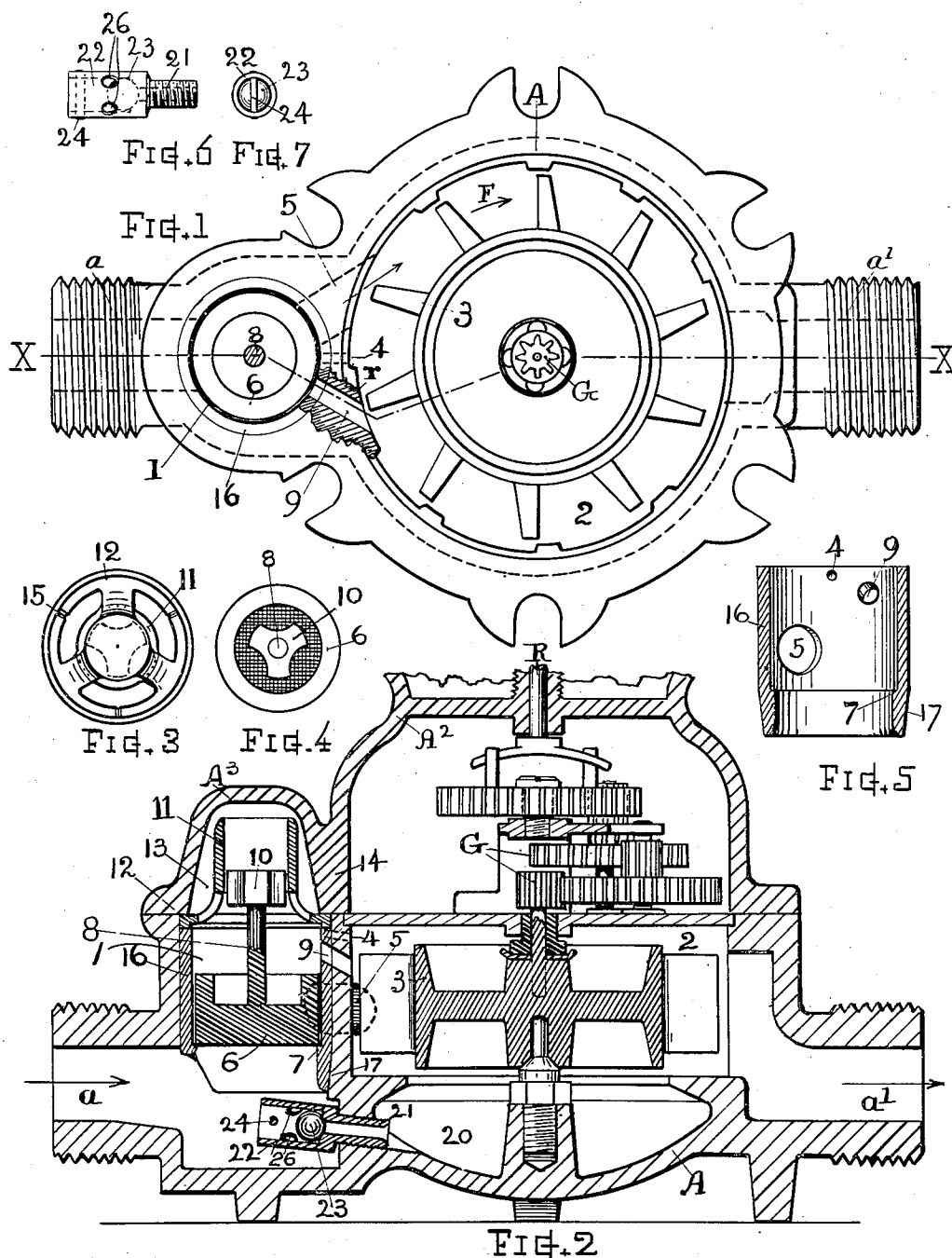


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WATER METER.
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WATER-METER.

1,057,854.

Specification of Letter's Patent.

Patented Apr. 1, 1913.

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To all whom it may concern:

Be it known that I, WILLIAM H. LARRABEE, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Water-Meters, of which the following is a specification, reference being made therein to the accompanying drawings.

