Sheet 1-3 Sheets.

J. B. Van Deusen

Water Meter

No. 91989. Patented Jun. 29. 1860

Fig. 1.

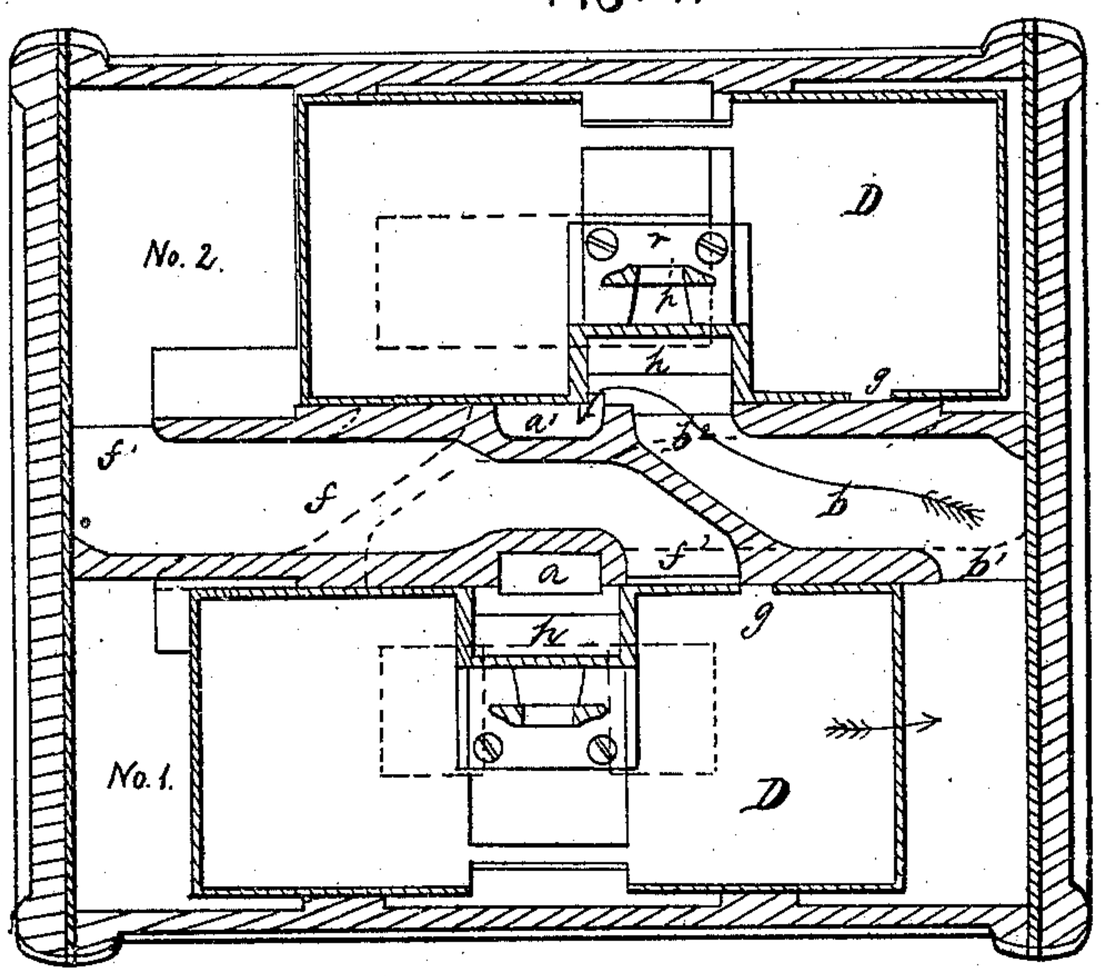
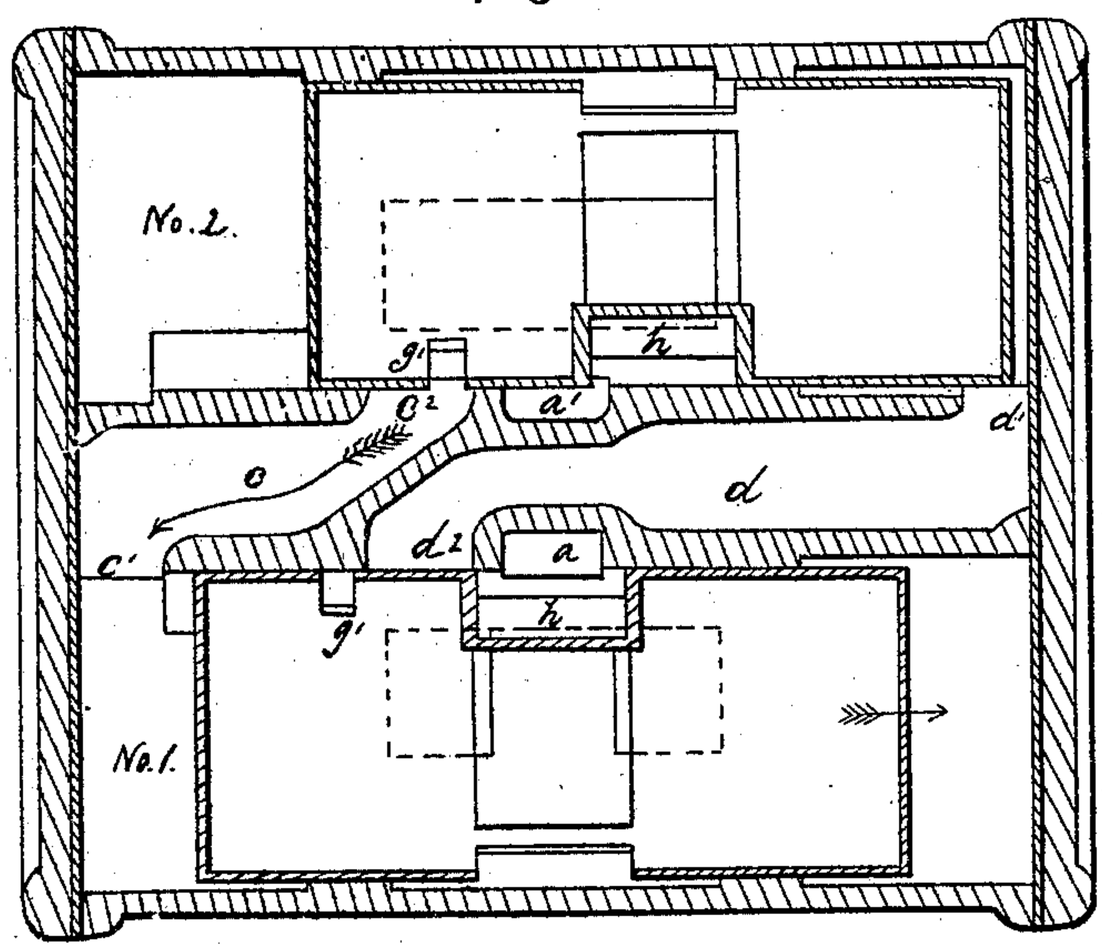


