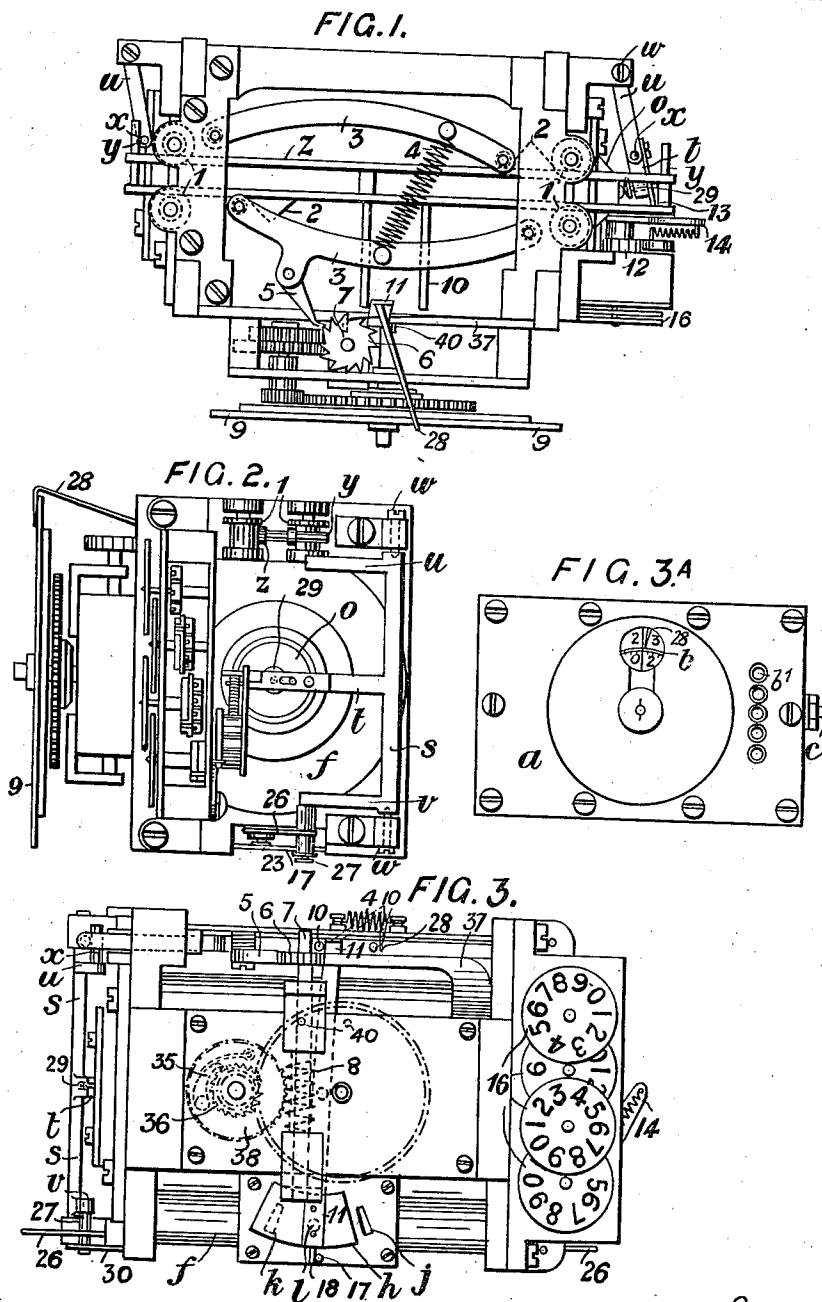


1,023,621.

D. CAHILL.
LIQUID METER.
APPLICATION FILED SEPT. 15, 1910.

Patented Apr. 16, 1912.
2 SHEETS—SHEET 1.



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FIG. 4.

