3 Sheets. Sheet 1.

W. G. Stuart,

Liquid Meter.

No. 112,091. Patented Feb. 21. 1871.

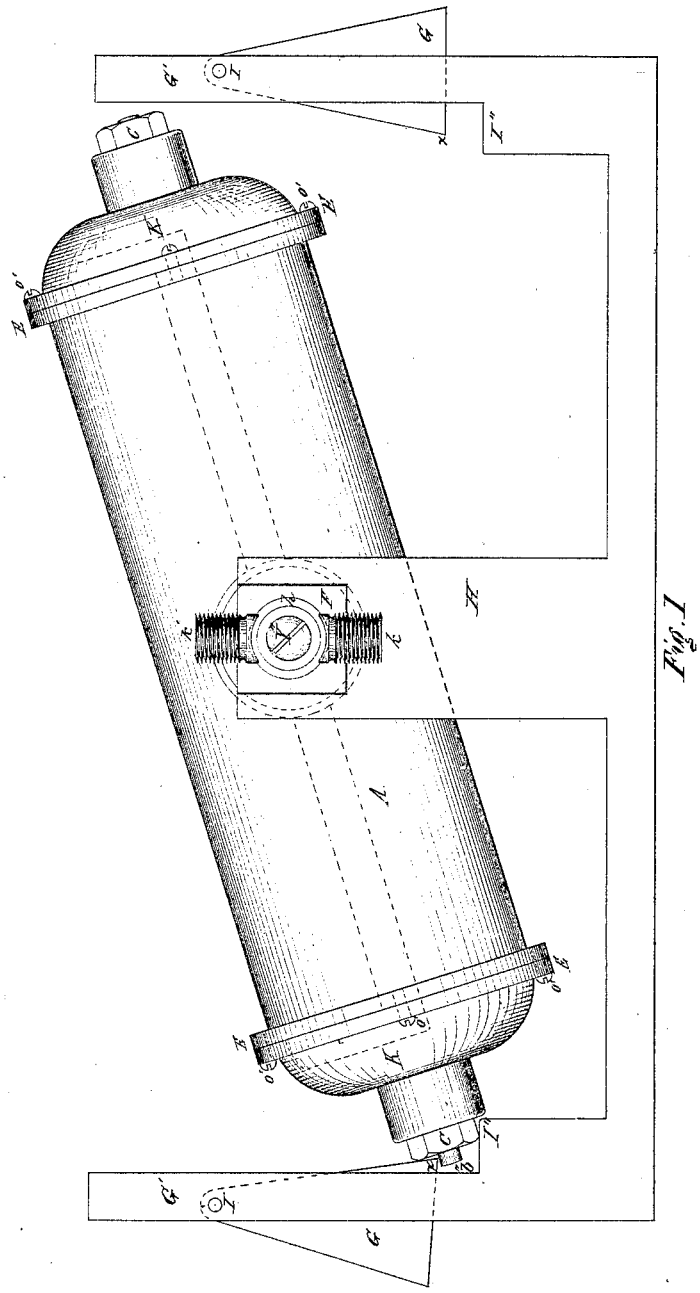

Fig. 1

Witnesses.

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W. F. Ball

William G. Stuart Inventor.

By T. A. Curtis, his atty.