10 My present invention relates to certain improvements more especially applicable to that type of water-meters known under the trade name as "The Columbia,"—or of the general character described in Letters Patent No. 521,493;—and in which the flow of water is measured by a single piston-wheel of the vaned or wing variety, revolving horizontally within its chamber, and receiving impulse from a stream of water tangentially directed thereon through a single port-hole located in fixed relation to the vanes or wings of the wheel; the velocity of the piston-wheel being controlled under varying rates of flow and pressures, and registration made uniform; by means of an automatic vertically acting valve located in a separate valve-chamber anterior to the meter chamber; which latter usually has a series of upright ribs placed at intervals around the interior of the chamber. It has been found in practice that under some conditions, and in some situations, this type of meter is subject to what is technically known as "creeping"; that is, registering when no water is being drawn. This may occur where there is pulsation in the pipes, as where the water is pumped directly into the pipes or mains, and quick-acting pumps are used; the throbs thereby induced causing a gradual movement of the piston wheel.

15 In all meters in which the piston will not revolve or move on reversing the stream of water, there is a tendency, to a slight forward movement of the piston; this continual creeping being transmitted to the register by the regular gearing, causes the meter to over-register. At times this over-registration may be excessive. Trouble of this sort is not experienced on water supplies where the gravity system is used, as the flow in the pipes is steady; but where the water supply is furnished by pumping direct into the pipes, there is an intermittent, slightly forward and backward movement, or pulsation of the water within the piping system, corre-

sponding with the forward and backward strokes of the pump-pistons; the pulsations varying in intensity in proportion to the distance from the pumping station and potential of the pumping effect. Thus, when the pumping piston moves forward it imparts a slightly forward movement to the water throughout the entire piping system, including the water in the meter; this slight forward movement of the water causes a slightly forward movement of the meter-wheel; then when the pump-piston moves backward there is a backward movement of water equal in intensity to the forward movement; and with meters that can be run backward there is a backward movement of the piston-wheel equal to the forward movement, so that the two forces are equal and the meter-wheel remains stationary; but with meters of the type named, in which the piston-wheel cannot be run backward by the stream of water, every forward stroke of the pump gives a slight forward movement of the meter-wheel without a corresponding backward movement on the back stroke of the pump; consequently the forward creeping ensues. This is very objectionable, and many attempts have been made to remedy the trouble, but so far as I am aware, nothing has heretofore been successful. Another objection met with in this class of meters, as heretofore constructed, is the occasional retention of the valve at elevated position, due to various causes, such as unbalanced pressures, corrosion and clogging by muddy water, and the cocking or canting of the valve. The valve surface is usually a plain cylinder of a length about one half its diameter, and made of a predetermined weight; the length and weight being arbitrary for controlling the registration. The valve requires a comparatively close moving fit for guiding within its chamber, and the top of the chamber being a flat plate, a continuation of the main cover at the division level; the relief-hole being drilled a short distance below the flat top-plate, about three thirty seconds of an inch from the under surface thereof. When the valve is at extreme elevation, as when the full sized stream is passing through the meter, the valve closes this relief hole, leaving only a thin mass of water between the valve and flat top-plate. With this prior construction it was found that with some muddy water the valve would

stick, or remain up. Especially was this the case in water that caused considerable corrosion. It also occurred that with an empty meter, as when first setting up the meter, if water was turned on suddenly, and before it had time to fill the chamber above the valve, the valve would be forced up past the pressure-relief hole and against the cover; and there being no water pressure then above the valve, and no way of getting it there, the valve would consequently stay up. This tendency of the valve to stick up at times, of course for the time being destroyed its function and interfered with proper action.

The objects of my present invention are—

to provide means, in a water-meter of the class named, that will overcome the objections above noted and render the mechanism more efficient and desirable; to prevent the meter from "creeping" or registering when no water is being drawn, in cases where there is pulsation in the pipes, or when pumps are used to pump directly into the mains. Also, to provide a construction of the valving means that will not be likely to become destructively deteriorated by corrosion from the effect of muddy water; and that will be free from cocking, cramping, or sticking of the valve, under the various conditions of use; also, to afford means for the automatic back drainage of the meter-chamber when the main controlling valve is on its seat. I attain these objects by the means illustrated, and explained in the following detailed description; the particular subject matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 represents a partly sectional plan view with the cover section of the case and register driving mechanism removed. Fig. 2 is a central vertical section at line X X; the register being omitted. Fig. 3 is a bottom view of the valve-guiding cylinder. Fig. 4 is a top view of the valve. Fig. 5 is a transverse vertical section of the valve-chamber lining, looking toward the ports, Fig. 6 shows a side view, and Fig. 7 an end view of the escape vent device.

