No. 684,910. Patented Oct. 22, 1901.

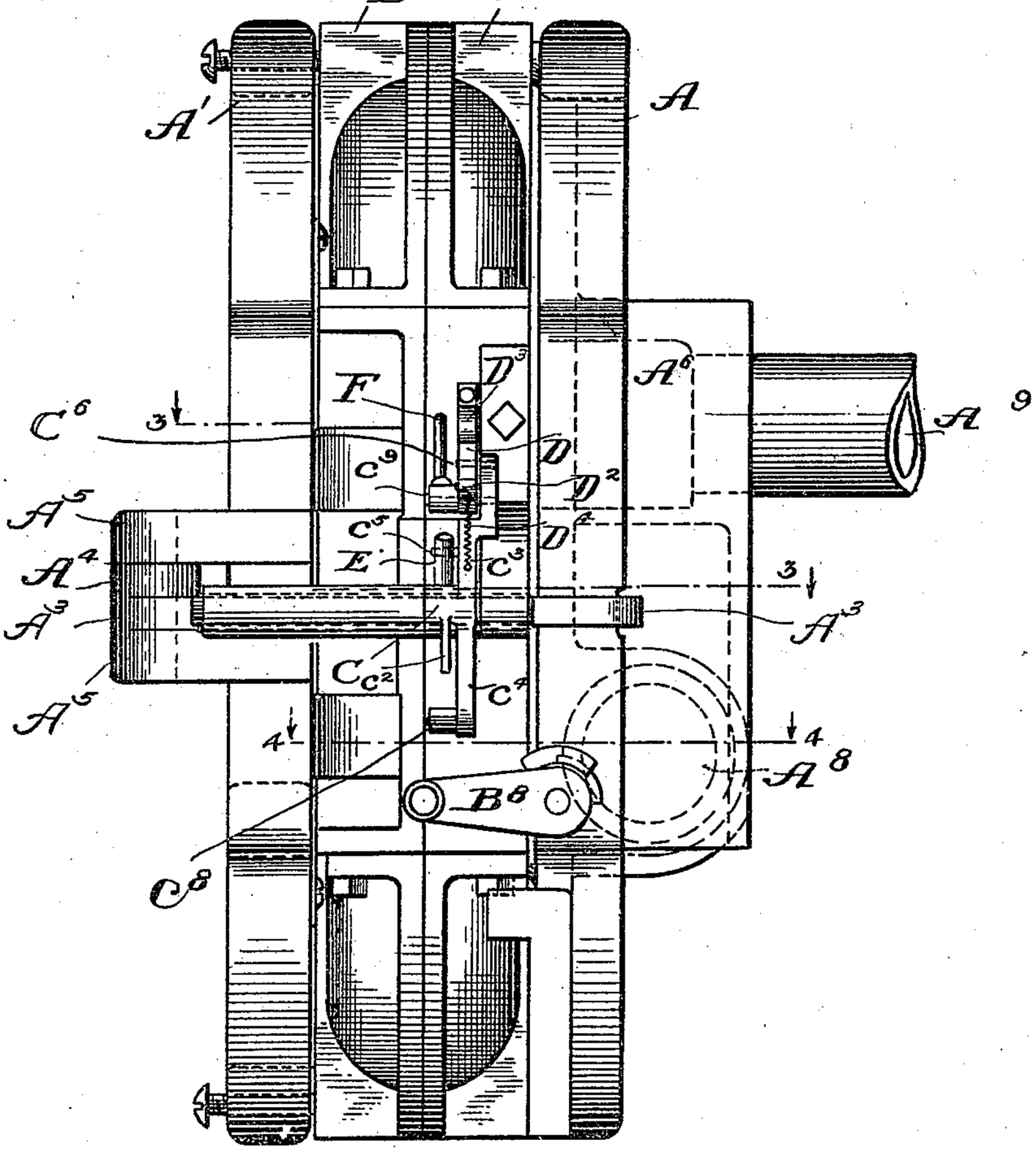
H. D. COLMAN.

LIQUID METER.

(Application filed Oct. 18, 1900. Renewed June 5, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1



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(No Model.) 4 Sheets—Sheet 2.

