(No Model.) 4 Sheets—Sheet 1.

J. THOMSON.

DISK WATER METER.

No. 387,831. Patented Aug. 14, 1888.

Fig. 1.

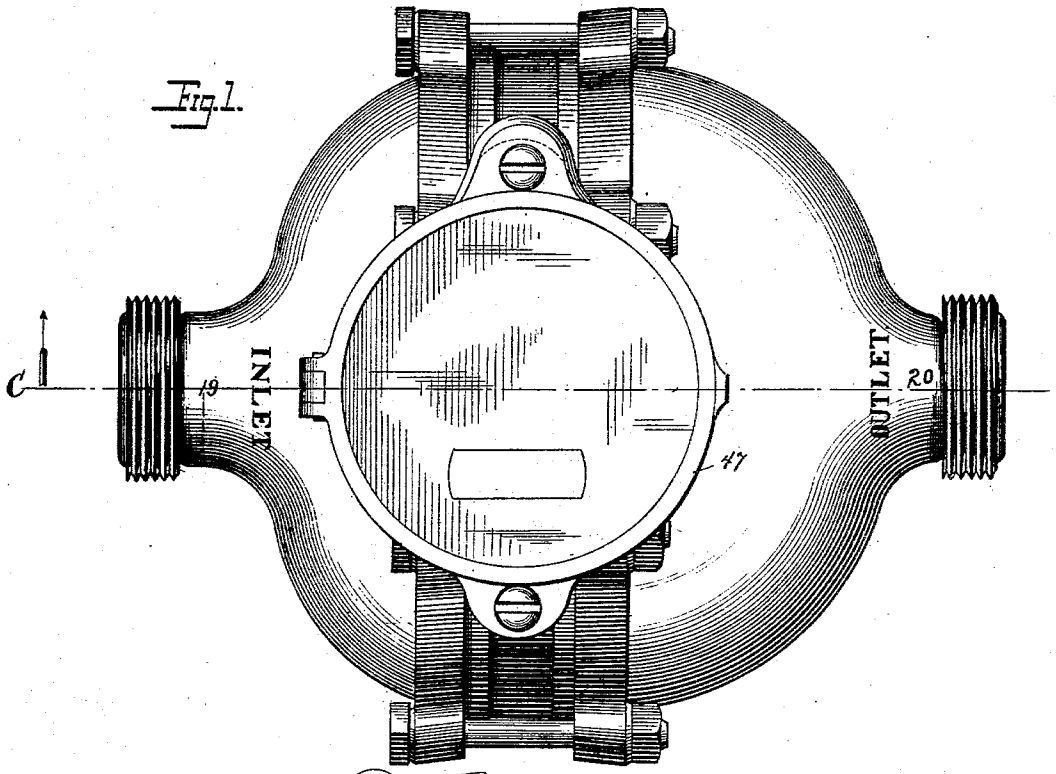


Fig. 10.

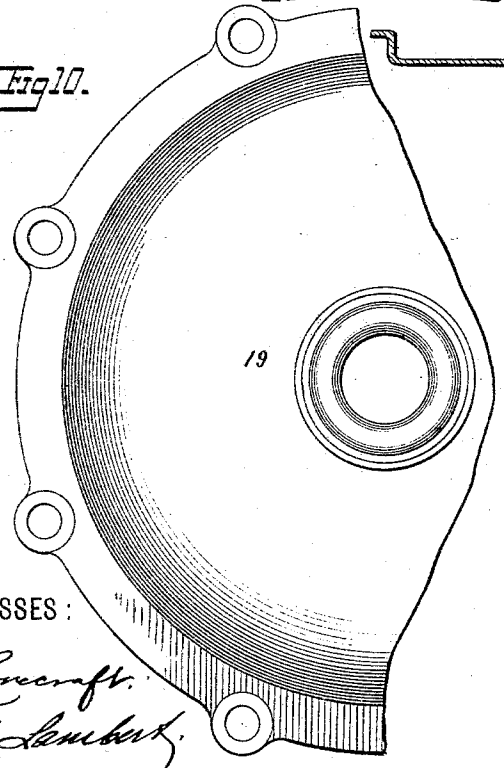
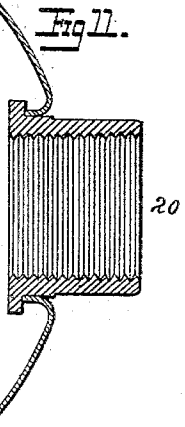


Fig. 11.



WITNESSES:

F. A. Lowcraft.

Frank Lambert.

