(No Model.) 3 Sheets—Sheet 1.

C. C. BARTON & J. A. MILLIKEN.

PISTON FLUID METER.

No. 274,879. Patented Mar. 27, 1883.

Fig. 1.

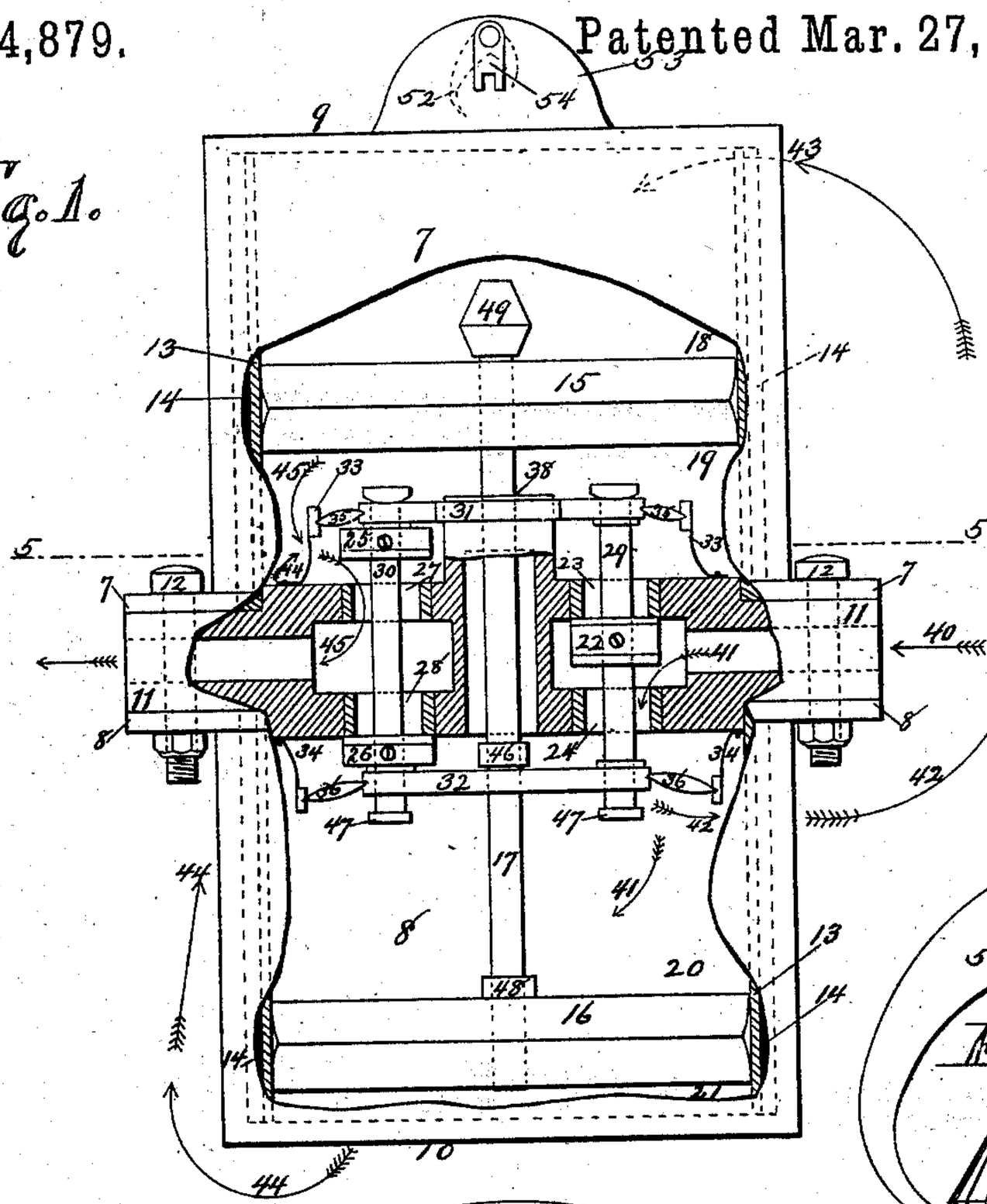


Fig. 4.