Fig. 2.



Witnesses

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J. B. VanDeusen. Sheet 2, 3 Sheets

Water Meter.

No. 91989. Patented Jun. 29. 1869.

Fig. 3.

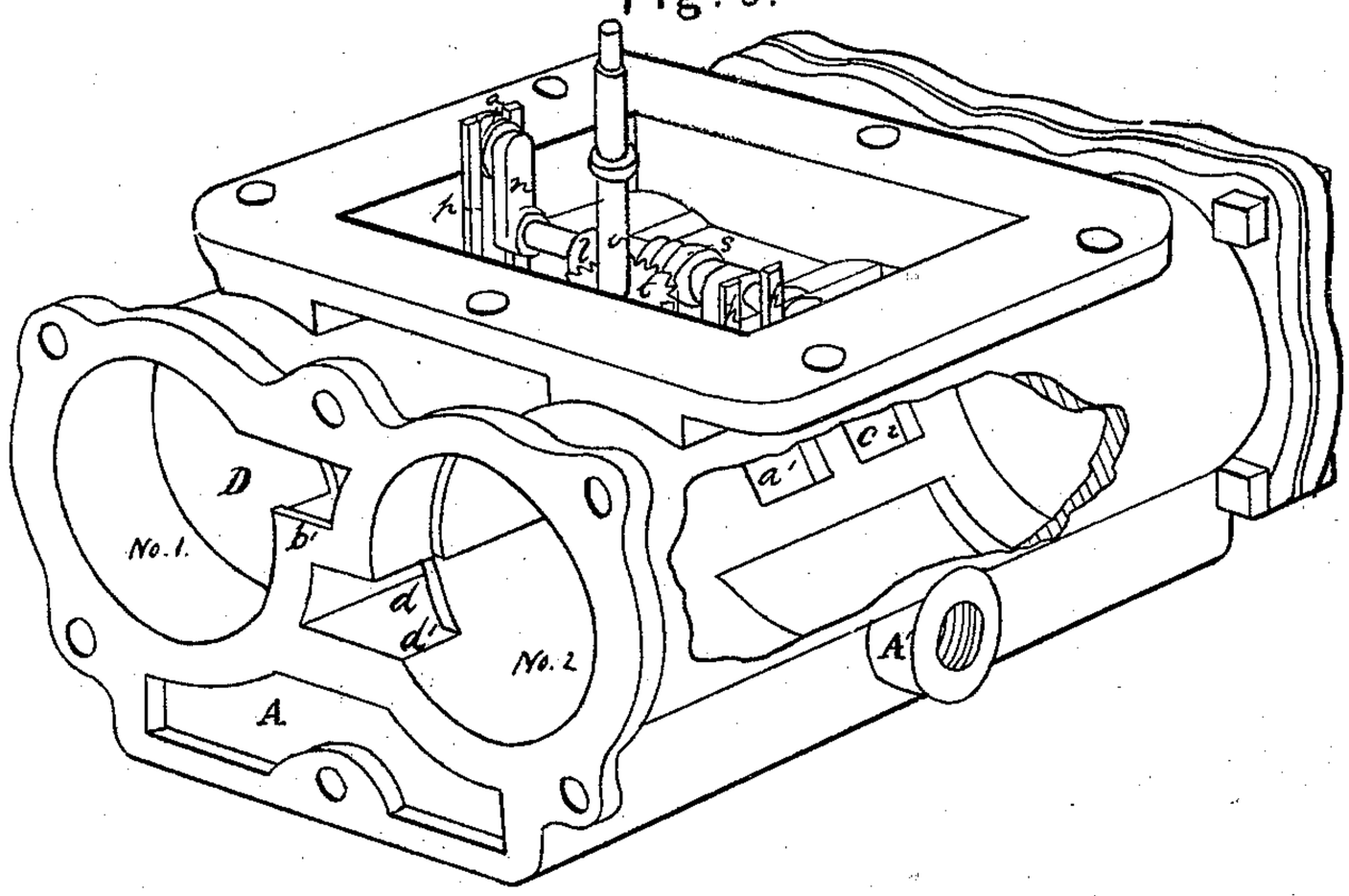


Fig. 4.

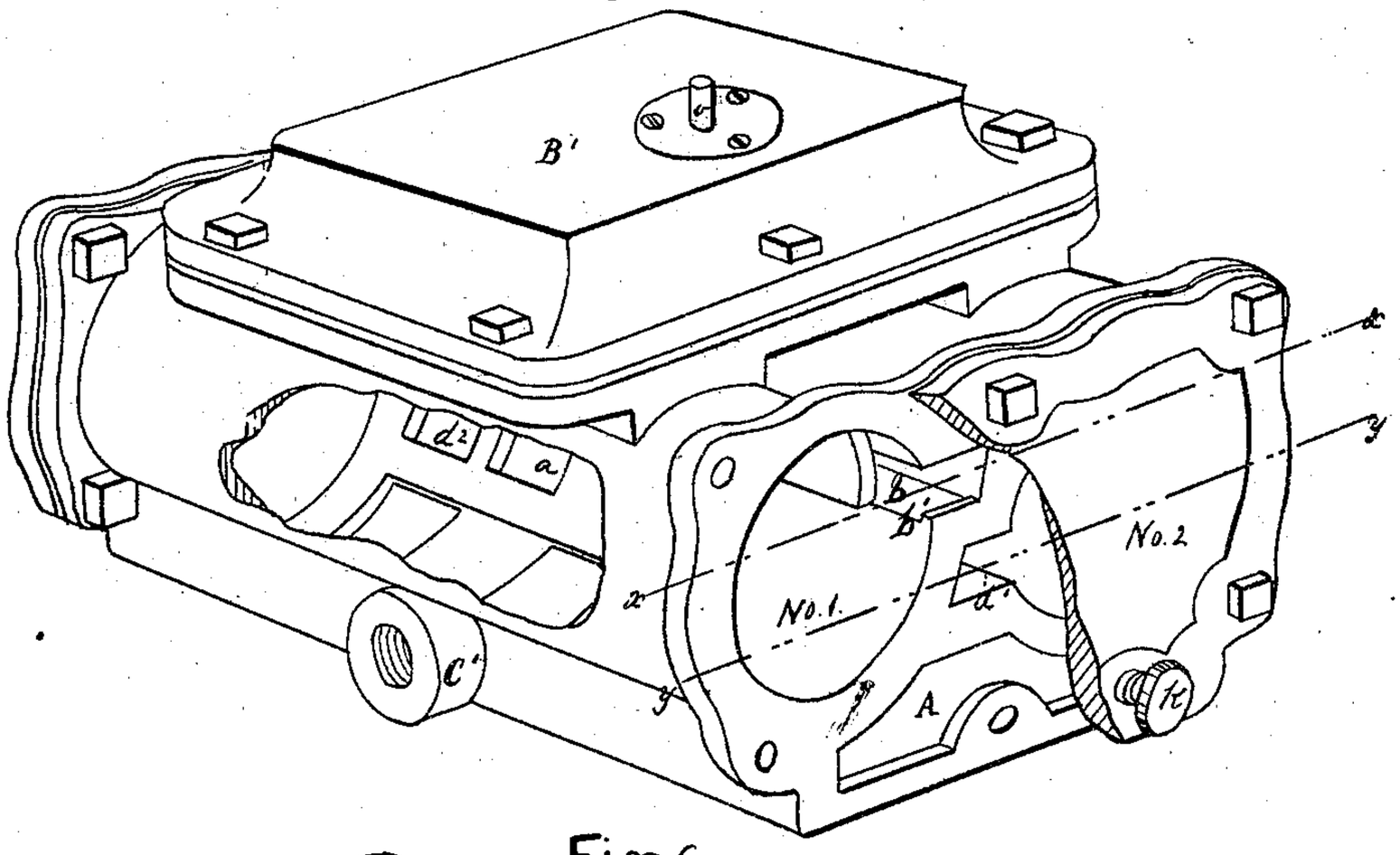
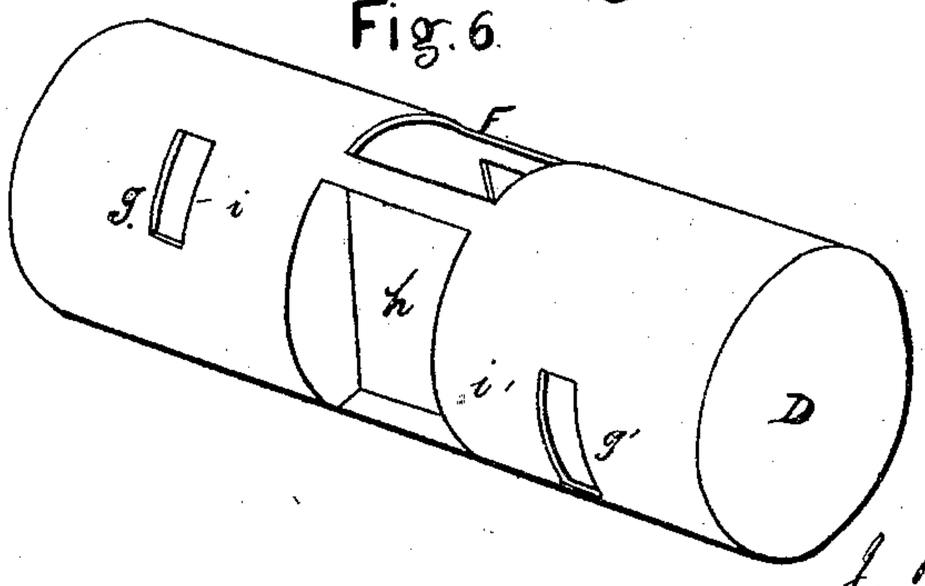


