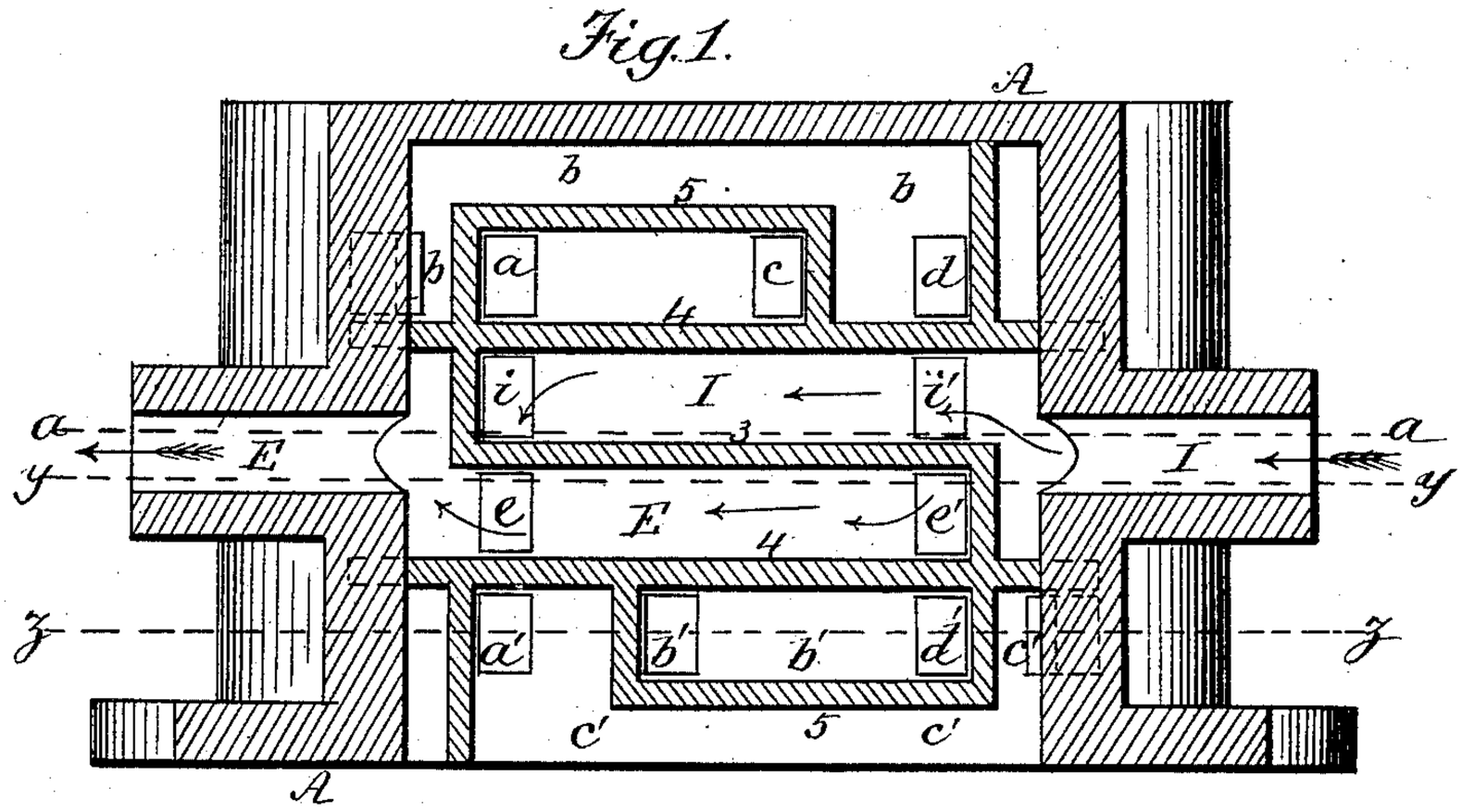
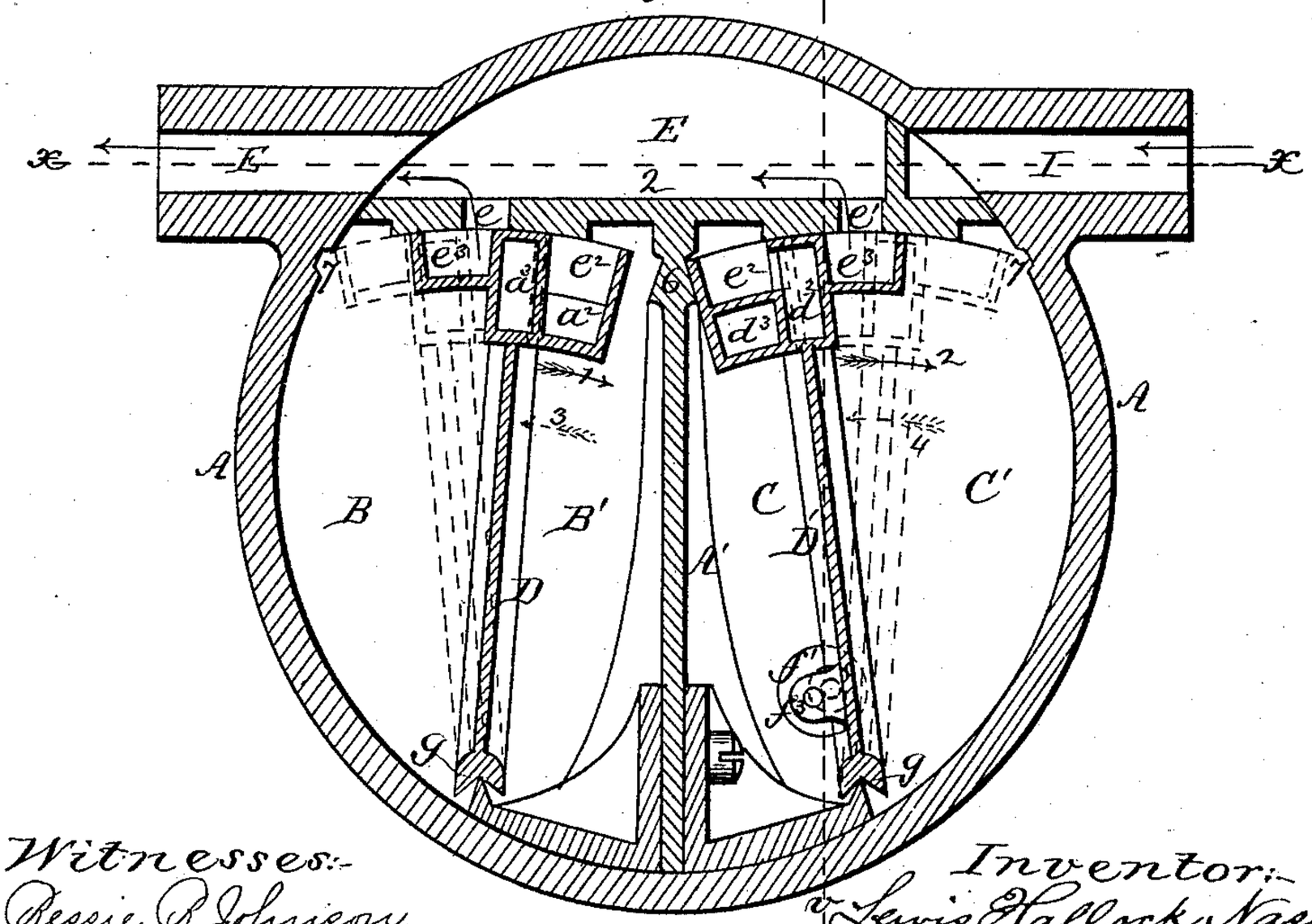