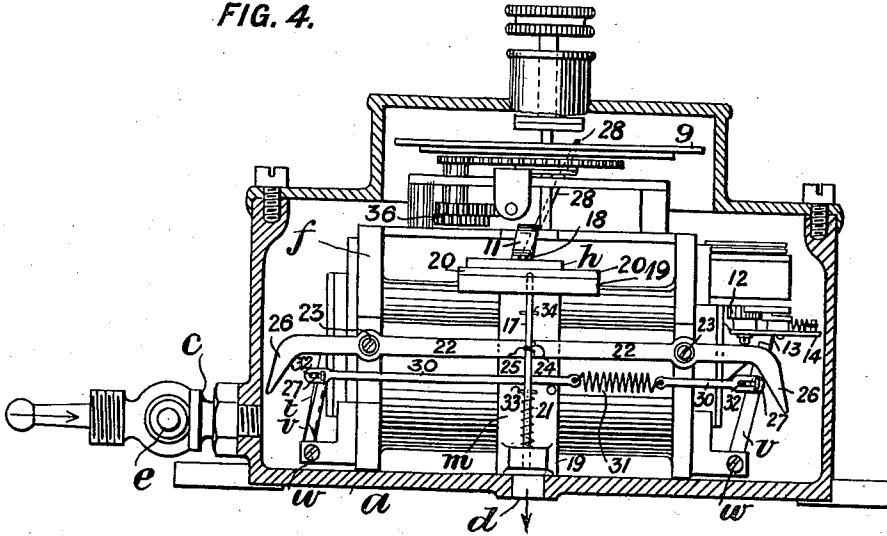


FIG. 6.

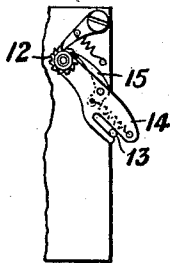
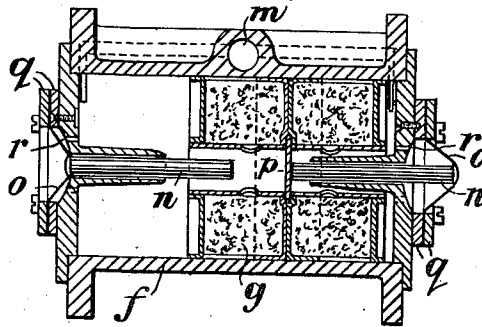


FIG. 5.



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LIQUID-METER.

1,023,621.

Specification of Letters Patent.

Patented Apr. 16, 1912.

Application filed September 15, 1910. Serial No. 582,236.

To all whom it may concern:

Be it known that I, DANIEL CAHILL, a subject of the King of Great Britain, formerly residing at 41 Avenue Kléber, Paris, in the Republic of France, but now residing at 13 Cliftonville street, Belfast, Ireland, have invented new and useful Improvements in and Relating to Liquid-Meters, of which the following is a specification.

This invention of improvements in and relating to liquid meters chiefly concerns the type of meter comprising a cylinder the piston of which, at the end of each stroke, strikes a rod or an abutment and thus operates its own valve gear and a counter. The rods or abutments are usually supported or packed each by a diaphragm secured in an opening in the respective cylinder cover, and the outward movement of the rod or abutment causes outward distention of the diaphragm and the corresponding movement of a linkage. The last named operates the valve gear and the dials or counter, and effects the collapse of the opposite diaphragm and brings about the inward movement of the rod or abutment supported by the latter. It has been proposed to employ what has been termed a shuttle bar in connection with the linkage aforesaid, which shuttle bar was formed with spring-operated cams designed to give an accelerated movement to the valve gear, which movement was partially independent of the piston.

Now the principal objects of the present improvements are firstly, to produce a greater degree of sensitiveness of the instrument in order to render it accurately responsive to very low pressure and to accomplish this the invention provides a novel arrangement of diaphragm and linkages for operating the mechanisms referred to; secondly, to positively lock the valve gear during the greater portion of the stroke of the piston so as to prevent erratic movements of the valve gear, due more especially to vibration and variations in the angle of the plane in which the instrument is carried say on a motor road vehicle or motor boat and for accomplishing this the invention provides an automatic lock to secure the valve during the greater portion of the stroke of the piston as aforesaid; thirdly, to provide a pointer or indicator in order to enable the actual moment of completion of each piston stroke to be accurately observed this being accomplished by providing a pointer on the

oscillating valve, and, fourthly to provide a more convenient arrangement of the levers and linkages employed for transmitting the movements of the abutments to the counters and valve gear and other detail improvements in the mechanism all of which will be hereinafter fully described with reference to the accompanying drawings in which:—

Figure 1 is a plan of a liquid meter constructed according to the present improvements. Fig. 2 is an end view of the instrument as seen from the right hand side of Fig. 1. Fig. 3 is a front elevation with the dials removed. Fig. 3^A is an elevation of the casing to a smaller scale. Fig. 4 is an inverted plan of the mechanism inclosed in the casing which is in section. Fig. 5 is a central vertical section of the cylinder and piston illustrating the improved arrangement of diaphragm, and Fig. 6 is an elevation of a detail.