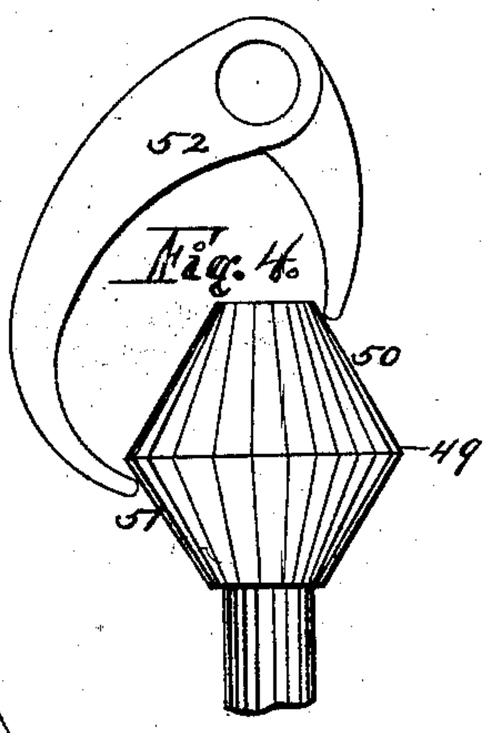
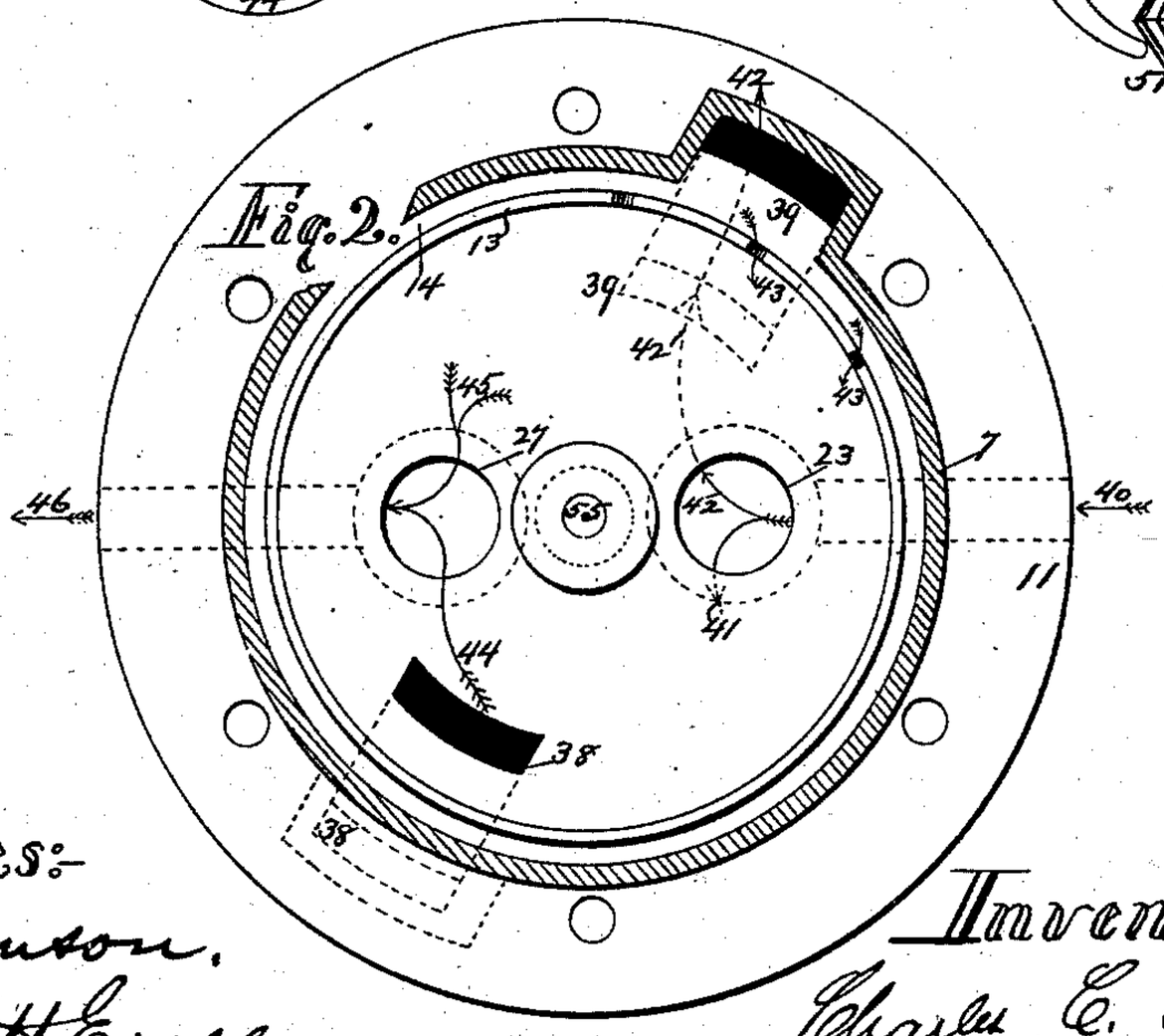