Fig. 2.



Witnesses:-
Bessie P. Johnson.
R. S. Grant

Inventor:-
Lewis Hallock Nash,
by Johnson & Johnson
Attys.

(No Model.) 4 Sheets—Sheet 2.

L. H. NASH.

OSCILLATING METER.

No. 336,423. Patented Feb. 16, 1886.

Fig. 3.

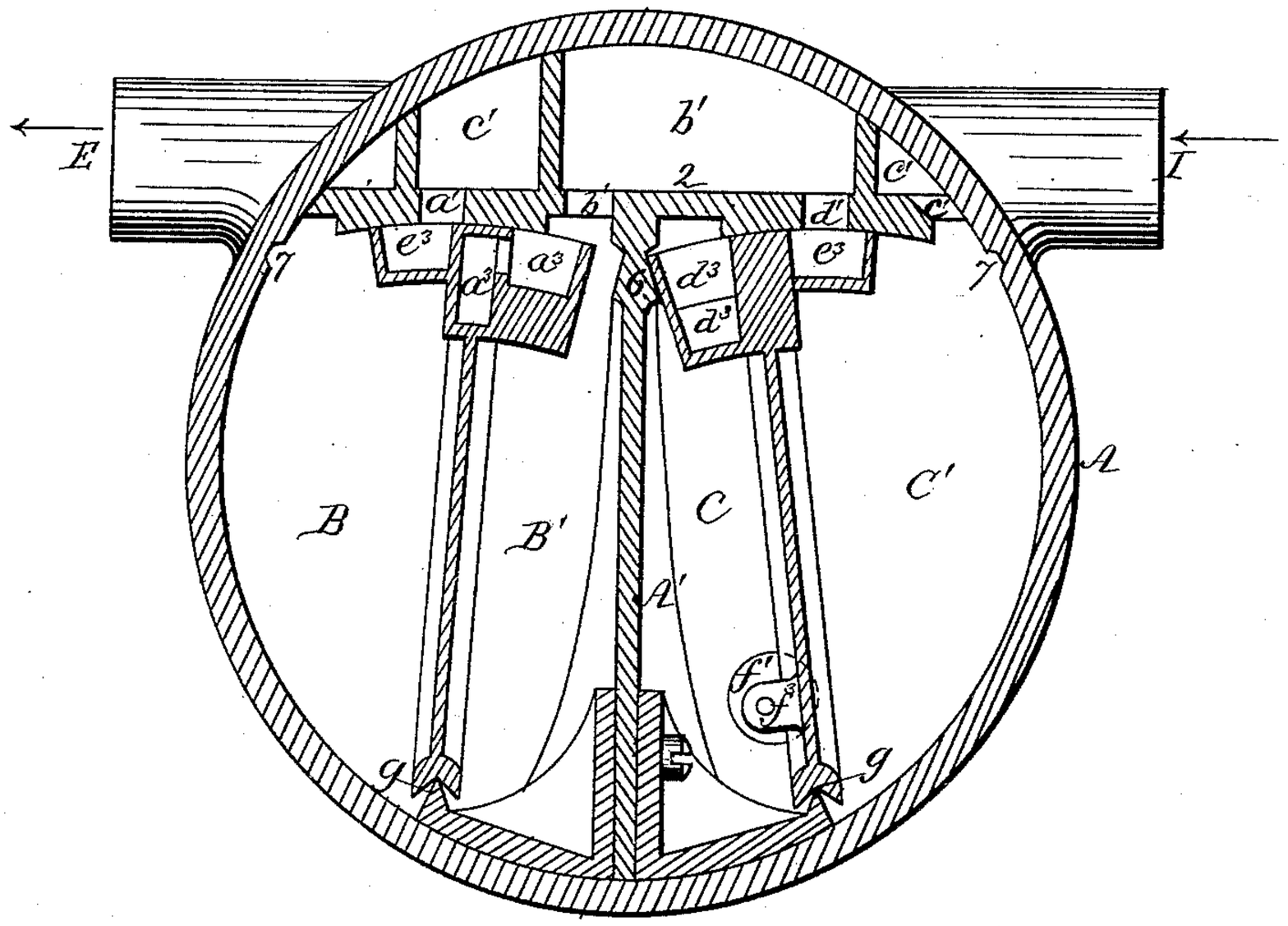