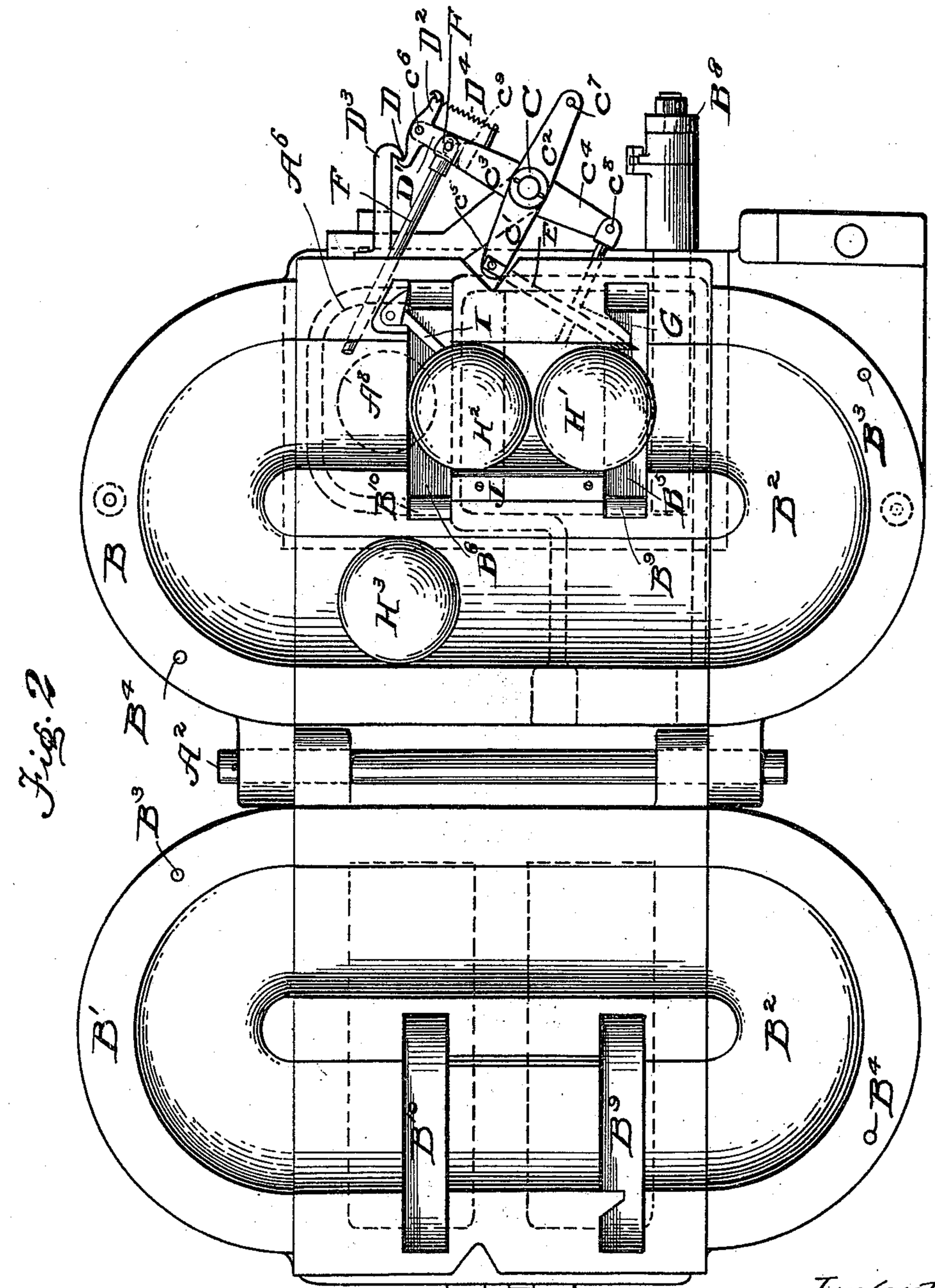

Fig. 2.

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(Application filed Oct. 18, 1900. Renewed June 5, 1901.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3

