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FLUID DELIVERY METERS
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Fig. 1

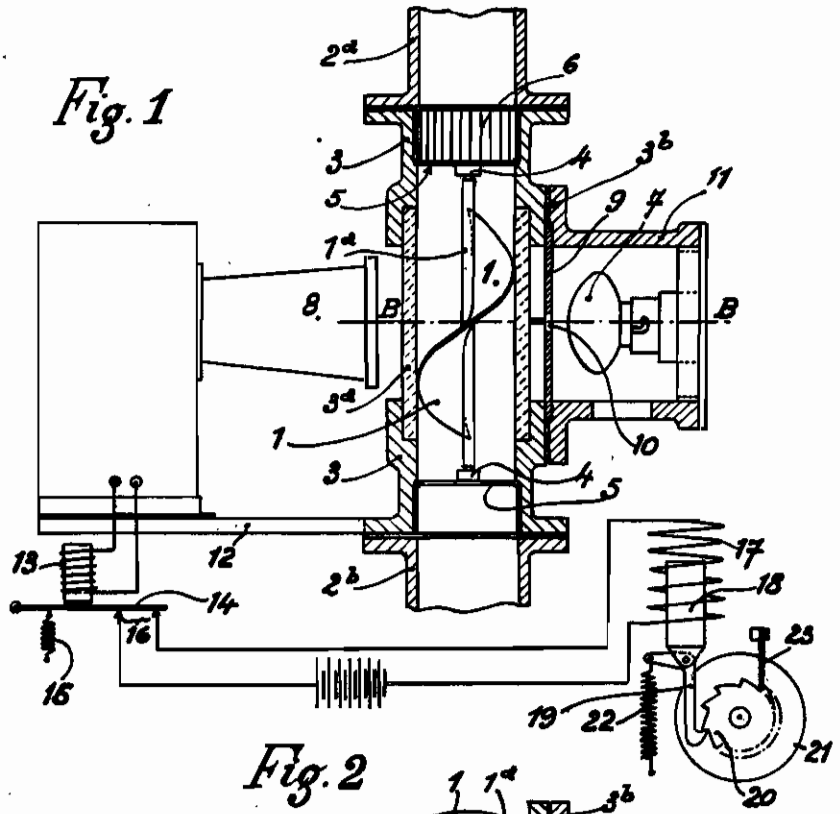
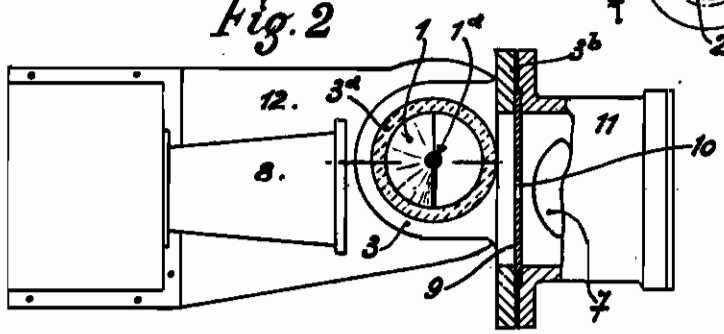


Fig. 2



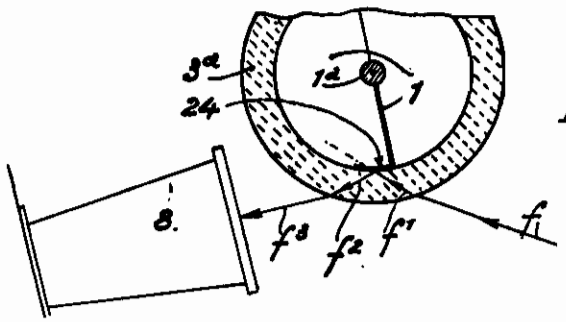


Fig. 3

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FLUID DELIVERY METERS

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The present invention relates to fluid delivery meters or counters of the continuous type, in which the metering member is a rotor arranged in, and operated by, the liquid current.