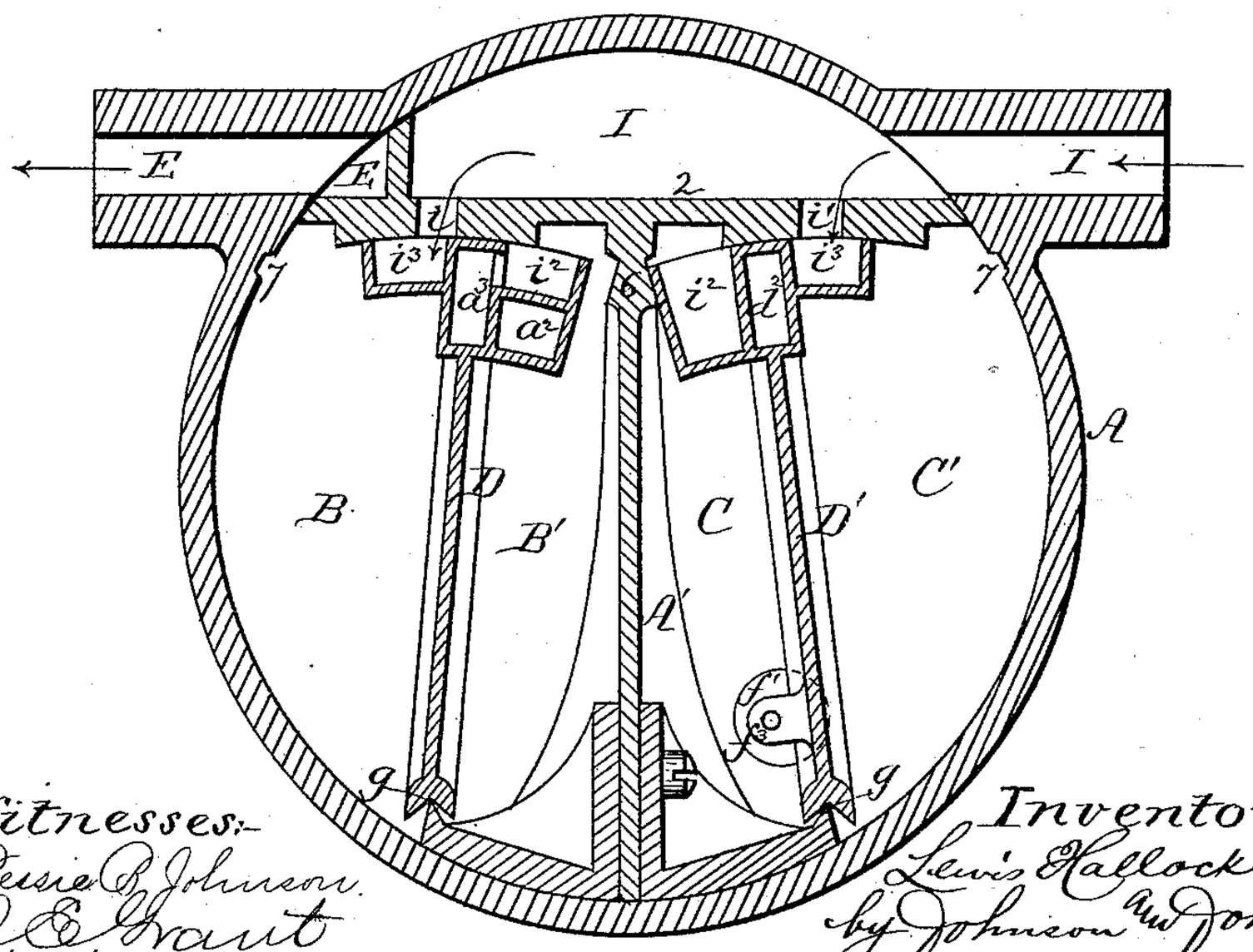


Fig. 4.



Witnesses:-
Jessie P. Johnson.
R. E. Grant

Inventor:-
Lewis Hallock Nash
by Johnson and Johnson
Attys.

(No Model.) 4 Sheets—Sheet 3.

L. H. NASH.

OSCILLATING METER.

No. 336,423. Patented Feb. 16, 1886.

Fig. 6.