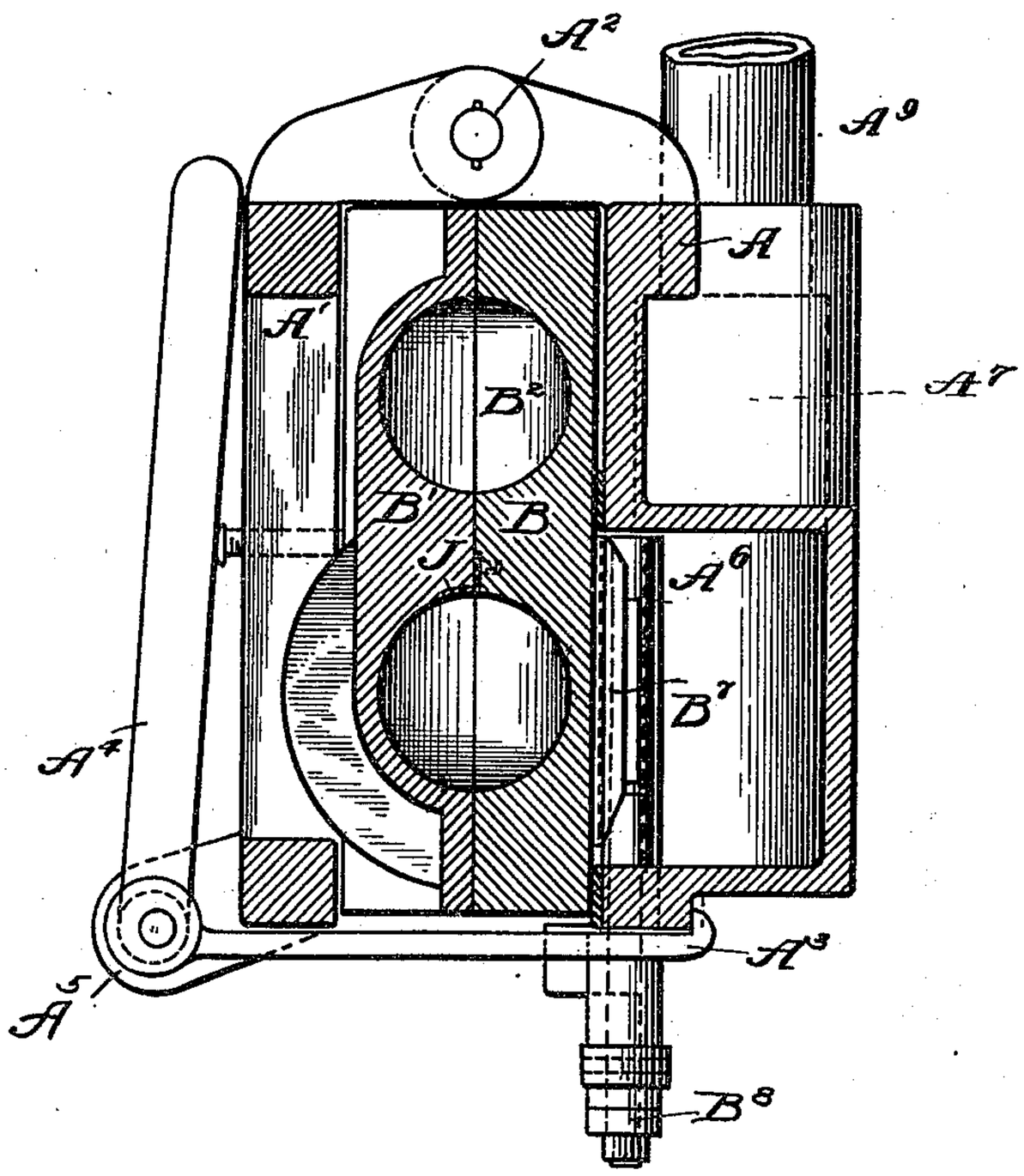
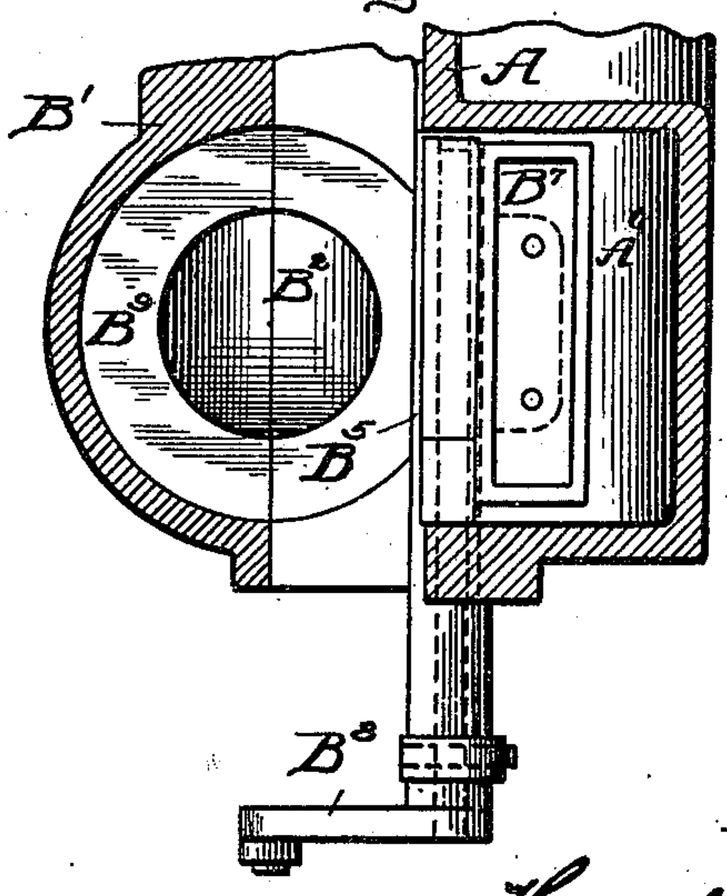