It is known that known apparatus of this kind, whether of the purely mechanical type, of the electro-mechanical type or of the magnetic type, have the general inconvenience of having a reduced sensitiveness, in consequence of the braking action applied to the rotation of the turbine by the marking device, which indicates the volumes as a function of the number of revolutions of the rotor.

The present invention has for its object to provide a novel meter of the turbine type which radically eliminates this inconvenience, and which consequently possesses a maximum sensitiveness limited only by the minimum pivoting friction of the turbine.

To this end, the invention is essentially characterised by the use, in order to control the indicator, of a photo-electric cell and of a luminous pencil constructed so as, alternatively, to illuminate the cell and to be cut off at a frequency proceeding from the rule of rotation of the turbine under the action of the fluid current.

The output of the amplifier of the photo-electric cell is connected to a relay which, at each illuminating phase, or at each cutting off phase, according to the arrangement chosen, closes the feeding contact of an electro-magnet controlling the base wheel of a counter, the graduation of which is arranged as a function of the volume of liquid that flows between two successive phases.

In a particularly simple embodiment, the apparatus comprises a turbine, which is co-axial with the fluid conduit and is of the helicoidal type with one or more spirals turning in a glass cage. The luminous pencil is established across the interval comprised between the hub of the turbine and the said cage by means of a source of light external to the latter. The photo-electric cell is arranged on the opposite side of the cage in a suitable position, account being taken of the refractions of the luminous rays through the cage and also through the flowing liquid. The said luminous pencil is cut off at the passage of each spiral, that is to say, a number of times per revolution of the turbine equal to the number of spirals of the latter.

In the case of an opaque fluid, a turbine rotating in a glass cage can still be used with a luminous pencil, which is arranged in such a manner as normally to be cut off by the mass of the said fluid but, at the time of the passage of a spiral or blade of the turbine, to be directed towards the photo-electric cell by means of a small reflecting surface integral with the spiral or blade and rotating in close contact with the internal cylindrical wall of the cage.

The annexed drawings show, by way of example, one embodiment of the invention.

Fig. 1 shows the complete apparatus, partly diagrammatically and partly in sectional elevation, on the line A—A—A—A in Fig. 2;

Fig. 2 is a fragmentary plan view partly in section, at the level of the line B—B in Fig. 1; and

Fig. 3 is a partial and diagrammatic plan view of a modification of the preceding construction for use in the case of an opaque fluid.

Referring to the drawing, the apparatus comprises a turbine 1, of the axial type, for example, and consequently mounted on the axis of the fluid conduit 2^a, 2^b. The turbine is supported in a tubular casing 3 inserted between the two sections 2^a, 2^b of the conduit. The ends of the shaft 1^a of the turbine forming pivots are advantageously carried, in the usual manner of clock-work pivots, in stones housed at 4, 4 on pierced supports 5, 5 in the interior of the casing 3, so as to reduce friction to a minimum.

In the present construction, the turbine comprises a single spiral which rotates without play in the internal conduit of the casing 3, the part of the latter housing the turbine consisting of a glass tube 3^a, hermetically encased at its ends in two metallic parts 3, 3 joined in a fluid-tight manner, in any suitable way, with the two sections 2^a, 2^b of the fluid conduit.

In the inlet of the turbine there is advantageously disposed a fluid current corrector or breaker-jet 6 which eventually, in a case in which the apparatus is branched immediately following a bend in the fluid conduit, will cause the fluid stream to flow parallel to the axis of the turbine.