3 Sheets, Sheet 2.

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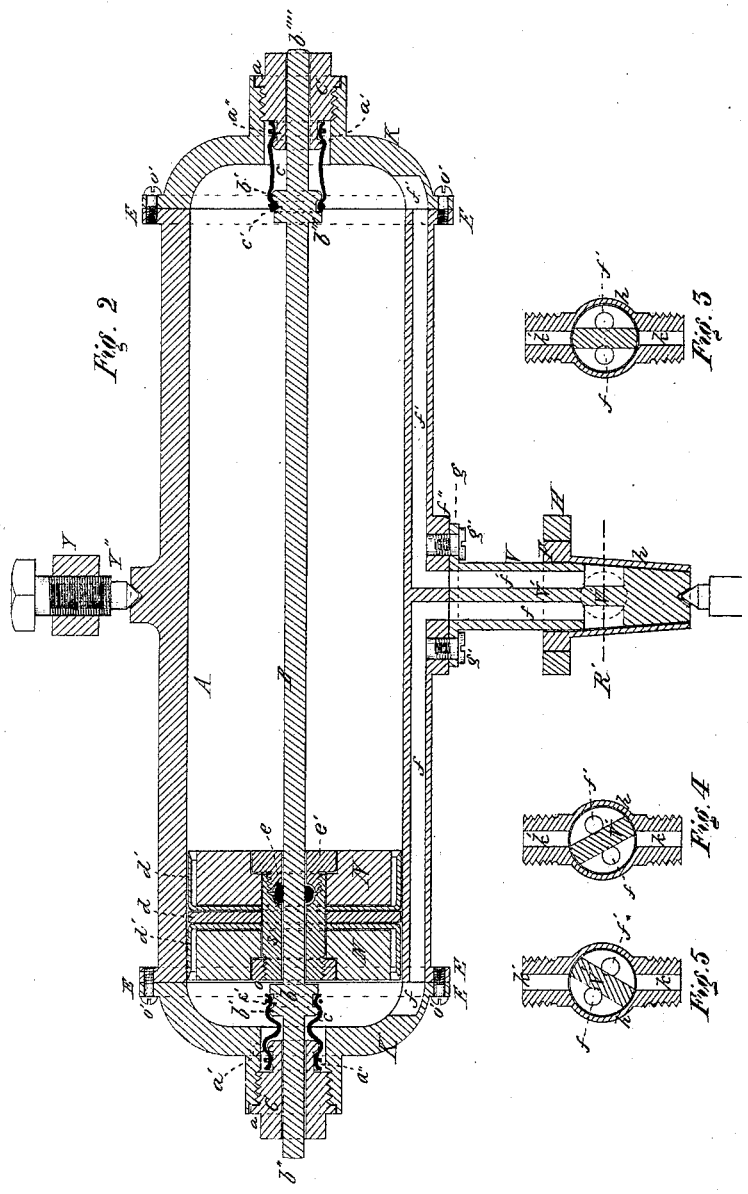

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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3 Sheets, Sheet 3

W. G. Stuart,

Liquid Meter.

No. 112,091. Patented Feb. 21, 1871.