In the drawings *a* designates the liquid tight casing, having windows *b* and *b'* Fig. 3^A through which the indications of the apparatus are observed and a liquid supply connection *c* and outlet *d*, the connection *c* being fitted if desired with a cock *e*.

The meter comprises a cylinder *f* fitted with a float piston *g* and having an oscillating slide valve *h* which alternately uncovers the inlet ports *j* *k*. Whenever either one of these ports is uncovered by the slide *h* the other one is covered and is placed in communication with the delivery port *l* by the valve *h*. The delivery port *l* opens into a delivery passage *m* arranged to communicate with the outlet *d* in the casing.

n, *n* are rods or abutments guided in respective ends of the cylinder *f* and having their outer ends packed or fitted water-tight by means of diaphragms *o*. The inner ends of the rods are alternately struck by the disk *p* in the piston. The diaphragms *o* are suitably secured between clamping rings *q*. These rods alternately drive the various mechanisms and are moved inward into the cylinder thereby in a manner hereinafter described. The amplitude of movement of the abutments or rods *n* *n* is increased, according to these improvements, so that the work performed by the piston is distributed over a greater portion of the stroke. This is accomplished, not by making the diaphragms *o* of greater diameter than heretofore but by arranging for the diaphragms *o* to be distensible toward both the interior

and exterior of the cylinder. If the diaphragms *o* are made of large diameter, in order to increase the amplitude of their movement, a proportionate increase in the counter-pressure due to the diaphragms is set up which is therefore obstructive of the free movement of the piston. By arranging for the diaphragms to have a maximum movement toward both sides of the cylinder cover, such diaphragms may be of small diameter and nevertheless have a movement of considerable amplitude. For instance by recessing the cylinder cover as at *r* and supporting the diaphragms in the manner illustrated they may have a movement equal to the entire stroke of the piston *g* so that in this way the resistance due to the slide valve mechanism and of the counters hereinafter described may be distributed over the whole of the piston stroke instead of over a small portion only as heretofore. Therefore it is possible for the meter to accurately measure a fluid at a considerably lower pressure than heretofore, a pressure as low as that corresponding to a head of two inches of petrol being sufficient for the purpose.

At each end of the cylinder *f* there is mounted a rock shaft or spindle *s* and each shaft *s* carries a central arm *t* and end arms *u*, *v* respectively. The shaft *s* may be mounted between adjustable centers *w* and the free ends of the arms *t* extend across the centers of the diaphragms *o* so that each of the arms *t* is struck in turn by the corresponding rod *n*. The arms *u* have each a lateral pin or projection *x* at the free end and the pins *x* lie in the paths of similar projections or pins *y* upon the so called shuttle bar *z*. The latter as shown, is composed of two parallel strips or bars connected by cross pieces and is movable to and fro in guides afforded by the grooved rims of pairs of antifriction rollers 1, 1. The shuttle bar *z* carries on each side a triangular cam 2 and these cams are so arranged as to force apart the oppositely or reversely pivoted curved levers 3 until such moment as the ends of the levers 3 ride over the summits of the cams 2, after which a spring 4 pulls the levers 3 toward each other and the levers acting upon the cams accelerate the movement of the shuttle bar. The right hand one of the curved levers 3 in Fig. 1 carries a pawl 5 adapted to drive a ratchet wheel 6 fixed on the shaft 7 of the worm 8, which latter drives a worm wheel 38 carrying a pawl 35 which drives a ratchet wheel 36 and thereby the train of wheels for moving the indicating dials 9; 37 designates the detent or click for the ratchet 6. The shuttle bar carries projecting pins 10 for engaging with the free end of the lever 11 for oscillating the slide valve *h* which is carried upon the opposite end of the double armed lever 11, and one of the levers *t* (seen to the right

hand of Fig. 1) carries a projection 13 for engaging a lever 14 (best seen in Fig. 6) which is provided with a pawl 15 for turning a ratchet wheel 12 which effects the advance of the dials 16 of a counter or totalizer adapted to show the total quantity passed through the meter.

