S. R. Wilmot,

Piston Meter,

No. 11,881. Patented Oct. 31, 1854.

Fig. 1

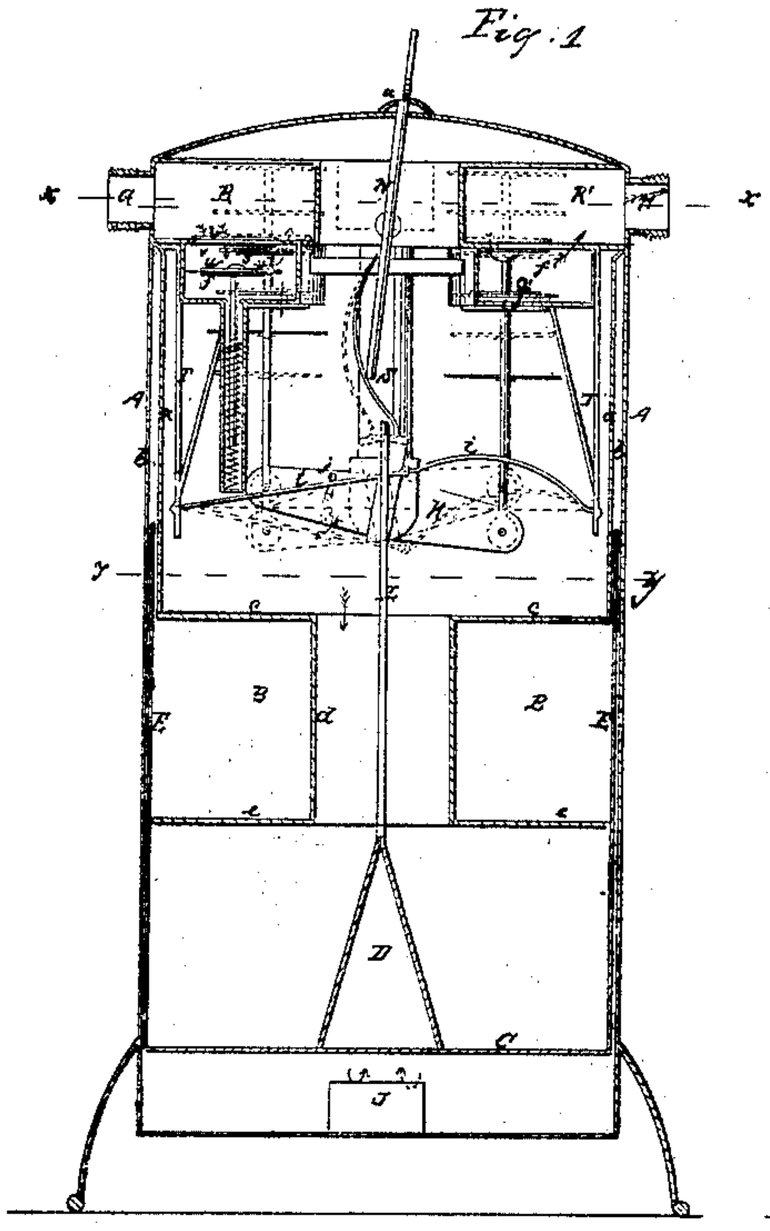


Fig. 2.

