J. H. SHEDD.
Water Meter.

3 Sheets—Sheet 1.

No. 231,939.

Patented Sept. 7, 1880.

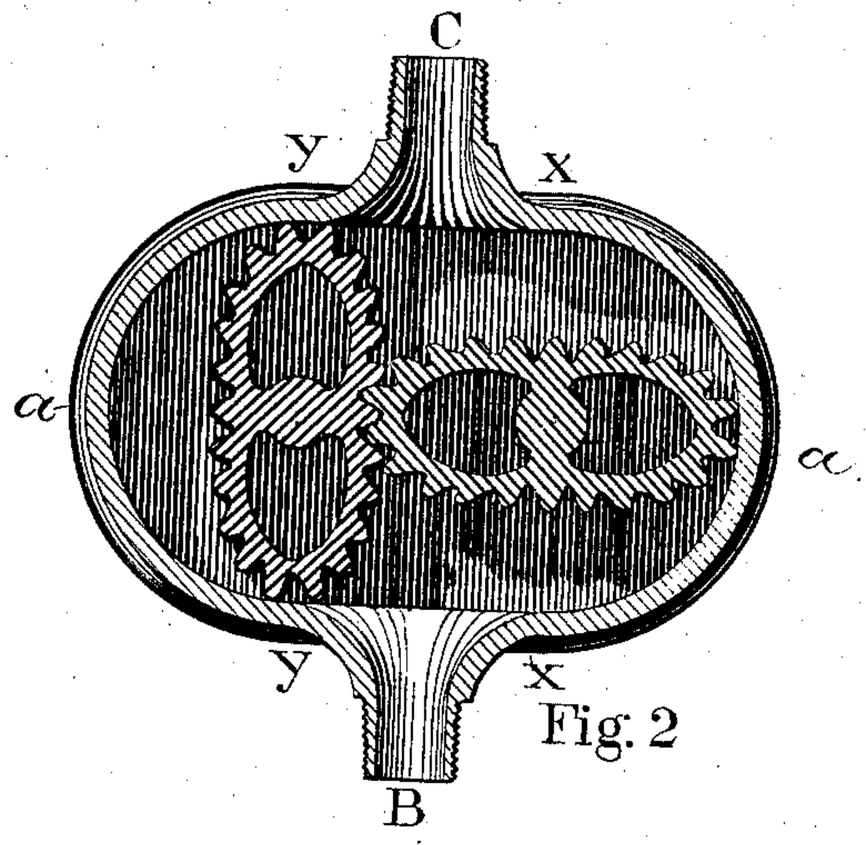

Fig. 2

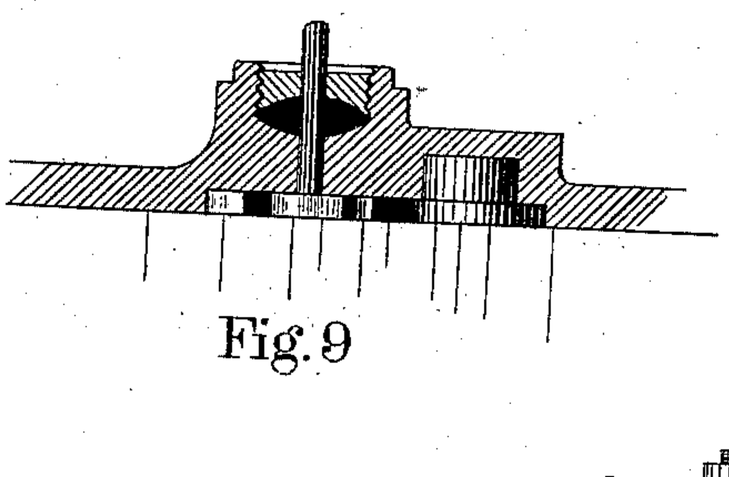

Fig. 9

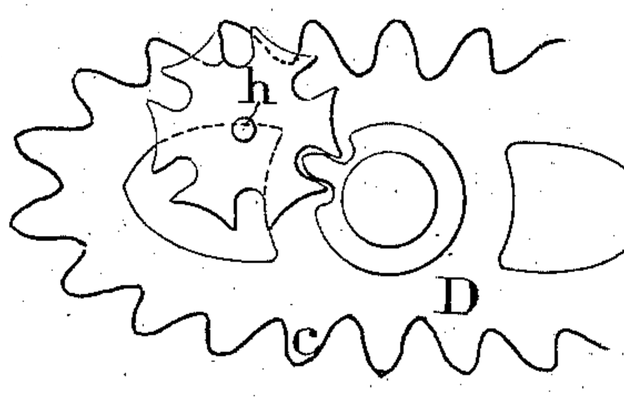

Fig. 10

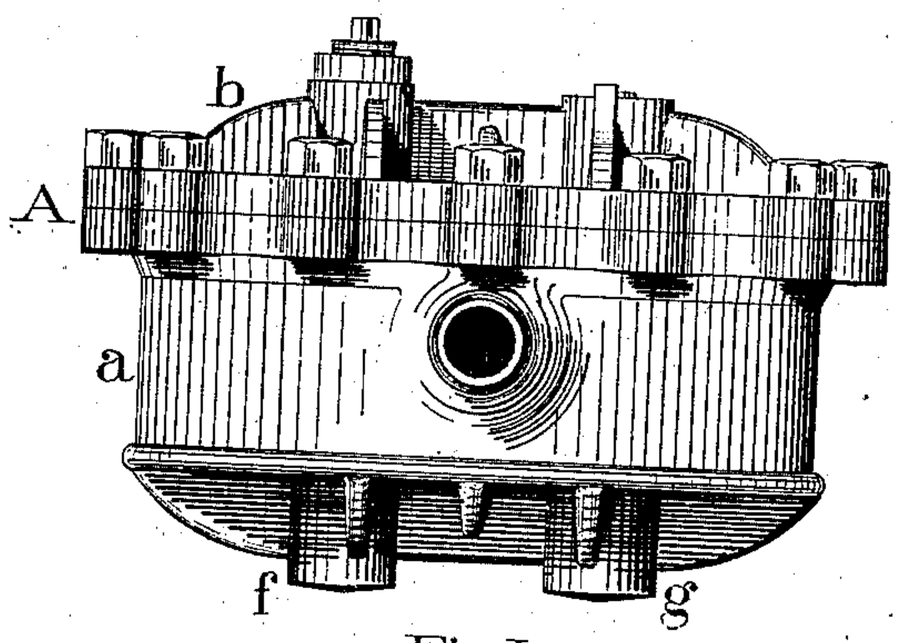

Fig. I