Fig. 2.



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C. C. BARTON & J. A. MILLIKEN.

PISTON FLUID METER.

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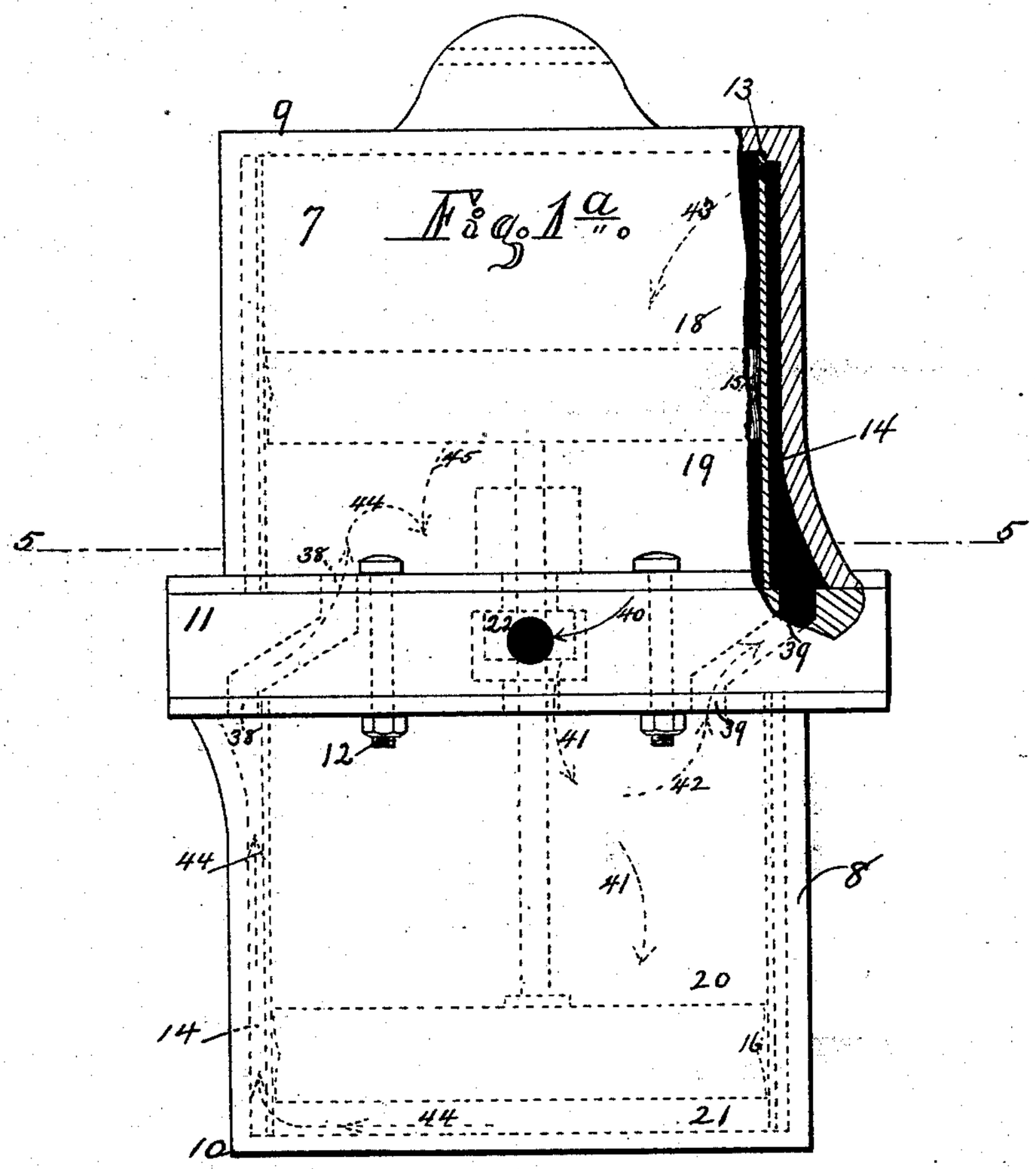