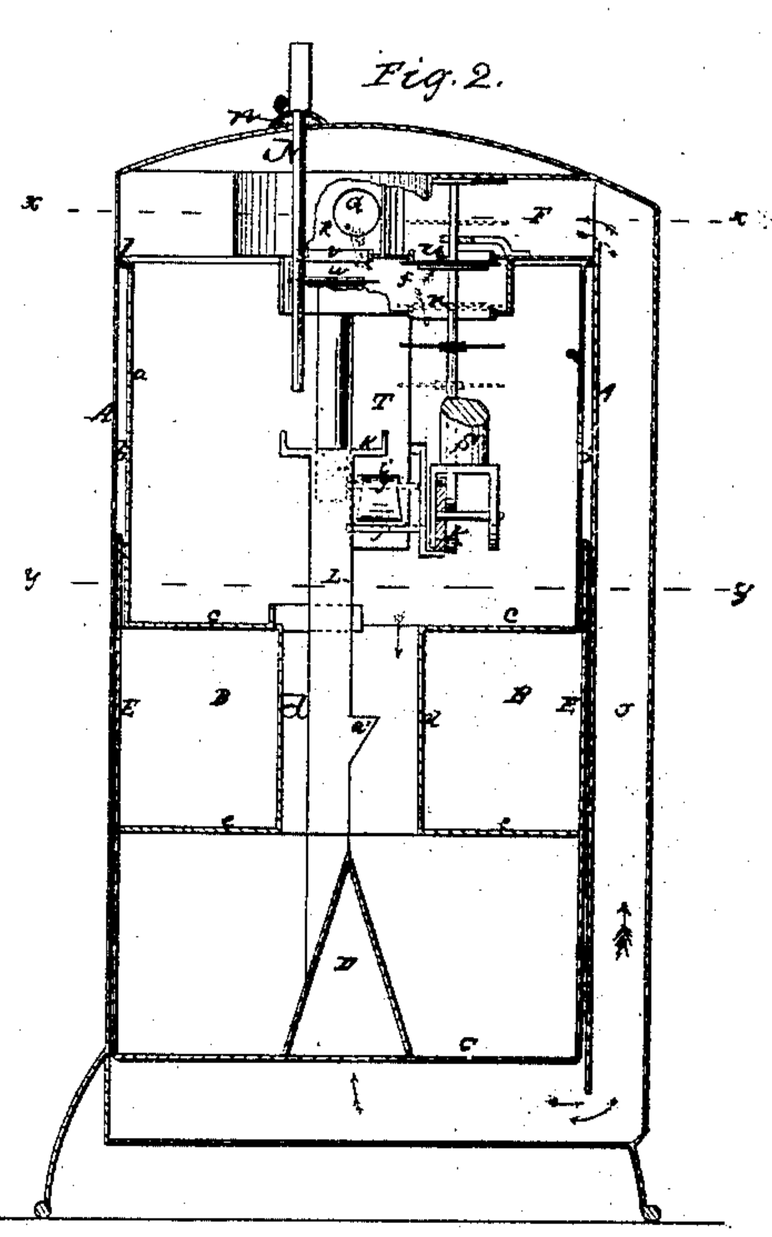


Fig. 3

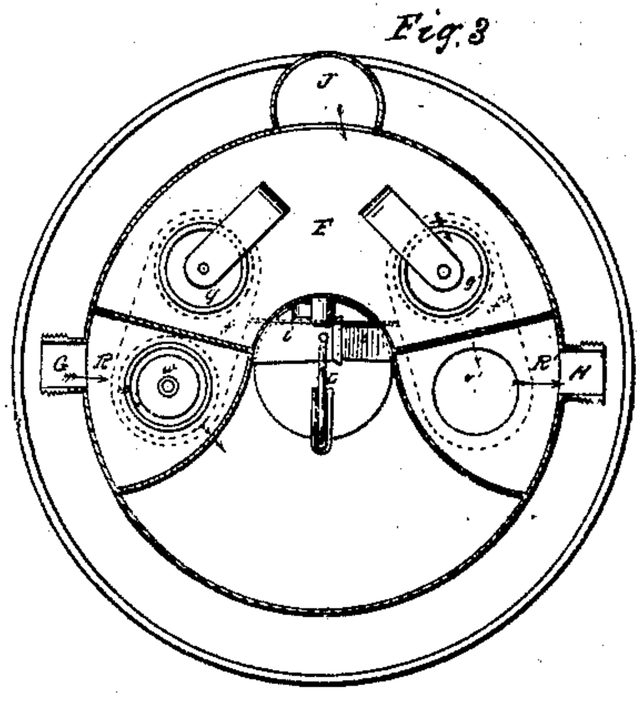
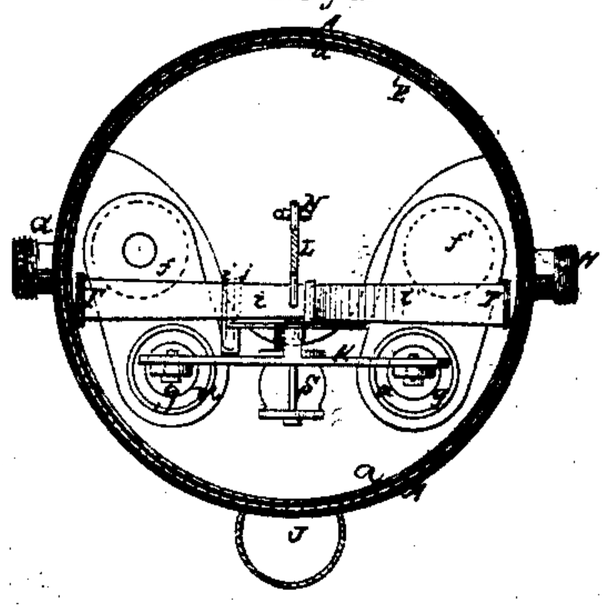