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Geo. Sulh
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Inventor:

J. Herbert Shedd.

3 Sheets—Sheet 2.

J. H. SHEDD.
Water Meter.

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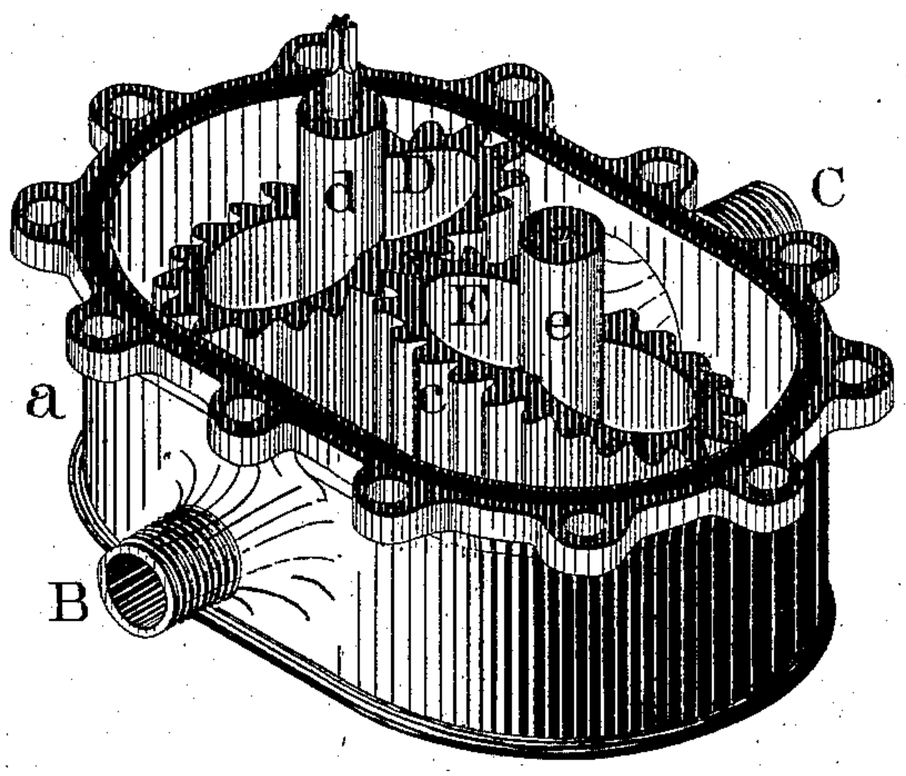