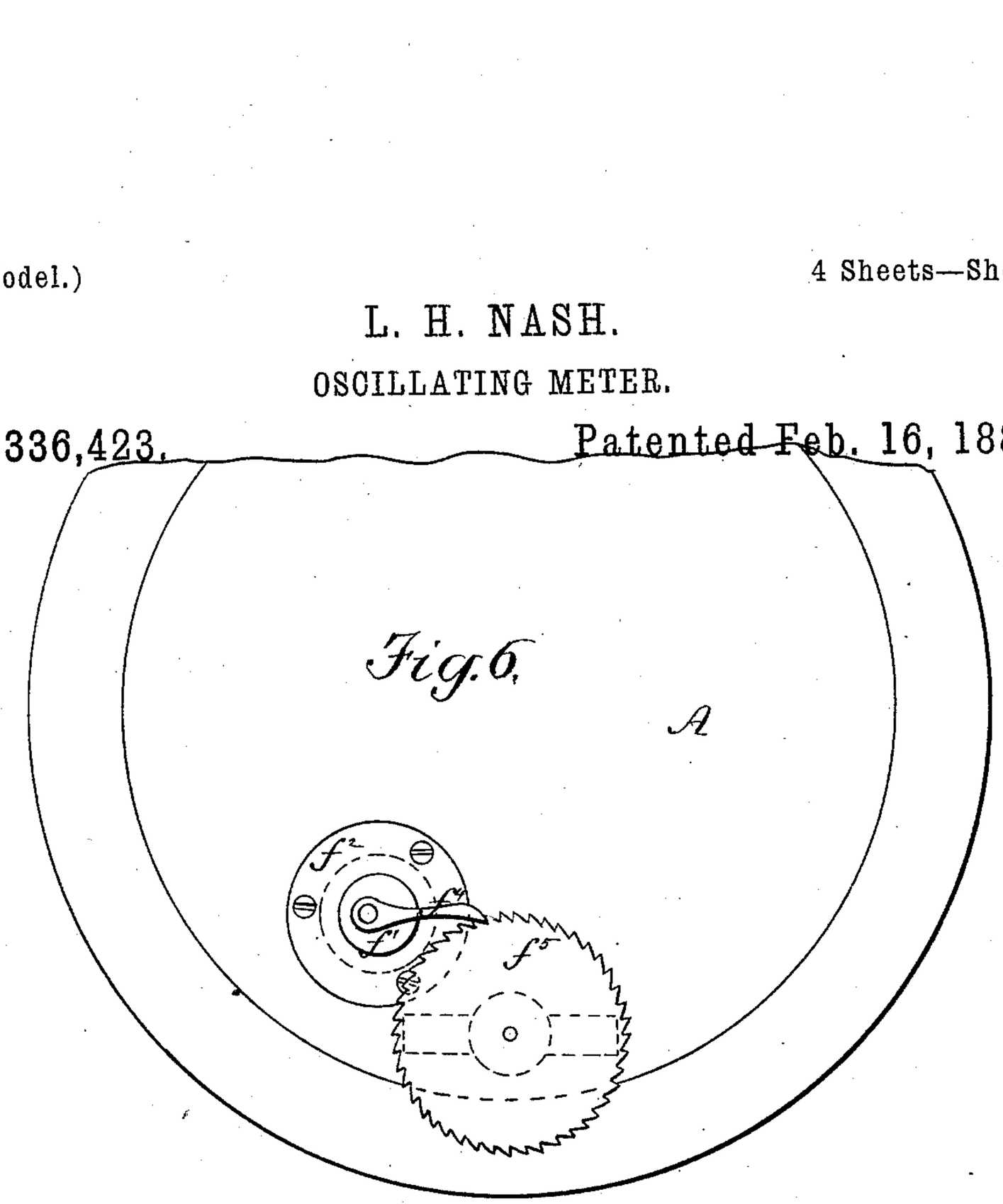


Fig. 5

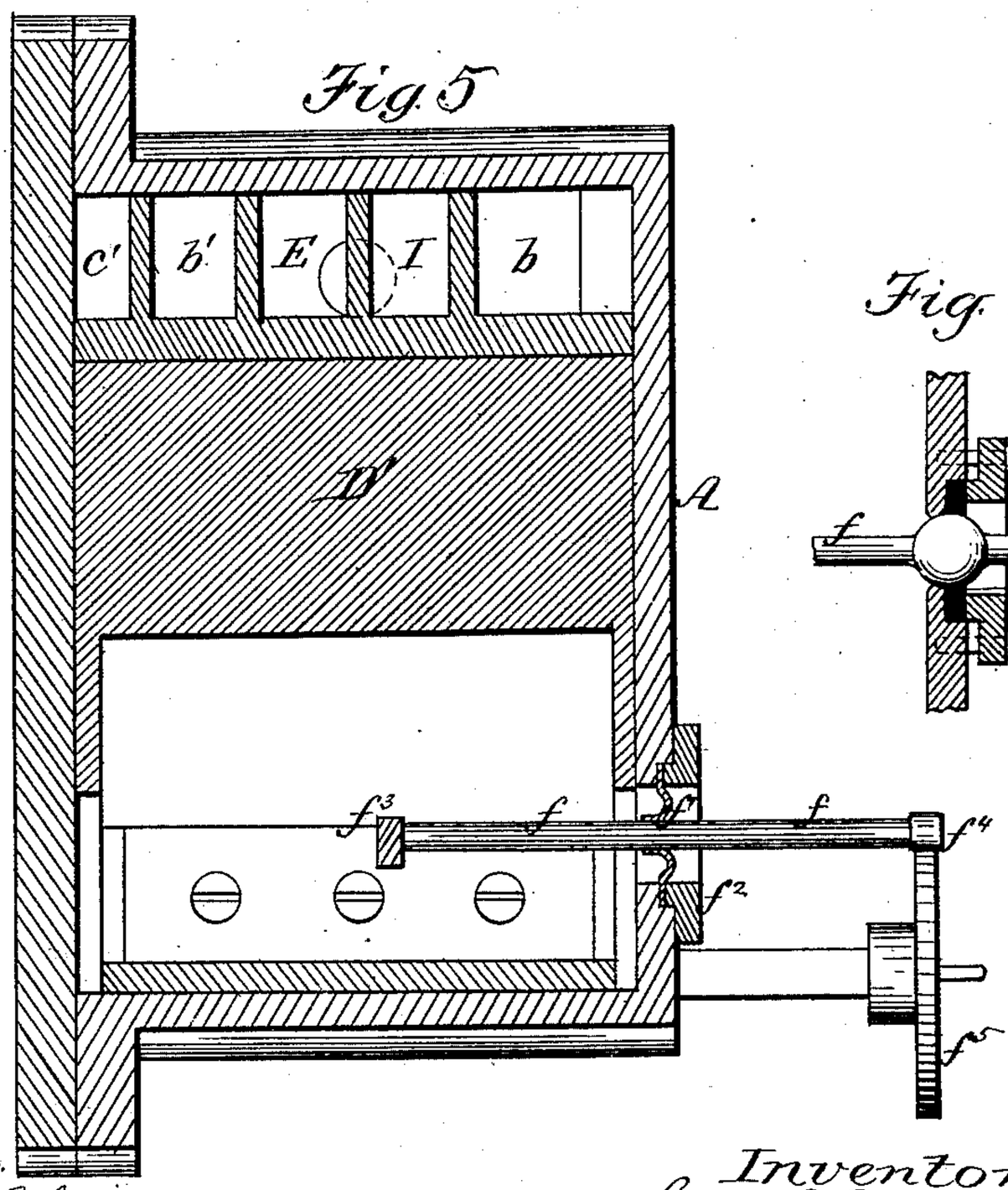


Fig. 11.

Witnesses.
Bessie B. Johnson
R. E. Arant

Inventor:-
Lewis Hallock Nash
by Johnson and Johnson.
Atty.