Fig. 6.



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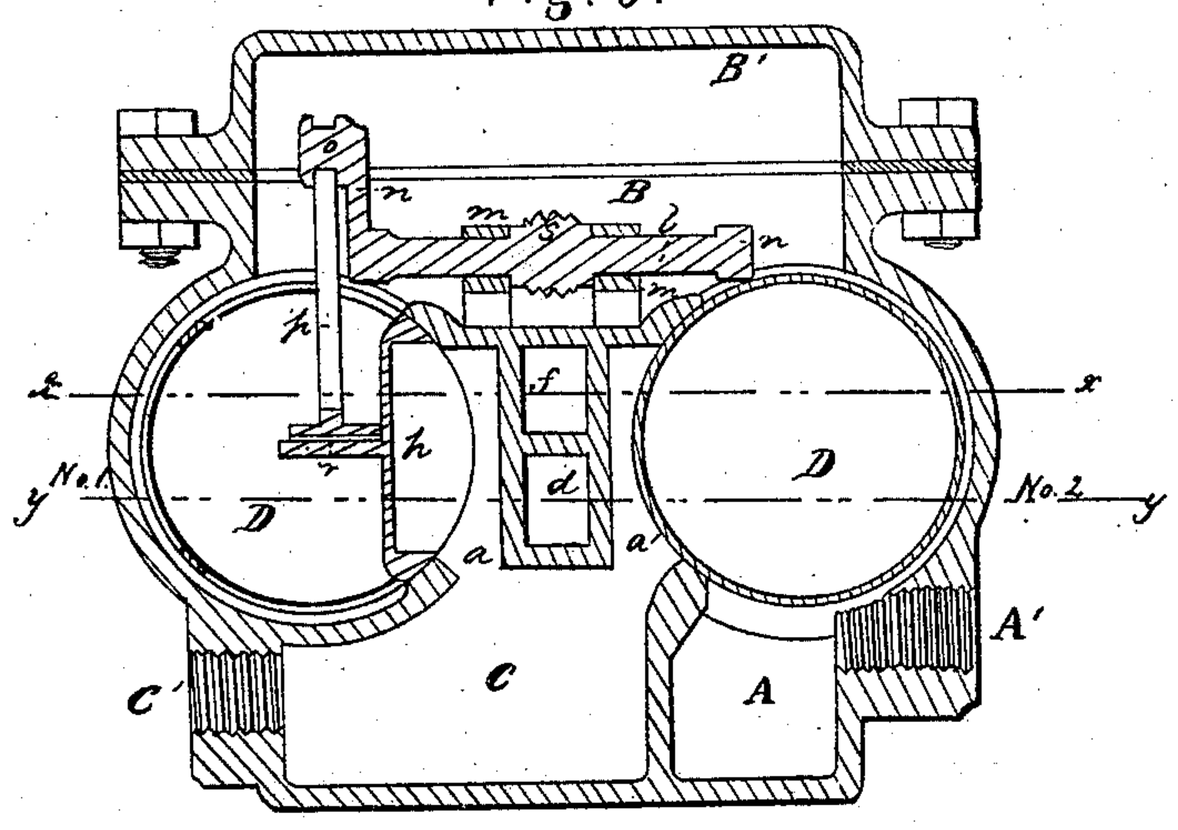
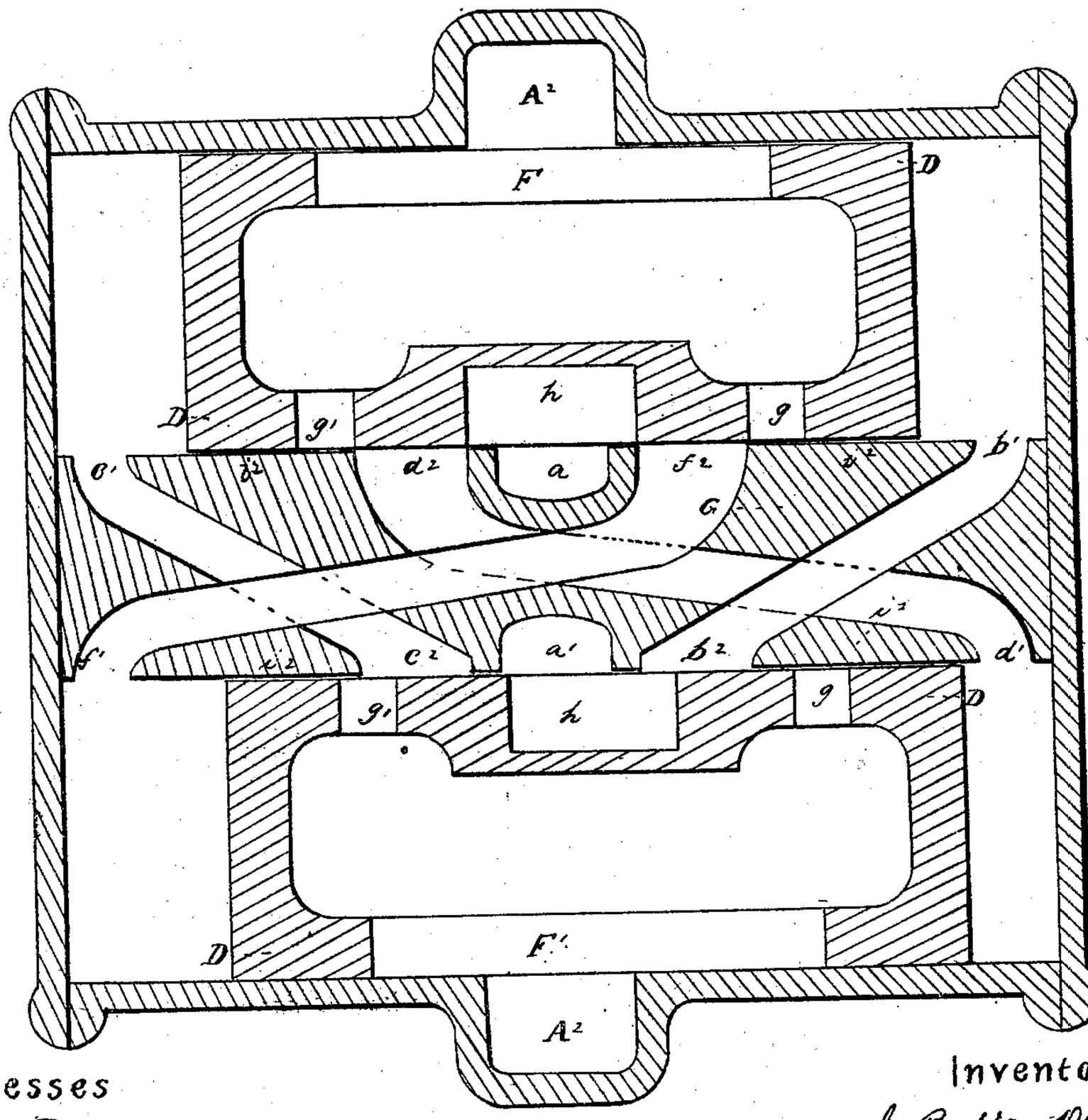
Water Meter