Fig. 3

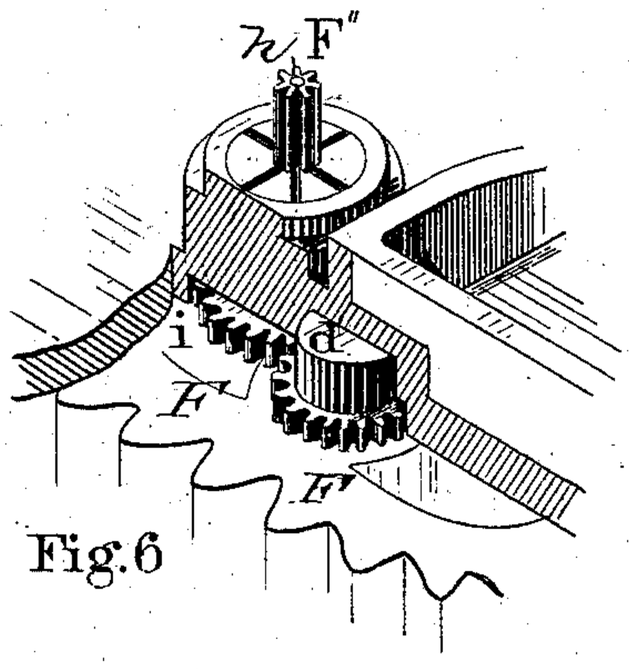

Fig. 6

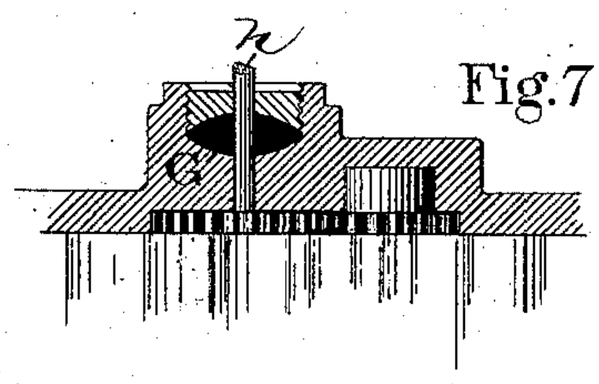

Fig. 7

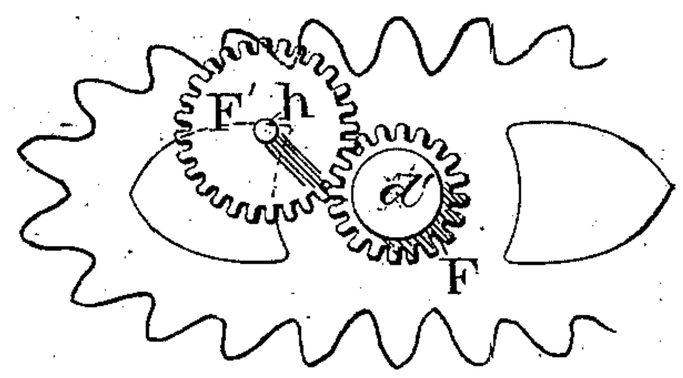

Fig. 8

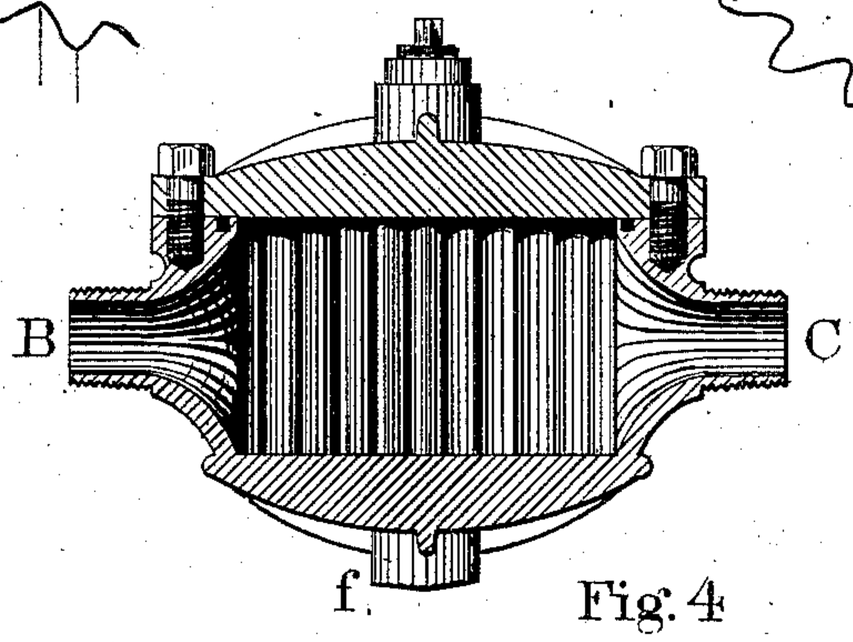

Fig. 4