INVENTOR.

John Thomson

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

4 Sheets—Sheet 2.

J. THOMSON.

DISK WATER METER.

No. 387,831. Patented Aug. 14, 1888.

Fig. 2.

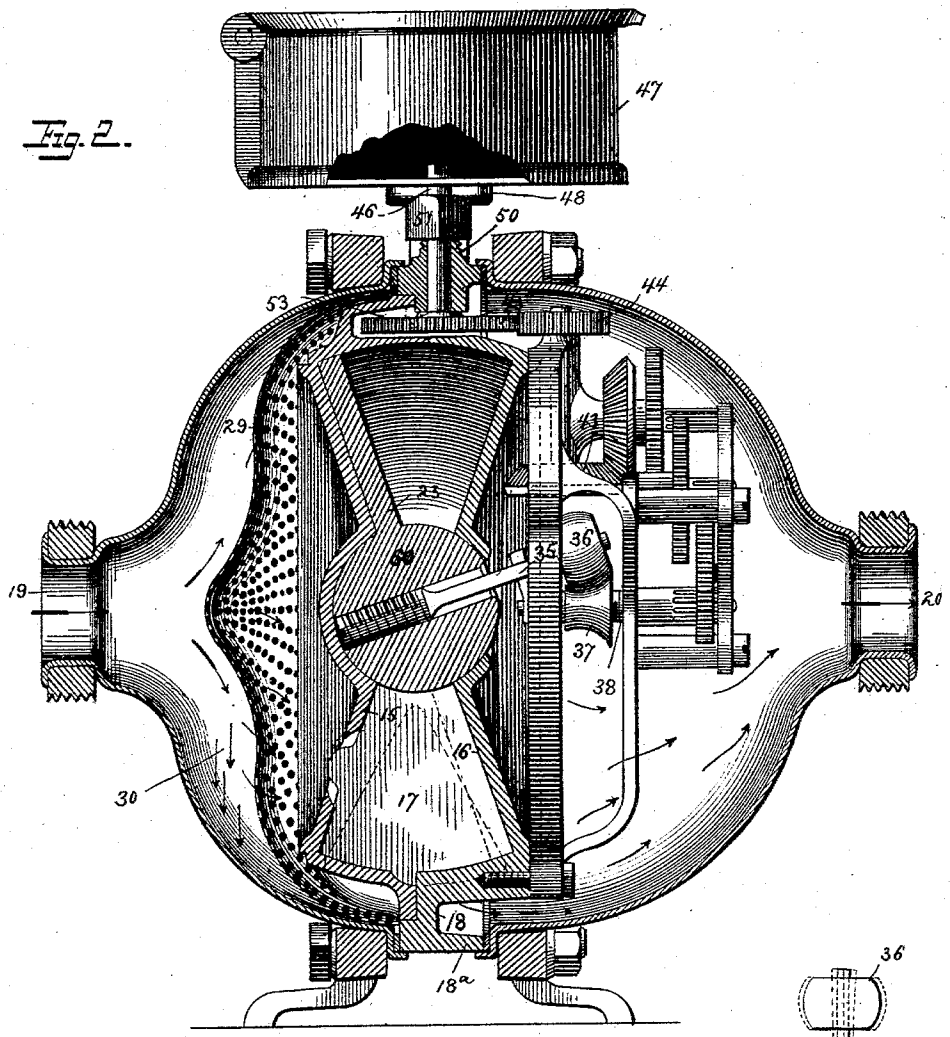


Fig. 8.

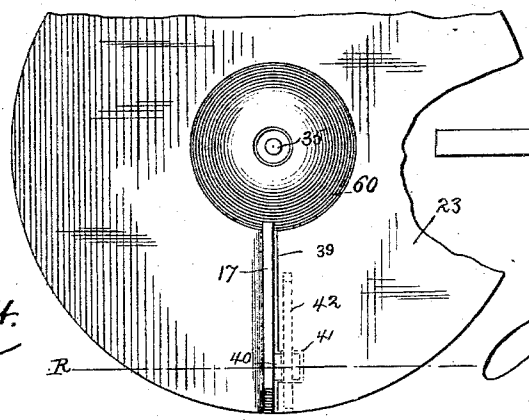
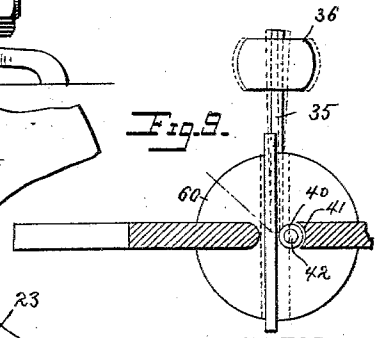


Fig. 9.



