

(No Model.)

2 Sheets—Sheet 1.

J. R. NORFOLK.

PISTON METER.

No. 384,065.

Patented June 5, 1888.

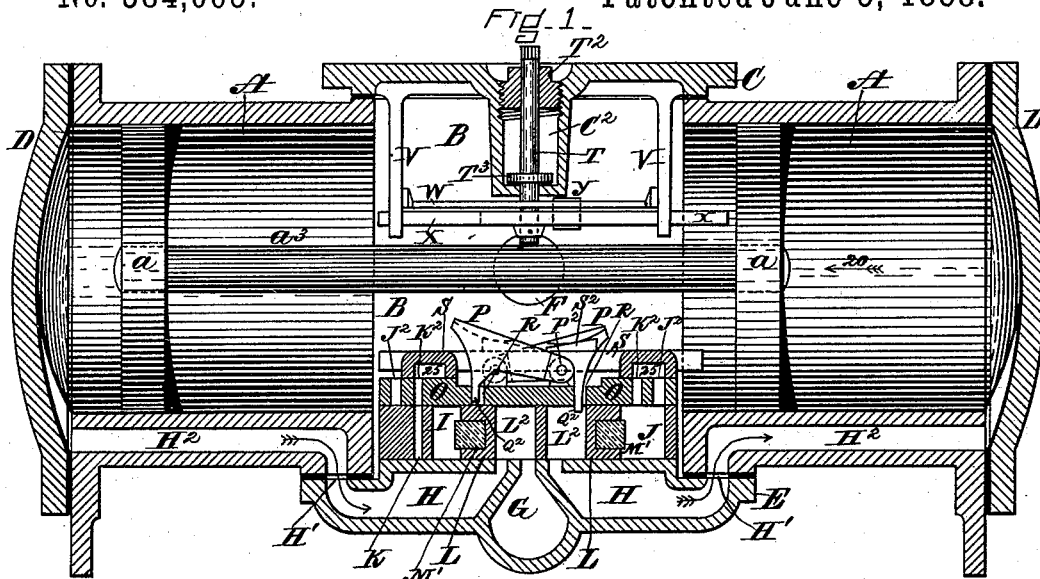


FIG. 2.

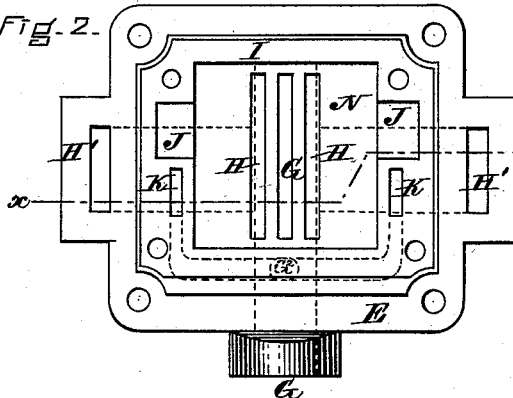


FIG. 4.

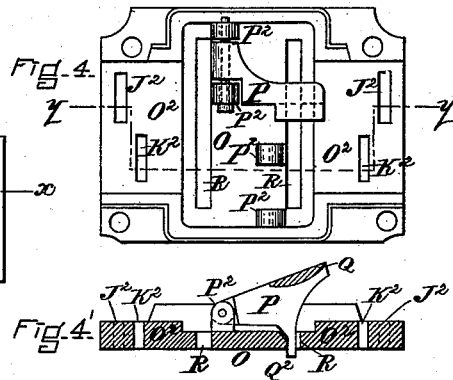


FIG. 3.

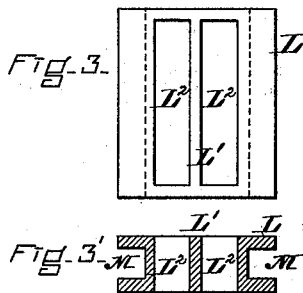


FIG. 6.

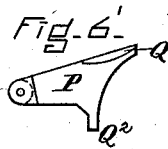
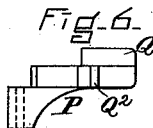


FIG. 5.

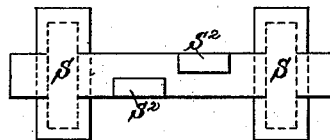
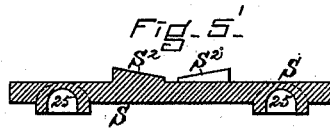


FIG. 5'.