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Wilmarth H. Thurston.

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J. H. SHEDD.
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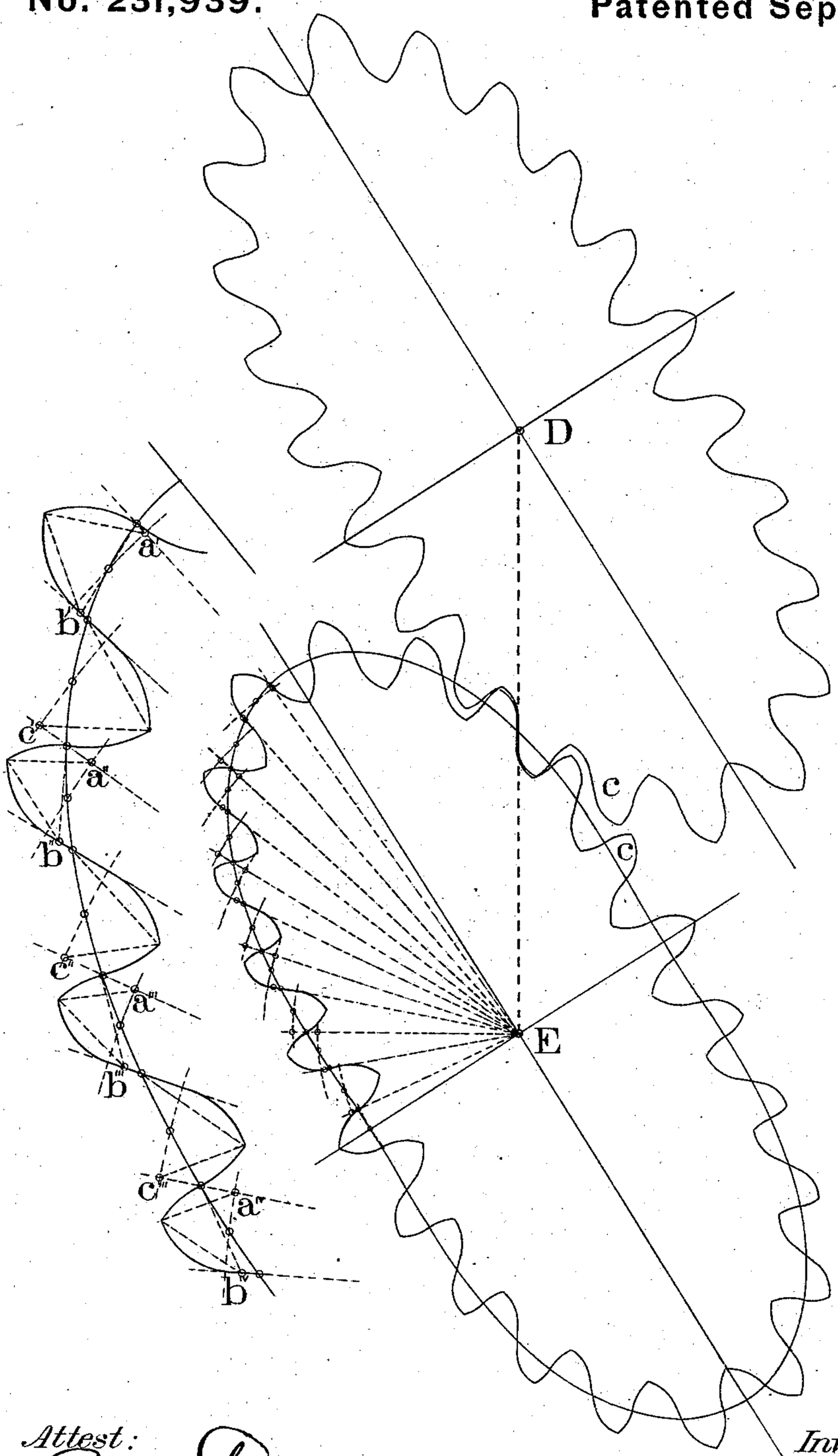

