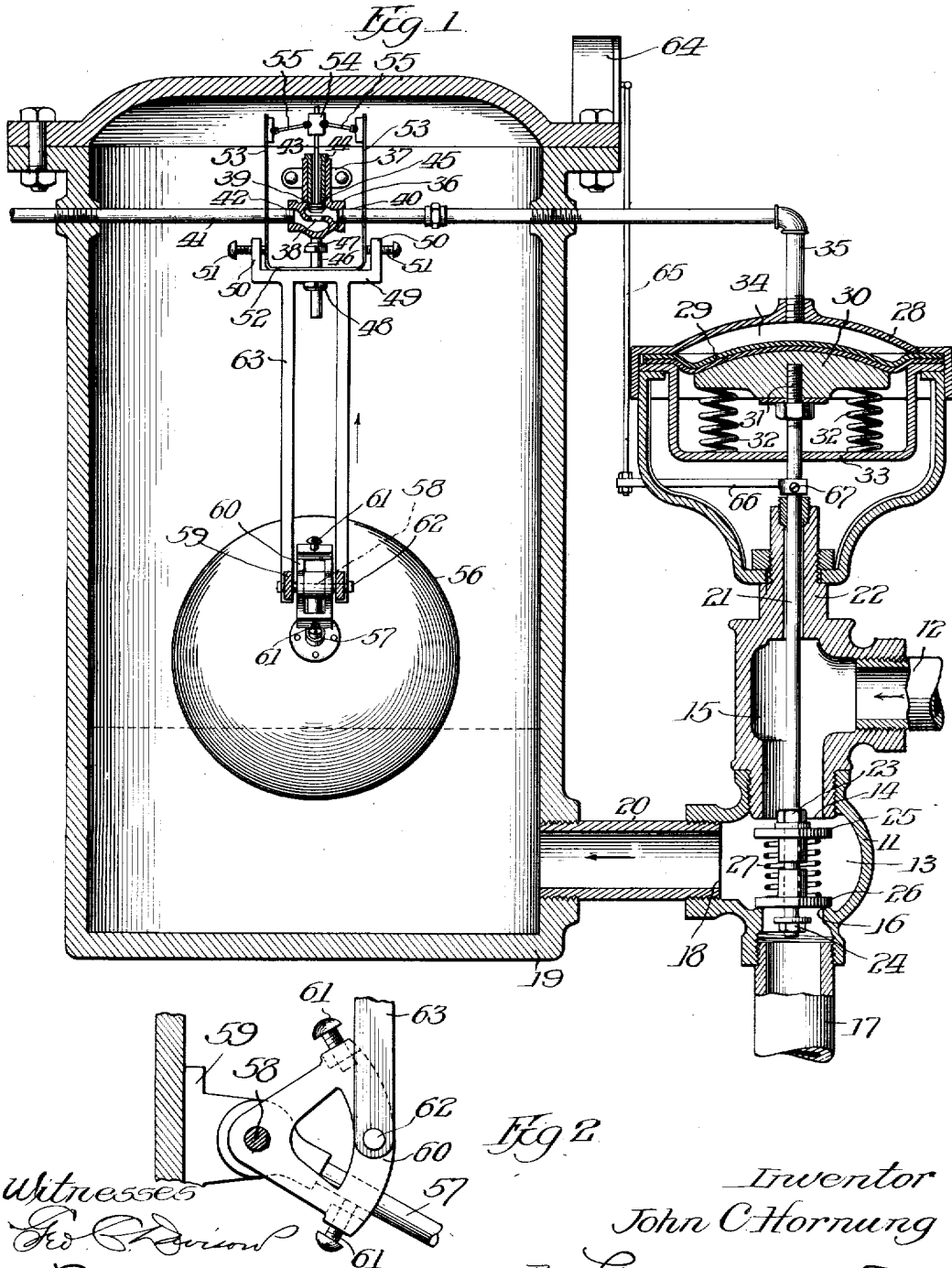


J. C. HORNUNG.
CONDENSATION METER.
APPLICATION FILED JULY 27, 1912.

1,114,360.