To prevent unintentional movement of the valve *h* a lock is designed to be operative for the greater portion of each stroke of the piston *g*, for instance during nine-tenths of the stroke, after which it is released and the valve is free to be operated. The locking device conveniently consists of a bolt or projection 17 which is moved into and out of the path of the lever 11 operating the valve *h* by a system of levers in connection with the valve linkage. In a convenient arrangement and as shown the lever 11 which has an oscillatory motion, is fitted with a projection 18 and the bolt 17 is slidably mounted in suitable guides 19 and is movable so as to protrude through the face plate 20 of the distribution ports about perpendicularly thereto. The positions and dimensions of the projection 18 and bolt 17 are such that in one extreme position of the valve *h* the bolt 17 protrudes just in front of one side of the projection 18 and in the other extreme position the bolt 17 protrudes just in front of the other side of the projection 18. A spring 21 may be arranged to constantly press the bolt 17 into or toward its operating position and the bolt 17 is moved out of its operative position and against the action of the spring 21 by either one of two levers 22 working on pivots 23 on the ends of the cylinder and adapted to be operated by the corresponding arms *v*. The spring 21 operates between a pin 33 in the bolt 17 and the rear one of the guides 19 and a pin 34 in the bolt abuts against the forward guide 19 to limit the upward movement of the bolt 17. The levers 22 may have their inner and overlapping ends forked as at 24 to engage a pin or projection 25 on the bolt 17. The outer ends of these levers 22 may be formed with cam projections 26 adapted to be engaged by projections or pins 27 on the arms *v*. It will be seen from Fig. 4 that for the greater portion of a piston stroke the bolt 17 remains projected so that the valve and valve lever are locked between the bolt 17, suitable stops 40 lying in the path of the arm 11 and limiting the motion of the valve. As the piston nears the end of its stroke and the free end of one of the arms *v* is moved away from the cylinder, the projection on such free ends strikes the corresponding cam 26 and sets the two levers 22 in horizontal alinement, this movement causing the forked end to move the bolt 17 out of locking position as shown in Fig. 4. During the period for which the bolt is removed from locking position the valve is

reversed by one of the pins 10 on the shuttle bar z striking the end of the lever 11 and thereafter movement of the valve will be resisted by that pin 10, movement of the shuttle bar z being elastically resisted by the spring-operated levers 3 bearing upon the cams 2. As soon as the piston reverses its stroke and the arm v which was moved outward begins to approach the cylinder, the bolt 17 is again permitted to be projected by its spring 21, into locking position and the levers 22 are again moved to an inclined position.

A pointer 28 may be carried by the lever 11 at the end opposite the end on which the valve is fixed and may be so arranged as to lie closely over the graduations of one of the dials 9 in such a position as to be seen through the window b , see Fig. 3^A, therefore if each double stroke of the piston is equivalent to an indication upon the dials of two ounces, a person on the car may, by observing the movement of the pointer 28 (which movement is much greater than the movement of the dial) ascertain the number of strokes of the piston and therefore the quantity of fuel consumed, over say a measured distance. Moreover the rate of flow of the liquid may be ascertained with facility by simply observing how long a time is occupied by the piston in completing a stroke these readings not being possible with accuracy, under all circumstances, if the small graduations on the disk were to be relied on. The arms t are suitably fitted each with an adjustable screw stud 29 for bearing upon the outer end of the respective rod or abutment n . The arms v fitted each with a projection or pin 27 are connected together by a link 30 which thus links the two rocking elements $s t u v$ together. The link 30 is preferably in two parts connected together by a tension spring 31 and the outer ends of the link 30 are connected to respective pins 27 by forming in each of such ends of the links an elongated or somewhat oval hole 32 which is passed over the correspondingly shaped head of a screw screwing into each respective pin. By giving the screw a quarter turn, the somewhat oval head will lie across the slot 32 and prevent accidental displacement of the link.

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

1. A liquid meter comprising in combination, a cylinder, a reciprocatory piston therein, a slide valve controlling the admission of fluid into said cylinder, two abutment rods in the path of said piston, one rod in each end of said cylinder, lever systems on the ends of said cylinder and comprising lever arms in the paths of said abutment rods, a reciprocatory bar, side lever arms also comprised in said lever systems, projections on said bar lying in the path of said side lever

arms, operative connections between said slide valve and said bar, diaphragms for packing said abutment rods, said diaphragms being distensible toward both sides of the planes in which their edges are fixed, indicators, and operating means between said reciprocatory bar and said indicators.

2. A liquid meter comprising in combination, a cylinder, a reciprocatory piston therein, a slide valve controlling the admission of fluid into said cylinder, two abutment rods in the path of said piston, one rod in each end of said cylinder, lever systems comprising arms in the path of said abutment rods, a reciprocatory bar, side lever arms also comprised in said lever systems, projections on said bar and lying in the path of said side lever arms, operative connections between said slide valve and said bar, a locking member, means on said slide valve to normally interlock with said locking member, side arms opposite to the side lever arms of said lever systems, operative connections between said side arms and said locking member, indicators, and operative means between said reciprocatory bar and said indicators.

