No. 710,212. **Patented Sept. 30, 1902.**

W. H. REYNOLDS.

FLUID METER.

(Application filed Dec. 2, 1901.)

(No Model.)

Fig. 5.

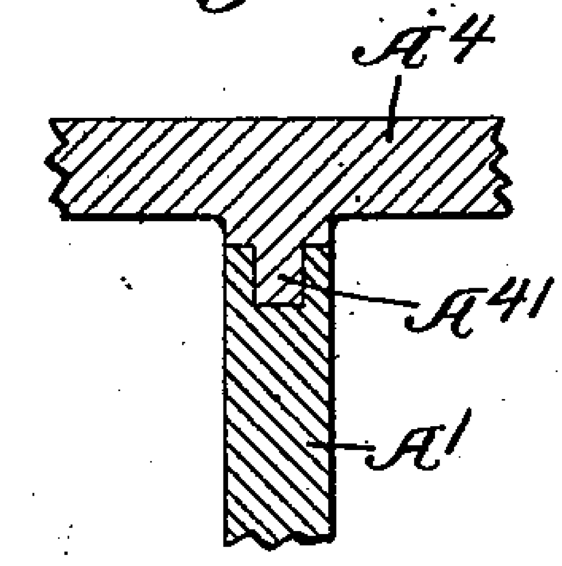


Fig. 1.