Patented Oct. 20, 1914.
2 SHEETS-SHEET 1.



Witnesses

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2 SHEETS—SHEET 2.

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UNITED STATES PATENT OFFICE.

JOHN C. HORNING, OF CHICAGO, ILLINOIS.

CONDENSATION-METER.

1,114,360.

Specification of Letters Patent.

Patented Oct. 20, 1914.

Application filed July 27, 1912. Serial No. 711,903.

To all whom it may concern:

Be it known that I, JOHN C. HORNING, 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 Condensation-Meters, of which the following is a specification.

The present invention relates to meters and especially devices of this general character adapted for the measurement of condensation in connection with central station heating plants although suited for use as will be obvious in other relations.

The primary object of the invention is the provision of means whereby the condensation will be accumulated and the amount determined in a wholly automatic and absolutely accurate manner thus providing a reliable gage and measure of efficiency for the system.

The invention as hereinafter particularly claimed will be readily understood from the following detailed description of one embodiment of the same based upon the accompanying illustrative drawing wherein,

Figure 1 is a vertical transverse section taken through the meter case and the main and motor valves; Fig. 2 is a fragmentary detail showing in side elevation the adjustable connection between the float and the motor valve; Fig. 3 is a view similar to Fig. 1, but showing a modification; and Fig. 4 is a fragmentary detail of the modified construction.

In these drawings the main valve 11 is shown as connected by the pipe 12 to the outlet below the trap of the house piping, not shown. This valve has a valve chamber 13 which is connected by means of the inlet port 14 with the pipe 12 through the passage 15. The valve chamber 13 also communicates by way of the port 16 with the waste pipe 17. A third port 18 establishes communication between the valve chamber 13 and the meter case 19 by way of the pipe 20.

The valve stem 21 is guided within the boss 22 of the valve casing for reciprocatory movement axially of the ports 14 and 16, the lower portion of the valve stem having threaded thereon adjustable stops 23 and 24 between which are loosely mounted the valve disk 25 seating upwardly upon the port 14 and the valve disk 26 seating downwardly upon the port 16. These valve disks have interposed therebetween a coiled compression spring 27 by which they are pressed

apart and held yieldingly against the stops 23 and 24, the distance separating the opposed faces of the stops corresponding substantially to the distance separating the two ports 14 and 16. It will thus be seen that in the intermediate position of the valve stem 21 both the valves 25 and 26 will be seated and the ports 14 and 16 will be closed, whereas in the upper extreme position of the valve stem 21 the valve 25 will be seated and the port 14 closed, while the valve 26 will be lifted from its seat by the stop 24 and the port 16 will be opened. At the lower extreme position of the valve stem 21, however, the parts will occupy the position shown in the drawing, the port 16 being closed by the valve 26 while the valve 25 will be removed from its seat upon the port 14 by the stop 23.

Immediately above the main valve 11 is shown one form of operating valve comprising a diaphragm case 28 containing a diaphragm 29 the lower face of which carries a block 30 adjustably connected at 31 to the valve stem 21. The lower face of the diaphragm bears against compression springs 32, 32 resting upon the yoke 33 and by these springs the diaphragm 29 and the valve stem 21 are yieldingly held in their upper extreme positions. The space 34 above the diaphragm is in communication by means of the pipe 35 with a source of suitable pressure fluid such as air or water by means of which, when admitted to the space 34, the diaphragm is forced downwardly in opposition to the springs 32 and thereby the valve stem 21 is moved to its lower extreme position, thus providing for the operation of the main valve to open and close the ports 14 and 16 in alternation.