Fig. 4



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LIQUID METER.

(Application filed Oct. 18, 1900. Renewed June 6, 1901.)

(No Model.) 4 Sheets—Sheet 4.

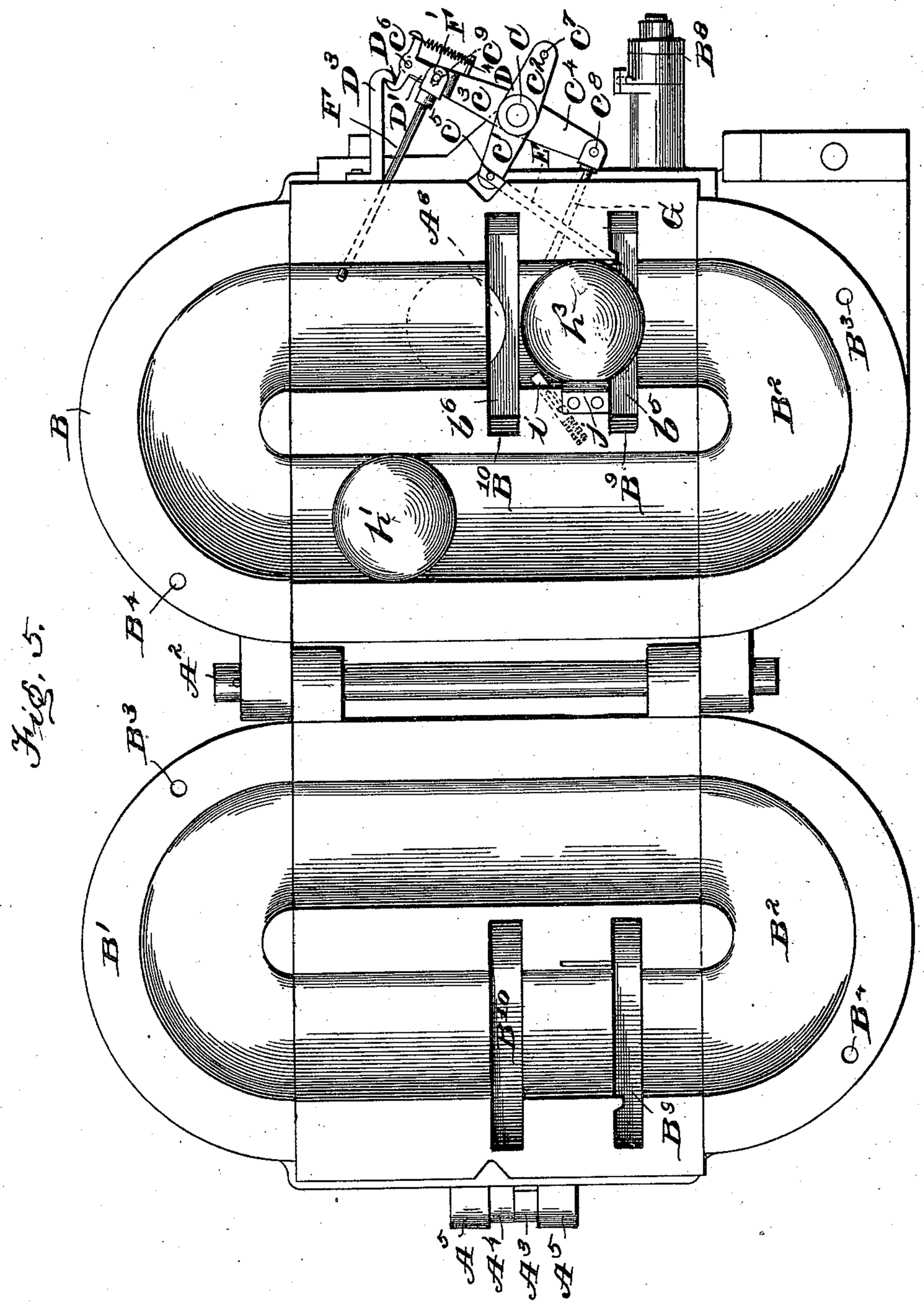

Fig. 5.