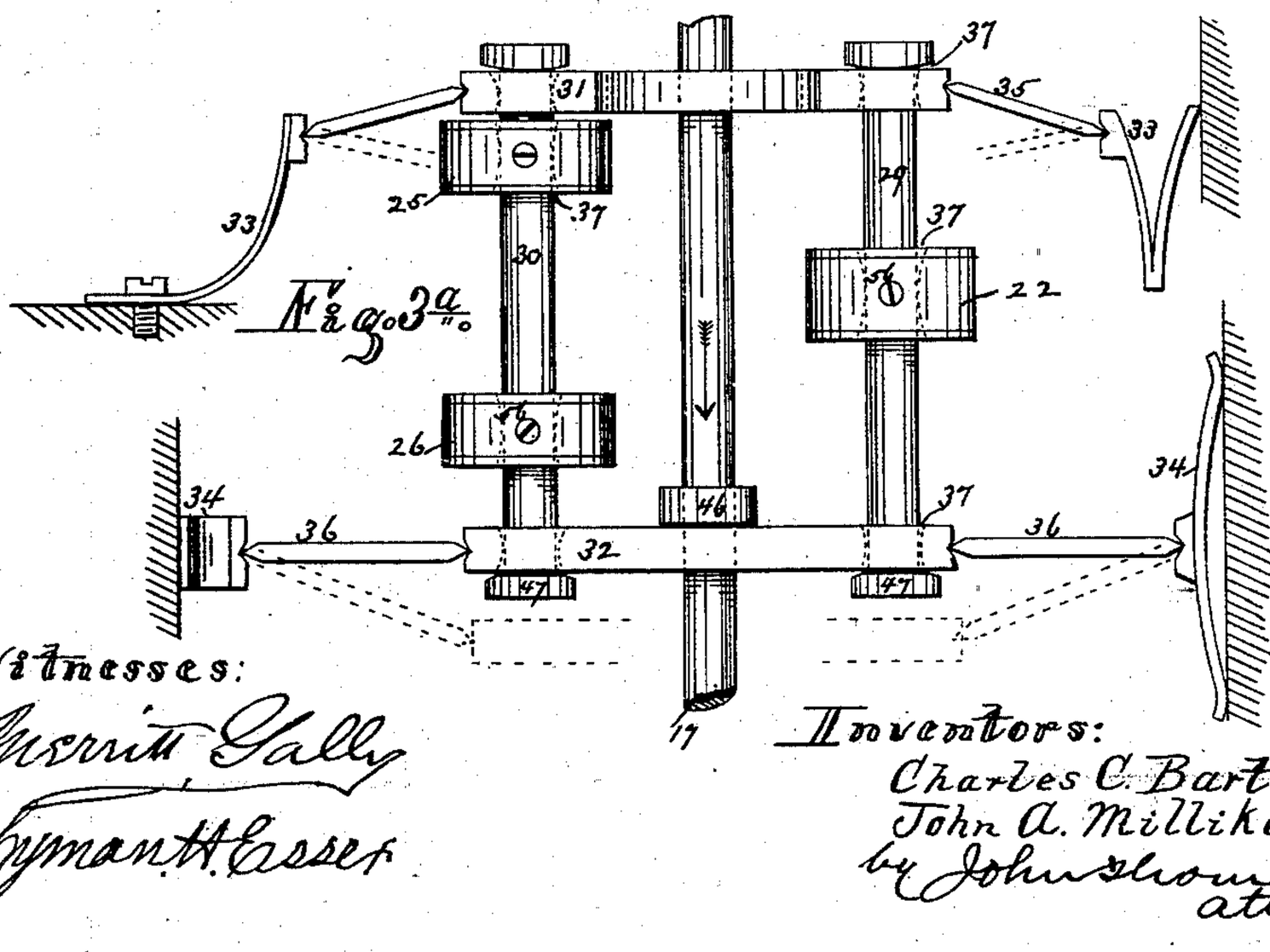

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