WITNESSES:

F. A. Lovecraft.

F. Lambert.

INVENTOR:

John Thomson.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 3.

J. THOMSON.

DISK WATER METER.

No. 387,831. Patented Aug. 14, 1888.

Fig. 3.

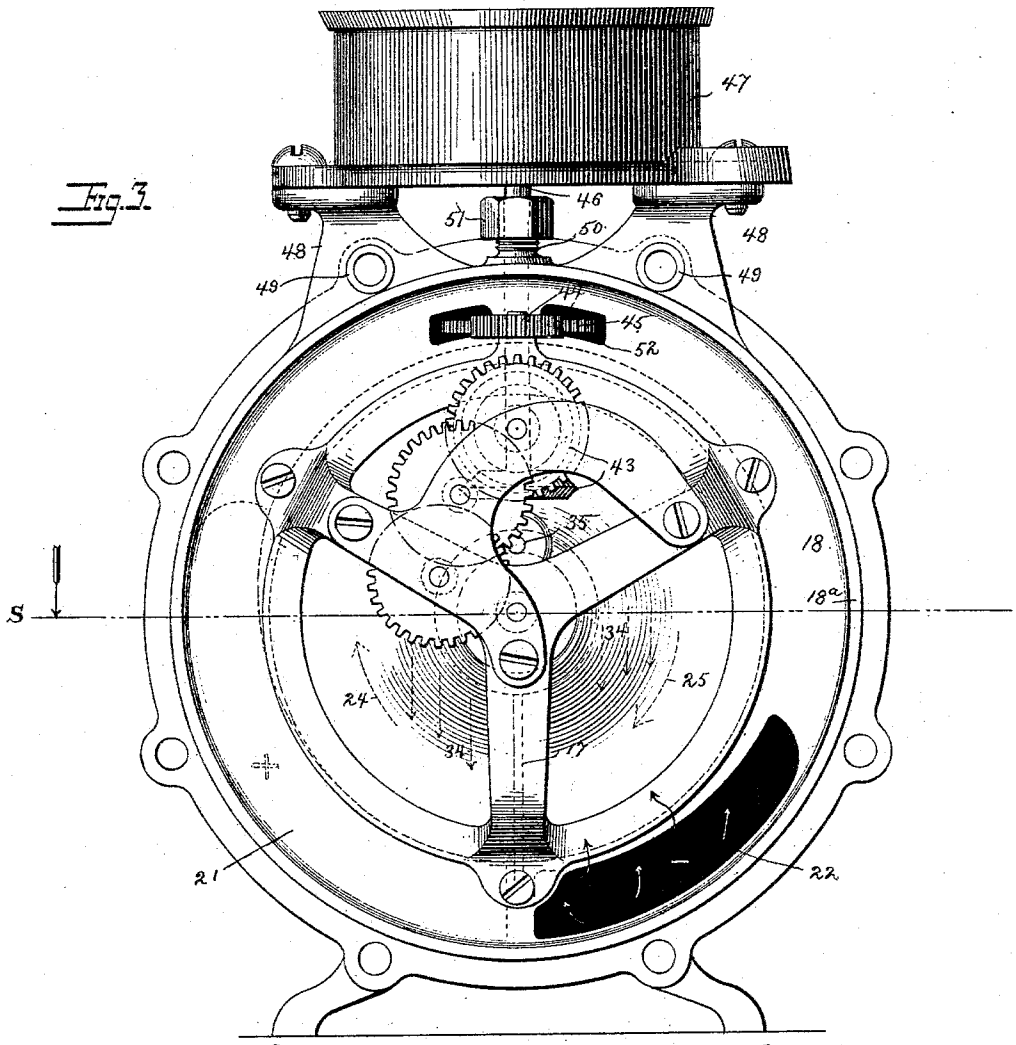
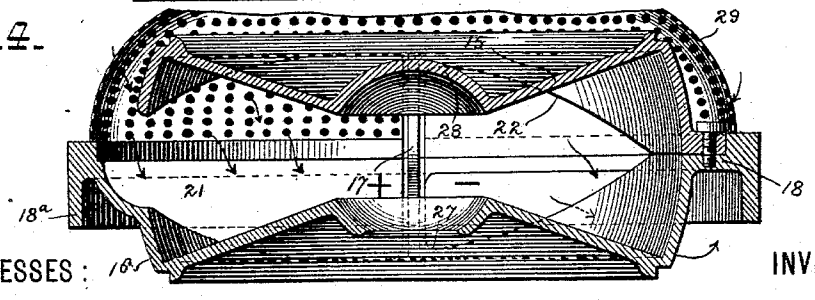


Fig. 4.