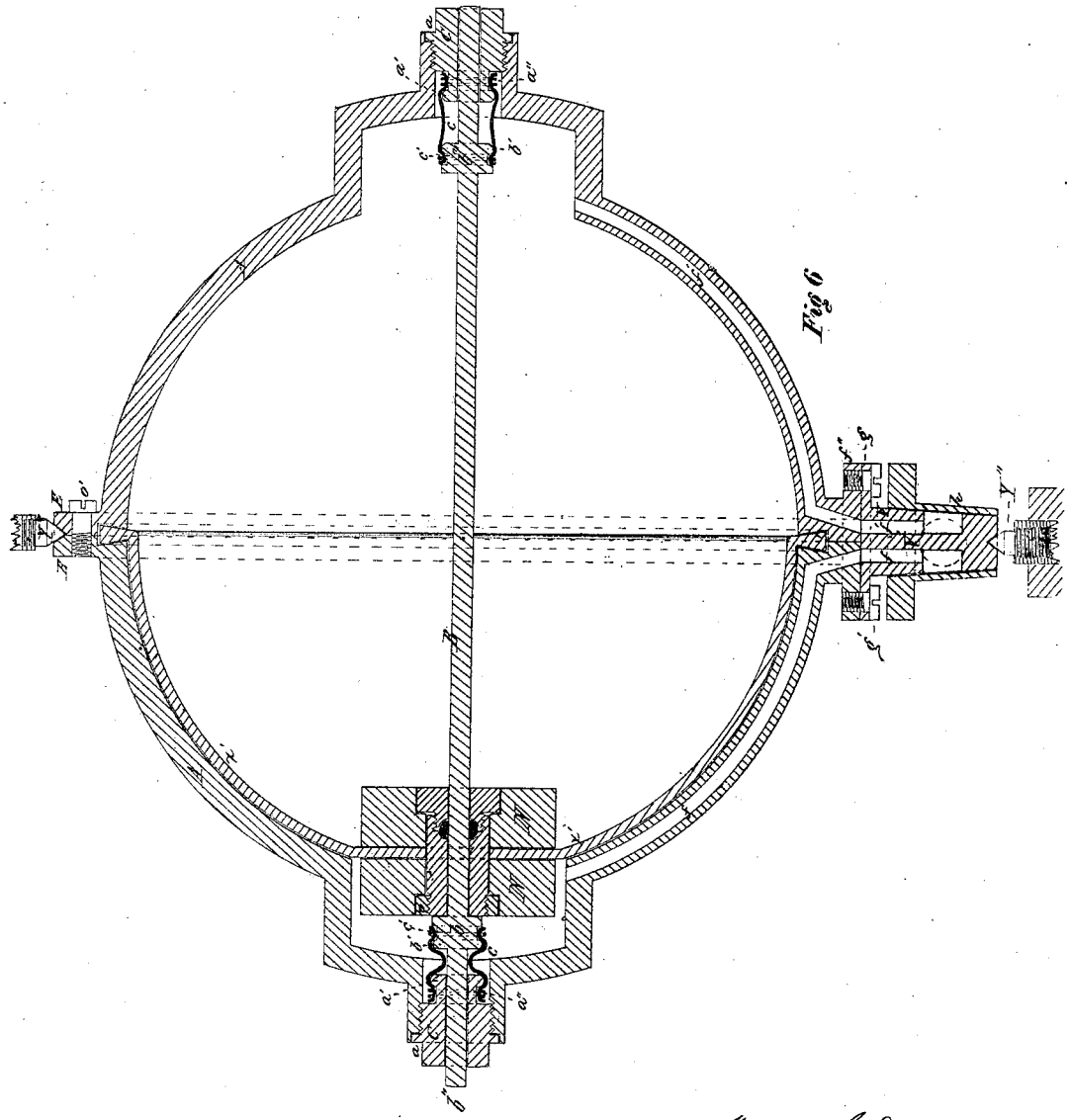

Fig 6

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Inventor.
By J. A. Curtis his atty.

Witnesses
J. Westhagen
W. F. Hall

United States Patent Office.

WILLIAM G. STUART, OF CHICOPEE, MASSACHUSETTS.

Letters Patent No. 112,091, dated February 21, 1871.

IMPROVEMENT IN LIQUID METERS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, WILLIAM G. STUART, of Chicopee, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Liquid Meters; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing making a part of this specification and to the letters of reference marked thereon, in which—

Figure 1, plate 1, is a side view of my invention.

Figure 2, plate 2, is a horizontal section through line R S of fig. 1.

Figure 3 is a vertical transverse section of the arm or trunnion of the measuring-vessel or cylinder at line R', fig. 2, with ports closed.

Figure 4 is a similar section at the same place, with the ports open so that the water may pass into one end of the vessel and out at the other.

Figure 5 is another vertical section, at the same place, showing the ports open so that the water may pass in at the opposite end of the cylinder or vessel from that last described, and out at the other end; and

Figure 6, plate 3, is a horizontal section, showing the same sliding weight and rod arranged in a differently-shaped measuring-vessel, with a diaphragm.

My invention consists of a cylinder, or other conveniently shaped measuring-vessel, having, at the two opposite extremities, a threaded hole made, into which is turned a threaded plug having a neck or exterior annular groove at the inner end.