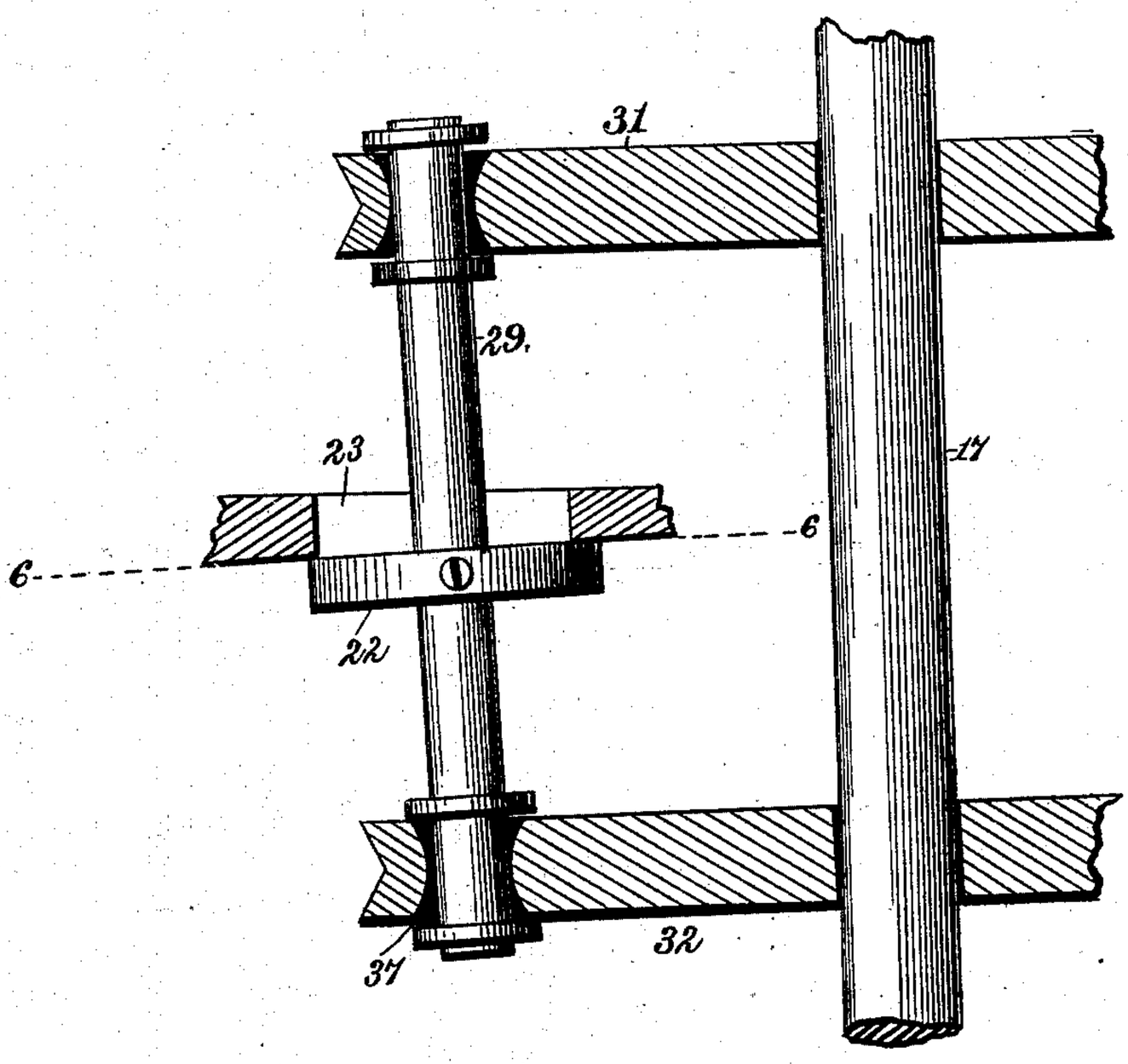
(No Model.) 3 Sheets—Sheet 3.