Fig. 4



Witnesses

J. W. Wales

J. W. Hamilton

Inventor

S. R. Wilmot

UNITED STATES PATENT OFFICE.

S. R. WILMOT, OF NEW HAVEN, CONNECTICUT.

WATER-METER.

Specification of Letters Patent No. 11,881, dated October 31, 1854.

To all whom it may concern:

Be it known that I, S. R. WILMOT, of the city and county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Meters for Measuring the Flow of Water and other Liquids; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figures 1, and 2, are vertical sections, taken at right angles to each other, nearly in the center, of a meter constructed according to my invention. Fig. 3, is a horizontal section in the line, *x*, *x*, of Figs. 1, and 2, looking downward. Fig. 4, is a horizontal section in the line *y*, *y*, of Figs. 1, and 2, looking upward.

Similar letters of reference indicate corresponding parts in the several figures.

The improvements which constitute my present invention, relate to that description of meter, consisting of a piston which is caused to move reciprocally within a cylinder of known capacity, by the admission of water on the opposite sides alternately, and measures the flow by registering the number of reciprocations. Meters of such construction, are known to work with a degree of accuracy unsurpassed; the only material objection having heretofore been the great friction of the piston, which, when tightly packed in the best known way, required a considerable head of water to actuate it. The main object of these improvements is, to destroy or reduce the friction and also the resistance of all the parts, so that an extremely slight head will be sufficient to actuate the meter.

The first improvement consists in forming an air seal or packing, to separate the water above from that below the piston, by extending the piston upward at its sides in the form of an open topped tube or cylinder, to enter a narrow, open bottomed, but close-topped chamber, which is formed around the upper part of the interior of the vertical working cylinder, and always contains a quantity of air, which cannot be expelled by the water. As there is no communication between the spaces above and below the piston, except through this chamber, the air forms a perfect seal or packing and admits of the piston being made to fit so loosely to the cylinder, that it need produce no friction.

The second improvement consists in enclosing all the mechanism through which the piston operates upon the valves, for the purpose of reversing its action within the cylinder itself, or a water chamber above or below the cylinder, having free communication therewith, whereby the necessity for stuffing boxes and other packing for the said valves and mechanism, and the friction attending the use of such devices, is obviated.

To enable those skilled in the art to which my invention appertains, to make and use my invention, I will proceed to describe its construction and operation.

A, is the working cylinder of the meter which occupies a vertical position, standing on any suitable base. It is constructed of sheet metal of sufficient strength to withstand the maximum pressure of water. Within the upper part of the cylinder, A, there is an interior cylinder, *a*, united with A, at the top by a small flange, *l*, and forming an annular space, *b*, with a closed top and open bottom; this space forms the chamber which contains the air, constituting the air seal or packing, but a larger chamber, B, is formed below it by a broad flange, *c*, extending inward from the bottom of the cylinder, *a*, and being united by a central tube, *d*, with a flange, *e*, which extends outward from the tube to the same external size as the cylinder, *a*. The larger chamber, B, serves as an air reservoir to the chamber, *b*.

C, is the piston, which consists of a thin disk of metal, having its edges united with a cylindrical tube, E, which works freely within the annular air chamber, *b*. It is furnished with a close air chamber, D, of such capacity as to serve as a float to keep it *in equilibrio* with the water or liquid being measured.