3. A liquid meter comprising in combination a cylinder, a reciprocatory piston therein, a slide valve controlling the admission of fluid into said cylinder, two abutment rods in the path of said piston, one rod in each end of said cylinder, lever systems mounted on the ends of said cylinder and comprising arms in the path of said abutment rods, locking means normally operative upon said slide valve, a reciprocatory bar, other lever arms also comprised in said lever systems, projections on said bar lying in the path of said other lever arms, operative connections between said slide valve and said bar, a pointer on said slide valve, and a scale in indicative relationship with said pointer.

4. A liquid meter comprising in combination a cylinder, a reciprocatory piston therein, two abutment rods in the path of said piston, one rod in each end of said cylinder, a slide valve adapted to control the admission of fluid into said cylinder, an oscillatory shaft on each end of the cylinder, each of said shafts carrying three arms, the intermediate one of which lies in the path of a corresponding abutment rod, a reciprocatory bolt, means on said valve to normally interlock with said bolt, two armed rocking levers operatively connected with said bolt and adapted to be operated by the arms on one end of said shafts, a sliding bar, projections on the latter in the paths of the respective outside arms opposite to those previously named, and driving connections between said bar and said valve.

5. A liquid meter comprising in combination, a cylinder, a reciprocatory piston therein, two abutment rods in the path of

said piston one rod in each end of said cylinder, a valve adapted to control the admission of fluid into said cylinder, an oscillatory shaft on each end of the cylinder, each of said shafts carrying three arms the intermediate one of which lies in the path of a corresponding abutment rod, a flexible link connected between corresponding end arms of the shafts, a reciprocatory bolt, means on said valve adapted to normally interlock with said bolt, two-armed rocking levers operatively connected with said bolt and adapted to be operated by the arms on one end of said shafts, a sliding bar, projections on said bar in the paths of the respective outside arms opposite to those previously named, and driving connections between said bar and valve.

6. A liquid meter comprising in combination, a cylinder, a reciprocatory piston therein, two abutment rods in the path of said piston, one rod in each end of said cylinder, a slide valve adapted to control the admission of fluid into said cylinder, an oscillatory shaft on each end of the cylinder, each of said shafts carrying three arms, the intermediate one of which lies in the path of a corresponding abutment rod, a reciprocatory bolt, means on said valve adapted to normally interlock with said bolt, two armed rocking levers operatively connected at one pair of ends with said bolt, cams on the opposite pair of ends of said two armed levers, projections on the arms on one end of said shafts, said cams adapted to lie in the paths of respective projections on the said lever arms, a sliding bar, projections on said bar in the paths of the respective outside arms opposite to those previously named, and driving connections between said bar and valve.

7. A liquid meter comprising in combination a cylinder, a reciprocatory piston therein, abutment rods in the path of said piston one rod in each end of said cylinder, an oscillatory shaft on each end of the cylinder, three arms fixed on each of said shafts with the intermediate arms in the paths of respective abutment rods, a sliding bar, guides therefor, projections there-

on lying in the paths of the extremities of the outside arms on one end of said shafts, an oscillatory slide valve for controlling the distribution of fluid to the opposite sides of said piston, an operating arm on said valve extending to the opposite side of the pivot of said operating arm, projections on said bar for engaging said operating arm in both directions of travel, a reciprocatory bolt, means on said slide valve to normally interlock with said bolt, oscillatory two armed levers mounted on said cylinder with their convergent arms engaged with said bolt, cams on the opposite arms of said two-armed levers, said cams lying in the paths of the outside arms on the opposite end of said shafts, indicating dials, and ratchet and pawl gear between said bar and said dials.

8. In a liquid meter of the reciprocatory piston type comprising indicators driven by mechanism operated by said piston, an oscillatory slide valve for controlling the distribution of fluid to the opposite sides of said piston, spring operated locking means normally operative to positively lock said slide valve, and lever mechanism connected with said locking means and operated by the piston at each end of its strokes for releasing said locking means.

9. In a liquid meter of the reciprocatory piston type comprising indicating dials, mechanism operated by said piston for driving said dials, an oscillatory slide valve for controlling the distribution of fluid to the opposite sides of said piston, a spring operated locking member, means on said slide valve to normally interlock with said member, lever mechanism connected with said locking member and operated by the piston at each end of its stroke for releasing said locking member, an indicating pointer on said slide valve, and a granulated arc in indicative relationship with said pointer.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DANIEL CAHILL.

Witnesses:

W. MORBEY,

H. D. JAMESON.