A hole is made horizontally through the plug, and a rod, having a protuberance or collar with a similar neck or exterior annular groove thereon, made near each end of said rod, passes through or operates within the holes in said plugs, the length of the rod being a little longer than the distance between the two outer extremities of said plugs.

A short piece of elastic tubing, or any tubing that is sufficiently flexible and pliable, is secured to the neck or groove of each collar by means of a piece of wire wound tightly thereon, the other end of the tubing being secured, in a similar manner, to the neck or groove of the corresponding plug. This arrangement of tubing serves as a check, operating, instead of a stuffing-box, to prevent the water which may be within the vessel from passing out through the orifice in the plug, through which the rod moves, and obviates the friction which would result in the use of a stuffing-box.

A sliding weight, made in two parts, with two cup-leathers placed with their bases toward each other, and a metallic disk between, or a diaphragm secured between the two parts, and a horizontal hole through the center, is made to slide to and fro upon the rod between the two collars, and the two parts of said weight are secured together by a bolt and nuts, or in other convenient manner, with a small packing secured within the weight and around the rod to prevent any water from passing from one side of the weight to the other through the central orifice, and between the weight and the rod upon which it slides.

The measuring-vessel itself is hung upon trunnions or arms, and is equally balanced thereon, having two passages through one of the trunnions, each communicating with one end of the interior of the measuring-cylinder.

The construction of the measuring-cylinder, with the passages extending from each end and through the arm or trunnion, and the arrangement for alternately changing the communications between the same, and the entrance and exit-ports, is similar to many of the oscillating engines heretofore made, and constitutes, in itself, no part of my invention, with the exception of the construction of the barrel containing the entrance and exit-ports, and the suspension of the whole between centers, as will be hereinafter more fully explained; for, instead of hanging the cylinder upon the trunnions in such manner that the whole weight bears directly upon the periphery of the trunnions, or of the shell or barrel which surrounds it, thereby causing much friction and consequent wear of the parts, especially in a full-sized operating meter, in which the utmost sensitiveness of the instrument and accuracy of operation are required, as well as no inconsiderable weight, I hang the oscillating measuring-vessel between two conical center points, one or both of which is made adjustable by having said points made upon the ends of threaded screws operating in correspondingly-threaded holes made in standards, each of the said points entering a small cavity made in the end of each trunnion, as will be hereinafter explained.

That others skilled in the art may be able to make and use my invention, I will proceed to explain its construction and the mode of its operation.

In the drawing—

A represents the cylinder or measuring-vessel, having the end caps K secured thereto by screws or bolts *o'* passing through the flanges E, and these caps have a central hole made therein, a part of which is threaded to receive the threaded plug C, which is turned in tightly to its shoulder or collar *a*, to make a water-tight joint.

These plugs C have a central horizontal hole made therein, of sufficient size to permit the rod B to move freely therein, and the inner ends of said plugs have either an annular projecting flange, *a'*, thereon, or an

annular groove, a'', or neck, to which to secure one end of the short elastic or flexible tube c, by winding a wire tightly around the same.

The rod B is a little longer than the distance between the two outside ends of the plugs C C, and has two protuberances or annular collars, b and b''', thereon, one of which may be made solid with the rod, the other being made separate and secured thereto by a set-screw.

These collars or protuberances have either an annular flange, b', or channel c', and the other end of the elastic or flexible tube c is secured thereto by a wire wound tightly around the outside, and both ends of said tube are so tightly secured that no water can pass from the outside of the tube to the inside at either end.

It will be seen that, by this arrangement, no packing is required around the rod B, within the plug C, the rod being free to operate within the plug even without any friction therein, and yet no water within the cylinder can pass out through the orifice in the plug.

This piston or sliding weight is made of metal, sufficiently heavy, in two parts N N, and of cylindrical form, each being placed within a cup-leather, d', and both in a position with the bases of the cup-leathers toward each other, with the circular metallic disk between them, and with the open end of each cup-leather toward either end of the cylinder.