Fig.5

Attest:
Geo. Gulbh
Wilmarth H. Thurston

Inventor:
J. Herbert Shedd.

UNITED STATES PATENT OFFICE.

J. HERBERT SHEDD, OF PROVIDENCE, ASSIGNOR OF ONE-HALF OF HIS RIGHT TO STEPHEN A. JENKS, OF PAWTUCKET, RHODE ISLAND.

WATER-METER.

SPECIFICATION forming part of Letters Patent No. 231,939, dated September 7, 1880.

Application filed June 27, 1879.

To all whom it may concern:

Be it known that I, J. HERBERT SHEDD, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Water-Meters; and I do hereby declare that the following specification, taken in connection with the drawings making a part of the same, is a full, clear, and exact description thereof.

The invention hereinafter described relates to rotary water or fluid meters, or to such as employ revolving pistons; and it consists, first, in a novel construction of the rotary pistons, which enables them, in addition to performing their proper functions as pistons or plungers, to perform the further function of gear-connections to alternately drive and be driven by each other, whereby I am able to dispense in this class of fluid-meters with a gear-chamber and a measuring or piston chamber separate from each other, but simplify the apparatus by employing a single chamber for both the pistons and the driving-gearing.

The improvement further comprehends, as a novel feature, the peculiar construction of the gear-formed peripheries of the pistons or plungers, whereby the areas of surface of the teeth in contact in the operation of revolving the pistons and in excluding the passage of the water under pressure from passing between the pistons are made very considerable, and a complete rolling movement instead of a partial sliding movement of such surfaces upon each other is obtained.

Referring to the accompanying drawings, A in the several figures indicates the metallic case of the meter, composed of two parts, which are, respectively, flanged and bolted together, so as to be water-tight at the joint, as shown at Figure 1.

The portion *a* contains the revolving plungers or pistons with suitable interior bearings for one end of their shafts; and the portion *b* is the cover, which is also furnished with similar bearings for the other ends of the shafts, and supports the clock-train registering apparatus employed, with the usual stuffing-box to pack the spindle, which passes through the cover to the outside and drives the clock-train.

In all former meters of this general class the interior of the case has been divided longitudinally by a diaphragm, thus forming two separate chambers. In one of these chambers the revolving pistons are placed, and the other chamber is occupied by the train of gearing attached to the shafts of the pistons, and which enables them to drive and in turn be driven by each other.

My improvement is shown in sectional view at Figs. 2 and 4, in perspective at Fig. 3, and partly in section and partly in elevation at Fig. 4.

B and C indicate, respectively, the induction and the eduction passages for the water, which is supposed to be entering through the pipe B under pressure.

The water pistons or plungers are indicated by D and E, respectively. They are both elliptical and identical in form and character, and are furnished with gear-teeth *c*, of peculiar construction, as hereinafter explained. They are thus toothed gears as well as pistons, and perform the double functions of gears and pistons. They are mounted, respectively, upon shafts *d* and *e*, which have their lower bearings in interior journals formed in the dome-like projections *f* and *g*, cast upon the case.

The interior end surfaces of the portion *a* of the case A from *x* to *x* and from *y* to *y* are true circles struck from the axes of the revolving plungers, respectively, with a radius equal to one-half the major axis of the plunger. The ends of the gear-teeth *c* on each side of the major axis of the two plungers are nicely finished, so as to make a practically water-tight joint with the circular parts of the case, and all the teeth of each gear are fitted so as to make practically water-tight joints with each other at all points in their revolution. Consequently no water can pass from the induction to the eduction orifice between the plungers nor between either plunger and the case, and as the top and bottom sides of the plungers are fitted to a joint with the the interior bottom surface of the case and the interior surface of the cover portion *b*, respectively, it follows that no water can flow through the meter, but it is discharged only as the result of being forced out by the revolving plungers.