WITNESSES:

F. A. Lorcraft.
Frank Lambert.

INVENTOR:

John Thomson.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 4.

J. THOMSON.

DISK WATER METER.

No. 387,831. Patented Aug. 14, 1888.

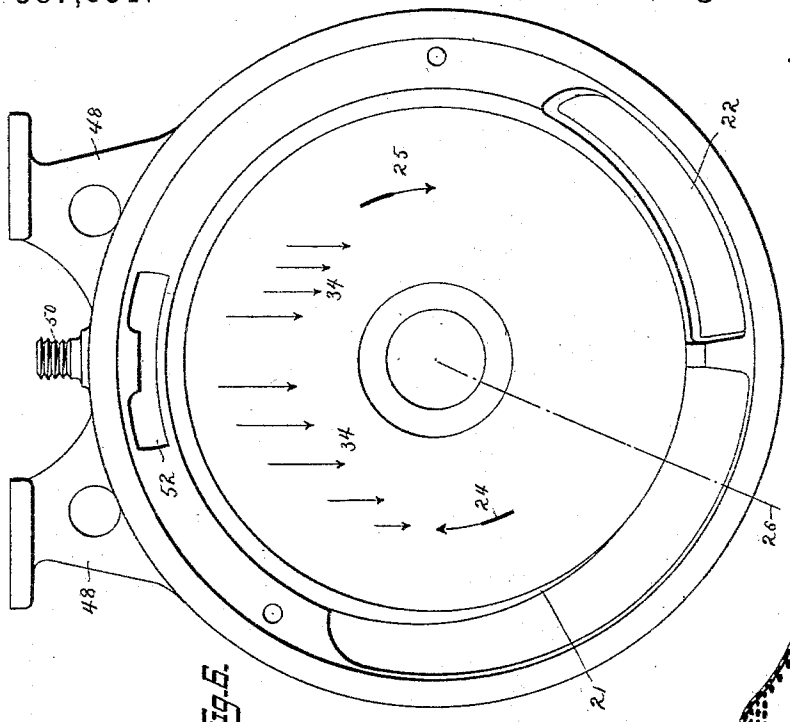


Fig. 6.

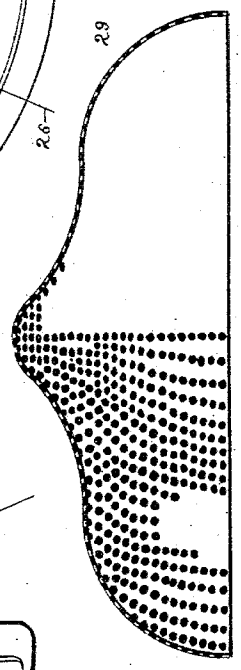


Fig. 7.

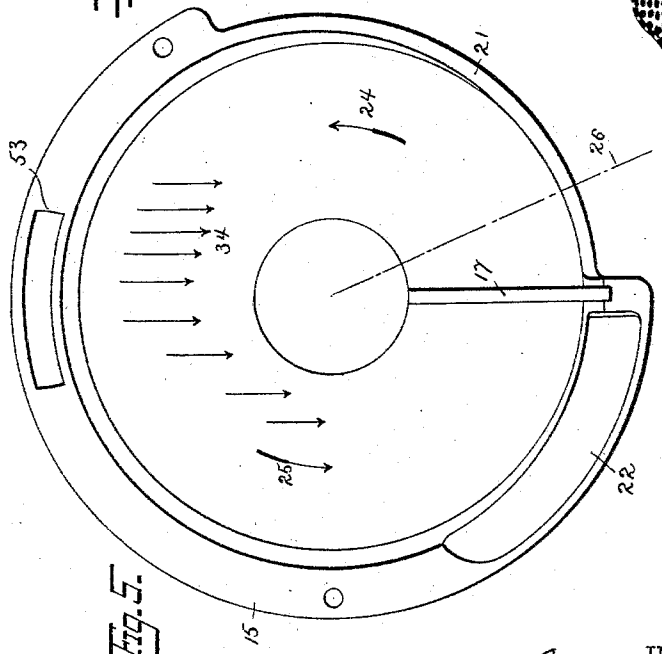


Fig. 5.