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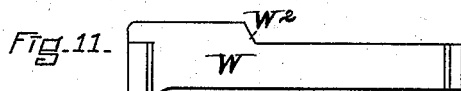
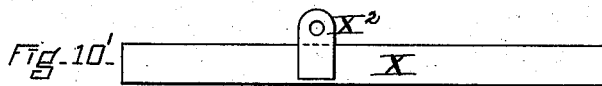
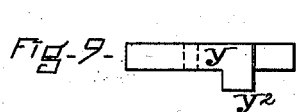
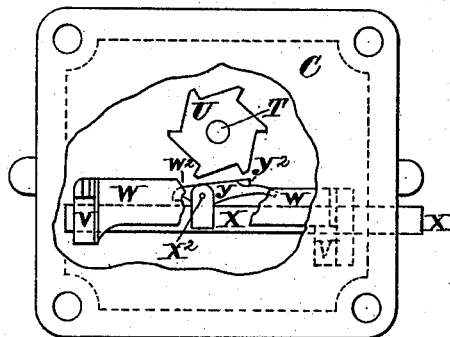
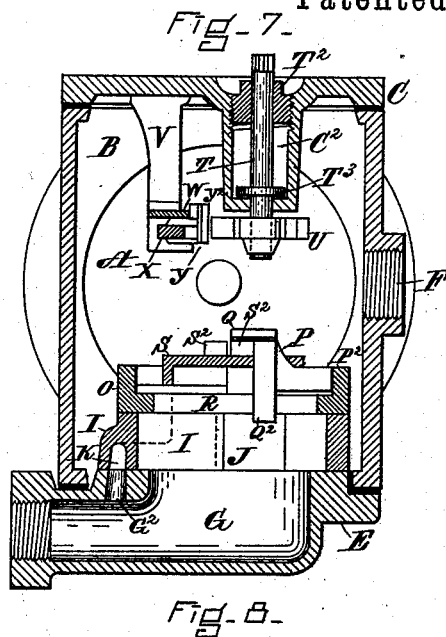
2 Sheets—Sheet 2.

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WITNESSES.

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UNITED STATES PATENT OFFICE.

JOHN R. NORFOLK, OF BOSTON, MASSACHUSETTS.

PISTON METER.

SPECIFICATION forming part of Letters Patent No. 384,065, dated June 5, 1888.

Application filed March 8, 1888. Serial No. 266,610. (No model.)

To all whom it may concern:

Be it known that I, JOHN R. NORFOLK, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Fluid-Meters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a longitudinal sectional elevation of a fluid-meter constructed in accordance with my invention, the direction of the section being indicated by the lines *xx* and *yy* of Figs. 2 and 4. Fig. 2 is a plan view of the bottom cover of the valve chamber, showing the valve-case, the main-valve seat, and the ports to the cylinders and main valve, and the outlet from the valve-chamber. Fig. 3 is a plan view, and Fig. 3' is a transverse vertical section, of the main valve. Fig. 4 is a plan view, and Fig. 4' is a vertical section, of the cover of the main-valve case, the supplemental-valve seats, and one latch, showing the bearings for the latches, the ports or openings from the valve-chamber to the main valve, and from the main valve to the outlet, and the ports from the valve-chamber to the cylinders. Fig. 5 is a plan view, and Fig. 5' a longitudinal vertical section, of the supplemental valve. Fig. 6 is a plan of the under side, and Fig. 6' an elevation, of one of the latches. Fig. 7 is a transverse vertical section through the center of the valve chamber and the main-valve case, the valve-cover, supplemental valve, and one latch, the mechanism for actuating the registering device, and the outlet-port. Fig. 8 is a plan view of the top or cover of the valve-chamber, partially broken away to show the position in the valve-chamber of the mechanism for actuating the registering device. Fig. 9 is a plan, and Fig. 9' an elevation, enlarged, of the finger which operates the ratchet-wheel on the spindle which actuates the registering device. Fig. 10 is a plan, and Fig. 10' a side elevation, enlarged, of the finger-bar which carries the finger shown in Fig. 9. Fig. 11 is a plan, and Fig. 11' an elevation, enlarged, of the fixed cam which operates the finger by which the ratchet-wheel is actuated.

