

No. 679,016.

Patented July 23, 1901.

J. M. DUCHAMP & R. PHILIPPE.

LIQUID METER.

(Application filed Dec. 4, 1900.)

(No Model.)

2 Sheets—Sheet 1.

FIG. 1

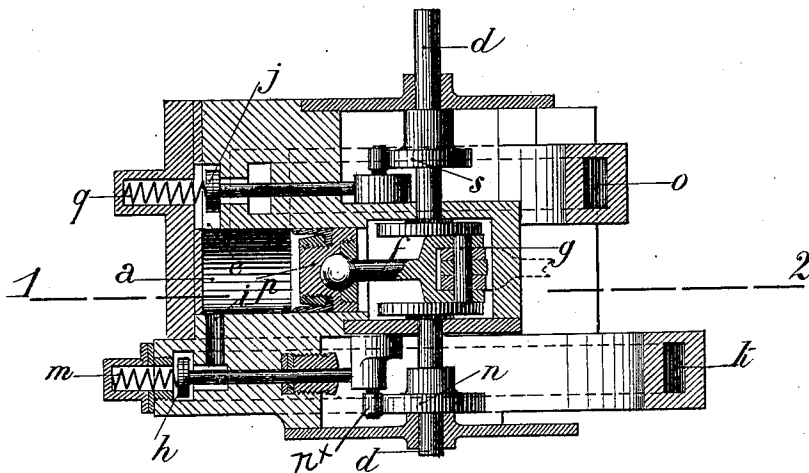
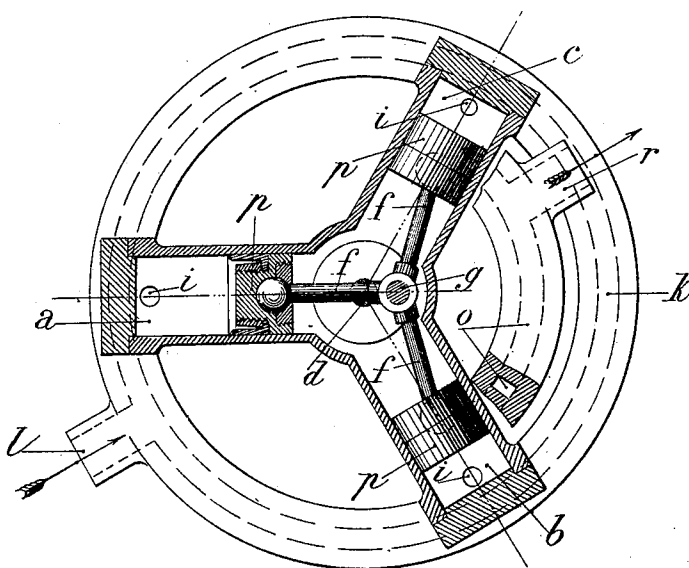