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UNITED STATES PATENT OFFICE.

HOWARD D. COLMAN, OF ROCKFORD, ILLINOIS, ASSIGNOR TO THE CREAMERY PACKAGE MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

LIQUID-METER.

SPECIFICATION forming part of Letters Patent No. 684,910, dated October 22, 1901.

Application filed October 18, 1900. Renewed June 5, 1901. Serial No. 63,336. (No model.)

To all whom it may concern:

Be it known that I, HOWARD D. COLMAN, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Liquid-Meters, of which the following is a specification.

The object of this invention is the production of a liquid-meter that shall be positive in its action, sufficiently accurate for practical purposes, and wherein the parts are readily accessible for cleaning and inspection.

In the accompanying drawings, Figure 1 is a side elevation of a meter embodying the novel features of my invention. Fig. 2 is a view of the two halves of the meter-casing open upon the connecting hinge-joint of the supporting-framework, showing the escapement mechanism and its actuating-balls in their raceway. Fig. 3 is a transverse section through the meter on dotted line 3 3 of Fig. 1. It shows the hinged supporting-framework, the means for locking the same together, the shutter closing the inlet-port, and the ball-retainer. Fig. 4 is a transverse section on dotted line 4 4 of Fig. 1 and illustrates principally the shutter mechanism for the inlet-port, showing the shutter open and the annular enlargement of the raceway coinciding with the inlet-port. Fig. 5 is a view similar to that of Fig. 2, showing the inlet and the outlet ports changed in size and position and with such other modifications of the parts as are necessary to produce a meter operating with two balls instead of three.

Like letters of reference indicate corresponding parts throughout the several views.

In the embodiment here shown of this invention I provide a casing comprising two halves or shelves hinged together at their edges by a pivoted supporting-framework and in the face of each of these shells form an endless groove, semicircular in cross-section, having straight parallel sides joined together by curved ends. When the hinged shells are closed together, the two semicircular grooves coincide and form a raceway, within which are placed three steel balls fitting exactly to the diameter of the raceway. At one side of the raceway is an inlet-port and just above it an outlet-port for the ingress and the egress of the liquid to be measured. Adjacent to these ports is an escapement mechanism for permitting the passage, one at a time, of said balls through the raceway. This mechanism comprises a sliding detent-rod for suspending one of the steel balls within the raceway just above the inlet-port and a gravity-detent for preventing the second ball, resting upon the first, from upward movement and for holding said balls as a closure in the raceway between the inlet and the outlet openings, constituting them an abutment for the pressure of the incoming liquid. Above the second ball is a sliding releasing-rod having a pivotal lever connection with the sliding detent-rod just mentioned and adapted to be engaged by the third ball driven through the raceway by the pressure of the liquid abutting against said first ball. When the third ball engages the sliding releasing-rod, it causes the sliding detent-rod to be withdrawn from the path of the first-mentioned ball, permitting that ball to drop into the current of inflowing liquid and to be driven by the pressure of the liquid around through the raceway, as was the preceding ball. A shutter controls the inlet-port, and a frame supports the two shells of the meter-casing and holds them rigidly in their proper positions. In practice the long diameter of the raceway is disposed vertically.

In the construction of this meter and following the foregoing outline I provide a supporting-framework comprising two members A and A′, hinged together upon the pintle A^2. A locking-hook A^3 has an eccentric connection with the hand-lever A^4, both said hook and said lever being pivotally mounted between the arms A^5, formed integral with and extending from the forward outer corner of the member A′ of the supporting-framework. The locking-hook engages a shoulder upon the member A of the supporting-framework, and when said hand-lever is thrown into the position shown in Fig. 3 the two members A and A′ of the supporting-framework are locked rigidly together. They may be released to permit access to the interior of the

meter by turning the hand-lever A^4 upon its pivot. The member A is provided with the inlet-chamber A^6 and the outlet-chamber A^7, communicating with the supply-pipe A^8 and the escape-pipe A^9, respectively.