No. 91989. Patented Jun 29 1869

Fig. 5.





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J. B. VAN DEUSEN, OF NEW YORK, N. Y.

Letters Patent No. 91,989, *dated June* 29, 1869.

IMPROVEMENT IN FLUID-METERS.

The Schedule referred to in these Letters Patent and making part of the same.

To whom it may concern:

Be it known that I, J. B. VAN DEUSEN, of New York, in the county of New York, and State of New York, have invented certain new and useful Improvements in Fluid-Meters; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 represents a horizontal section on the line *x x*, fig. 5, of a meter made in accordance with my invention, the piston in No. 1 of the two cylinders being at half stroke, and the piston in No. 2, at the end of its stroke.

Figure 2 is a like section of the same on the line *y y*, fig. 5.

Figure 3 is a perspective view of the meter on the side of No. 2 cylinder, with a portion broken away to show the arrangement of the openings and passage-ways.

Figure 4 is a like view, looking from the side of No. 1 cylinder.

Figure 5 is a transverse vertical central section of the meter.

Figure 6 is a perspective view of one of the pistons detached.

The meter, which is the subject of the present patent, consists of a pair of cylinders having a common inlet and outlet, provided each with a hollow slide-valve, having preferably the form of a cylinder closed at both ends, and communicating with one another in the manner hereinafter described, whereby the hollow D-valve, or piston, as it may be termed, in the one cylinder, is made to control automatically the supply and delivery of the fluid to the other cylinder, and *vice versa*, so as to obtain a positive automatic reciprocating movement of the pistons without the aid of other mechanism, each, when in motion, opening and closing the channels through which the fluid acts upon the other.

In connection with the meter constructed upon this general plan, I employ a registering-apparatus, connected with the two moving-pieces or pistons by a crank, which, while actuating the register, serves also to regulate the length of stroke of the piston, so as to always measure the same quantity of fluid for each revolution, and with the same accuracy.