WITNESSES:

W. S. McArthur

Sidney S. Johnson.

INVENTOR:

John Thomson

BY

Foster & Freeman

ATTORNEYS.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF BROOKLYN, NEW YORK.

DISK WATER-METER.

SPECIFICATION forming part of Letters Patent No. 387,831, dated August 14, 1888.

Application filed April 5, 1888. Serial No. 269,739. (No model.)

To all whom it may concern:

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

This invention relates to oscillating water-meters, and particularly to that class of meters shown and described in Letters Patent of the United States issued to myself and F. Lambert under date of December 20, 1887, No. 375,023.

In the accompanying drawings, illustrating the invention, Figure 1 is a top plan view of the meter complete. Fig. 2 is a vertical central section on the line C of Fig. 1, viewed in the direction of the arrow, the register-box being in side view partially broken. Fig. 3 is an upright front elevation of the disk-chamber, gear-train, and register-box, the cap being removed. Fig. 4 is a central horizontal section through the disk-chamber and a portion of the straining-cap on the line S of Fig. 3, the view being downward, as indicated by the arrow. Figs. 5 and 6 are inside detail views of the disk-chambers in their vertical position, each being opened from the other like the leaves of a book. Fig. 7 is a detached view of the straining-cap. Fig. 8 is a detached view of the disk and diaphragm, and Fig. 9 is a similar view in partial section on the line R of Fig. 8. Fig. 10 is a partial end view of the caps; and Fig. 11 a partial central section through one of the caps, showing a modification in the construction of the spud.

The first object of this invention is to adapt this type of meter to be operated with the disk in a vertical position, in contradistinction to the heretofore universal practice of operating it in a horizontal position, whereby foreign material which may be carried into the meter will tend to gravitate into the external receiving-chamber, and if carried within the displacing-chamber will also have opportunity to gravitate out of said chamber back into the external spaces provided therefor.

The second object of the invention is to provide a simple and inexpensive straining apparatus of the greatest possible area, whereby, while preventing the introduction of foreign substances of dimensions liable to be injurious to the meter, it will at the same time present no serious obstruction to the free flow of the fluid.

The third object of the invention is to attach the entire working mechanism of the meter, including the register and register-box complete, directly to the disk-chamber, whereby the entire apparatus is self-contained upon a single part, and may be fully assembled and examined before the caps are applied.

The fourth object of the invention is to provide the greatest possible area for the inlet of the fluid to the disk-chamber, thereby adapting a smaller size of meter than heretofore to greater duty.

The fifth object of the invention is to produce the pressure-caps in their theoretically best form to resist distortion, thus making it possible to produce them from the least possible amount of material.

One method of attaining the said several objects and branches relating thereto will now be pointed out in detail with reference to the construction shown in the drawings.

The disk-chamber, composed of the inlet-section 15 and the outlet-section 16, is set so that the diaphragm 17 is at the bottom and in a vertical position. The outlet-section is provided with a flange, 18, to which the inlet-section is attached, and also with a cylindrical section, 18^a, formed at a right angle to the flange, against the faces of which the caps are bolted. The inlet and outlet spuds 19 20 are formed in the center of each cap, and are thus in axial line with each other, and also at a right angle to the disk-chamber. In other words, the said disk-chamber forms a dividing partition or septum between the two caps, and forms a compartment on each side of the disk-chamber. Communication from one compartment to the other is provided by means of the inlet and outlet ports 21 22, which latter are controlled by the disk 23. The conditions necessary to such operation are that the inlet-port shall communicate with the disk-chamber only on one side, while the outlet-port communicates only with the outlet-chamber on the other side, and this is effected by inclosing that portion of the inlet-port which is formed in the outlet-section 16, while that section of the outlet-port which is formed in the inlet-section 15 is also inclosed. Hence, when the disk is in position to operate, the fluid

can only pass by first entering at the inlet-port, passing up around and down the disk-chamber, as indicated by arrows 24 25, and causing the disk to operate, and thence out through the outlet-port and outlet-chamber to the pipe.