B and B′ are two shells secured in any suitable manner to the hinged members A and A′ of the supporting-framework. Each of these shells B and B′ is provided in its face with the endless groove B^2, of semicircular cross-section, and when the said shells are folded together by the closing of the two members A and A′ of the supporting-framework upon the pintle A^2 the two semicircular grooves coincide and form a channel or raceway circular in cross-section. Pins B^3 entering corresponding holes B^4 in the two shells insure the exact coincidence of said parts. An inlet-port B^5 has communication with the raceway B^2 and with the inlet-chamber A^6, and a shutter B^7, operated by the crank B^8, controls the admission of liquid through the inlet-port B^5 to the raceway B^2. An outlet-port B^6 opens from the raceway B^2 into the outlet-chamber A^7 for the passage of the escaping liquid. Coincident with the inlet and outlet ports B^5 and B^6, respectively, are the annular chambers B^9 and B^{10}, each formed one-half in the shells B and B′, which chambers are provided for the free passage of the liquid about the balls.

C is a four-arm lever pivotally mounted upon a projection extending from the shell B and has the arms C′, C^2, C^3, and C^4, C′ and C^2 being opposite and C^3 and C^4 being likewise opposite. These arms, at their outer ends, are provided with pivotal studs C^5, C^7, C^6, and C^8, respectively. The arm C^3 of said four-arm lever has a transversely-elongated opening C^9 intermediate its ends, and upon its pivotal stud C^6 carries the detent-hook D, having the stem D′ and the arm D^2. The hook D engages with the corresponding hook D^3, fixed to the side of the shell B. A spring D^4, extending between the arm D^2 and a fixed point of attachment with the arm C^3 of the four-arm lever, tends to hold the detent-hook D in engagement with the fixed hook D^3.

A detent-rod E lies in a suitable opening formed in the walls of the shell B and is free to slide endwise in said opening. Its forward end normally projects slightly within the raceway B^2, and at its rear end it has a pivotal connection with the arm C′ of the four-arm lever C. The opposite arm C^2 of said four-arm lever C has connection with a suitable counting mechanism for registering the number of movements of the escapement mechanism.

A tripping-rod F extends through an opening in the walls of the shell B, its forward end projecting into the raceway B^2 and its rear end having a pivotal engagement, by means of the stud F′, with the stem D′ of the detent-hook D. This stud F′ also extends through the transversely-elongated opening C^9 in the lever C^3, whereby the tripping-rod F and the detent-hook D have a slight movement relative to the lever C^3, the tripping-rod first releasing the engagement of the detent-hook and then moving the lever. This device is necessary under certain conditions to prevent the rebounding of the escapement mechanism and the accidental passage of two balls in immediate succession.

The arm C^4 of the four-arm lever C has by means of the stud C^8 a pivotal engagement with the sliding setting-rod G. This setting-rod extends through an opening in the shell B and is capable of being thrust into the raceway B^2. The setting-rod G is intended to push forward the detent-rod E and the tripping-rod F to their positions, as shown in Fig. 2, after said rods have been pushed backward by an escape movement of the mechanism.

Three balls H′, H^2, and H^3, of a diameter slightly less than that of the raceway B^2, are placed within said raceway, the ball H′ resting against the end of the detent-rod E, which projects within the raceway. The ball H^2 rests upon the ball H′, both being supported by the end of the detent-rod E. The upward movement of the ball H^2 is prevented by the pivoted gravity-detent I. The ball H^3 may be anywhere about the raceway B^2. All three of the balls are movable and free to pass through the raceway, except as they are engaged by the said detents. Therefore it will be understood that the position occupied by the ball H′ in Fig. 2 will be occupied successively by the balls H^2 and H^3 as the meter operates.

J is a curved shield secured to the shell B and, extending outward, acts as a ball-retainer to permit of the assembling of the balls H′ and H^2 in the positions indicated in Fig. 2 and to retain said balls when the shells B and B′ of the meter are separated.

The operation of the mechanism of this meter, assuming the parts to be in the positions as represented in Fig. 2, the inflow and the outflow pipes A^8 and A^9 suitably connected, and the former being supplied with liquid under pressure, is as follows: The ball H^3 is driven through the raceway B^2 by the pressure of the incoming liquid entering the inlet-port B^5 until said ball strikes the tripping-rod F and pushes it back out of the raceway. This movement of the tripping-rod first moves the detent-hook D out of engagement with the fixed hook D^3, and when the stud F′ comes in contact with the end of the elongated opening C^9 moves the four-arm lever C on its pivot. This movement of the said lever C withdraws the detent-rod E from the raceway B^2 and permits the lower ball H′ to fall into the current of incoming liquid. The ball H^2 also descends, pushing back the setting-rod G, which by the movement of the four-arm lever C, just described, was projected slightly into the raceway B^2, and this backward movement of the setting-rod G thrusts forward the detent-rod E and the tripping-

rod F into their normal positions, as shown in Fig. 2. The ball H′ after falling into the incoming current is driven through the raceway B^2, and coming into contact with the tripping-rod F the movement of the escapement is repeated.