(No Model.) 4 Sheets—Sheet 4.

L. H. NASH.

OSCILLATING METER.

No. 336,423. Patented Feb. 16, 1886.

Fig. 7.

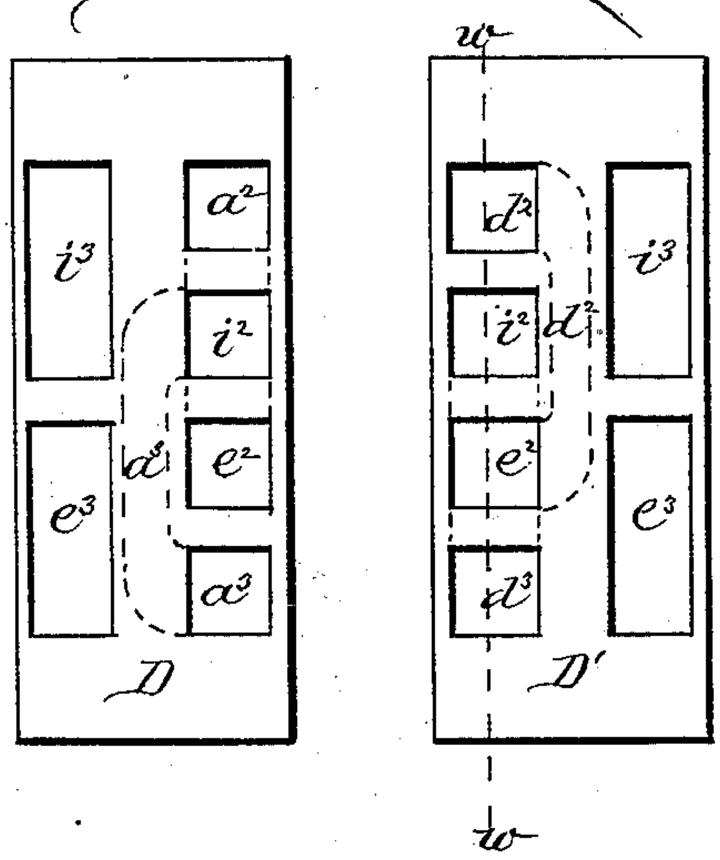


Fig. 8.

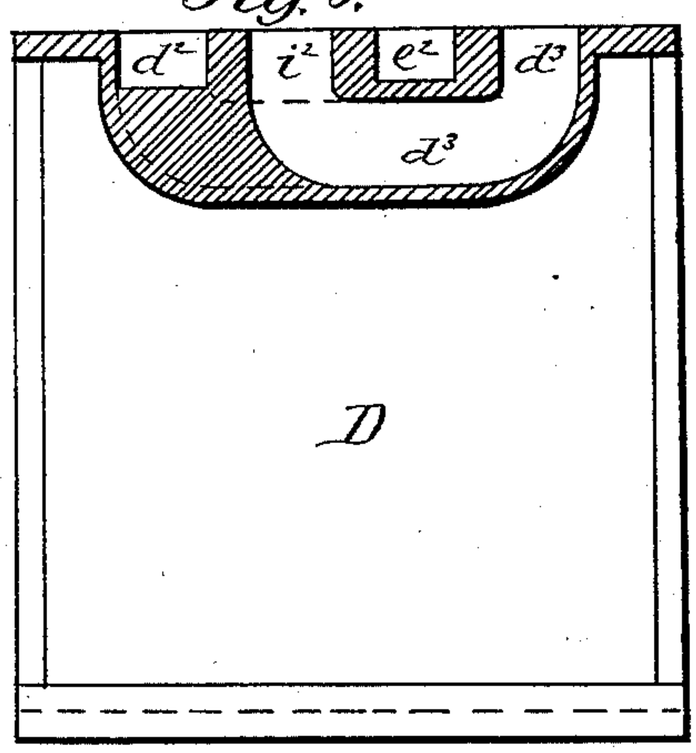


Fig. 9.