While preferring, however, to employ the crank for this double purpose, other means may be employed for registering, as well as for regulating the length of stroke.

In order to effect the movement of the piston above described, it is necessary that the channels in the meter between the two cylinders, and the valve-ports and seats in the pistons, which open and close such passages, should bear a certain fixed relation to each other. This, however, can best be explained by reference to the accompanying drawings, which I will now proceed to describe, in order that the nature of my invention may be fully and clearly comprehended.

The two cylinders, of which the body of the meter is composed, are marked No. 1 and No. 2. They lie side by side, and between them is the valve-seat piece, in which are located the horizontal channels or passage-ways, through which the fluid acts.

Under the cylinders is the inlet-chamber A, which the induction A^1 enters.

This chamber, in which the sediment and other impurities are deposited, opens into the cylinders; and the latter are also open at the top, (where a chamber, B, is formed in which the registering-apparatus is located,) so that there is free communication between the chamber A, the cylinders and the chamber B, the fluid filling all parts of the meter, including the hollow pistons, as hereinafter indicated.

Within, but separate from the chamber A, is the discharge or eduction-chamber C, provided with the outlet C', and communicating with the cylinders through the central conduit *a*, which opens into the inner side of No. 1 cylinder, midway between its two ends, and through the conduit a^1, which opens at a corresponding point into cylinder No. 2.

I desire here to say that the arrangement of the bottom chamber A and upper chamber B may be variously modified, all that is necessary being that there should be free communication between the two cylinders, as above specified.

Indeed, the bottom chamber may be dispensed with entirely, the inlet A^1 opening directly into either cylinder.

Having sufficiently explained the manner in which the cylinders are combined, I now proceed to describe the arrangement of the channels through which the fluid is caused to act upon the pistons, this, together with the pistons themselves, constituting the most essential part of my invention.

These channels, as above indicated, are located between the cylinders, and as the pressure of the fluid is to be exerted on the ends of the pistons, it is necessary that the channels should open into the ends of the cylinders.

Confining attention to the channels through which the fluid acts upon the piston in cylinder No. 1, the manner in which they are placed will be fully understood by reference to figs. 3 and 4.

There are two channels, *b c*. The one, *b*, has its port, b^1, at one end of the cylinder, and extends diagonally across to near the centre of cylinder No. 2, into which it opens, at b^2, upon that side of the central opening a^1, nearest the end of cylinder No. 1, in which the port b^1 is located. The other, *c*, has its port c^1 at the opposite end of cylinder No. 1, and extends diagonally across to cylinder No. 2, into which it opens, at

c^1, on the side of the central opening a^1, opposite the port b^2.

With regard to the channels which open into the ends of cylinders No. 2, the arrangement is somewhat different.

These two channels are represented at *d f*.

The channel *d* has its port d^1 in that end of cylinder No. 2 which corresponds to that of cylinder No. 1, where the port b^1 is formed, and it thence extends diagonally across to cylinder No. 1, passing under the channel *b*, and enters the latter cylinder near its centre at d^2, but upon that side of the central opening *a* farthest removed from the port d^1.

The channel *f* has its port f^1 at the opposite end of cylinder No. 1, and thence extending diagonally across to cylinder No. 2, passing above the channel *c*, enters the latter cylinder at f^2 on that side of the central opening *a*, opposite to d^2.

It will be seen that all these diagonal channels are entirely distinct, and have no direct communication with each other, and that they are arranged, as it were, in two tiers, as shown in figs. 3, 4, and 5, and in dotted lines, fig. 1, *d* and *f* constituting the upper tier, and *d* and *c* the lower tier; and, further, that while the channels *b c* do not cross each other, they are crossed by *d f*, which latter also cross each other near the centre of the meter, or between the two openings *a* a^1.

This arrangement of the two sets is quite essential, for were the channels *d f* to open into the centre of cylinder No. 1, in the same manner as the channels *b c* open into cylinder No. 2, the pistons would not work, as will be made apparent hereafter.

The construction of the pistons, or hollow D-slide valves, which move in the two cylinders, is shown plainly in fig. 6.

Each piston D is double-headed, and made hollow, with openings in its centre, through which the fluid passes and fills its interior. Upon that side of the piston which adjoins the central channel-ports and conduits, are formed valve-openings *g* g^1, and a cup or cavity, *h*.

Supposing that the piston D is that which belongs to cylinder No. 1, the central cavity or recess *h* will correspond to the discharge-opening *a*, the lower valve-opening g^1 to the port d^2, and the upper valve-opening *g* to the port f^2, and the piston of cylinder No. 2 is constructed in a like manner.

The relation which the parts *g*, g^1, and *h* of each piston must bear to their corresponding openings in the cylinder, can best be illustrated by supposing the width of the central discharge-opening *a*, to be one inch, the distance between it and the ports d^2 f^1 on each side to be one-quarter of an inch, and the width of each port to be one inch.

In such case, in order to be perfectly adapted for operation, the central cavity *h* should be about one inch and a half wide, and the distance between it and each valve-opening *g* g^1, one inch, as seen at *i* i^1, so that when the piston is at half stroke, the central cavity *h* will cover the opening *a* and that part of the cylinder intervening between the opening and the ports d^2 f^2, while the parts *i* i^1 of the piston will cover the ports d^2 f^2.