In order to control the supply of pressure fluid to the operating valve 28 an actuating device in the form of a valve 36 of peculiarly advantageous construction is interposed in the pipe 35 preferably at a point within the meter case 19 and above the extreme level of the fluid therein. This actuating valve 36 is shown as rigidly mounted upon the wall of the case by means of the bracket 37 and said valve comprises an inlet port 38, a waste port 39 and a third port 40 to which the pipe 35 is connected, a pressure fluid supply pipe 41 being connected to said valve at 42. A valve stem 43 is guided within the bushing 44 for vertical reciprocation coaxially with the ports 38 and 39, the lower

end of the stem having mounted thereon the doubly coned diamond valve 45 adapted to seat at the two extremes of its movement to control said ports 38 and 39 in alternation.

A guide pin 46 depending from the valve 36 is provided with upper and lower stops 47 and 48 and upon this guide pin between the two stops is mounted for vertical movement a cross head 49 having upwardly extending arms 50, 50, within which are threaded set screws 51, 51.

Supported upon the cross head 49 between the arms 50, 50 is a U-spring 52, the spring arms 53, 53 of which are pressed inwardly by the set screws 51 and extend upwardly upon each side of the stem 43. A collar 54 is mounted upon the upper end of the stem 43 and links 55, 55 are inserted between said collar and the spring arms having preferably a knuckle joint connection therebetween, these links serving to hold apart the spring arms 53 against the inward pressure of the set screws 51.

It will thus be seen that in the position of the parts shown the valve 45 is held upwardly against its seat closing the port 39 by the spring pressure of the arms 53 transmitted through the links 55 to the shoulder 54 on the stem and it will also be evident that if the cross head 49 is moved upwardly carrying with it the spring arms 53 the position of the valve will remain the same until the outer ends of the links 55 reach a point in horizontal alinement with the inner ends of said links and immediately thereafter the inward pressure of the spring 53 will be transmitted in a downward direction to the collar 54 so that the valve 45 will instantaneously snap to its lower position opening the port 39 and closing the port 38. The further upward and return movement of the cross head 49 will not affect the valve 45 until upon the return movement the links 55 are again brought into horizontal alinement and immediately thereafter upon a continuation of the downward movement the valve 45 will be snapped to its upper position as shown in the drawing.

In the valve case 19 a float 56 is arranged upon the rod 57 which is pivoted at 58 to the bracket 59 or in any other approved manner. Upon the pivot 58 is also mounted a segmental yoke 60 provided at its two extremes with set screws 61, 61 forming adjustable stops between which the float rod 57 plays within the yoke 60. This segmental yoke is attached at 62 to the lower end of the shifting rod 63, the upper end of which is rigidly attached to the cross head 49. For purposes of convenience this shifting rod may be double, as illustrated, and attached to the outer faces of the yoke 60. It will be observed that by this construction the shifting rod 63 will be unaffected by the

movement of the float except at the two extreme positions of such float. In the lowermost position the float rod 57 will impinge against the lower stop 61 and move the yoke with the shifting rod 63 downwardly and in the uppermost position the float rod will impinge against the upper stop 61 and shift the parts upwardly to operate the actuating valve 45, as above described, by snapping the same instantaneously from one position to the other.