Referring to the drawings, A indicates the casing or body of the meter having the inlet spud a and outlet spud a^1 , and the removable top-section or cover A^2 .

The numeral 1 indicates the valve chamber; 2 the meter-chamber; 3 the rotatable piston or meter-wheel mounted therein in the usual well known manner.

G indicates the usual train of reducing gearing for transmitting motion from the wheel 3 to the register-driving spindle R of the registering mechanism, which register may be of well known construction and is not herein shown.

5 indicates the delivery port or mouth through which the fluid or water is deliv-

ered from the valve-chamber into the meter-chamber and against the vanes of the meter-wheel 3 for rotating the same, and 4 the relief hole admitting water from the chamber 2 into the space above the valve, or vice versa. The forward movement is in the direction indicated by arrow F on Fig. 1. The method of directing the flow against the meter-wheel is substantially the same as heretofore practised.

The controlling valve 6, which is an automatically acting gravity valve arranged to move up and down within the chamber 1, in accordance with my present improvement is arranged to drop to a position where its lower edge is somewhat below the bottom of the port 5, and to rest upon a seat ring, or shoulder 7, when there is no flow in the meter; thus completely closing the port 5. The seat ring or shoulder, in the meter shown, is placed about one eighth of an inch, more or less, below the bottom of the delivery port, thereby fully closing said port instead of leaving a small portion thereof open, as in former practice. Said valve 6 I provide with a central upwardly projecting rod or wire 8 having at its upper end suitable guiding means to prevent the valve from cocking or cramping; while the valve is permitted a looseness of fit to prevent it from sticking. Preferably I extend the guide-rod or wire, up from the top of the valve for a distance equal to about one and one-half times the length of the valve; and upon the upper end of the guide-wire I fasten a three-lobed hard-rubber guide-piece 10 of a diameter somewhat less than half of the diameter of the valve, and of a suitable length for working freely in a guide-cylinder 11 in axial alinement with the valve-chamber. This guide being made of hard-rubber is not subject to corrosion; and being three-lobed and comparatively small, presents very little contact surface; and the valve fitting freely, likelihood of its sticking is practically obviated.

The guide-cylinder 11 is provided with spider arms and a base ring 12 that fits in a recess at the upper part of the valve-chamber, where it is retained by the cover A^2 when in place. The bottoms of the recess and base ring are slightly above the top of the pressure-relief hole 4, thus allowing the valve to have its full length of travel. The guide-cylinder 11 extends upward a suitable distance for the travel of the hard-rubber guide. A suitable chamber 13 is formed over the valve-chamber 1 within a dome-like projection A^3 on the main cover A^2 of the casing. This chamber is separated from the main chamber of the cover by a partition 14 and forms, in addition to its service as a chamber for the guide-cylinder, a compression chamber for the relief of the valve. The ring-base of the guide-

cylinder is best provided with small grooves 15, so that when the valve is elevated it will not entirely cut off passage to the chamber 13.

5 By the means described I preserve the standard short length of the valve necessary for the proper regulation of the flow through the port 5, and at the same time attain for the guiding of the valve an increased length of at least two and a half 10 times the travel; hence the valve can be made much looser in its chamber, and this construction prevents the valve from cocking or sticking, thus enabling the valve to perform its proper function, of regulating 15 the velocity of flow, with greater efficiency and accuracy.

When the valve is raised to its extreme height, as when a full sized stream is passing 20 through the meter, the top part of the valve 6 just closes the hole 4, leaving a considerable body of water above the valve in the chamber 13, which acts to help force the valve back when the draft of water is shut 25 off. This water compression chamber is important, as it prevents an excess of water pressure on the under side of the valve which would tend to keep it up. Should the valve be forced up suddenly to the top of the 30 valve-chamber, as before mentioned, it will not remain there, as the valve would only be forced up to the bottom ring of the guide-cylinder, which is but slightly higher than the top of the pressure-relief hole; and as 35 there is a large compression chamber above, this chamber is sure to fill up in a short time by the leakage around the valve. Small grooves are made on the under side of the guide-cylinder to facilitate this filling; and 40 the pressures on the two sides of the valve then become equal and the valve drops by its own weight. With the old construction the valve would not, and could not, do this when it was forced up, there being no compression 45 chamber to fill up and equalize the pressures.