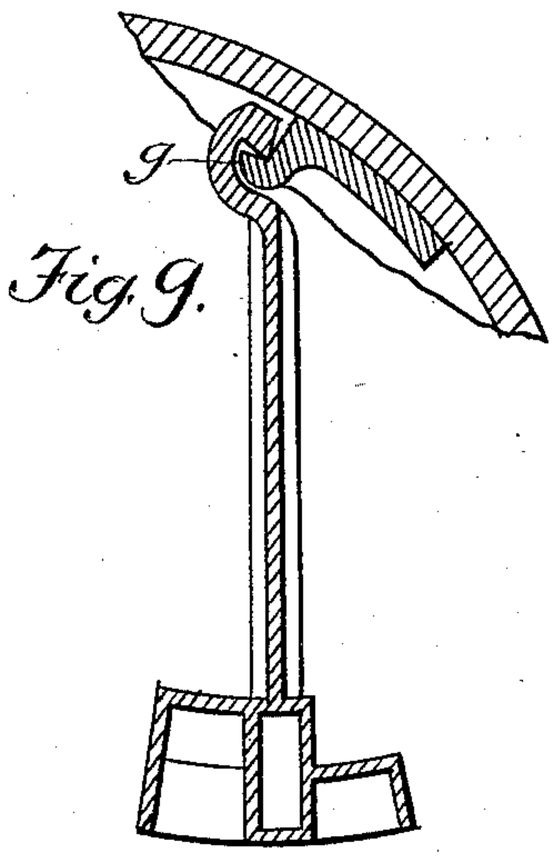
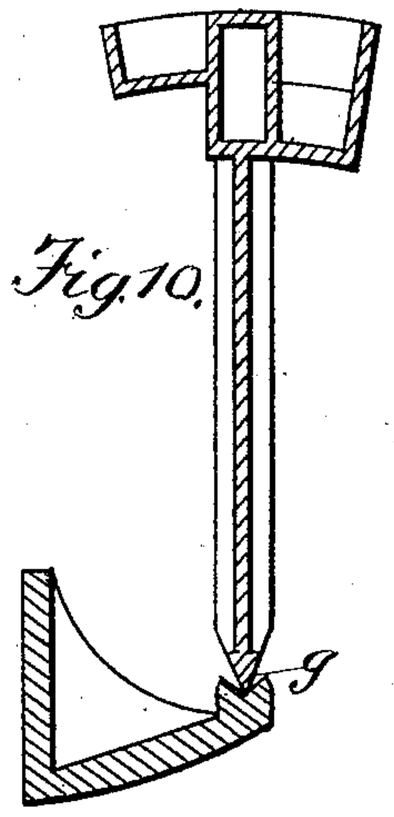


Fig. 10.



Witnesses:-
Bessie P. Johnson.
R. E. Grant

Inventor:-
Lewis Hallock Nash
by Johnson & Johnson
Attys.

UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

OSCILLATING METER.

SPECIFICATION forming part of Letters Patent No. 336,423, dated February 16, 1886.

Application filed September 23, 1885. Serial No. 177,942. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Water-Meters, of which the following is a specification.

My invention in water-meters embraces coacting rocking pistons to divide a measuring-chamber; and the objects of my improvements are to relieve the working parts of wear; to avoid wearing-surfaces for the piston, and thereby prevent the destruction of the meter by water containing gritty substances; to avoid the use of a stuffing-box for the connection which transmits the motion of the interior working parts through the case to the registering mechanism, and to provide coacting rocking pistons with valves for each, the valve for one piston controlled by the operation of the other piston. The piston is adapted to rock upon one end, the opposite end having a segmental bearing-surface to form a joint-forming contact with a similar bearing-surface upon the case, within which it works, the point upon which the piston rocks forming the other joint-forming contact upon the walls of the case, whereby the measuring-chambers of the case are divided. The piston is placed vertical, so that its weight will be borne upon a rocking bearing to prevent the sliding bearing-faces from touching each other. In the rocking movement of the piston it has the same displacing principle of action as that of a reciprocating piston, and the advantage of its rocking action with its weight borne upon one edge is not dependent upon the particular valve used. Such rocking pistons may be combined in pairs or threes having communicating parts leading from the valve of one piston to the receiving and discharging chambers of the other piston, and these piston-chambers may be placed side by side or end to end, or in any position so that their ports and passages communicate with each other and with the piston-valves. A yielding packing forms the joint of the connection passing through the case to operate the registering mechanism. These matters I will now describe in connection with an organized meter having two measuring-chambers, preparatory to a designation of the devices and combinations which constitute my invention.

Referring to the accompanying drawings, Figure 1 represents a horizontal section taken through the meter-case on the line *x x* of Fig. 2 of the inlet and outlet passages, showing the top ports which communicate with the measuring-chambers in which the pistons rock. Fig. 2 represents a vertical section taken on the line *y y* of Fig. 1. Fig. 3 represents a vertical section taken on the line *z z* of Fig. 1; Fig. 4, a vertical section taken on the line *a a* of Fig. 1. In these figures the rocking pistons are shown in the same relative positions. Fig. 5 represents a vertical section taken on the line *v v* of Fig. 2, showing the flexible connection which takes the place of the usual stuffing-box of the register-connecting mechanism; and Fig. 6 shows an end elevation of the meter-case and the register-connecting mechanism. Fig. 7 represents top views of the two rocking pistons, showing their valve-ports. Fig. 8 shows a vertical section of one of the valved rocking pistons on the line *w w* of Fig. 7. Figs. 9 and 10 show vertical sections of the valved rocking piston, illustrating the knife-edge bearing as a foot-support and as a suspension-support. Fig. 11 shows a modified construction of the yielding joint-packing for the register connecting-rod.

These drawings illustrate in a compact form the operation of rocking pistons in separate measuring-chambers placed side by side, each piston having a valve for operating the other piston.