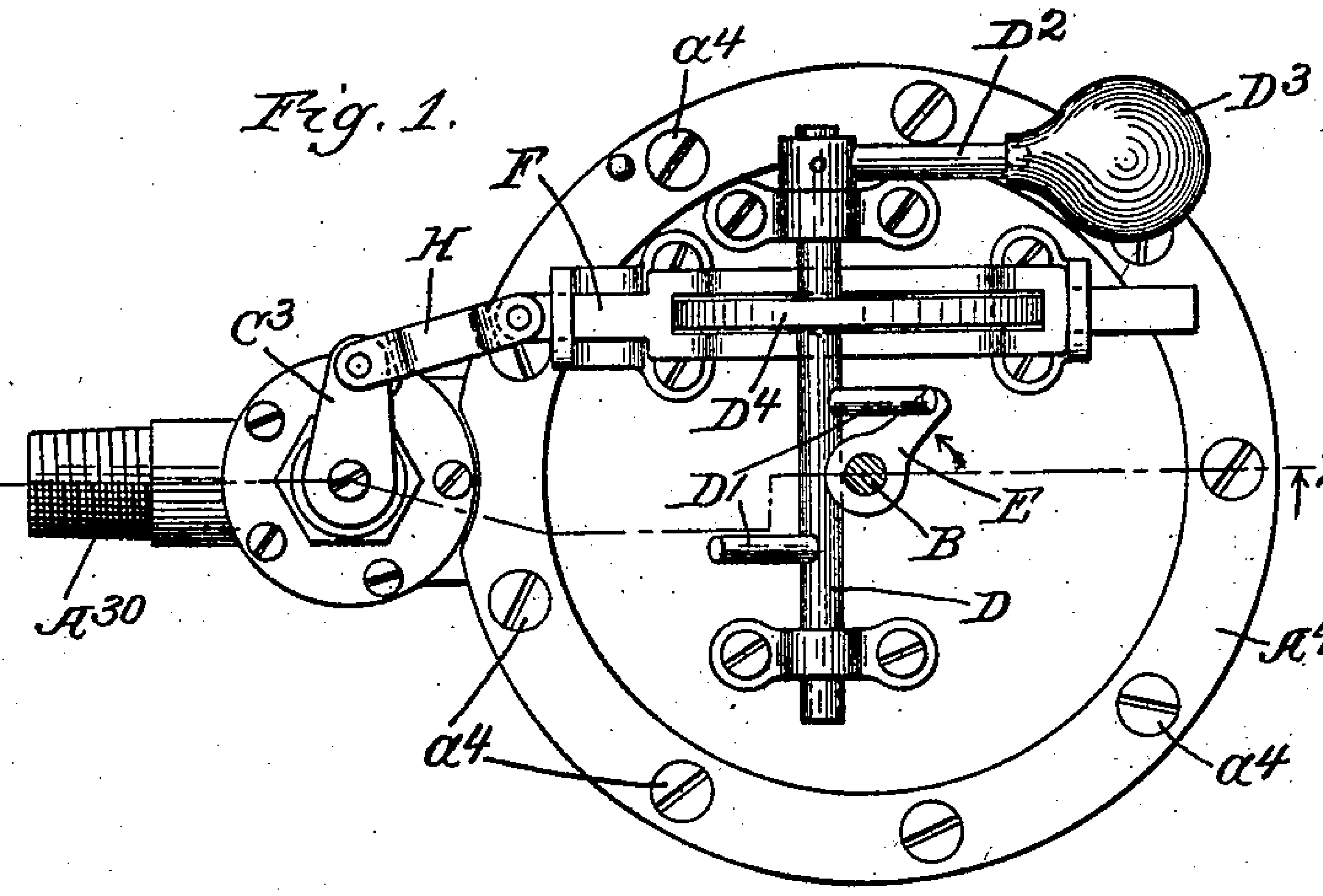


Fig. 8.

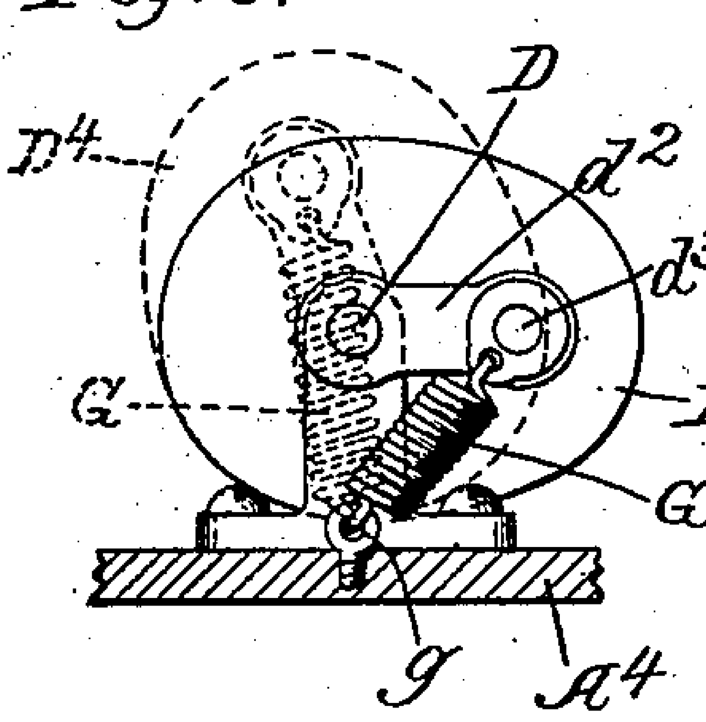


Fig. 2.