The space between the shaft or hub 1^a of the turbine and the internal wall of the glass case 3^a is traversed by a luminous pencil from a lamp 7, arranged to illuminate a photo-electric cell intermittently in dependence on the delivery of fluid through the turbine, that is to say, in accordance with the rule of rotation of the turbine and as a function of the number of spirals of the latter. In the present construction, in which the turbine comprises a single spiral only, the luminous pencil will thus be cut off once per revolution and, in this connection, it will be noticed that the number of spirals of the turbine is only limited by the condition that the

luminous pencil should only meet a single spiral at a time. The whole of the photo-electric cell with its accessories (amplifier) represented diagrammatically is designated by **8** on the drawing. The luminous pencil advantageously is limited by means of a diaphragm **9** provided with an operculum **10** or concentrated by means of an optical condenser.

In Fig. 2 it is assumed that the axis of the luminous source is aligned with the axis of the receiving cell but, in reality, these two members are disposed one with respect to the other so as to take into account the refraction of the light through the glass of the tube **3a** and, eventually, by the fluid which flows into the conduit.

The lamp **7** is mounted in a support **11** which is fixed, for example, against a plane face, in the form of a ring **3b** on the side of the metallic parts **3** of the casing of the turbine, and maintains the diaphragm **9** in position at the same time.

The cell and its accessories can be mounted, for example, on a seat **12** integral with the lower member **3** of the casing.

The apparatus as just described is closed in a light-tight casing (not shown), which prevents the action on the cell of daylight or any other source but the lamp **7**.

The current furnished by the photo-electric cell is duly amplified and feeds a relay **13** which itself serves to feed the counter-mechanism proper, either at the time of the lighting phases, or at the time of the cutting off phases. On the drawing, the parts are shown as being arranged to operate according to the second method, that is to say, each time that the luminous pencil is cut off, the relay **13** releases its armature **14** which, under the action of a return spring **15**, bridges contacts **15** and closes a circuit by which an electro-magnet or a solenoid controlling the counter is fed. The illustrated example of the circuit comprises a solenoid **17** having a plunger core **18**, which is articulated to a click **19** adapted to operate the base wheel **20** of a drum counter **21**. A spring **22** ensures the return of the click **19** and of the core **18** and another click **23**, such as a resilient blade, ensures the retention of the base wheel.

It will be understood that in the present case the base wheel advances by one tooth for each revolution of the turbine **1**, this corresponding to the passage through the turbine of a predetermined volume of fluid.

The number of teeth of the base wheel and the transmission between the latter and the first graduated drum or the first indicating wheel are naturally established in dependence on the units (litres or others) indicated by the first drum or the first wheel. It will be understood that the measurement for a pipe of given diameter will be the more precise as the delivery corresponding to an operation of the counter is smaller, the maximum precision being obtained by providing the turbine with a maximum number of spirals compatible with the observance of the condition indicated above, that is to say, that the luminous pencil shall never encounter more than one spiral at a time.

In the case of the metering of the delivery of an opaque fluid, apparatus of the same kind as the preceding can be used but with a different relative arrangement of the luminous source and the photo-electric cell. In this case, the luminous pencil *f*, Fig. 3, refracted at f^1, will be made in such a manner as to be cut off normally by the mass of the opaque fluid. Each spiral or blade **1** of the turbine will be provided, however, at the height of the plane of the pencil with a small rim **24** having a reflecting surface which, during the passage of the spiral, encounters the pencil and causes it to pass from f^2 to f^3 in the direction of the photo-electric cell **8**.

In this sense, if the turbine only comprises a single spiral, the illuminating phases will be shorter than the cutting-off phases and, in consequence, it will be of interest to arrange the relay **13** in a reverse manner to that of Fig. 1, so that it closes the circuit of the electro-magnet of the counter during the phases of attraction of its armature **14**.

It will be noted that the meter of the present invention operates exactly in the same manner in the same direction of flow of the fluid.

It goes without saying that the counter mechanism proper can be arranged either for counting positively or for deducting from a quantity marked in advance by the indicator members.

It will be understood that the invention is not limited to the constructional methods described and shown, of which it comprises all modifications. Any other type of turbine can be employed and the luminous pencil may be arranged out of the zone swept by the turbine proper, in such a manner as to cut the path of any member integral with the latter.

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