FIG. 2



WITNESSES:
Ella L. Giles
Otto Munk

INVENTORS
Jean Marie Duchamp
Raoul Philippe
BY
Richardson

ATTORNEYS

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FIG. 4

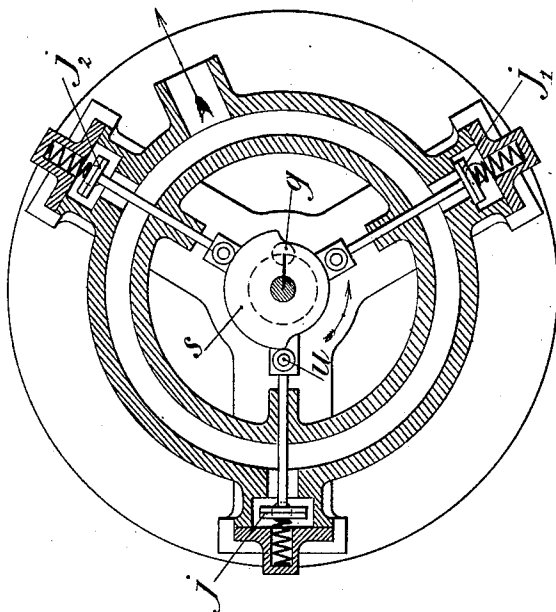
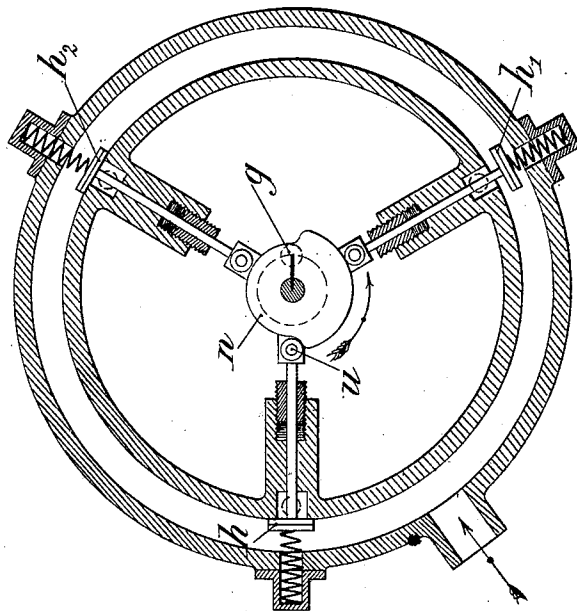


FIG. 3



WITNESSES:

Emabella Haglund.
Adelaide Gleason.

INVENTORS.

Jean Marie Duchamp
Paul Philippe

BY

Richardson

ATTORNEYS

UNITED STATES PATENT OFFICE.

JEAN MARIE DUCHAMP, OF LYONS, AND RAOUL PHILIPPE, OF ST.
RAMBERT-L'ILE-BARBE, FRANCE.

LIQUID-METER.

SPECIFICATION forming part of Letters Patent No. 679,016, dated July 23, 1901.

Application filed December 4, 1900. Serial No. 38,613. (No model.)

To all whom it may concern:

Be it known that we, JEAN MARIE DUCHAMP, residing at Lyons, and RAOUL PHILIPPE, residing at St. Rambert-L'ile-Barbe, in the department of Rhône, France, have invented a new and useful Liquid-Meter, of which the following is a full, clear, and exact description, and for which we have made application for patent in France, dated May 29, 1900.

The invention has for its object a liquid-meter composed of at least three pistons moving in as many cylinders, which are filled and emptied successively by means of a set of valves operated by the passage of the liquid to be measured.

The accompanying drawings represent an example of our improved meter having three cylinders.

Figure 1 is a vertical section drawn on the axis of one of the cylinders. Fig. 2 is a horizontal section drawn on the axes of the three cylinders. This figure shows also a part of the conduit *o*, this being in a higher plane than the cylinders, but being shown here for convenience of illustration. Figs. 3 and 4 illustrate the valves and the cams with connections for operating them. Fig. 3 shows the cam *n*, governing the inlet or admission valves *h* *h'* *h''*. The crank-knob *g* is situated in the extension of the axis of the valve *h*, and it turns in the arrow direction, the same as the cam. Fig. 4 shows the cam *s*, which actuates the outlet or discharge valves, the crank *g* being in the same position as in Fig. 3.

The piston corresponding to valves *h* and *j* is at the end of its forward stroke, the inlet or admission valve *h*, Fig. 3, has just closed, and the outlet or discharge valve *j* has just opened. These valves will remain in that position during a half-revolution of the cam, while the rollers *u* run on concentric parts. Thereafter they will take the contrary or inverse position when the piston will be at the end of its back stroke. The three valves will be actuated in the same manner.