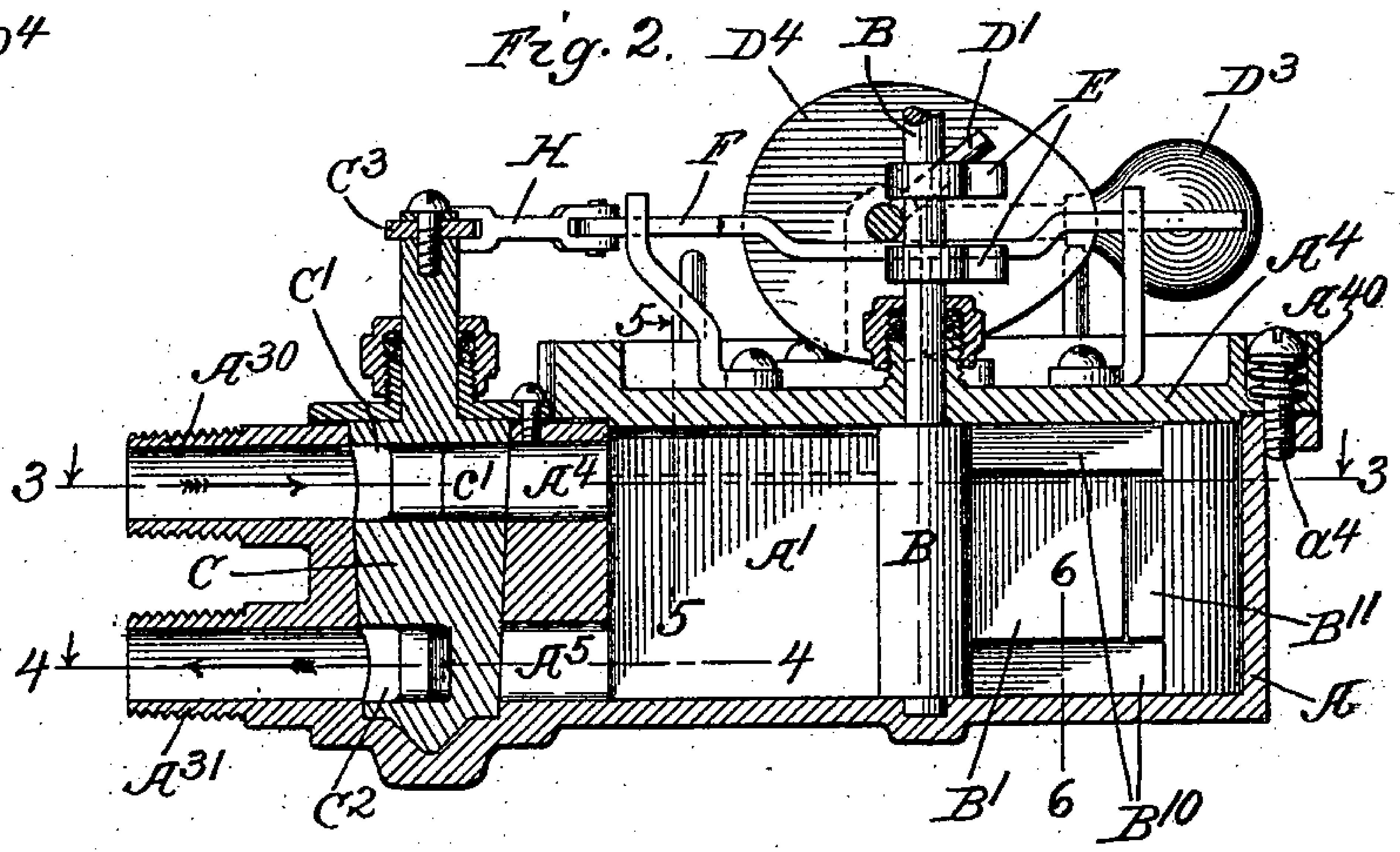


Fig. 6.

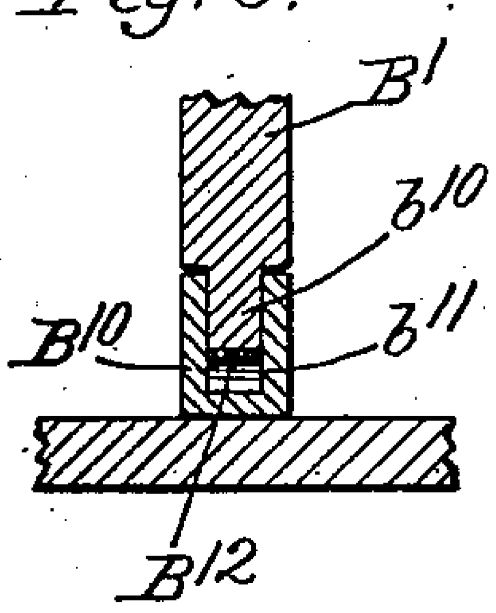


Fig. 4.