The manner in which the revolving plun-

gers (each alternately acting as a diaphragm and a piston) perform their office of causing the water received into the case of the apparatus through the induction-passage to be discharged afterward through the eduction-passage, as the result of the continuous revolution of the plungers under the force of unbalanced pressure, is well understood, and constitutes no part of my invention. I have improved this well-known class of water-meters by dispensing with a separate gear-chamber and a separate measuring-chamber, and have given to the plungers a form and construction which enable them to act both as plungers or pistons and as gears for driving and being driven by each other; and this improvement involves a change in the form of the plungers heretofore employed, so as to adapt them to be furnished with teeth upon their peripheries, which will engage throughout the entire revolution of the plungers with each other.

The cross-section of the plungers is shown at Fig. 2. The figure is not that of a true ellipse, although resembling it. The minor axis is shorter than it would be if the figure were an ellipse, causing the figure of the section to be a bi-lobe, or one bounded by four intersecting curves. This figure is necessarily to be given to the plungers to obtain the most complete engagement between the teeth during all parts of their revolution.

Another feature of my invention is shown at Fig. 5, which represents, upon an enlarged scale, the peculiar formation of the teeth which surround the edges or peripheries of the water-plungers and enable them to act as gear-wheels.

The object of the peculiar form given to the teeth is to obtain an easy rolling motion and a continuous engagement of the teeth with each other, and also as large an extent of surfaces in contact for the security of the joint between the teeth against the passage of water as is possible.

The formula for laying out the teeth of a gear so that the center of each tooth, as well as a point upon each side thereof located in the pitch-line, shall all be intersected by radii drawn from the center of revolution of the gear was devised by me and is as follows: Divide the pitch-line into spaces by points which denote in succession the front edge of a tooth, the center of a tooth, the back edge of a tooth, and the center of a space. Through the points denoting the edges of teeth draw radial lines from the center of the gear, and through the points denoting centers of teeth and centers of spaces draw circular arcs to intersect the aforesaid radial lines. Two points of intersection are thus obtained upon each arc, one of which lies within and the other lies without the pitch-line of the gear. The points lying within the pitch-line on the arcs drawn through the centers of teeth are designated in the figure as a' a^2 a^3 a^4. From these points as centers strike curves external to the pitch-line with a radius equal to the distance from the point within the pitch-line to the point without the pitch-line. Divide equally the distance between the points of intersection previously referred to as outside the pitch-line and corresponding points in the pitch-line, and from such division-points as centers (marked b' b^2 b^3 b^4 in the figure) strike curves external to the pitch-line with a radius equal to the distance from b' b^2 b^3 b^4, respectively, to points in the pitch-line indicating the opposite edges of the teeth. The intersection of these curves with the curves previously struck from a' a^2 a^3 a^4 as centers will locate the extreme points of the teeth. Continue the bounding line of each tooth within the pitch-line by a curve struck from a point on the pitch-line denoting the near edge of the next succeeding tooth.

On the arcs passing through the centers of spaces intersecting the radial lines before mentioned the points of intersection lying without the pitch-line are designated in the figure as c' c^2 c^3 c^4. From each of these points as centers strike curves internal to the pitch-line with a radius in each case equal to the distance from the point of intersection without to the point of intersection within the pitch-line. The intersection of these curves will locate the angular point of the spaces.

The construction of the remaining side of each tooth is completed by that portion of the line radial to the center of the gear which passes through the point denoting that side of the tooth on the pitch-line, and which connects the arcs previously drawn through the center of spaces internal to the pitch-line with the arc drawn through the center of teeth external to the pitch-line.