The general operation of the device is as follows: In the position of the parts shown the condensed fluid flows through the pipe 12, the passage 15 and the port 14 to the valve chamber 13, its egress through the port 16 to the waste 17 being prevented by the valve 26 closing said port so that the fluid flows through the pipe 20 into the meter case 19 which serves as a measure for the fluid. As the level of the fluid rises within the meter case constituting the measure the float will move upwardly as is well understood but all of the other mechanism remains inactive, the float rod 57 moving freely within the yoke 60. When the fluid reaches a predetermined level which corresponds to a given unit of measurement depending upon the capacity of the meter case and to correspond to which level the adjusting screws 61 are set, the float rod 57 will have contacted with the upper stop 61 and the shifting rod 63 together with the yoke 49 and the spring 53 will move upwardly until the links 55 are brought into horizontal alinement as above described. Thus far it will be understood that the pressure fluid in the pipe 41 acting through the port 38 and the pipe 35 upon the upper face of the diaphragm 29 holds the valve stem 21 in its lower position against the springs 32 so as to maintain the inlet port 14 open. After the upwardly moving spring arms 53 have passed the position referred to the valve 45 is snapped to its lower position closing the port 38 and opening the port 39 whereupon the pressure in the chamber 34 being relieved the springs 32 of the operating valve force said diaphragm upwardly exhausting the pressure fluid from the space 34 through the pipe 35 and the port 39 at the same time lifting the valve stem 21 and permitting the spring 27 to expand to first seat the valve 25 and as the valve stem 21 continues to rise the stop 24 next lifts the valve 26 off its seat upon the port 16. The condensed fluid which has accumulated within the meter case 19 is thus permitted to discharge outwardly through the pipe 20, the port 16 and the waste pipe 17 during which time the incoming condensed fluid accumulates within the passage 15 above the closed valve 25. As the measured fluid is discharged from the meter case the float 56 will sink and the float rod 57 retrace its

way within the yoke 60 until at a predetermined point of discharge, which may or may not occur when the case is entirely emptied, the rod 57 contacts with the lower stop 61 and causes a downward movement of the rod 63 and the spring arms 53, the inward spring tendency of which arms causes the valve 45 to snap to its lower position as before described whereupon the waste port 39 is again first closed and the inlet port 38 then opened permitting the pressure fluid access through the pipe 35 to the space 34 whereby the diaphragm and with it the valve stem 21 is moved downwardly first closing the waste port 16 by means of the valve 26 and then opening the inlet port 14 by the contact of the stop 23 with the valve 25. The accumulated fluid within the passage 15 is thus allowed to flow to the meter case and open communication established between the trap and the case as before described, the parts being again in the positions illustrated.

It will be understood that if the pressure fluid supplied by the pipe 41 be air the waste of the same through the port 39 around the valve stem 43 will be to the atmosphere. It will also be readily seen that if this pressure fluid be a liquid such as water, the waste discharge of the same will be to the body of measured liquid within the meter case, but as such waste takes place after the measuring and during the discharge from the case it will not affect in any way the accuracy of the measurement.

For the purpose of registering the amount of condensed fluid passing through the meter I provide any convenient type of counter indicated at 64 which counter is operatively connected by means of the rod 65 to an arm 66 which in turn is shown as attached at 67 to the stem 21 of the main valve whereby the counter is actuated in unison with the movements of said main valve to register the operations of the meter.

In Figs. 3 and 4 I have shown a modified form of operative connection between the float mechanism and the main valve wherein a solenoid is substituted for the diaphragm valve and a snap switch for the actuating valve. In this form of construction the solenoid 68 is connected in known manner to the valve stem 21 whereby to depress the same against the lifting tendency of the spring 69. To periodically energize and de-energize the solenoid under the influence of the float mechanism, I extend the pivot shaft 58 of the float from its bearings in the bracket 70 through the side of the case at 71 and secure thereon a short arm 72 having fixed relation to the float arm 57. The segment 73 is mounted on the pivot shaft 58 and is provided as in the former case with adjustable stops 74, 74 at its two extremes, between which stops the arm 72 plays. A

shifting rod 75 is connected to the segment at 76 and carries at its upper end the yoke 77 having the arms 78 provided with set screws 79 engaging the spring arms 80 which are connected by the links 81 with the plunger 82. The plunger is guided within the boss 83 of the bracket 84. The plunger 81 carries the binding post 85 forming one terminal of an electric circuit which includes the solenoid, while the contact 86, arranged in line with the plunger, forms the other terminal of said circuit. The operation is analogous to that previously described. The spring 69 moves the valve in an upward direction when the contact is broken, and when, in the position illustrated, contact is made between the plunger 82 and the terminal 86, the solenoid is energized and depresses the valve. The actuation of the plunger 82 by means of the float mechanism is effected in identically the same manner as is that of the valve stem 43 in the former construction.