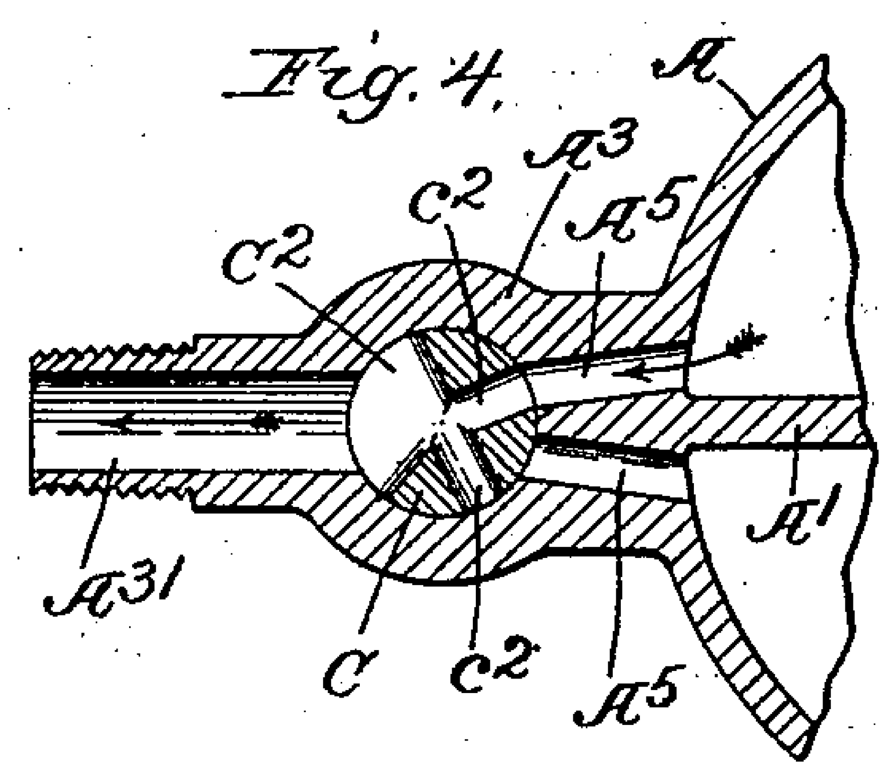


Fig. 3.