The case A is preferably of cylindrical form, having its upper portion divided horizontally and vertically to form the inlet-passage I, the outlet-passage E, and the case-ports communicating with the valves of the rocking pistons, as seen in Fig. 1, while a diameter partition, A′, divides the case into two measuring-chambers, within which the pistons rock. The upper divided portion is formed by the horizontal and vertical walls 2 and 3, for the inlet and for the outlet passages I and E, and the vertical walls 4 and 5 for the case-ports. The inlet-passage I extends along one side of the middle vertical wall, 3, and the outlet-passage E extends along the opposite side of the middle vertical wall, while the case-ports are

formed in the floor of the top division between the vertical walls 4 and 5 and the heads of the case. One of the case-heads is made removable for the proper placing of the rocking pistons.

The piston consists of a rectangular plate having a chambered formation at one end resembling the letter T and is supported upon the knife-edge bearing *g* at its other end suitably secured to the inner wall of the case upon which the piston has its rocking movement. Its chamber end has its face next the case curved with an arc struck from the knife-edge bearing, and a similar curved surface upon the inner wall of the case forms the joint-forming contact at the moving end of the piston around the case-ports. The knife-edge bearing also forms a joint-forming contact with the case, and each piston thus mounted divides each measuring-chamber of the case into two separate chambers, B B′ C C′, into and from which the water is caused to flow in operating the pistons. The chambered end of the piston forms its valve, which co-operates with the case-ports in a manner which I shall presently describe.

To avoid all friction upon the bearing-surfaces of the piston, it is placed in vertical position, so that its weight will be borne upon the bearing end and not upon the sliding valved end, which latter, however, will be sufficiently close to form a joint with the case. The vertical edges of the piston will, like its valved end, form joint-forming contact with the inner walls of the case, and the measuring-chambers will thereby be divided each into a receiving and a discharging chamber; but the piston in its movements will be practically free from friction, its whole weight being borne upon a single joint-forming edge.

The knife-edge bearing of the piston is horizontal and forms a line-axis the full width of the piston, so that the piston rocks upon a line-joint at one side, and whether this line-joint be a supporting-foot, as shown in Fig. 10, or a suspension-point is immaterial, since when the suspension-point is used the case is turned upside down, and the piston-plate is formed with a hook-shaped bearing-edge suspended within a V-shaped bearing-trough secured to the wall of the case, as shown in Fig. 9.

When the bearing of the piston is at the foot, the lower edge of the piston terminates in a knife-edge fitted in a V-groove formed in a foot-piece secured to the partition plate A′, as in Fig. 10; or the lower edge of the piston may terminate in an inverted V, fitted on a knife-edge bearing, as in Figs. 2, 3, 4.

As stated, the chamber-head of the piston forms the valve, and the valves of the two pistons are of identical construction and arrangement—that is, the ports which constitute the valve—which I will presently describe.

The case-ports are all made in the floor which divides the inlet and the outlet passages from the measuring-chambers, and their arrangement is shown in Fig. 1, in which *i i′* are the two inlet-ports communicating with the inlet-passage I, and *e e′* are the two outlet-ports communicating with the outlet-passage E. These two passages I and E are separated by the Z-shaped middle wall 3, and they are formed by the said middle wall and the vertical parallel walls 4, which rise from the floor 2, crossing the axis of the case and parallel with the middle vertical wall, 3. These case-ports are arranged so as to make, in connection with the piston-valve, each measuring-chamber a receiving and a discharging chamber, as follows, viz: The floor-port *a* communicates through the inclosed passage *c* with the division C of the measuring-chamber, and the port *a′* communicates through the passage *c′* with the division C′ of the measuring-chamber, the said port *a*, and passage *c* being inclosed by the vertical walls 4 and 5 on the outer side of the inlet-passage I, and the port *a′* and passage *c′* being inclosed by the wall 4 and the head of the case. The floor-port *d* communicates through the passage *b* with the division B of the measuring-chamber, and the port *d′* communicates through the passage *b′* with the division B′ of the measuring-chamber, the said port *d* and passage *b* being outside of the inclosed ports *a c* in the space between the wall 5 and the head of the case, and the said port *d′* and passage *b′* being inclosed like the port *a*, but on the outer side of the outlet-passage E. The piston-valves co-operate with these floor-ports to effect the communication of the inlet and the outlet case passages with the measuring-chambers, as follows, viz:

The piston-head extends from head to head of the case, as shown in Fig. 5, and is wide enough to receive two rows of interior ports—one row on each side of the piston-plate. One of these rows has two ports, i^3 and e^3, and the other row has four ports, and when the piston D′ is in position shown by full lines in Fig. 2, the port i^3 opens direct communication between the inlet floor-port *i′* and the floor-port *d*, and the port e^3 opens communication between the floor-ports *e′* and *d′*. For reversing the flow of the water when the piston D′ is in the position shown in dotted lines in Fig. 2, the four ports are arranged to cross each other, so that the piston-inlet port i^2 communicates with its port d^3, as shown in Fig. 8, which operates the floor-port *d′* for the piston D′, and the discharge-port e^2 communicates with its piston-port d^2, which operates with the floor-port *d*. The four ports are arranged on the side of the piston-plate next the chamber-partition A′, and the movements of the pistons are limited between the points 6 of the partition and the points 7 of the case, so that both rows of the piston-ports will communicate with the floor-ports.

The valve-ports of piston D′ operate piston D, as follows, viz: Piston D′ being in the position shown in full lines in Fig. 2, the inlet-water will enter from port *i′* through piston-

port i^3 to the case-ports d and b, into chamber B, moving the piston D in the direction of the arrow 1, (shown in full lines,) forcing out the water from chamber B′ through ports and passages b', d', e^3, e', and E. If the piston D′ be in the position shown by dotted lines, the water will enter port i' into piston passage i^2, and through port d^3 into case-port d', from which it passes through passage b' to chamber B′, thus reversing the motion of the piston D, as shown by dotted arrow, and forcing out the water from chamber B, through ports and passages b, d, d^2, e^2, and E.