C. C. BARTON & J. A. MILLIKEN.

PISTON FLUID METER.

No. 274,879. Patented Mar. 27, 1883.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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PISTON FLUID-METER.

SPECIFICATION forming part of Letters Patent No. 274,879, dated March 27, 1883.

Application filed April 10, 1882. (No model.)

To all whom it may concern:

Be it known that we, CHARLES C. BARTON, of Brooklyn, county of Kings, and State of New York, and JOHN A. MILLIKEN, of the city, county, and State of New York, have invented certain new and useful Improvements in Fluid-Meters, which improvements are fully described and illustrated in the following specification and accompanying drawings.

Our invention relates to piston fluid-meters, and our improvements therein refer, in the main, to the following elements: first, in the construction of the valves; second, in the manner of operating and locating said valves; third, in the valve-chamber; fourth, in the combination of ports, sluices, and "fluid-ways;" fifth, in the construction of the cylinders, and, sixth, in the adaptation of a compound piston to said cylinder.

In the drawings, Figure 1 is an upright front elevation of our improved meter, with a portion of the cylinder shown as cut away, exposing the valves in upright elevation, and the septum-wall, in which said valves are situated, in cross-section. Fig. 1ª is an upright front elevation, in partial section and dotted outlines, as viewed from the right-hand side of Fig. 1. Fig. 2 is a plan view of septum-wall on line 5 5 of Fig. 1, showing the port and sluice openings. Fig. 3 is a broken sectional view, showing the manner in which the valves accommodate themselves to the valve-seats. Fig. 3ª is an upright elevation, detached, of the valve-action, also showing modifications in the operating-springs. Fig. 4 is a detached view of the apparatus for operating register.

In Figs. 1 and 1ª, numbers 7 and 8 represent an upright cylinder, having solid heads 9 10. Said cylinder is divided crosswise in equal sections by a septum-wall or diaphragm, 11, the two portions of the cylinder being joined by the attachment of their projecting flanges to the septum-wall, the upper, as 7, and the lower, as 8, by means of the bolts 12. The cylinder is lined with non-corrosive metal 13 13, made to form upper and lower internal fluid-ways, 14 14, said ways having passage to the inside of the cylinder through openings formed in the annular lining 13, as in ordinary practice, and will not require detailed description. In the cylinder are two pistons, 15 16, both of which are rigidly attached to the same piston-rod, 17, and these pistons divide the cylinder into four compartments—an upper and a lower—on each side of the septum-wall, respectively, as 18 19 and 20 21.

The valves are of that class known as "puppet" valves. The single valve 22 controls the upper and lower ports of ingress, 23 24, and is made with a double face, operating in an internal chamber formed in the septum-wall, while the single valves 25 26, controlling the upper and lower ports of egress 27 28, operate upon each external side of the septum-wall. These valves are of the direct-acting type, secured to valve-stems 29 30, which latter are in turn held in the same relative position by the yokes 31 32, the valves and valve-stems being mainly guided by the bearing of the lower yoke upon the piston-rod. The valves are held to their seats by the tension of the springs 33 34, which first act upon the knife-edge toggle-connections 35 36, thereby tending, as shown in the present instance, to force the yokes, and through the yokes the valves, upwardly. Though all the springs are exerting their pressure in the same general direction, it will be seen that the thrust upon each valve comes from a separate spring acting upon its end of the yoke. This will be referred to again further on.