From this it will be seen that the moment the piston moves beyond the centre, say in the direction of the arrow in fig. 1, the cavity *h* will be brought partly over the port f^2, from which the water passes down through the discharge *a*, while at the same time the valve-opening g^1 is brought over the port d^2, thus allowing the inlet-water within the piston to pass through *d* to the end of the other piston, which is consequently put in motion. The piston, therefore, in this instance, can have a two-inch stroke, just double the width of the parts *a*, d^2, and f^2, and this relation between the length of stroke of the piston, and the width of these parts should always be maintained. If, for instance, it be desired to have a four-inch stroke, the width of the central channel-ports and discharge-openings should be two inches, the width of the cavity *h* and valve-seats *i* i^1 should be proportionately increased, and so on.

The manner in which the meter operates will be understood by reference to figs. 1 and 2, where the piston D, in cylinder 1, is at half stroke, and that in cylinder 2 is at the end of its stroke, the inlet-pipe A^1 is open, the outlet-pipe C′ is closed, and all parts of the meter, cylinders, and pistons, and passage-ways, are filled with water, or other fluid, at the same pressure which exists in the main pipe.

In this position, it will be seen that the piston in cylinder No. 1 closes the channels *d f*, leading to cylinder No. 2, while, on the other hand, the central cavity *h*, in piston No. 2, will be partly over the discharge-opening a^1 and the port b^2, and the valve-opening g^1 of the piston will be over the port c^2.

Now, if the discharge-pipe C′ be opened, water will flow from the end of cylinder No. 1, through the channel *b*, passing from its port b^2, into the central cavity *h* of piston No. 2, and thence down into the discharge-chamber C, and out through the pipe C′, pressure upon the one end thus being reduced.

At the same time, the inlet-water, with full pressure, will pass through the valve g^1 in piston No. 2, and the port c^2 and channel *c*, into the other end of cylinder No. 1, pressing against the end of the piston and forcing it to move in the direction of the arrow; but no sooner does the piston in cylinder No. 1 pass the centre, than its cavity *h* opens the port f^2, and its valve-opening g^1 comes over the port d^2, and the liquid now passes from one end of cylinder No. 2, through the channel *f*, down the discharge-opening *a*, and out from the pipe C′, while the full pressure of the fluid is exerted through the valve-opening g^1 and channel *d* upon the opposite end of piston No. 2, which thus commences its reverse movement; and in this manner each piston acts alternately to open and close the channels and passages through which the liquid acts upon the other, and so long as the slightest pressure is maintained, it suffices to produce this automatic reciprocating movement of the pistons.

For the further elucidation of this portion of my invention, and in order to clearly present its essential characteristic, I have appended an explanatory diagram, (see sheet 2,) which will now be described.

The moving pieces D D′ each consists of a hollow D-slide valve, with ports, and the D-cavity, made preferably, as above stated, in the form of a cylinder closed at both ends.

The face of these valves will be cylindrical, uniform with the surface of the cylinder D D′, of which they form a part.

The valve-cylinders are placed in working-cylinders 1 and 2, which are closed at the ends, and of sufficient length to allow the slide-valve cylinders to have such extent of endwise movement as may be intended.

The cylinders D D′ fill the inside of cylinders 1 and 2 as near water-tight as may be, and allow perfect freedom of motion.

When the cylinders D D′ are placed in the cylinders 1 and 2, the ends of 1 and 2 are closed.

The cylinders 1 and 2 are in a water-box, and are placed in the same plane, parallel to each other.

A^2 A^2 are openings in cylinders 1 and 2′, by which water can pass into the valve-cylinders through openings, F F′, at the centre.

The water in the water-box is under pressure from some head of water with which it is connected, and thus the cylinders D D′ are kept full of water under pressure at all times.

The cylinders 1 and 2′ are a few inches apart, the space between being filled by the valve-seat piece G, which is connected with both cylinders 1 and 2′.

i^2 i^2 are the seats of the D-valves, the surfaces being cylindrical, to receive and be truly in contact with the cylindrical surfaces of the D-slides D D′, and are uniform with the cylindrical surfaces of the cylinders 1 and 2′, of which they form part.

In the seat-piece G are the four passages *b c d f*, the outer ends of which communicate with the four chambers at the end of the cylinders 1 and 2, as shown in the diagram, and as previously described.

The inner ends of these passages are in such position, and of such extent, that passage *b* can, in one position of D-slide D′, be in communication with opening *g*, and in another, with D-cavity *h* of cylinder D′; and the inner port c^2 of passage *c*, with opening *g′* and D-cavity *h* of the cylinder D′; and inner port d^2 of passage *d*, with opening *g′* of cavity *h* of cylinder D; and inner port f^2 of passage *f*, with opening *g* and cavity *h* of cylinder D.

a a^1 are discharge-outlets, in communication with cavities *h h*.

On examination it will be found that the cylinder D D′ cannot be in a position in which, whenever water is free to enter a passage open to the inside of the cylinder, there will not be freedom for the water at the one end of cylinder 1 and the opposite end of cylinder 2 to escape, and as the entering water is always under pressure, and as the outgoing water is under less pressure, motion must ensue, unless the position of the parts prevents motion.