In previous practice it has generally been presumed to be necessary that the inlet and outlet ports should be formed of equal area and disposed in equal extent on either side of the diaphragm. I have found, however, that this is not necessary, and utilize this fact to provide an inlet-port of greater area than that of the outlet-port, as fully illustrated in the drawings. This is accomplished by extending the line of change in the disk from the center of the diaphragm around into the inlet-port, as indicated by the broken line 26. When the disk is in contact with the cone frusta at this section, the edges of the ports are lapped. In other words, it is at this portion of the motion of the disk that the change of displacement occurs from one side to the other thereof. To permit such a formation of the inlet-port and at the same time prevent communication from one side to the other at the time of change it is necessary to form the corners 27 28 of the outlet-port somewhat higher than that of the corresponding corners of the inlet-port, and also that the contact of the disk upon the diaphragm shall be made with approximate accuracy. The advantage of this construction is that the velocity of the inlet-current upon the disk may thus be reduced to the greatest possible extent, as the area of the port may equal or even exceed the area of the passage through the disk-chamber.

To protect the disk-chamber from the introduction of foreign material, which might be injurious to the mechanism, I provide a straining-cap, 29, formed either of perforated metal or woven wire or equivalent, the greatest external diameter of which is equal, or nearly so, to the greatest internal diameter of the pressure-cap. The center of the strainer is preferably carried up in conical form, thereby acting to deflect the inlet-current evenly and smoothly to all portions of the surface of the strainer. So constructed, it is evident that the greatest possible area may be obtained in the perforations to permit the free passage of the fluid; also, that the greatest available external space is obtained for the lodgment of obstructed material, that it envelops the entire disk-chamber, is of a form readily constructed, and requires no additional mechanism to keep it in place, as it will not go farther into the pressure-cap during shipment or handling of the meter, and it is held to its seat by the impact of the current.

Any deposit of foreign material which may be made in the meter may be readily removed and the meter cleaned by simply reversing the flow of fluid with inlet-spud downward in a vertical plane.

I would now call particular attention to the direction of the flow of the fluid through the meter and the consequent result obtained in this peculiar disposal of the disk-chamber and caps.

It will first be seen that any foreign material carried into the meter will impinge against the strainer, the effect of which will be to destroy its velocity, when the material will tend to gravitate downward, as indicated by arrows 30. The current passing on through the perforations of the strainer, as well as any material which may also be carried in suspension, will now flow in all directions around the disk-chamber to the inlet-port, when the direction of the flow is changed upward, as indicated by arrow 24, then downward, as indicated by arrow 25, to the outlet-port 22, to the outlet-chamber, and thence by the outlet 20 to the pipe. It is thus clear that whether the meter be at rest or in operation the tendency and opportunity are constantly presented for any foreign particles to gravitate either, as first shown, outside the strainer, or, if from within the disk-chamber, as indicated by the arrows 34, into either or both of the inlet and outlet ports. In other words, no particle of material which may once enter the disk-chamber can remain there, whether the disk be either in a state of motion or of rest. This statement will at once be understood and proven if we for an instant consider that the position of the section shown in Fig. 4 be in a horizontal plane instead of the vertical, in which instance it is clear that, the meter being for a time inoperative and the fluid in a static condition, any material in suspension will precipitate and gravitate either into the bottom of the disk-chamber or upon the upper surface of the disk; hence when the disk is next put in operation a collection of foreign material is accumulated to interfere with its action. To still further provide for the proper operation of the disk under all conditions, I provide a yielding resistance in which are combined the following peculiar conditions:

The disk is carried normally without tension; but in the event of foreign matter being introduced between the contacting-surfaces of the disk and the cone frusta the disk may lift or vibrate against the yielding resistance and be again instantly reset to its proper position as soon as relieved. This is accomplished by simply forming the controlling spindle or axis 35 of the disk so that its resisting-point is near the center of the ball 60. In this wise the spindle may be made with practical accuracy and of considerable rigidity, so as to control the motion of the disk properly without subjecting it to spring-tension; but upon the introduction of foreign material it will yield readily, acting as a spring, for the reason that a very considerable amount of motion at the periphery of the ball or disk will involve but a very slight amount of motion upon the yielding section of the spindle.

I provide for the positive control and motion of the disk by mounting upon the end of the said spindle a friction-roller, 36, having a

spherical contour and bearing upon a fixed bearing-piece, 37, also of spherical contour, corresponding to that of the roller. While I am aware that this does not produce the theoretically best contact between the impinging faces of the roller and the bearing-piece, there are yet these advantages in favor of this construction: The roller and axis do not require any additional means whatever to maintain them in proper relative position—such as collars or pins—as the spherical contour of the bearing-piece insures the roller against shifting either up or down upon the axis. There is also no false thrust set up on the bearing between the roller and the axis tending to clamp them or to force the ball and disk against the sockets and cone frusta. The said fixed sleeve is made adjustable with respect to the gear-frame by means of the threaded bearing 38. In this wise it is not necessary to set the gear-frame with absolute exactness with respect to the center of the ball and disk, as the said fixed bearing may be adjusted back and forth until the exact and proper relative position is reached.