Hitherto the main objection against the use of puppet-valves for fluid-meters (in a necessarily combined valve system which must operate synchronously) has been that the slightest inequality of wear upon their faces or seats, or a foreign obstruction between a single valve-face and its seat, causes leakage and consequent imperfect duty in the meter as a whole. We obviate this difficulty, as will be seen more fully in Figs. 3 and 3ª, by loosely connecting the yokes where attached to or bearing upon the valve-stems, the bearings through the yokes being preferably of an elliptical formation, as 37, which permit of a limited vibrating movement on the part of the valve and valve-stem approximating that, as it were, of a ball-and-socket joint. The bearing of the yoke upon the piston-rod is also loosely fitted, but in lesser degree than that of the valve-stems. Now, suppose one of the valve-seats to have been worn to an angle. Were the valve-

stems rigidly attached to the yokes, the contact of the valve upon its seat would necessarily be as assumed in the full lines of Fig. 1; but in consequence of the distinct pressure exerted upon each end of the yokes by the separate springs 33 34, and of the loosely-formed valve-stem bearings, the valve must "find its seat" and make a perfect face contact either through the valve or its seat, as one or both become worn from a proper right line. While we preferably allow for automatic adjustment in the manner just described, rigidly securing the valves to the valve-stems, as by screws 56, it will readily be seen, as indicated in the drawings, that the connection of the valves to the valve-stems may also be constructed in such manner as to effect the result set forth, or may be used, if desirable, in combination with the loosely-fitted connections of the valve-stems. This action of the springs and the adjustable character of the bearings will be more clearly understood by assuming, illustratively, that a foreign obstruction has become temporarily caught between, say, the left-hand side of the valve 26 and its seat. Now, it is evident that were the valve-stems rigidly attached to the valves and yokes the entire circumference of the valve thus obstructed would be restrained from seating, as also the valve 22; but inasmuch as there is yield in the attachment of the valve-stem bearings through the yokes, and, furthermore, in consequence of the separate but direct pressure of the coacting springs, the valve 26 will only be deflected on the left-hand side the height of the obstruction, while the proper action of the valve 22 is not disturbed whatever; hence the proper action of the meter would be but slightly interfered with during the time of a single stroke, and would not be rendered inoperative, as might otherwise be the case.

In Fig. 2, showing a plan view of septum-wall, with cylinder in section, are five openings. 55 is the bearing for the piston-rod, which is packed; 23 and 27, the upper faces of the ports of ingress and egress, and 38 and 39 cored sluices connecting the upper and lower portions of the cylinder with respect to the pistons and valves.