My invention relates to certain improve-

ments on that class of meters of the positive displacement type, known as "single-piston meters," with a reciprocating movement, and in which the main valve is operated by the water from the valve-chamber directly through the movement of a supplemental valve which is moved by the piston, the movement of the main valve in my meter being controlled by latches operated by the supplemental valve, the latter being actuated by the piston.

The novelty of my invention consists in the construction and arrangement of the valves, valve case and ports, and the latches which control the movement of the main valve, and also in a fixed cam and finger-bar for operating the mechanism which actuates the registering device, as hereinafter more particularly set forth.

The meter herein described, and illustrated in the said drawings, consists of two cylinders, A A, having a valve-chamber, B, between them, in which is placed the valve mechanism and the mechanism for actuating the registering device, the cylinders being each provided at the outer end with a cover, D, and on the under side with a port or water-way, H², the valve-chamber and cylinders being made in a single casting. Within the cylinders A A fits the piston *a*, consisting of two heads connected by a piston-rod, *a*³.

The valve-chamber B is covered by two plates, E C. The bottom plate, E, to which the valve mechanism is attached, and in which are formed the ports or passages H H, connecting with the passages or water-ways H² in the cylinders, and the outlet-port G, I term the "valve-plate." The top plate, C, I term the "cover," and to this cover is attached the mechanism for actuating the registering device. This mechanism consists of a packing-chamber, C², cast integral with the plate C and having a packing-nut, T², screwed into its top, and a spindle, T, which passes through this chamber from the inside to the outside, the outer end of this spindle being intended to be connected with the registering device, (not shown,) which may be of any suitable or well-known construction. The spindle T is enlarged near the lower end, forming a collar, T³, which fits into and rests on the bottom of the chamber C², and to the inner end of this

spindle is secured a ratchet-wheel, U, Figs. 7 and 8, having teeth on its edge.

V V are two hangers secured to and depending from the cover C. Through the lower ends of these hangers slides the finger-bar X, to which is attached a finger, Y, Figs. 7 and 8, which operates the ratchet-wheel U, said finger having a projection, Y², on the upper side of its working end, which engages with the teeth of the ratchet-wheel.

W is a cross-bar, which is firmly attached to the lower ends of the hangers V V above the finger-bar X. The side of this cross-bar nearest the ratchet-wheel is provided with an incline or offset, W², Figs. 8 and 11, at the proper point to move the finger Y as the latter is carried over it by the movement of the bar X, by which construction the finger is caused to engage with and operate the ratchet-wheel at each alternate stroke of the piston.

The valve-case I and the valve-plate E are two separate castings, the valve-case being secured to the plate by means of screws or solder. The valve-case I is provided with two ports, J K, at each end, the ports J J being open to the inside of the case, as shown in Fig. 2. The ports K K are connected together by a passage or water-way (shown dotted in Fig. 2) which opens at G² into the outlet G in the valve-plate, making a continuous opening of the ports K K and outlet-port G, as shown in Fig. 7.

The valve-plate E is firmly bolted to the bottom side of the valve-chamber B. The upper side of the plate E, to which the valve-case I is secured, forms the seat N for the main valve L, and this plate E is provided with ports H, G, H, and G², the ports G and G² forming the outlet-port. The ports H H are continued to the openings H' H' at the ends of the plate E, and are of the proper size and form to fit the ports or water-ways H² H² in the bottom of and extending to the outer ends of the cylinders A.

The case I has a cover, O, of the same length and width as the top of the case to which it is securely bolted, and on the upper side of this cover O, at its opposite ends, are formed the supplemental-valve seats O² O², each seat having two ports, J² K², as seen in Figs. 4 and 4'. When the cover O is bolted to the case I, the ports J² are open with the ports or openings J in the ends of the valve-case, and the ports K² are open with the ports K in the valve-case, which are open to the outlet G. There are two openings or water-ways, R R, between the valve-seats O² O², which allow the water to pass from the valve-chamber B into the valve-case I. On the upper side of the cover O, between the water-ways R R, are formed the bearings P² for the latches P P, to be hereinafter described, one of the latches P being shown in Figs. 4 and 4'.

The supplemental valve S is a single casting, and is provided with two inclines, S² S², on the upper side for operating the latches P, as hereinafter described. At each end of the valve

S, on its under side, is formed a recess, 25, of sufficient length and width to extend over both of the ports J² K² at one end of the cover O, and thus afford communication between them, so that when one of these recesses 25 is centrally over both of these ports at one end of the cover the fluid can pass from one to the other.