R, R′, are two boxes situate on opposite sides of the meter, close to the top, the former receiving the inlet pipe, G, and the latter, the outlet pipe, H. The boxes, R, R′, may be respectively termed the inlet box, and outlet box.

F, is a box situate between the inlet and outlet boxes, and communicating at all times with the bottom of the cylinder, A, by an exterior passage, J, extending all down the back. Under the inlet box, R,

communicating with it through a passage, *v*, furnished with a check valve, *w*, there is a valve box, *f*, which extends partly under the box, F, and under the outlet box, communicating with it through a passage, *v'*, there is a similar valve box, *f'*, also extending partly under the box, F. The valve box, *f*, contains a valve, *g*, which may be termed the inlet valve, which is capable of opening either one, and closing the other of two passages, *u*, *u'*, the first of which leads from the valve box directly into the upper part of the cylinder, *a*, and the other, from the valve box into the box, F. The valve box, *f'*, contains a valve, *g'*, which is precisely similar to *g*, and may be termed the outlet valve, which is capable of opening either one, and closing the other of two passages, similar to *u*, *u'*, one leading directly into the upper part of the cylinder, *a*, and the other into the box, F. These valves are connected with opposite ends of a beam, K, which vibrates on an arbor secured to a post, S, within the meter, and when either one closes the upper, and opens the lower passage leading to or from its box, the other opens the upper, and closes the lower one of its box.

The positions of the two valves, *g*, *g'*, require to be changed at the end of every stroke of the piston, in order to reverse its action. This change of position is effected by means of a rod, L, which is attached to the piston, and is furnished on one side, see Fig. 2, with two projecting pieces, *h*, *h'*, one of which, as the piston arrives near the end of its stroke, comes in contact with one, *i*, of two flat bars, *i*, *i'*, which are arranged, end to end, and fit to each other and to fixed posts, T, T', with knife edge joints.

The bar, *i*, which plays between two studs, *j*, *j'*, on the face of the beam, K, is straight and rigid, but the other, *i'*, is bent to form a spring, and thus allow the two bars to vibrate, but still to keep in contact with each other. The bars can never remain in a fixed position without some rest on one side or other at some distance from the posts, T, T', and when the ends or points where they are in contact with each other are out of a central line passing directly through the points where they are in contact with the posts, they have a tendency to throw the ends still farther out of the said central line. When the valves are stationary, the bar, *i*, rests against one or other of the studs, *j*, *j'*, on the beam, and secures them; but, when the bar, *i*, is operated upon, just before the termination of the stroke of the piston by one of the projecting pieces, *h*, *h'*, it is pushed out of contact with the stud on the beam with which it has been in contact during the last stroke of the piston, and the ends of the bars, *i*, *i'*, are, by the same means, made to move to the opposite side of the central line before spoken of, when their tendency to move from the said central line, throws them suddenly into contact with the other stud on the beam, and quickly changes the position of the beam and the valves. The action of the bars, *i*, *i'*, is assisted by a spring, *m*, applied to the beam. In order to prevent too great percussion being caused by the sudden closing of the valves, the valve rods are furnished with large disks, *t*, *t*, above and below, to produce a certain degree of resistance to their closing.

In order to facilitate the description of the operation of the meter, the water which may be considered to be in communication with the lower side of the piston, is represented in Figs. 1, and 2, of the drawing, in red color, and that with the upper side, in blue. The water is now supposed to be entering above the piston and forcing it down, expelling the water from below. Its course is indicated by black arrows, entering the inlet pipe, and passing through the inlet box, R, into the valve box, *f*, whose upper passage leading to the box, F, being closed by its valve, *g*, and the lower passage being open, causes it to escape into the upper part of the meter, and thus act on the top of the piston and force it down, expelling the water from below through the passage, J, and into the box, F, whose communication with the outlet box and pipe, is open, to allow its escape. The valves are kept in the position shown, by the pressure of the water, and the rod, *i*, pressing upon the stud, *j*, in the beam, tends further to keep them tight; but when the piston has nearly reached the intended limit of its downward movement, the projection, *h*, on the piston rod comes in contact with the bar, *i*, and pushes it and the bar, *i'*, down slowly, from contact the stud, *j*, till they pass that position, (indicated by a red dotted line in Fig. 1), in which all their knife-edges are in line, when they fly downward out of line rapidly, and *i*, coming forcibly and suddenly in contact with the stud, *j'*, instantly reverses the position of the beam, as indicated in red color in Fig. 1. The passage leading from the inlet valve box, *f*, to the upper part of the meter being now closed, and that to the box, F, opened, while the passage from F, to the outlet valve box, *f'*, is closed; the water is caused to pass into F, and through, J, as indicated by red arrows in Figs. 1, and 2, to the bottom of the cylinder, forcing up the piston, the water above the piston being forced through the lower passage in the outlet valve box, and thus into the outlet pipe. As the piston terminates its upward movement, the lower projection, *h*, on the piston rod, comes in contact with the rod, *i*, and returns the rods, *i*, *i'*, to the position shown in black, reversing