The ports of piston D operate piston D′ as follows, viz: The piston D being in position shown in full lines, Fig. 2, the inlet-water enters from port i, through the piston-port i^3, Fig. 7, through the case-port a and passage c into chamber C, moving piston D′ in the direction of the arrow 2 in full lines, and forcing out the water from chamber C′ through ports and passages c', a', e^3, e', and E. If the piston D be in the position shown in dotted lines, the water will enter port i into piston-passage i^2 and a^3, and through case-port and passage a' c' into chamber C′, driving the piston in the direction of the dotted arrow 4, and forcing out the water from chamber C through ports and passages c, a, a^2, e^2, e, and E. Hence the pistons being in the position of the full lines, Fig. 2, piston D will be moving in the direction of the arrow 1, and piston D′ will just be beginning its motion in the direction of the arrow 2. Piston D now completes its stroke, and piston D′, moving into position by dotted lines, reverses the movement of piston D and completes its own stroke. When piston D moves into position of dotted lines, it reverses piston D′, and thus the pistons alternately operate each other. The valves of each piston coact with the case-ports and with each other, so that each piston forms the operating-valve for the other, but the operation of the pistons will not be changed even though the positions of the valves may be changed.

The device which connects the registering mechanism with one of the pistons to indicate the movements of both, and thereby measure the flow of the water into and from each of the chambers, consists of a rod, f, loosely connected to a lug, f^3, on the side of one of the piston-plates near its knife-bearing, and, extending horizontally through the side of the case, is secured to a water-tight flexible packing or diaphragm, f', which forms a cover for and closes the opening in the case at the point through which the rod f passes, and permits of a vibrating or rocking movement of said rod and dispenses with the use of a stuffing-box. The outer end of the rod f carries a pawl, f^4, which drives a ratchet-wheel, f^5, to which is attached the indicating mechanism, because the rocking movement of the piston vibrates the arm f, and the latter, being supported by the diaphragm as a flexible fulcrum, is thereby permitted to have a vibrating movement at its outer end to operate the pawl. This means of forming the flexible joint-bearing or packing in the case for the means of transmitting the motion of the inner working parts of the meter to the registering device may be applied to any meter of whatever form of moving parts, and its motion communicated to any form of exterior dial mechanism so long as the packing for the motion-transmitting arm, rod, or lever is water-tight and capable of yielding with the movement of said lever-arm, so that the latter may swing upon the diaphragm as a stuffing-box and transmit any motion communicated to the inner end of the lever-arm to its outer end without the least friction at the case-joint. In Fig. 11 this packing case-joint is formed by rubber or hemp and a joint bearing upon an enlargement of the rod. The rod f may be operated by pistons having other than rocking movement.

I have shown and described provision for limiting the movements of the free ends of the coacting swinging pistons, so that the valve-ports of the said pistons will register with the case-ports; and it will be understood that this limiting provision for the swing of the pistons also serves to limit the movements of the registering operating connections, which are connected to one of said swinging pistons.

I claim—

1. The combination, with the case having inlet and outlet ports and passages, of coacting rocking or swinging pistons having valve-ports formed in their swinging ends operating to control the said case-ports, substantially as described, for the purpose specified.

2. The combination, with rocking pistons each having a valve at its swinging end and supported upon a bearing at its other end, of a case having ports and passages operating in connection with the valved ends of said pistons, substantially as described, for the purpose specified.

3. The combination, with a case divided into measuring-chambers and having inlet and outlet ports and passages communicating with said measuring-chambers, of two coacting rocking pistons having valve-ports formed in their swinging ends operating with said case ports and passages, whereby each piston forms the operating-valve for the other piston, substantially as described, for the purpose specified.

4. The combination, in a water-meter, of rocking-plate pistons each having a knife-edge bearing support at one edge upon the case and a valved head at its other edge, with a case having ports and passages coacting with said valved piston-heads, the joint-forming contact of said valved surface being relieved of the weight of said pistons, substantially as described, for the purpose specified.

5. The two rocking-plate pistons each having a series of valve-ports at its swinging end, each having a knife-edge bearing at its other end, sustaining the weight of said piston, in combination with a case divided at its diameter into two measuring-chambers and having

ports and passages corresponding with the valve-ports of the pistons, whereby each piston forms the operating-valve for the other and divides its chamber into receiving and discharging chambers, whereby both pistons swing upon separate line-joint bearings and carry their coacting valves free of frictional contact with the case-ports, substantially as described, for the purpose specified.

6. The combination, with the meter-case having inlet and outlet ports and the independent swinging coacting valved pistons having the movements of their free ends controlled and limited for co-operation with said case-ports, of means directly connected with one of said pistons for transmitting its motion to the registering mechanism controlled and limited in such transmitting function by the controlling provision for the said pistons, substantially as described.

7. The combination, with the meter-case having inlet and outlet ports and the independent coacting swinging valved pistons, limited in their movements by interior wall-stops, 6 7, for co-operation with said case-ports, of the lever-arm *f*, the flexible case-bearing joint for said lever-arm, and the register-operating connections, substantially as described.

8. The meter-case divided vertically and horizontally and having inlet and outlet ports in its horizontal division, arranged substantially as described, combined with the independent coacting swinging pistons having valve-ports in their swinging ends, each piston controlled and limited in its swinging movements by the interior stops, 6 and 7, whereby the pistons are caused to operate independently of each other and their ports to register with the case-ports.

9. The combination, in a water-meter having separate measuring-chambers, of two coacting rocking pistons, each rocking upon a knife-edge, and an inclosing-case having ports and passages connecting each measuring-chamber with valves for each piston, whereby each piston operates the valve for the other piston, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:
H. W. BRINCKERHOFF,
A. E. H. JOHNSON.