The whole is secured together by a tubular bolt passing through the center, and a threaded nut, o, turned upon one end of the bolt, and another shorter threaded bolt with a head, e', upon one end, and turned into a threaded cavity in the end of the tube s, an annular-shaped packing, made of leather, soap-stone, or other suitable material, being first introduced into a recess between the bolt e' and the tube s.

A central hole is made through the bolts s and e', and the rod B is inserted therein, and the packing e is adjusted to the desired degree of contact with the rod by turning the nut e in, more or less, against the packing.

Instead of securing the parts of the piston together, as above described, one of the parts N may have a central cylindrical projection with an external thread made thereon, and the other part N may have a corresponding central cylindrical cavity with an internal thread, and the two be screwed together against the bases of the cup-leathers and the disk d, a hole being made through both for the central projecting part of the weight which secures its two parts together; or any other convenient method may be employed to secure the two parts together.

After the weight is placed on the rod the other collar, b or b''', as the case may be, is also placed upon the rod and secured in its place by a set-screw.

The passages f and f' may be cast in the cylinder, extending from the middle toward each end, and communicating with the interior of the cylinder at each end; and at the middle, where the two said passages open or extend outward, there is a faced projection, f''', to which is bolted, by means of the screws or bolts g', the arm or trunnion V, having a central partition, V', with the passage f and f' on either side, coinciding within the passages f and f' in the cylinder.

The outer end of said arm V terminates in a tapered plug, which is made to fit its shell or barrel h perfectly, by a ground joint or fitting; and the barrel h is prevented from turning with the plug or arm V by inserting the square part F into a corresponding square socket in the standard H, or by confining the barrel so that it will not turn with its plug in any other convenient manner, taking care, however, to leave the barrel free from support, so that it may always be concentric with its plug.

The arm or plug V, with the barrel h secured thereon, constitutes in itself the common two-way cock, well known and extensively used in hydraulics, and the whole arranged with a cylinder, is shown in oscillating engines, as, for instance, in the patent granted to Sprenkle and Basford, December 22, 1857, and in others; but in cases where this arrangement has been used the greater portion of the weight of the cylinder bears upon the lower side of the trunnion, within its shell or barrel, so that the tendency is to wear off that side of the trunnion and barrel, and soon the joint would leak, and be worthless, in so sensitive and delicate an instrument as a liquid meter; but I entirely obviate that difficulty by merely confining the shell h so that it will not turn with its plug, and suspending the cylinder or vessel at the vertical ends of the trunnions, between center points.

Hung or suspended in this manner, the bearing and wear are equal all around the trunnion, within the shell h; and should it work loose at any time, by slightly loosening the center point at the end of the plug V, and correspondingly tightening the other center point at the opposite side of the cylinder.

In fig. 1, plate 1—

G' represents a standard near each end of the cylinder or vessel, in each of which is hung, by a pivot, I, a weight, G, having a corner at x, and at I' is a shoulder or stop, upon which the cylinder or the plug C strikes when either end of the cylinder or vessel is forced down, and when in this position, as shown in fig. 1, the corner of the weight rests upon the end of the rod B, seen protruding from the plug C.

The stops I' may be cushioned with any elastic material, and may be placed in any convenient position either above or beneath the cylinder.

At k, figs. 4 and 5, is represented the entrance-pipe, and at k' the exit-pipe, which are alternately placed in communication with either end of the interior of the cylinder by the vibrations of the cylinder in a vertical direction.

The operation of the device is as follows:

If the cylinder is in the position shown in fig. 1 and the water be permitted to pass in at the entrance-pipe k, it will pass on through the passage f into the small space in the cylinder, between its end and the sliding weight or piston N, the position of the flat part or partition V being shown in fig. 4.

The pressure of the water in this space against the weight forcing it up and along the rod B, the water entering the annular space between the periphery of the metallic part N, and the cup-leather d' pressing the edge or rim of the leather outward into contact with the interior surface of the cylinder, and preventing any leakage of water past the piston, between it and the cylinder.