Any suitable form of counter mechanism may be connected with the arm C^2 of the four-arm lever C and the number of delivery movements of the mechanism recorded.

The gravity-detent I prevents a backward movement of the balls. The ball-retainer shield J prevents the two balls occupying the positions of H′ and H^2, Fig. 2, from dropping out of the raceway B^2 when the shells B and B′ are separated, as in Fig. 2. The shells B and B′ are locked together by the hand-lever A^4, as hereinbefore described. The balls are readily removable for cleaning the parts of the meter.

The modified form of this meter (shown in Fig. 5) illustrates a construction adapted to operate with two balls instead of three. The ball h' in this modified structure corresponds to the ball H′ of Fig. 2, and the ball h^3 to the ball H^3 of said figure. In this modified construction the inlet and the outlet ports b^5 and b^6 are placed nearer together, (one diameter of the balls from center to center of the two ports,) so that the balls in passing said ports close both of the ports. The weight of both balls carries the lower one, h', past the inlet-port b^5, and the second ball h^3 is stopped by the detent E, where it is held from movement either upward or downward by the detents i and E, respectively, said ball h^3 acting while held in this position as an abutment for the incoming liquid. The ball h' is driven by the pressure liquid through the raceway B^2, striking the tripping-rod F and withdrawing the detent-rod E from beneath the other ball h^3. The ball h^3, however, is held upward against the detent i by the pressure of the inflow until the ball h' strikes against it, when it is driven downward, both balls passing both ports simultaneously, closing said ports. The ball h' in passing the setting-rod G restores the detent-rods G and E and comes to rest against the latter, being held against upward movement by the detent i, while the ball h^3 is driven around the raceway.

In the modified construction shown in Fig. 5 the gravity-detent I is replaced by a receding detent-rod i, better adapted for this altered form, and the length of the ball-retainer J is reduced in the ball-retainer j, as only one ball is to be held in the modified form.

The quantity of liquid delivered for each escape movement of the meter is the capacity of that portion of the raceway B^2 between the inlet-port B^5 and the outlet-port B^6 traversed by the balls.

I claim as my invention—

1. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; two independent closures movable along said raceway, actuated by the liquid being measured; and means for positively holding one of said closures, which means is adapted to be actuated by the free closure to release the held closure.

2. In a liquid-meter, in combination, a casing having an endless raceway, also having inlet and outlet openings communicating with said raceway; two independently-movable closures in said raceway, actuated by the liquid being measured; and means for positively holding one of said closures, which means is adapted to be actuated by the free closure to release the held closure.

3. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; two independent closures movable along said raceway, actuated by the liquid being measured; and means for positively holding one of said closures, which means is adapted to be actuated by the free closure to release the held closure and hold said previously-free closure.

4. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; two independent closures movable along said raceway, actuated by the liquid being measured; a detent for one of said closures; and means adapted to be actuated by the free closure for withdrawing the detent to release the held closure.

5. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; two independently-movable closures in said raceway, actuated by the liquid being measured; a detent for one of said closures; means adapted to be actuated by the free closure for withdrawing the detent to release the held closure; and means for restoring the detent to hold said previously-free closure.

6. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three independently-movable closures in said raceway; and means for positively holding two of said closures, which means is adapted to be actuated by the free closure to release one of said held closures.

7. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three independently-movable closures in said raceway; means for positively holding two of said closures, which means is adapted to be actuated by the free closure to release one of said held closures; and means for holding said previously-free closure.

8. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three independently-movable closures in said raceway; a detent-pawl and a detent-rod for positively holding two of said

closures; and a tripping-rod adapted to be actuated by the free closure to release one of said held closures.

9. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; balls in said raceway; and mechanism for positively holding all of said balls except one, and for successively releasing a held ball to the action of the flowing liquid.

10. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; balls in said raceway; and mechanism for positively holding all of said balls except one, and for successively releasing a held ball to the action of the flowing liquid, which means is actuated by the free ball.