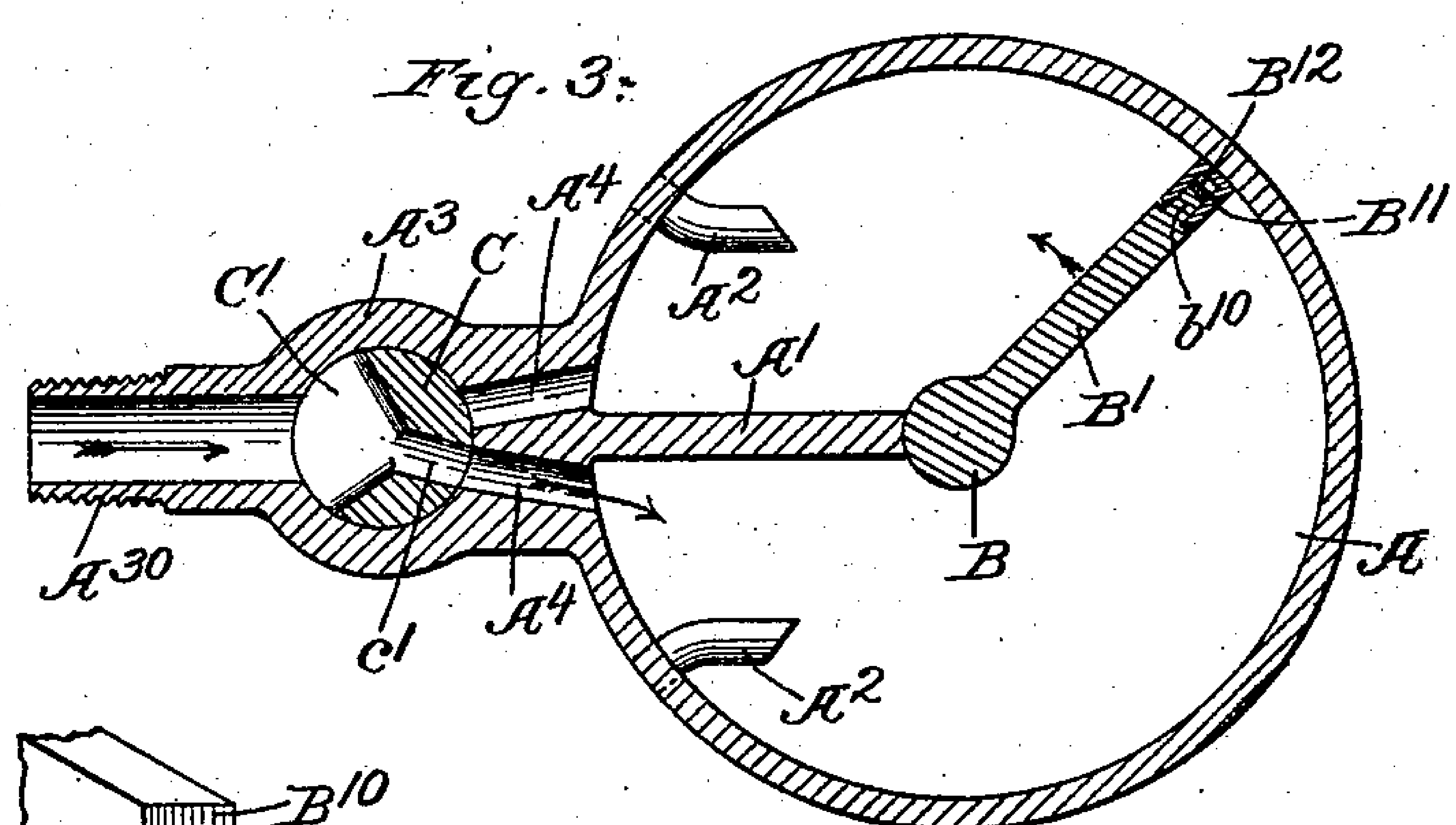
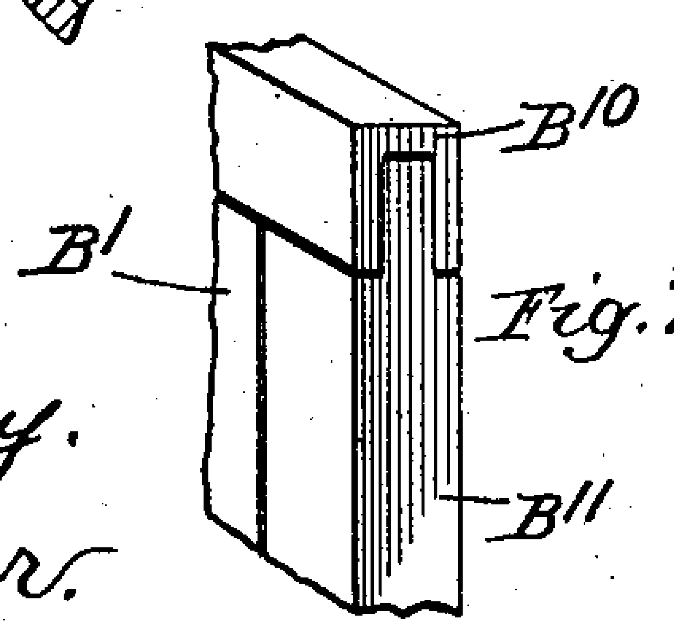


Fig. 7.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

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FLUID-METER.