When the meter is at rest the valve 6 is down on its rest, and the pressures in the measuring-chamber and valve-chamber are practically the same as the inlet pressure. 50 When water is being drawn the pressure is reduced in the measuring-chamber, depending in amount on the size or volume of stream that is being drawn, and by means of the relief hole 4 it is correspondingly 55 reduced at the upper side of the valve. This difference in pressure upon the under and upper side of the valve will cause the valve to rise to an extent corresponding to the amount that pressure is reduced; thus opening the delivery port 5 so that a jet of water 60 therethrough will be directed against the vanes of the piston-wheel, causing it to revolve. This general operation of the valve and piston-wheel is old and well known, and 65 is not my invention, but is here explained

to make clear the manner of working, and the specific character of my present improvements as relating thereto.

As heretofore constructed the combination was such that the valve, when down to its 70 lowest limit, did not quite cover the bottom of the port 5, but necessarily a small opening was left therethrough; and as before stated, the slight forward movement or pulsation of the water, occasioned by the effect of the 75 pumping into mains, would act on the valve and meter-piston, causing the latter to creep forward continuously to an amount varying with the intensity of pulsation. As a means for overcoming the "creeping" tendency, 80 and as an important feature of my invention, I arrange the valve 6 so that its bottom end can drop to about one-eighth of an inch, more or less, below the bottom of the port 5 for completely closing said port. Also, I 85 provide an auxiliary port or hole 9 from the valve-chamber 1 to the meter-chamber 2; said auxiliary port being backwardly inclined, or directed in respect to the rotation of the meter-wheel, tangentially opposite to 90 the direction of the delivery-port 5, as shown on Fig. 1, and downwardly inclined from the upper space of the valve-chamber toward the vanes of the meter-wheel 3, as shown on Fig. 2, the bore of said auxiliary 95 port being of a diameter equal to about one third, more or less, of the diameter of the delivery-port 5. The entrance end of the auxiliary port 9 is positioned about one eighth of an inch, more or less, above the top 100 of the valve 6 when said valve is down; but said port becomes closed by the valve as the latter rises and opens the delivery port 5. One of the ribs r in the meter-chamber is broadened sufficiently to include the mouth 105 of this auxiliary port, so that the jet of water therefrom may not be greatly diffused before it impinges against the vanes of the wheel or piston. By this simple means the piston or meter-wheel is kept from creeping 110 or moving forward, and a fully reliable meter is the result. Its action is as follows: The forward impulse movement of the water, with its excess of pressure, acting on the underside of valve 6, causes it to rise 115 quickly, thereby forcing a small jet of water through the auxiliary port 9 against the piston 3, causing a slight movement backward; the valve continuing its movement upward opens up a small space of the main 120 port 5 when a slight forward movement of water is delivered to the piston-wheel which advances it an amount equal to the amount that it was forced backward by the auxiliary jet, and the two forces are thus balanced. 125 It will be understood that these two movements are impulsive and of very short duration. It might be supposed that if the pressures are equal above and below the valve the two pressures above and below the valve 130

would balance each other, and the valve consequently remain stationary. When the water is supplied by gravity alone such would be the case; but where the water is supplied by pumps this is not so; since the action of the pump-piston in forcing water forward, induces a slight excess of pressure in the pipes and under the valve, while the pressure above the valve is normal. This difference in pressure will consequently raise the valve, as above stated.

In some situations, when the metal of the valve-chamber is of the same composition as the main body, the corrosive action of some waters is such as to cause the walls of the valve-chamber to soften. When this occurs the continual up and down movement of the valve 6 causes this softened metal to wear away in a comparatively short time. After the chamber has become thus badly worn, there being no way of cheaply repairing same, the whole body of the meter has to be thrown away, thereby entailing considerable cost for repairs. As a remedy for this evil I provide an interior non-corroding cylinder or lining member 16, preferably made of hard-rubber, or its equivalent, and inserted tightly within the body casing; the bore for the valve-chamber being formed sufficiently larger than the valve to contain the cylindrical lining member. The cylinder is molded with its interior of the exact shape and size required and with the valve-seat ring or shoulder 7 formed integral therewith; (see Figs. 2 and 5) the ports 4, 5 and 9 being made therein to correspond with the same in the wall of the meter casing. At its lower end the cylinder is formed with a slight taper of about one degree, more or less, that fits a corresponding taper 17 in the metal body which helps hold the rubber lining cylinder in place when it is forced down to proper position. The rubber being non-corrodible the water will have no corroding effect upon it; therefore it is not liable to rapid wear; but should some wear occur, the lining can be easily replaced at a slight expense, doing away with the necessity of a new body. If the meter is to be used for hot or warm water, some one of the so called "die cast" non-corrodible metals may be used for the part 16, instead of hard-rubber.