Each of the latches P is made substantially as shown in Fig. 6, with a lip or projection, Q, on the innerside of its upper end, of the proper width to cover one of the inclines S² on the supplemental valve when the latch is in place, and a spur or projection, Q², on the under side, of the proper form and length to extend through and below and partially fill the water-way R in the cover O when the latch is down. These latches are journaled in the upper side of the cover O in the bearings P² P², and move freely in a vertical direction.

The valve L is a casting of brass or other suitable material, and is of the proper size and form to fit the valve case I so as to move easily therein. It has two central ports, L² L², open from top to bottom, which are of proper length to correspond with the ports H G H in the valve-seat N of the plate E, and the water-ways R R in the valve-cover O. The valve L has a pocket or groove, M, extending across each end, for holding a rubber stop, M', which serves to regulate or limit the movement of the valve, the width of this stop being varied as desired to adjust or vary the length of the movement of the valve within its case. The ends and the middle bar, L', of the valve L must be of the proper width and distance apart to allow full opening or communication through the water-way R in the cover O, and the port L² in the valve L with port H in the valve-seat N when the valve is at the end of its movement. The middle bar, L', extends over the entire length of the outlet-port G in the valve-seat N when the valve L is in the center of its movement. When the valve is in this position, there is a small opening on each side of the bar L' into the port G in the valve-seat N of plate E, and an opening of about one-sixteenth of the area of each of the water-ways R R in the cover O into the ports L² L² in the valve L, thus allowing a small passage for the water from the chamber B through the water-ways R R in the cover O, and through ports L² L² in the valve L to the outlet-port G. The advantages secured by this mode of construction of the valve-case and valve and the arrangement of the ports are, that there is no pulsation or water-hammer, as the pressure is equalized on each end of the piston when its movement is being reversed, and that the parts are durable, simple, and inexpensive, and operate positively and correctly under varying pressures with a full opening or with a very small stream.

The operation of the meter may thus be described: Referring to the drawings, the piston *a* is shown near the end of its stroke and moving in the direction of the arrow 20, the finger-bar X, the supplemental valve S, the latches

P, and the main valve L being at rest in the position shown in Fig. 1. The fluid passes through the inlet F into the valve-chamber B, and thence passes through the ports and passages before described to and from the cylinders A to the outlet G. The supplemental valve S is moved by one of the piston-heads coming into contact therewith when the said piston-head has nearly completed the full length of its stroke. In the position shown in Fig. 1 the piston-head on the right-hand side has not reached the valve S. The port J² on the left-hand end of the valve seat O² is open with the chamber B and also with the inside of the valve-case I, through the port J, which lies under the port J², and the port J² on the right-hand end is closed to the chamber B and open through the recess 25 in the end of the supplemental valve S and the port K² with the port K into the outlet G. This allows the water to pass from the chamber B to the left-hand end of the main valve L, and from the right-hand end of this valve into the outlet, thereby causing a difference of pressure on the ends of the main valve, which difference of pressure has already moved and holds the valve L in the position shown in Fig. 1 until the supplemental valve S is forced to the other end of the valve seat by the contact therewith of the piston, which will open the port J² on the right hand and close port J² on the left hand to the chamber B, and cause the valve L to move to the other end of the valve-case, thereby changing the direction of the current of fluid and causing it to enter the opposite cylinder and reverse the movement of the piston. This operation is repeated at each reciprocation of the piston. When the main valve is in the position shown in Fig. 1, the right-hand port L² in the valve is open, with the water-way R in the cover O on the right-hand side and the right-hand port H in the valve-seat N, allowing the water to pass from the chamber B through the water-way R, the port L², and the port H into the water-way H² to the right-hand cylinder, when it will move the piston if the outlet is open. The left-hand port L² of the valve L is closed to the water-way R in the cover O, and open to the port H in the valve-seat and the outlet-port G, allowing the water to pass from the left-hand cylinder through the water-way H² and port H into the outlet G. When the valves are in the position shown, the incline S² on the top of the supplemental valve S is moved away from the lip Q on the latch P on the right-hand side, and the latch is lowered, causing the spur Q² to extend below the upper surface of the main valve into the port L², as seen in Fig. 1. The other incline, S², is moved under the lip Q of the left-hand latch, and has raised its spur Q² out of the port L² and above the top of the valve L. When the supplemental valve is being moved by the piston, and has closed port J² on the left hand and commenced to open port J² on the right hand, the main valve will move toward the other end of the valve-case until it