As the weight or piston N passes along upon the rod, it forces out the water which has filled the cylinder through the passage f' and exit-pipe k', until the water is all expelled from the cylinder upon that side of the weight, or nearly so, and the piston has nearly completed its stroke, sliding upon the rod.

As the piston approaches the end of the cylinder, it impinges against the collar or protuberance b''', and moves the rod with it a little, until the other end of the rod b'' is drawn from under the weight G into the plug, the other end then protruding.

The weight of the piston N then causes that end of the cylinder to drop, the protruding end b'''' of the rod, as it passes down, forcing the hanging weight G at that end back, the weight dropping back to its position again over the rod as soon as the rod is down.

This downward movement of this end of the cylinder opens communication between the entrance-pipe k and the interior of this end of the cylinder, through the passage f', while the passage f becomes the exit-passage for the water which is in the cylinder upon that side of the piston.

The position of the flat part or partition V of the

plug being shown in fig. 5, the water flows in through the entrance-pipe *k* and passage *f'*, and the piston N is forced up and along the rod B, forcing the water in front of it out through the passage *f* and exit-pipe *k'*.

As the piston approaches the other end of the cylinder it impinges against the collar or protuberance *b*, and moves the rod along sufficiently to draw the protruding end from under the weight G, forcing out the opposite end, and the weight of the piston causes that end of the cylinder to fall, bringing the flat part or partition V of the plug or trunnion again to the position shown in fig. 4, and so on.

By knowing the exact amount of water expelled from the cylinder between any two pulsations, any proper and desirable connection may be made between any part of the cylinder or vibrating parts, and an index.

One important object to be attained in the construction of a liquid meter of this description is, that the measuring-vessel should be as long as may be convenient, in order that the sliding weight or piston may make a long stroke between every two pulsations, for by that means, at the end of each stroke, the weight is thrown further than the central point of suspension of the vessel, and as this distance is lengthened and the leverage increased the end of the vessel containing the weight will drop much quicker and more promptly to its lowest position, and the changes of the vessel from one inclined position to the other, and the accompanying changing operations of the meter are made much more rapidly than if the length of the vessel and the consequent stroke of the piston were shorter, using the same amount of weight.

Instead of a cylinder any other vessel of greater diameter than the piston may be used by making the vessel in halves, and secured together by bolts *o'* passing through flanges E, as shown in fig. 6, and instead of cup-leathers, using a flexible diaphragm, *x'*, the edge of which is secured between the two flanges E, while the center is secured between the two parts N of the sliding weight or piston, as shown in fig. 6.

Whatever may be the shape of the vessel, the arrangement of the passages *f* and *f'*, and entrance and exit-ports *k* and *k'*, and the manner of changing communication between the interior of each end of the vessel and the entrance and exit-ports, is precisely similar to that shown in the oscillating-engines already before mentioned, with the exception of the different construction of the barrel or shell of the trunnion, and the suspension of the vessel between center points, which are both valuable features in my invention as applied to a liquid meter, as great wear of the parts and consequent speedy derangement of the instrument is, by my peculiar construction of these portions, entirely obviated.

I am also aware that diaphragms of various forms have been made heretofore, and I do not claim the same irrespective of my adaptation of it to a liquid meter.

Having thus described my invention,

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

1. The metal plate *a*, arranged in combination with the sliding weights N N and cup-leather *d' d'*, substantially as and for the purpose set forth.

2. The combination and arrangement of the rod B, sliding weights N N, and flexible tubing *c* with the parts it envelops, substantially as described.

3. The flexible tubing *c c*, sliding weights N N, plugs C C, and cup-leathers *d' d'*, all combined and arranged substantially as shown and for the purpose described.

4. The vessel V, suspended between two centers or points *y''*, operating and adjustable within barrel *h*, all arranged to perform the function herein set forth.

Witnesses: WILLIAM G. STUART.

T. A. CURTIS,

J. WEST WAGNER.