The operation of the valves and passage of the fluid through the ports, sluices, and cylinder fluidways during two complete rectilinear motions of the compound piston will now be described. Starting with the arrow 40, indicating the attachment of the induction-pipe the current passes on to arrows 41 41, finding egress through the now open lower port, 24, filling the compartment 20, the valve 26 stopping a direct passage outward through the lower egress-port, 28; but during this time the fluid will have found further outlet through the slanting cored sluice 39, formed in the septum-wall 11, following the course indicated by arrows 42 42, filling the upper way, 14, and passing into the compartment 18, as see arrows 43 43. Meantime the fluid from compartment 21 is being forced, by the excess of pressure of the ingress-current in compartments 18 20 acting upon the compound-piston 15 16, up the lower way, 14, through the slanting cored sluice 38, also formed in the septum-wall, into compartment 19, as see arrows 44, while from the latter compartment both its previous contents and that incoming from compartment 21 will find egress through the open port 27, arrows 45, being finally discharged as a known volume at the eduction-pipe. During the latter portion of the piston movement the yoke 32 will be carried downward by the fixed collar 46, attached to the piston-rod, against the tension of the springs 34, carrying the toggle-connections 36 to a straight line, as see Fig. 3ª. Up to this point the valves will remain undisturbed, being held to their seats both by the excess of pressure of the incoming current and by the lighter set of retaining-springs 33, which as yet remain in their normal position, and act, as designed, to hold the valves positively in position during the time in which force is being gradually accumulated in the motor-springs 34. Now, at the instant that the movement of the piston suffices to carry the motor-toggles 36 beyond a straight line, or their "dead-centers," the tension of the motor-springs 34 (which, it will be understood, is considerably in excess of that of the retaining-springs 33) will immediately act to throw the yoke 32 downward, which in turn, impinging upon the valve-stem collar-heads 47, will carry down the upper yoke, 31, against the tension of the retaining-toggles 35 and springs 33, and changing the position of the valves in respect to their ports to the direct opposite of that assumed in the figure, when the force of the entire set of springs is again utilized in seating the valves. The ingress-current will now enter through the upper ingress-port, 23, first filling compartment 19, and then through the open sluice 38 and the lower way, 14, into the lower compartment, 21, while the charge in compartment 18 is being forced through the upper way and the sluice 39 into compartment 20, being discharged with the previous contents of compartment 20 by the lower egress-port, 28, into the valve-chamber, and thence outward again as a known volume to eduction-pipe 46, when the valves are again changed, as hereinbefore described, excepting that in this instance the yoke will be forced upward by the collar 48, effecting a reversion of the valves to the assumed position of Fig. 1.

It will be observed that the sluices 38 39 are valveless and continuously open to and connect the same compartments of the cylinder, the valves acting simply to alternately change the direction of the current to the compartments into which said valves open. Hence the advantage derived from this construction enables us to deliver the full capacity of the cylinder at each single stroke of the piston without complication in the valve-action, and for the minimum of valve movement and friction of parts.

Should the valves at any time become stuck to their seats beyond the power of the motor springs to unseat, the operation of the meter will not thereby be stopped, as the continued movement of the piston, allowance being made in the clearance of the cylinder-heads for such a contingency, with all the force of the ingress-current, would be exerted against the yoke to start the valves.

The operation of any suitable register may be readily effected by means of the piston movement. That shown in Figs. 1 and 4 is by means of the piston-rod head turned to approximate two frustums of cones joined at their bases, as 50 51, which, when near the terminus of each alternate stroke of the compound piston, enters the forked connection 52, having a packed journal-bearing in the dome 53, and communicates to the outside arm, as 54, the required ratchet step movement.

As shown in Fig. 3ª, the construction of the retaining and motor springs may be very considerably modified without changing the general principle of their operation.

In assembling the parts of the meter the internal valve, 22, is first placed in its chamber and the non corrosive bushings (indicated in the drawings) afterward forced to their position.

The adjustment of the meter for accurate measurement of volume is effected by means of the piston-rod collars 46 47, which, being brought to or from each other, as the case may be, determine the length of stroke of the piston.

We claim—

1. In a fluid-meter, the combination, with a cylinder, a coacting compound piston, and a septum-wall, within and upon which are valves for changing the direction of the current, of open valveless sluices, as 38 39, when each of said sluices continuously connect a pair of compartments with each other, as 20 to 18 and 21 to 19, for the purpose set forth.

2. In a fluid-meter, the combination, with a cylinder, a coacting compound piston, and a septum-wall, 11, in which are formed open valveless sluices 38 39, of direct-acting puppet-valves, as 22 25 26, when operating upon and within said septum-wall, for the purpose specified.

3. In a fluid-meter having a system of puppet-valves, the combination, with said valves and their stems, of loosely-fitted bearings for the stems, independent but coacting springs 33 34, and connections between the springs and the valve-stems operating to effect a proper seating of the valves, substantially in the manner described and shown.

4. In a fluid-meter having a system of puppet-valves, the combination, with the valve mechanism, of independent but coacting retaining and motor springs, as 33 34, and toggle-connections 35 36, for the purpose specified.

5. In a fluid-meter having a cylinder, a compound piston, and a septum-wall, the combination, with the valves, as 22 25 26, and yokes, as 31 32, of the knife-edged toggles 35 36, and springs, as 33 34, as and for the purpose herein described and specified.

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