With the valve 6 arranged to descend below the port 5, the chamber 2 becomes cut off from backward drainage therethrough. I therefore provide, in combination with the meter-chamber, valve-chamber and valve, an automatic backward by-pass means that permits backward flow for the drainage of the meter when the service supply is shut off; but which resists forward flow through said by-pass means when the meter is in action. For this means a tapped hole is formed through the casing wall which sepa-

rates the valve-chamber 1 from the lower portion 20 of the measuring chamber 2, below the piston-wheel 3, and in said hole I insert a tubular element, preferably consisting of a hollow-headed tubular screw containing a ball-valve. (See Figs. 2, 6 and 7.) Said element is provided with a threaded hollow shank 21 of proper length to screw into the hole in the wall, and a cage-like hollow head 22 of larger diameter provided with an interior valve seat, and containing a loose ball or valve 23 freely movable within the head, but prevented from escaping therefrom by a small pin or bar 24 fixed across the interior near its mouth. Holes 26 are formed in the sides of the head for passage of water when the ball-valve is open. This tubular device is preferably set in a slightly inclined position, so that the ball 23 will normally roll down against its seat. When water is turned on the meter the pressure keeps the ball against its seat and prevents passage of water through the tube into the measuring chamber; but when the water supply is shut off the back pressure forces the ball away from its seat and allows the water to drain out from the meter chamber through the waste cock, while the main valve 6 remains closed. This hollow-headed tubular screw is arranged so it can be screwed into place by means of a rod or spindle tool introduced through the spud *a*, the end of the tool fitting in the bore of the screw-head and having a cross-wise notch or recess for embracing the cross-bar 24 to give a turning grip thereon.

What I claim and desire to secure by Letters Patent, is—

1. In a meter mechanism of the class described, in combination, a meter-casing provided with a valve-chamber, having an inlet passage thereinto, having a wheel-chamber with the exit passage therefrom, and having also a definite mouth or port leading from the valve-chamber into said wheel-chamber, and disposed for directing a fluid current tangentially upon, and for forwardly rotating the measuring-wheel or piston; said casing being also provided with a backwardly and downwardly inclined auxiliary port through the dividing wall of said chambers, for tangentially delivering a backward impulse jet against the wheel, a vertically moving valve within the valve chamber controlling both said ports, and a wing-vaned measuring-wheel or piston rotatably mounted in said wheel-chamber.

2. In a meter mechanism of the type described, in combination with a measuring wheel, and a gravity-controlled valve, a meter-casing inclosing a wheel-chamber and a valve-chamber with an intervening wall having therethrough a forwardly inclined main port for directing flow for driving

said measuring wheel, a relief passage into the chamber above the valve, and also provided with a backwardly directed auxiliary delivery port from the valve-chamber to the measuring-wheel chamber, for the purpose set forth.

3. In a meter mechanism of the type specified, the meter-casing including the measuring-wheel-chamber and valve-chamber, and provided with inlet and outlet passages respectively communicating with said chambers, and with the forwardly inclined delivery port from the valve-chamber to the wheel-chamber, the measuring wheel revoluble in said chamber, and the control-valve freely movable within said valve-chamber automatically actuated by current and gravity to open and close said delivery port, said meter-casing being also provided with a lesser backwardly inclined auxiliary port from the space above the closed valve into the wheel-chamber, for ejection of fluid against said wheel by impulsive action occurring in the service, said auxiliary port adapted to be closed by the valve when the main delivery port is opened, and vice versa.

4. In a water-meter of the class described, the meter-casing provided with the wheel-chamber, the valve-chamber, and the delivery-port from said valve-chamber into the wheel-chamber; of the cylindrical valve, and the annular valve-supporting ledge or ring within the valve-chamber, said ledge being positioned a short distance below the bottom of said delivery-port, the bottom of said valve seating upon said ring when the valve is at its lowest position, thereby effecting full closure of the delivery-port.