11. In a liquid-meter, in combination, a casing having a raceway, also having an inlet and an outlet opening communicating with said raceway; two balls in said raceway; a detent for holding one of said balls; and mechanism actuated by the other one of said balls for withdrawing said detent to release the held ball.

12. In a liquid-meter, in combination, a casing having an endless raceway, also having inlet and outlet openings communicating with said raceway; two balls in said raceway; and means for positively holding one of said balls, which means is adapted to be actuated by the free ball, for releasing the held ball to the action of the flowing liquid.

13. In a liquid-meter, in combination, a casing having an endless raceway, also having inlet and outlet openings communicating with said raceway; two balls in said raceway; and means for positively holding one of said balls, which means is adapted to be actuated by the free ball, for releasing the held ball to the action of the flowing liquid, and in turn hold said previously-free ball.

14. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl and a detent-rod for holding two of said balls; and a tripping-rod adapted to be engaged by the third ball, and to withdraw the detent-rod from engagement with one of said held balls, to release said ball to the action of the flowing liquid.

15. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl and a detent-rod for holding two of said balls; a tripping-rod, and a setting-rod, which tripping-rod is adapted to be engaged by the third ball to move the detent-rod from engagement with one of said held balls, and which setting-rod is adapted to be engaged by the other one of said held balls.

16. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl and a detent-rod for holding two of said balls; a tripping-rod, and a setting-rod, each having a pivotal connection with said detent-rod, which setting-rod is adapted to restore said detent-rod and said tripping-rod to their normal positions.

17. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl; a detent-rod, a tripping-rod, and a setting-rod, all capable of projecting into said raceway, and adapted to be engaged by said balls; and a pivoted lever to which said detent-rod, said setting-rod, and said tripping-rod are pivoted.

18. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl for preventing the upward movement of two of said balls; a detent-rod for preventing the downward movement of said two balls; a lever having a pivotal connection with said detent-rod; and a tripping-rod having a pivotal connection with said lever, which tripping-rod is adapted to be engaged by the third one of said balls.

19. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl and a detent-rod for holding two of said balls; a tripping-rod having a pivotal connection with said detent-rod, which tripping-rod is adapted to be engaged by said third ball to withdraw said detent-rod; and a setting-rod adapted to be engaged by one of said held balls, for restoring said detent-rod and said tripping-rod to their normal positions.

20. In a liquid-meter, in combination, a casing having a raceway, also having inlet and outlet openings communicating with said raceway; three balls in said raceway; a detent-pawl and a detent-rod for holding two of said balls; a pivoted lever having a pivotal connection with said detent-rod; a setting-rod having a pivotal connection with said lever; a tripping-rod; and a detent-hook.

21. In a liquid-meter, in combination, a casing having an endless raceway, also having inlet and outlet openings communicating with said raceway; a shutter for said inlet-opening; three balls in said raceway; a gravity detent-pawl for preventing upward movement of two of said balls; a detent-rod for preventing downward movement of said two balls; a setting-rod; a tripping-rod; and a pivoted lever having a pivotal connection with the detent-rod, the setting-rod, and the tripping-rod.

22. In a liquid-meter, in combination, a two-part casing capable of being folded together, and having an endless raceway, also having inlet and outlet openings communicating with

said raceway, and being provided with annular chambers adjacent to said inlet and outlet openings; two independently-movable closures in said raceway; and means for positively holding one of said closures, which means is adapted to be operated by the free closure to release the held closure.

23. In a liquid-meter, in combination, a casing comprising two shells capable of being folded together, and forming between them an endless raceway; said casing having inlet and outlet openings communicating with said raceway; a two-part hinged framework adapted to support the two shells of the casing; a measuring mechanism; and a pivoted latch mechanism for locking the two shells of the casing together.

24. In a liquid-meter, in combination, a casing comprising two shells capable of being folded together, and forming between them an endless raceway, one of said shells having inlet and outlet openings communicating with said raceway; a supporting-framework composed of two members hinged together, each member being adapted to support one of the shells of the casing; a measuring mechanism; a locking-lever; and a locking-hook having an eccentric connection with said locking-lever.

25. In a liquid-meter, in combination, a casing comprising two shells capable of being folded together, and forming between them an endless raceway, one of said shells having inlet and outlet openings communicating with said raceway; a supporting-framework composed of two members hinged together, each adapted to support one of the shells of the casing; an inlet-chamber and an outlet-chamber in one of said members of the framework, which chambers communicate with the inlet-opening and the outlet-opening, respectively; a measuring mechanism; and means for locking the two shells of the casing together.

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