has covered two-thirds of the right-hand water-way R in the cover O, when it is stopped by the spur Q², and held until the supplemental valve has fully opened the port J² on the right hand. At this point the incline S² will raise the right-hand latch and free the main valve, which quickly finishes its movement, by reason of the full pressure of the water being allowed to act on its right-hand side, and as the valve S completes its movement it allows the other latch to drop into the left-hand port L² and lock the main valve on that side, this movement being repeated at each reciprocation of the piston, the object of the latches being to lock the main valve after the latter has moved a portion of its stroke, and hold it in that position until both the piston and the supplemental valve have moved to their full extent, when the right-hand port J², being fully open, and the latch raised to release the main valve, the water will act with its full force upon said main valve, causing it to be instantly thrown over to the opposite side to reverse the direction of the current of fluid as required to cause the piston to move in the opposite direction.

In Fig. 8 of the drawings, which represents the mechanism for actuating the registering device, the finger-bar X is shown as having made the full movement to the right, the finger Y, which is pivoted to the finger-bar at X², being disengaged from the ratchet-wheel U and from the offset or fixed cam W² on the cross-bar W. At the end of the cross-bar, to the right of the cam W², there is sufficient space between the ratchet-wheel and the side of the cross-bar to allow the finger to pass freely between them. The finger will occupy this space when it is being moved to the left until the portion Y² of the finger Y is opposite to the point of the first tooth on the left-hand side of the ratchet-wheel. At this point the projection Y² on the finger will engage with the fixed cam W², and as the movement to the left is continued the cam will force the portion Y² of the finger out of its former position into line to engage the tooth of the ratchet-wheel on the return movement. The return of the finger-bar to the right will cause the finger to move the ratchet-wheel around a distance equal to that between two of its teeth. Here the finger will leave the tooth and will be in the position first described.

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

1. In a fluid-meter, the combination, with the cylinders A A, reciprocating piston a, and the valve-chamber B, of the main valve L, operated by the direct pressure of the fluid thereon, the supplemental valve S, actuated by the piston, and the latches P P, operated by the said supplemental valve and adapted to control the movement of the main valve, substantially as and for the purpose set forth.

2. In a fluid-meter, the combination, with the main valve L, operated by the direct pressure of the fluid, and the pivoted latches P P, adapted to control the movement of the main

valve, substantially as described, of the supplemental valve S, provided with inclines S² S², for operating the latches when the supplemental valve is moved by the piston, substantially as described.

3. In a fluid-meter, the combination, with the cylinders A A, reciprocating piston a, and the valve chamber B, of the main valve L, having the ports L² L² extending entirely through it, the valve-plate E, having the ports H H and outlet-port G, the valve-case I, with its ports J K, the cover O, with its ports J² K² and openings or water-ways R R, the supplemental valve S, with its recesses 25 and inclines S² S², and the pivoted latches P P, having lips or projections Q and spurs or projections Q², the latter adapted to pass through the openings R into the ports L² of the main valve, whereby the movement of the latter is controlled, all co-operating substantially in the manner and for the purpose set forth.

4. In a fluid-meter, the combination, with the main valve L, its casing I, and the cover O, with their ports and water-ways, substantially as described, of the latches P, pivoted to the cover O and having the lips or projec-

tions Q and spurs or projections Q², and the supplemental valve S, adapted, when operated by the piston, to alternately raise the latches to release the main valve, whereby the latter is prevented from completing its movement until the piston has been moved to its full extent and the supplemental valve has admitted the water under full pressure to act upon the main valve, substantially as and for the purpose set forth.

5. In a fluid-meter, the combination, with the spindle T and ratchet-wheel U secured thereto, of the reciprocating finger-bar X, provided with a finger, Y, pivoted thereto and adapted to engage with the ratchet-wheel, and the fixed cam W² on the bar W, for throwing the finger into engagement with the ratchet-wheel, all constructed to operate substantially in the manner and for the purpose set forth.

Witness my hand this 5th day of March, A. D. 1888.

JOHN R. NORFOLK.

In presence of—

P. E. TESCHEMACHER,
H. W. AIKEN.