SPECIFICATION forming part of Letters Patent No. 710,212, dated September 30, 1902.

Application filed December 2, 1901. Serial No. 84,313. (No model.)

To all whom it may concern:

Be it known that I, WILLIE H. REYNOLDS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fluid-Meters, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a top plan of my improved meter. Fig. 2 is a section at the line 2 2 on Fig. 1. Fig. 3 is a section at the line 3 3 on Fig. 2. Fig. 4 is a detail section through the ports and valve at the line 4 4 on Fig. 2. Fig. 5 is a detail section at the line 5 5 on Fig. 2. Fig. 6 is a detail section at the line 6 6 on Fig. 2. Fig. 7 is a perspective of half of one corner of the oscillating diaphragm, showing the packing-strips. Fig. 8 is a detail showing a modified device for assisting in reversing the valve.

My improved meter comprises circular chamber A, having an axial shaft B journaled in and protruding from it, the chamber having a radial diaphragm or partial partition A′ extending from the circular wall to the shaft B, and the latter has rigid with it a wing constituting an oscillating diaphragm B′, which extends from the shaft to the walls of the chamber, with which it makes contact at its entire periphery. The oscillation of the shaft in its bearings causes the diaphragm B′ to vibrate through any arc desired to the limit permitted by the presence of the fixed diaphragm A′. The studs A^2 A^2 indicate the limit of movement provided for and afford exact and positive stops for the vibrating movement of the diaphragm in the opposite directions. The chamber A has a boss A^3, through which inlet and outlet ports lead. There are two inlet-ports A^4 at opposite sides of the diaphragm at the upper part of the chamber and similarly two outlet-ports A^5 A^5 at opposite sides of the diaphragm at the very bottom of the chamber. All these ports lead to the seat of the plug-valve C, which extends preferably parallel with the axis of the chamber in the boss A^3. From the opposite side of the boss pipe connections A^{30} and A^{31} afford means for attaching the inlet and outlet pipes, respectively. The plug-valve C has inlet and outlet courses C′ and C^2, both being at the outer side—that is, the side remote from the chamber—wide mouthed, as seen in Fig. 3, so that through the entire hereinafter-described movement of the valve the inlet and outlet passages A^{30} and A^{31} remain unclosed by the valve. The inlet-course terminates at the seating-surface of the valve on the side toward the chamber in the single port c', and the two inlet-ports A^4 A^4, leading to the chamber, terminate at the seating-surface of the valve at a short distance apart, the action of the valve being designed to be practically instantaneous to shift the port c' from one to the other of the ports A^4. The outlet-course C^2 forks from the wide mouth at the outer side and terminates at the seating-surface on the side toward the chamber in two ports c^2 c^2, which are separated from each other a distance equal to the distance between the mouths of the ports A^5 A^5 at the seating-surface of the valve plus the distance between the mouths of the ports A^4 A^4 at the same surface. The relative positions of ports c^2 c^2 on the one hand and the port c' on the other hand are such that when the right-hand port c^2 is registered with the right-hand outlet-port A^5 the port c' is registered with the left-hand inlet-port A^4, and the spacing of the several ports, as above stated, gives the result that when the valve is turned in its seat to bring the port c' into registration with the right-hand port A^4 the right-hand port c^2 comes into registration with the left-hand port A^5, thus reversing both inlet and outlet connections by the same movement of the valve. It will be understood that when the inlet connection is made with one side of the diaphragm A′ and the outlet with the opposite side the fluid admitted will cause the oscillating diaphragm B′ to swing from the stopped position at the side at which the fluid is entering around to its stopped position at the opposite side, the fluid in front of it as it thus moves being discharged through the outlet-port at the side toward which it is moving, and that when the valve connections are reversed the fluid which has first entered on the side from which the diaphragm was moved will be free to pass out, while fluid will enter at the opposite side and cause the diaphragm to move in the opposite direction, thus filling the chamber on the side of the diaphragm which was previously emptied by its movement. Thus when fluid is continuously drawn through the system supplied by the outlet it will be supplied practically continuously first through one side and then through the other side of the chamber, provided the reversion of the valve is so prompt as to cause no practical interruption in the flow. In order to effect such prompt reversion of the valve, I provide the means shown mounted upon the top of the chamber, which will now be described.