In Figs. 1 to 4 the pistons or plungers D and E are shown as attached to their respective shafts *d* and *e*, which must be provided with sufficient journal-bearings in the top and bottom of the case. When the plungers are made of metal it is easy to mount them on shafts, as shown; but for various reasons it is desirable to make the plunger of hard rubber, in which case it is not easy to attach to them a metallic shaft. I therefore have devised a plan, which is shown at Figs. 6 to 10, for combining a plunger which revolves around a stationary shaft with a train of gearing for driving a registering apparatus. The arrangement possesses very considerable advantages even in case metallic plungers are employed, for the reason that the apparatus is more economically constructed and is less bulky and cumbrous in appearance. The arrangement is shown in perspective at Fig. 6 and in section at Fig. 7 and in plan at Fig. 8. A cylindrical hole is bored through the center of revolution of the plunger, and stationary shafts to fit such holes are properly combined with the top and bottom of the case of the meter in the right relation to each other.

F, Fig. 8, is an annular gear which surrounds

the axial hole through the plunger selected to drive the register, and is secured to the plunger by dowel-pins or by a sleeve concentric with the hole and having radial ribs thereon, or by any other convenient device that will cause the said gear to revolve with the plunger. The stationary shaft around which the plunger revolves is shown at *d'*, Fig. 6. The annular gear F engages with the toothed wheel F', which is upon the spindle-shaft *h*, which passes through a stuffing-box, G, Fig. 7, and the cover of the meter, and carries the gear F^2, which drives the train located upon the cover.

It will be observed that the annular gear F and the toothed wheel F' engaging therewith are located in recesses or chambers cut in the under side of the cover, as shown at *i*, and, although the cover is so chambered, no water can pass from one side of the plunger to the other through the same, because one side of such chamber is always covered by the plunger. It would be practicable to form the recesses in the plunger itself, but in that case the recess must be considerably smaller in diameter or width; otherwise it would extend into the bases of the peripheral teeth upon the plunger and make a water-passage.

At Fig. 10 a modified arrangement is shown, which is the same as the one first described, except that in place of the gear F and the toothed wheel F' a Geneva stop is substituted, and consequently the plunger D will revolve six times to one revolution of the spindle-shaft *h*.

I am well aware that in rotary pumps pistons have heretofore been employed so toothed and recessed on their peripheries as to enable one piston to continuously drive the other, and also that such pistons at their ends have been corrugated or grooved for attaining a water-packing between them and the case of the pump, and it is to be distinctly understood that my improvements relate exclusively to fluid-meters, as I am not aware that any portion thereof possesses special value for application to rotary pumps or to any other class of apparatus not specially adapted and intended for the measurement of liquids.

I am aware that heretofore in pumps and motors pistons having a general elliptical outline have been geared together within a case; but therein the gear-teeth all occupy a line concentric to the axis of the piston, and the sides of each piston being deeply recessed to receive the ends of its fellow piston, said recesses and ends merely operate as large gear-teeth, and so that both pistons are always moved together and at the same speed, and do not operate alternately as plunger and diaphragm, and at variable speed, as when the teeth occupy an elliptical line, as in my meter. This alternate action by the plungers as pistons and diaphragms enables all of the water-pressure to be devoted to the driving movement of that piston which, for the time being, is not operating as a diaphragm; and the teeth of my pistons, occupying, as they do, an elliptical line, are capable of being provided with a more extensive area of close contact of tooth with tooth than is possible with teeth which occupy a concentric line, as in the pumps or motors before referred to.

What I claim as my invention, and desire to secure by Letters Patent, as an improvement in rotary water-meters, is—

1. The combination, substantially as before set forth, of a suitable meter-case, as described, with revolving elliptical pistons or plungers in constant direct gear-connection by means of teeth formed on their peripheries, each of said pistons or plungers, in turn, acting as a plunger and as a diaphragm during one revolution.

2. The combination, substantially as before set forth, of a suitable meter-case, as described, with revolving elliptical pistons or plungers, in constant direct gear-connection by means of teeth radial to the axis of revolution of the plungers formed on the peripheries of the plungers, and of the peculiar configuration substantially as specified.

3. The combination of a suitable meter-case, as described, revolving pistons or plungers in direct gear-connection by means of teeth formed on their peripheries, each of said pistons or plungers, in turn, acting as a plunger and as a diaphragm during one revolution, an annular gear or equivalent prime mover located around the axis of revolution of one of the plungers and contained in a chamber communicating with the chamber in which the pistons revolve, and the train of a registering apparatus, substantially as specified.

J. HERBERT SHEDD.

Witnesses:
GEORGE FULLER,
WILMARTH H. THURSTON.