In the construction of water-meters, the cylinders 1 and 2 are placed side by side in the same horizontal plane, in which case the central openings F F′ are on top of the cylinders.

It will here be noted, recurring to sheet 1 of the drawings, that while, in order to illustrate the manner in which the invention may be carried into effect, I have named A′ as the inlet, and C′ the outlet for the water, the relations of the two may be reversed, that is to say, the water may enter at C′ instead of A′, in which case, supposing the parts to be in the position shown in the drawings, the action of the liquid and the movements of the pistons will be in the reverse direction, as will be readily understood without further explanation. But in either case the arrangement of the channels, valve-openings, and passage-ways is such as to cause the meter to operate with equal facility and precision.

In constructing the pistons, it is desirable to make them as light as possible, consistent with strength, and I therefore prefer to construct them of sheet-brass or other sheet-metal, or even of glass. Or, again, each may consist of two heads, connected by a skeleton-frame, closed on that side adjoining the centre and end-channel ports, so as to form the requisite valve-openings, seats, and central cup for regulating the flow of the liquid.

The ends of the cylinders are closed by heads, and in the usual manner, and when the chamber A is employed, it will be found desirable to provide a tap, K, fig. 4, for the purpose of drawing off the sediment and other matter which may in time collect in the chamber.

In order to regulate the length of stroke of the pistons, buffers may be formed on the inner side of the cylinder-heads, against which the ends of the pistons will strike; and the pistons themselves may be connected, in any known or suitable manner, with a registering-apparatus, which, the capacity of the meter being ascertained, will register the quantity of liquid discharged at each stroke of the pistons.

As hereinbefore mentioned, I prefer to employ in this connection a mechanism which serves the twofold purpose of regulating the length of stroke of the pistons and of actuating the register. This mechanism consists of a shaft, *l*, mounted in suitable bearings, *m m*, in the chamber B, carrying on each end a crank-arm, *n n*, the two standing at right angles to one another.

The arms carry grooved rolls, *o o*, which fit between vertical forked standards, *p p*, secured to base-plates, *r r*, formed in the pistons.

The shaft *l* carries an endless screw, *s*, engaging with the toothed wheel *t*, of the upright spindle *v*, which communicates motion to the register. The crank-shaft and mechanism connected with it are covered by the cap B′, which fits over and closes the chamber B.

The reciprocating movement of the pistons causes, through the intermediary of the crank-arms *n*, the revolution of the shaft *l*, and the latter, through the worm *s* and spur-wheel *t*, puts in motion the register-spindle.

The crank-arms *n*, at the same time, serve to regulate and determine the length of stroke of the pistons, and, moreover, their grooved rolls *o*, which fit between the forked standards *p*, prevent the pistons from turning or rolling in their cylinders, and thus serve to hold the valve-openings *g g′* and central cup *h* accurately in position with respect to their corresponding channel and discharge-ports.

An apparatus thus constructed may be used, not only as a meter, but also as a water-engine if desired, by making it of the requisite dimensions, and procuring a sufficient pressure of the fluid which moves the pistons.

Having now described my invention, and the manner in which the same is or may be carried into effect,

What I claim, and desire to secure by Letters Patent, is—

1. A water-meter, composed of the following elements combined, viz:

(1.) Two D-valve cylinders, or pistons, each provided with a D-cavity and two valve-ports leading out of the cylinder, water under pressure having access at all times to the inside of said cylinder, substantially in the manner herein set forth.

(2.) Two water-cylinders, within which the D-valve cylinders are to operate as specified, said water-cylinders being of sufficiently greater length than the D-valve cylinders, to provide a water-chamber at each end of water-cylinders, substantially as described.

(3.) A valve-seat piece, forming part of the two water-cylinders, having two seats, one the seat of one D-valve cylinder, and the other the seat of the other D-valve cylinder, said seats having each, at centre of length, a discharge-port, and said seat-piece having four passages through it, viz, one from each water-chamber of the one water-cylinder, leading to and opening into the seat of the D-valve of the other water-cylinder, so that the D-valve cylinder of one water-cylinder is at all times supplying water under pressure to the one chamber, and taking water from the other chamber of the opposite water-cylinder, continuous reciprocating movements of the two D-valve cylinders being thus produced, substantially in the manner set forth.

2. The valve-cylinders, or pistons, constructed with a central cavity, and a valve-opening on each side of said cavity, bearing the relation to the channel-ports and discharge-opening in each water-cylinder, substantially as herein shown and set forth.

3. The combination, with the two water-cylinders and central discharge-openings, of the inlet, or bottom

sediment-chamber, and the outlet, or discharge-chamber, substantially as shown and specified.

4. The combination, with the reciprocating valve-cylinders, or pistons, of the cranks and shaft, for actuating the register and regulating the length of stroke of said valve-cylinders, substantially as shown and described.

5. The formation of the cylindrical valve-pistons, of brass or other sheet-metal, substantially as and for the purposes set forth.

In testimony whereof, I have signed my name to this specification, before two subscribing witnesses.

J. B. VAN DEUSEN.

Witnesses:

JACOB CARPENTER,

T. V. JARVIS CHRISTOPHERS.