I claim:

1. In a meter, the combination of a measure, a reverse flow main valve arranged to establish communication between the measure and the supply and waste alternatively and in its intermediate position to interrupt communication with both, and a float-operated actuating device to reverse the position of the main valve, the said actuating device having a snap operation, substantially as described.

2. In a meter, the combination of a measure, a reverse flow main valve arranged to establish communication between the measure and the supply and waste alternatively and in its intermediate position to interrupt communication with both, an actuating device to reverse the position of the main valve, and a float mechanism mounted within the measure to operate the actuating device, the said actuating device having a snap operation, substantially as described.

3. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation and in its intermediate position to interrupt communication with both, an actuating device, a float arranged within the measure and controlled by the amount of fluid therein, an operative snap connection between the float and the actuating device, and an operative connection between the actuating device and the main valve whereby to operate the latter, substantially as described.

4. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation and in its intermediate position to interrupt communication with both, a float controlled by the volume of fluid in the measure, and an operative snap-spring connection between the

float and the main valve whereby to operate the latter, substantially as described.

5. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation and in its intermediate position to interrupt communication with both, a float controlled snap operated actuating valve controlled by the volume of fluid in the measure and an operative connection between the actuating valve and the main valve whereby to operate the latter, substantially as described.

6. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation and in its intermediate position to interrupt communication with both, an actuating device, a float arranged within the measure and controlled by the volume of fluid therein, an operative snap connection between the float and the actuating device, and an operative connection between the actuating device and the main valve whereby to operate the latter, substantially as described.

7. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, a pressure controlled operating valve connected to the main valve, a pressure fluid supply therefor, an actuating valve interposed in the pressure fluid supply, a float mechanism mounted within the measure and controlled by the volume of the fluid therein, and a connection between the float mechanism and the actuating valve whereby to control the supply of pressure fluid to the operating valve whereby to operate the main valve, substantially as described.

8. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, said main valve comprising a casing inclosing a valve chamber provided with an inlet port and a waste port and a port leading to and from the measure, a valve stem having stops thereon, valves loosely mounted on the stem between the stops, means mounted between the valves and yieldingly pressing them apart whereby in a medial position both the inlet and outlet ports will be closed and in extreme positions one will be open and the other will be closed, a float controlled by the volume of fluid in the measure, and an operative connection between the float and the main valve whereby to operate the latter, substantially as described.

9. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, said main valve comprising a casing inclosing a valve

chamber provided with an inlet port and a waste port and a port leading to and from the measure, a valve stem having stops thereon at a distance apart corresponding substantially to the distance between the inlet and waste ports, valves loosely mounted on the stem between the stops, a spring mounted on the stem between the valves and yieldingly pressing them apart whereby in a medial position both the inlet and outlet ports will be closed and in extreme positions one will be open and the other closed, an actuating valve, a float mounted within the measure and controlled by the fluid therein, an operative connection between the float and the actuating valve, and an operative connection between the actuating valve and the main valve whereby to operate the latter, substantially as described.

10. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, said main valve comprising a casing inclosing a valve chamber provided with an inlet port and a waste port and a port leading to and from the measure, a valve stem having stops thereon at a distance apart corresponding substantially to the distance between the inlet and waste ports, valves loosely mounted on the stem between the stops, a spring mounted on the stem between the valves and yieldingly pressing them apart whereby in a medial position both the inlet and outlet ports will be closed and in extreme positions one will be open and the other closed, a fluid pressure controlled operating valve connected to the stem of the main valve, a pressure fluid supply to the operating valve, an actuating valve interposed in the pressure fluid supply, float mechanism operated by the variations of volume of fluid within the measure, and an operative connection between the float mechanism and the actuating valve whereby to control the supply of pressure fluid to the operating valve to operate the main valve, substantially as described.

11. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, an operating valve comprising a casing, a diaphragm therein, an operative connection between one side of the diaphragm and the main valve, yielding means bearing upon the diaphragm to press the same in one direction, a pressure fluid supply on the opposite face of the diaphragm, an actuating valve interposed in the pressure fluid supply, float mechanism controlled by the volume of fluid in the measure, and an operative connection between the float mechanism and the actuating valve whereby to control the supply of pressure fluid to the operating valve to operate the main valve, substantially as described.

12. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, a fluid pressure controlled operating valve, an operative connection between the operating valve and main valve, a pressure fluid supply to the operating valve, an actuating valve interposed in the pressure fluid supply, said actuating valve comprising a valve casing having a port leading to and from the operating valve and also an inlet port and a waste port and a valve arranged to seat alternatively upon the inlet and waste ports, float mechanism controlled by the volume of fluid in the measure, and an operative connection between the float mechanism and the actuating valve, substantially as described.

13. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, a fluid pressure controlled operating valve, an operative connection between the operating valve and main valve, a pressure fluid supply to the operating valve, an actuating valve interposed in the pressure fluid supply, said actuating valve comprising a valve casing inclosing a valve chamber having an inlet port and a waste port and also a port leading to and from the operating valve, a valve arranged to seat alternatively upon the inlet and waste ports, float mechanism controlled by the volume of the fluid within the measure, and means to establish communication between the float mechanism and the actuating valve at the extremes of the float movement whereby to snap the actuating valve from one position to another to actuate the operating valve to operate the main valve, substantially as described.

14. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, a fluid pressure controlled operating valve, an operative connection between the operating valve and main valve, a pressure fluid supply to the operating valve, an actuating valve interposed in the pressure fluid supply, said actuating valve comprising a casing inclosing a valve chamber having an inlet port and a waste port and also a port leading to and from the operating valve and a valve arranged to seat alternatively upon the inlet and waste ports, a U-spring having arms arranged on opposite sides of the valve stem, links interposed between the stem and spring arms, a pivoted yoke, a connection between the yoke and spring, operating means controlled by fluctuations of the volume of fluid in the measure, and a connection between said operating means

and the yoke whereby to shift the latter and with it the spring to snap the actuating valve from one position to the other to control the supply of pressure fluid to the operating valve to operate the main valve, substantially as described.

15. In a meter, the combination of a measure, a main valve arranged to establish communication between the measure and the supply and waste in alternation, a fluid pressure controlled operating valve, an operative connection between the operating valve and main valve, a pressure fluid supply to the operating valve, an actuating valve interposed in the pressure fluid supply, said actuating valve comprising a casing inclosing a valve chamber having an inlet port and a waste port and also a port leading to and from the operating valve and a valve arranged to seat alternatively upon the inlet and waste ports, a U-spring having inwardly tending arms arranged on opposite sides of the valve stem, links interposed between the stem and spring arms to hold the latter apart, a cross head carrying the spring, means to adjust the inward pressure of the spring arms, a pivotally mounted segment yoke provided at its two extremes with adjustable stops, a shift rod attached at one end to the cross head and at the other end to the yoke, a float controlled by the fluctuations of the volume of fluid in the measure, the float rod playing within the yoke between the stops whereby to shift the spring arms at the two extremes of the float movement to snap the actuating valve from one position to the other to control the supply of pressure fluid to the operating valve to operate the main valve, substantially as described.

16. The combination with a fluid supply pipe, of a valve interposed therein and comprising a casing inclosing a valve chamber having two ports, a valve arranged to seat alternatively upon the two ports, a U-spring having inwardly tending arms arranged on opposite sides of the valve stem, links interposed between the stem and spring arms and holding the latter apart, a cross head carrying the spring, and means to shift the position of the spring longitudinally of the valve stem whereby to shift the valve by snapping action when the links are brought past the dead center, substantially as described.