5. In a water-meter of the type described, the combination with the vertically acting free valve, and the valve-chamber casing having the delivery port therefrom; of a valve-supporting ring or shoulder located within the valve-chamber adjacently below the bottom of said port and forming an annular rest for said valve when at its low position with the valve completely closing said port.

6. In a water-meter of the class described, comprising the meter-casing provided with the wheel-chamber, the valve-chamber, and the delivery-port from said valve-chamber into said wheel-chamber; of a gravity valve vertically movable within the valve-chamber, said valve being provided with a projecting guide-rod or wire extending above the top of the valve, in combination with guiding means for the top of said rod within the meter cover, for preventing lateral tilt of the valve, said valve being free for vertical self-adjustment within the valve-chamber in accord with the volume of draft and weight of said valve.

7. In a water-meter of the class described, in combination, with the meter-body having

the meter-wheel chamber, and the anterior valve-chamber having the delivery port, and the automatic vertically movable controlling valve therefor; the meter-casing cover provided with an upwardly projecting hollow member forming a compression-chamber over and above the limit of movement of said automatic valve, and separate from the main meter-chamber, for the purpose specified.

8. In a water-meter of the character described, comprising a meter-casing having a wheel-chamber, and an anterior valve-chamber with a port therefrom into said wheel-chamber, the rotatable meter-wheel, and vertically acting valve; of the guide-cylinder arranged in a supplemental chamber above the valve-chamber, said cylinder having a foot or seating ring rigidly supporting the same, and guiding means connected with the valve and movable within said guide-cylinder, for the purpose set forth.

9. In a water-meter of the class described; the combination with the meter-casing including the valve-chamber, and the cover of said meter-casing, provided with a chamber over said valve-chamber; of the automatic controlling valve, vertically movable within said valve-chamber, said valve being provided with a guide-rod furnished with a guiding head having a plurality of lobes, and a guide-cylinder within which said plurally lobed head is confined, but freely slidable, said cylinder being disposed within a chamber in the cover and supported at the meeting joint of the cover and body of the casing.

10. In a water-meter of the class specified, comprising the casing or body having the measuring-chamber and valve-chamber therein, and delivery ports from one chamber to the other; the combination with the meter-controlling valve and its casing, of a hard-rubber lining cylinder within the valve-chamber, said lining cylinder having ports therethrough to match the ports of the casing, and provided with an integrally formed valve-support-ring or shoulder on its interior surface.

11. In a water-meter of the class specified, having the rotatable measuring wheel, a port that directs the fluid current against said wheel, an automatically acting gravity-valve for regulating the current at said port and the casing cover having a chamber over said valve; the combination, of a removable non-corrodible die-cast lining member fitting within the valve-chamber, the valve being provided with an upwardly projecting rod having a plurally lobed guiding-head thereon, and a co-axially disposed guiding-cylinder surrounding said head and positioned within the chamber in the cover of the meter-casing, said cylinder having an open base or ring that rests upon the top of

said lining member and is confined by said casing cover:

12. In a meter mechanism of the class described, the combination with the meter-casing having the measuring-wheel chamber, the delivery-port thereinto, and the valve-chamber provided with the valve-support below said port, the measuring-wheel or piston, and the gravity-valve adapted for closing said port; of a casing partition having therethrough a by-pass way communicating between the measuring-wheel chamber and valve-chamber below the valve, and means for controlling said by-pass to prevent forward flow while permitting backward flow therethrough, for the purpose set forth.

13. The combination with a meter-casing provided with inlet and outlet spuds, and having a measuring-chamber and a valve-

chamber therein with a delivery-port, a meter-wheel in said measuring-chamber, a gravity-valve within said valve-chamber, and a supporting ring below the bottom of the port, upon which said valve rests when idle; of a hollow-headed tubular screw containing a ball-valve therein, said tubular screw being arranged through the wall between the lower part of the valve-chamber and the lower portion of the measuring-chamber below the meter-wheel, and accessible through the inlet spud.

Witness my hand this 2nd day of April 1912.

WILLIAM H. LARRABEE.

Witnesses:

CHAS. H. BURLEIGH,
C. S. PUTNAM.