To reduce the frictional contact as much as possible between the edge 39 of the slot of the disk and the diaphragm, I mount a friction-roller, 40, within the edge of the disk, in which are involved novel features, it being borne in mind that the thickness of the disk in practice is necessarily restricted as much as possible, which makes the application more difficult. A recess, 41, is first milled into the face of the edge of the disk very slightly larger in diameter than the roller intended to be used. A pivot-bearing is then formed, and preferably of a depth several times greater than the length of the roller intended to be used. The roller is then placed to position and the pivot 42 forced in, the bearing through the roller being a snug fit, while the bearing in the disk is free. Now, by slightly relieving the edge of the slot it will be seen that the entire thrust upon the diaphragm is borne by the friction-roller, and that in consequence of causing the pivot to turn with the roller a bearing of ample extent may thus be obtained. This is preferable to a roller of greater length turning on the spindle, for the reason that the proper form for a roller of this kind, in view of the angular motion of the disk, would be a cone, which, in an apparatus of this character, would, to say the least, be exceedingly difficult to construct and apply.

The arrangement of the gear-frame and gear-train shown is substantially the same as that of the said previous patent and need not be particularly described, except that in placing the disk-chamber in a vertical position it becomes necessary, as a part of the general scheme, to change the relative position of the register. This I accomplish by introducing a pair of right-angle miter-gears, 43, which, acting upon the pinion 44 and gear 45, fast to the stuffing-box spindle 46, make proper and direct communication; but it will be observed that the register, the stuffing-box, the spindle, the entire gear-train, the disk, and operating mechanism are all mounted upon the outlet-section of the disk-chamber. Thus the pressure-caps are distinct and free from any communication with the mechanism of the meter and act entirely as pressure members.

I mount the register (not shown) and the register-box 47 upon two standards, 48, which project from the cylindrical portion of the outlet-section of the disk-chamber. These are pierced, as at 49, to permit the proper disposal and insertion of the flange-bolts; but the standards are yet sufficiently ample in dimensions to properly serve the intended purpose. The stuffing-box 50 is brought up midway between these standards and sufficient space is provided, so that the stuffing-box nut 51 may be operated without interfering with the register.

To provide for the proper size of spindle-gear, and yet to keep all of the gearing within one compartment, it is necessary that the outlet-section of the disk-chamber shall be provided with an opening, 52, through the flange and that the inlet-section of the disk-chamber shall be provided with a recess, 53, corresponding in its general dimensions to that of the opening just referred to. In this wise a pocket is formed for the gear, which is first inserted to its proper position and the spindle then secured by being screwed thereto.

The following advantages may be pointed out, although evidently obvious, with respect to the construction and disposal of the register and gear train: The gear-train is in the upper portion of the outlet-compartment and the gearing is in a vertical position edgewise. Thus any foreign material which may be introduced into this compartment is less liable to lodge upon the gearing, and is also free, as already described, to gravitate into the space beneath. The entire apparatus may be assembled and tested completely before applying the pressure-caps, and no work whatever is required upon the said caps, except as relates to the flange-bolts and means for connecting the pipes.

Passing now to the construction of the pressure-caps, it will be seen, in consequence of introducing the spuds at the centers thereof, and in that no provision is necessary for the application of the register or its appliances, that it becomes possible to form the caps of practically hemispherical contour, so that the external appearance of the meter, aside from the register-box, is similar to that of a ball or sphere. This form avoids the necessity of providing sufficient additional material in the caps to avoid distortion, as the spherical form, being least liable to distortion, will properly resist internal pressure to the limit of the tensile strength of the material of which they may be formed. In the manufacture of large-size meters there is also an additional gain in quantity of material necessary to form the caps, due to attaching the inlet and outlet pipes to the cen-

ter of the caps in consequence of the material that is removed therefrom.

Utilizing the conditions and facts set forth, I form the pressure-caps from sheet metal—such, for instance, as mild steel, brass, or bronze—of a strength sufficient to resist rupture, the flanges being formed with lips to engage the cylindrical portion of the disk-chamber and to prevent ejecting the gaskets. Suitable bearing is then provided for the flange-bolts by forming a separate ring, which is applied over the flanges of the caps and transmits the strain of the bolts and resists the internal pressure. Where an ordinary union connection is to be made, a threaded ring is first formed. This is inserted over the spud to a shoulder, when the projecting metal of the pressure-cap is spun over the end of the ring. When it is desirable to provide for an internal thread, the arrangement is reversed, as indicated in Fig. 11.