17. In a meter, the combination of a measure, a main valve arranged to establish a communication between the measure and the supply and waste in alternation, said main valve comprising a casing inclosing a valve chamber provided with an inlet port and a waste port and a port leading to and from the measure, a valve stem having stops thereon at a distance apart corresponding substantially to the distance between

the inlet and waste ports, valves loosely mounted on the stem between the stops, a spring mounted on the stem between the valves and yieldingly pressing them apart whereby in a medial position both the inlet and outlet ports will be closed and in extreme positions one will be open and the other closed, an operating valve comprising a casing, a diaphragm therein, a connection between one side of the diaphragm and the main valve stem, a spring bearing upon the diaphragm to press the same in one direction, a pressure fluid supply to the space on the opposite side of the diaphragm to press the same in the opposite direction whereby to operate the main valve, an actuating valve interposed in the pressure fluid supply and comprising a valve casing inclosing a chamber having an inlet port and a waste port and also a port leading to and from the diaphragm space in the operating valve, a valve arranged to seat alternatively upon the inlet and waste ports, float mechanism controlled by the volume of the fluid within the measure, and means to establish a connection between the float mechanism and the actuating valve at the two extremes of the float movement to instantaneously shift the position of the motor valve to control the supply of pressure fluid to the operating valve to operate the main valve, substantially as described.

18. In a meter, the combination of a measure, a main valve arranged to establish a communication between the measure and the supply and waste in alternation, said main valve comprising a casing inclosing a valve chamber provided with an inlet port and a waste port and a port leading to and from the measure, a valve stem having stops thereon at a distance apart corresponding substantially to the distance between the inlet and waste ports, valves loosely mounted on the stem between the stops, a spring mounted on the stem between the valves and yieldingly pressing them apart whereby in a medial position both the inlet and outlet ports will be closed and in extreme positions one will be open and the other closed, an operating valve comprising a casing, a diaphragm therein, a connection between one

side of the diaphragm and the main valve stem, a spring bearing upon the diaphragm to press the same in one direction, a pressure fluid supply to the space on the opposite side of the diaphragm to press the same in the opposite direction whereby to operate the main valve, an actuating valve interposed in the pressure fluid supply and comprising a valve casing inclosing a chamber having an inlet port and a waste port and also a port leading to and from the diaphragm space in the operating valve and a valve arranged to seat alternatively upon the inlet and waste ports, a U-spring having inwardly tending arms arranged on opposite sides of the valve stem, links interposed between the stem and spring arms substantially in alinement one with the other and holding the arms apart, a cross head carrying the spring, means to adjust the inward pressure of the spring arms, a pivotally mounted segment yoke provided at its two extremes with adjustable stops, a shift rod attached at one end to the cross head and at the other to the yoke, a float pivotally mounted within the measure and moving with the level of the fluid therein, the float rod playing within the yoke between the stops and adapted to impinge against one of said stops at the extremes of its movement whereby to shift the spring arms relative to the valve and to snap the valve to another position upon passing the dead center, thus to control the pressure fluid supply to the operating valve to operate the main valve, substantially as described.

19. In a meter, the combination of a measure, a supply pipe, a waste pipe, and a reverse flow main valve controlling the inlet from the supply and the outlet to the waste, in alternation and arranged in its intermediate position to maintain both closed and means controlled by the volume of fluid in the measure to operate the said valves in well defined succession, substantially as described.

JOHN C. HORNUNG.

Witnesses:

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It is hereby certified that in Letters Patent No. 1,114,360, granted October 20, 1914, upon the application of John C. Hornung, of Chicago, Illinois, for an improvement in "Condensation-Meters," errors appear in the printed specification requiring correction as follows: Page 6, line 92, after the word "waste" strike out the comma; same page, line 94, after the word "closed" insert a comma; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of December, A. D., 1914.

[SEAL.]

R. F. WHITEHEAD,
Acting Commissioner of Patents.