the valves to the position already described, to admit the water above and allow its escape from below the piston.

It is now shown how a reciprocating movement of the piston is produced, and it is obvious that, the internal capacity of the meter being known, it is only necessary to register the number of strokes to measure the quantity passing through it. The registering apparatus I employ, is such as is common to all meters, and therefore needs no description here, all that is necessary, being to show the means by which motion is transmitted to the said apparatus from the piston, which are as follows.

N, is a small metal rod passing through an opening in the top of the meter, and through a ring, *n*, of india rubber, placed above the said opening. The ring, *n*, is covered and confined by a concave plate, *o*, whose edges are soldered or otherwise secured all round to the top of the meter. The rod fits tightly to the india rubber, and is prevented falling through, by being provided with a shoulder above the plate, *o*. It occupies an oblique position, and its lower part is struck by the top of the piston rod every time the latter rises, and caused to receive a vibrating motion. The part of the rod which protrudes through the cover of the meter, vibrates in such a manner, that by means of a ratchet wheel, or any such means of converting motion as would suggest themselves to a skillful mechanic, the motion may be given to the registering apparatus.

When the water is first admitted to the meter, by two strokes of the piston, one up and one down, all the air is expelled, except such a quantity as, at an ordinary atmospheric pressure, would fill the chamber, *b*, and reserve chamber, B; for this quantity there is no escape, as air must rise above water, and the upper part of the chamber is closed, and the air is confined by the water on both sides of the piston, that below the piston rising outside the tube, E, and that above being within it, and preventing its escape either way. The air, acting equally on the water within and without the tube, prevents that on either side overflowing the top of the tube; and without such overflow, the water cannot pass the piston. When the head of the water is considerbale, the air will be compressed, and the water will rise into the chamber, B; but, as the piston is perfectly free to move, it must rise on both sides of the tube alike, and cannot thus be made to overflow. The reserve chamber, B, is not an absolutely necessary part of the meter; but, where the water is subject to a variable pressure, if this chamber were not used, the chamber, *b*, would require to be of greater depth, in order to give the top edge of the tube, E, a greater lap in the bottom of the chamber, *a*, to prevent overflow when the piston is in its lowest position; therefore, it is desirable to use the reserve chamber, B.

It may be well to remark that any fluids which are of less specific gravity than, and incapable of mixture with, water, may be employed in place of air, as the seal or packing, and are therefore the equivalents of water; though, owing to the comparatively great specific gravity of oil, compared with air, it is not so applicable, and gases are not so available.

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

1. Extending the sides of the piston upward in the form of a tube, E, to enter an open-bottomed but close-topped chamber, *b*, in which a quantity of air, or its equivalent, is so confined, as described, as to press equally on the water above and below the piston, and thus prevent it overflowing the top of the tube on either side, and hence to form an effectual air seal or packing, and allow the piston to be fitted to the cylinder so loosely as to produce no friction.

2. Enclosing all the mechanism by which the valves are actuated, within the cylinder itself, or in a chamber in free communication with the same, as shown, whereby the necessity for stuffing boxes or other packing for the valves, rods, or other parts connected with the valves and the consequent expense of construction, and friction of such packing, is obviated, as herein set forth.

S. R. WILMOT.

Witnesses:
S. H. Wales,
J. W. Hamilton.