While I have thus described one embodiment of my invention, which is the preferred form, it will be evident to those skilled in the art that many of my improvements can be embodied in various other constructions without departing from the principles thereof. It will be also evident that various features set forth may be combined in a single structure, as shown, or may be used separately or in combination with other equivalent features; and my invention is not, therefore, limited to the precise construction and arrangement shown.

What I claim is—

1. In a water-meter, a separate disk-chamber composed of two sections secured together, provided with a disk, a diaphragm, and an external cylindrical portion, 18^a, and having inlet and outlet ports formed equally in both sections of the chamber, and having two pressure-caps, forming separate compartments on either side of the disk-chamber, secured to the said external cylindrical portion, 18^a, substantially as described.

2. In a water-meter, the combination, with a disk-chamber having a fixed diaphragm and an oscillating disk therein, of inlet and outlet ports formed in said chamber, the area and the circumferential extent of the inlet-port being greater than that of the outlet-port, whereby the impact of the inflowing current upon the disk is decreased, substantially as set forth.

3. In a water-meter, the combination, with a disk-chamber having a diaphragm and an oscillating disk therein, of inlet and outlet ports, the diaphragm being set so as to divide the circumferential extent and area of the ports unequally, whereby the change in the displacement of the disk is carried around within the disk-chamber entirely away from the diaphragm, substantially as described.

4. In a water-meter, the combination, with a disk-chamber having a diaphragm and oscillating disk therein, of inlet and outlet ports divided in unequal extent and area by the diaphragm, the corners 27 28 of the outlet-port being higher than the corresponding corners of the inlet-port, substantially as described.

5. In a water-meter, the combination, with a disk-chamber, of a conical strainer arranged to envelop the inlet side of said disk-chamber, substantially as described.

6. The combination, with the disk-chamber and pressure caps, of a strainer arranged between the inlet pressure-cap and the inlet side of the chamber, the said strainer being arranged to entirely envelop the inlet side of the disk-chamber, substantially as described.

7. In a water-meter, the combination, with a disk-chamber having a disk and diaphragm therein, and arranged to stand and operate in a vertical position, of a register arranged horizontally on the meter and connected to be operated by the disk at a right angle thereto, substantially as described.

8. In a water-meter, the combination, with a vertical disk-chamber and oscillating disk therein, of a horizontal register and register-operating mechanism, the register and operating mechanism being mounted upon the disk-chamber, substantially as described.

9. In a water-meter, the combination, with a vertical disk-chamber composed of two sections secured together, and an oscillating disk operating therein, of a horizontal register and register-operating mechanism, both the register and operating mechanism being mounted upon one of the sections of the disk-chamber, substantially as described.

10. In a water-meter, the combination, with a vertical disk-chamber and disk therein, of a horizontal register mounted on top of the disk-chamber, register-operating mechanism mounted on the side of the disk-chamber, and beveled-gear connections between the register and operating mechanism, substantially as described.

11. The combination, with a disk-chamber, oscillating disk, and fixed bearing-piece, of the disk-spindle secured to and controlling the normal action of the disk without tension, but capable of yielding elastically within the diameter of the ball upon the introduction of foreign material between the disk and disk-chamber, substantially as described.

12. In a water-meter, the combination, with a disk-chamber and oscillating disk therein, of the disk-spindle, a spherical roller on said disk-spindle, and a grooved bearing for said roller, substantially as described.

13. In a water meter, the combination of a disk-chamber, an oscillating disk therein, a disk-spindle, a spherical roller mounted thereon, and a grooved bearing adjustable upon its support, substantially as described.

14. In a water-meter, the combination, with a disk-chamber, of a register mounted thereon and a stuffing-box connected to the disk-chamber, the disk-chamber being formed with a pocket, as 53, for the stuffing-box-spindle gear, substantially as described.

15. In a water-meter, the combination, with a

disk-chamber and oscillating disk therein, of the pressure-caps having inlet and outlet spuds connected to the disk-chamber, the pressure-caps being of spherical contour, substantially as described.

16. In a water-meter, the combination, with a disk-chamber, of pressure-caps secured thereto, the caps being of sheet metal, and inlet and outlet spuds secured to the caps, substantially as described.

17. In a water-meter, the combination, with a disk-chamber and oscillating disk, of the diaphragm, the disk being provided with a friction-roller bearing upon the diaphragm, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN THOMSON.

Witnesses:
JOHN F. FOX,
WM. THOMSON.