D is a horizontal rock-shaft, suitably journaled, extending close to the diaphragm-shaft B, which projects through the top plate. The diaphragm-shaft has two tappets E E, one above and the other below the horizontal shaft, and the latter shaft has two abutments or projecting lever-fingers D′ D′. These fingers are about ninety degrees apart about the axis of the horizontal shaft and at opposite sides of the vertical shaft B, within the sweep of the tappets E E, so that as the shaft B oscillates it will in its movement in one direction cause the upper tappet to encounter the abutment D′ at one side of the vertical shaft, and as the tappet swings around above the horizontal shaft operating against the abutment it will rock the shaft through a certain angle. Means to be hereinafter described are provided for causing the horizontal shaft to continue this rocking movement beyond the range of the positive action of the tappet, so that the total rocking movement of the shaft is sufficient to bring the other abutment D′ around to a position at the side toward the vertical shaft, so that when the vertical shaft reverses its direction of movement it will be encountered by the other tappet at the same angle as the first-mentioned projection was encountered by the first tappet and with the result of rocking the horizontal shaft, but in the opposite direction from which it was first rocked, because the encounter and the driving action of the tappet now occur below instead of above the horizontal shaft. The horizontal shaft has a lever-arm D^2, carrying a weight D^3 at the end, said lever-arm extending substantially horizontally, or, at least, well over to one side, when the shaft is in position of rest, with the valve set at position for admitting fluid to one side and permitting it to escape at the other side, and the range of movement which the horizontal shaft can be given by the tappet operating to rock it away from this position is sufficient to carry the weight D^3 past the vertical plane of the axis of the shaft D, and the weight is designed to be sufficient in falling from that position to cause a cam D^4, which is mounted on the shaft, to act on the valve by suitable connections, to be described, and shift it from one operative position to the other—that is to say, to reverse the fluid connections of both inlet and outlet. This construction, commonly termed a "tumble-bob," is but the equivalent of a modified structure shown in Fig. 8 for accomplishing the same result by the operation of substantially the same principle—that is, the forcible shifting of a pivoted element exposed to a force action in the general direction of the pivot until the line along which the force operates passes the pivot. This modified device consists of a spring G, pivotally connected at one end to a lever-arm d^2, extending from the shaft D and corresponding to the lever-arm D^2, the wrist d^3, at which the pivotal attachment of the spring as made corresponding in a certain way to the center of gravity of the weight D^3, the other end of the spring G being connected at an eye *g* directly below the center of the shaft D. It will be understood that the rocking of the shaft D from the position at which the lever-arm and spring are in the full line in Fig. 8 to a point at which the stress of the force exerted by the spring between the two connections has passed the center of the shaft D will cause the spring to operate to complete the movement in the same direction and bring the lever to the opposite horizontal position. I design the term "tumble-bob" to be taken as covering both these devices, although strictly applicable only to the first described, the spring device being, however, a well-understood mechanical equivalent. For the purpose of transmitting the movement from the tumble-bob device—that is, the movement derived by this rocking shaft D—to the valve, I provide on the shaft D the cam D^4 and a slide-bar F, slotted to admit the cam, which is arranged to act by one end on the ends of the slot and shift the slide-bar in the direction in which the longer radius of the cam moves as the shaft rocks. A link R, connected at one end to the slide-bar F and at the other end to the lever-arm C^3 of the valve C, gives proper oscillating movement to the valve to shift it back and forth between its operative positions. The cam D^4 is formed so that during the entire lifting movement caused positively by the engagement of the tappets E with the abutments D′ no movement of the slide-bar is caused. This renders the cam practically circular through one entire half of its extent about the shaft. It is also constructed so that the edge shall not begin to crowd on the slide-bar after the weight passes the center of the shaft until the weight has had time by falling through a considerable angle (from thirty degrees to forty-five degrees) to acquire momentum and sufficient leverage to force the slide-bar and operate the valve. It will be understood that the shape of the cam should be modified when the spring structure shown in Fig. 8 is employed, because in that case the best work will be done while the spring is at its greatest tension—that is to say, immediately after the wrist d^3 passes by the axis of the shaft D—and the shifting of the valve would be made to occur at that stage rather than at the later stage, when the spring is less stretched. Fig.