The cylinders *a b c* are arranged radially around a vertical shaft *d* at equal angles of one hundred and twenty degrees. They are each traversed by a piston *p*, attached by a connecting-rod *f* to a single crank-pin *g* of the

shaft *d*. The piston-rods are connected with the pistons through any suitable ball-and-socket joint, such as illustrated. This, however, forms no part of my invention, being a common expedient. Each cylinder is provided near the outer end—that is, the end farthest from the crank-shaft *d*—with an inlet-opening *i*, closed by a valve *h*, and with a discharge-opening *e*, closed by a valve *j*. The three inlet-valves *h* open into a circular channel *k*, into which opens the tube *l*, conveying the liquid into the meter. They are kept closed by springs *m* and are opened by the action of a cam *n*, fixed on the shaft *d*. The shape of this cam is such that with each cylinder the admission remains open during the entire forward stroke of the piston and closed during the entire backward stroke. Whatever may be the position of the pistons there is therefore at least one valve open. The cam *n* is provided with high and low parts, the high parts pushing the valve-rod to open the valve, while when a low part comes opposite the roller *n'*, connected with the rod, the spring *m* exerting its force and meeting no resistance from the cam will close the valve.

The three discharge-valves *j* open into a circular channel *o*, to which is connected the tube *r*, serving for the discharge of the liquid. They are kept closed by springs *q* and are opened during the backward stroke of the piston by the action of a cam *s*, fixed to the shaft *d*. The cam *s* is provided with high and low parts, like an ordinary cam, and it operates in connection with the spring *q* in a manner similar to that described in connection with the cam *n* and the spring *m*.

From the above explanation the operation of the meter, which is as follows, will be readily understood. The liquid entering by the tube *l* into the circular channel *k* enters that cylinder the admission-valve of which is open—for example, the cylinder *a*—and pushes the piston to the end of its stroke to the position shown at Fig. 2. At this moment the admission to the cylinder *a* is closed; but the piston of the cylinder *b* having already made a third of its forward stroke this cylinder is opened to the admission, and the motion continues. The piston of the cylinder *a*

then forces the liquid into the channel *c*, past the discharge-valve which has just opened. The same effects are reproduced successively in the cylinders *b* and *c*, and after a complete rotation there has passed from the channel *k* to the channel *c* a volume of liquid equal to the volumes generated by the three pistons. This volume is registered outside by a train of gearing and dials of any desired system operated by the shaft *d*.

It is to be remarked that the absence of dead-points in the mechanism enables it to work at very slow speeds, while, on the other hand, the readily-obtainable water-tightness of the pistons and valves does not permit the liquid to escape before the completion of the stroke of the pistons. The apparatus will therefore give the exact measure of the liquid passing through the meter, however slow the flow may be. This result is completely obtained with three cylinders, but a greater number of them may be employed. In any case they will be arranged radially at equal distances around the central shaft.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In a liquid-meter, the combination of at least three cylinders, pistons working in said cylinders, a crank-shaft having a single crank thereon, around which the cylinders are ar-

anged radially, a connecting-rod to each piston connected to the said crank, an inlet-valve and an outlet-valve to each cylinder, an inlet-channel and an outlet-channel with which such valves respectively communicate, a single cam on the crank-shaft to open successively the three inlet-valves, springs to close said valves, another cam on the crank-shaft to open successively the three outlet-valves, and springs to close these latter valves, substantially as herein set forth.

2. In a liquid-meter, the combination of at least three cylinders, pistons working in said cylinders, a crank-shaft, a connecting-rod to each piston connected with a crank on the crank-shaft, an inlet-valve and an outlet-valve to each cylinder, cams on the crank-shaft to open the said valves, springs to close the valves, and an inlet-channel and an outlet-channel with which the inlet and outlet valves respectively communicate, substantially as herein set forth.

In witness whereof we have hereunto set our hands in presence of two witnesses.

JEAN MARIE DUCHAMP.
RAOUL PHILIPPE.

Witnesses:

GASTON JEAUNIAUX,
THOS. N. BROWNE.