8 therefore shows a cam somewhat modified in form suitable for the modified character of the action.

In order to keep the oscillating diaphragm B′ substantially fluid-tight at its periphery bearing on the walls of the chamber, I provide all its edges with packing-strips. These strips B^{10} B^{10} at the upper and lower edges and B^{11} at the outer edge are preferably in the form of channel-bars—that is, having grooves b^{11} to receive tongues b^{10}, formed at the edge of diaphragm B′—springs B^{12} being lodged in the grooves of the channel-bars, operating to hold the latter outward against the walls of the chamber. At the corners the channel-bars B″ have the flanges or wings forming the channels cut away clear across the end, so that the corresponding wings on the flanges of the channel-bars B^{10} take over the reduced ends of said bars B^{11}, as seen in Fig. 7, thus completing the packing to the corner.

In order to prevent injury to the meter in case of freezing when it is used for water, I make the top plate or cap A^4 separable from the body of the chamber by direct axial movement, and I secure it to the body of the chamber by screws a^4 a^4, under whose heads in the sockets provided to receive them are lodged springs A^{40}, one of which is shown in Fig. 2. These springs are designed to be sufficiently stiff, so that the screws being set down to a certain distance, which still leaves room for the operation of the springs, the cap-plate will be held on the body firmly enough to resist the maximum water-pressure; but in case of freezing the expansion in the formation of ice greatly exceeding the water-pressure will lift the cap, the springs yielding sufficiently for that purpose, and thus the chamber will be saved the strain which would otherwise burst it. In order to permit such action without disturbing the packing which might be provided at the upper edge of the partition of the diaphragm A′, I form on the under side of the top cap a rib or tongue A^{41}, which enters a groove in the upper edge of the diaphragm A′, forming a packing similar to that afforded by the packing-strips B^{10} and B^{11} on the oscillating diaphragm and allowing for the movement of the chamber caused from freezing, as above described, without danger of bursting the joint.

I claim—

1. In a fluid-meter, in combination with a chamber; a shaft at the axis of the chamber; a radial diaphragm in the chamber extending to the shaft; a diaphragm fixed on the shaft and oscillating therewith from one side to the other of the radial diaphragm; a shaft mounted on the chamber extending transverse and proximate to the axial shaft, said axial shaft having two tappets or radial fingers at opposite sides respectively of the plane of the transverse shaft, the latter having abutments projecting in the path of said tappets respectively; whereby the oscillation of the diaphragm rocks the transverse shaft; and connections by which the rocking of the latter shaft operates the valve.

2. In a fluid-meter, in combination with a chamber; an oscillating diaphragm therein; inlets and outlets for such chamber; an exterior shaft, and means by which the diaphragm rocks said exterior shaft; a tumble-bob connected to the exterior shaft; a cam operated by the tumble-bob; a slide-bar operated by the cam; and means by which the slide-bar operates the valve.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 19th day of November, A. D. 1901.

WILLIE H. REYNOLDS.

In presence of—
HAROLD WARNER,
EDWARD T. WRAY.