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METER FOR LIQUID

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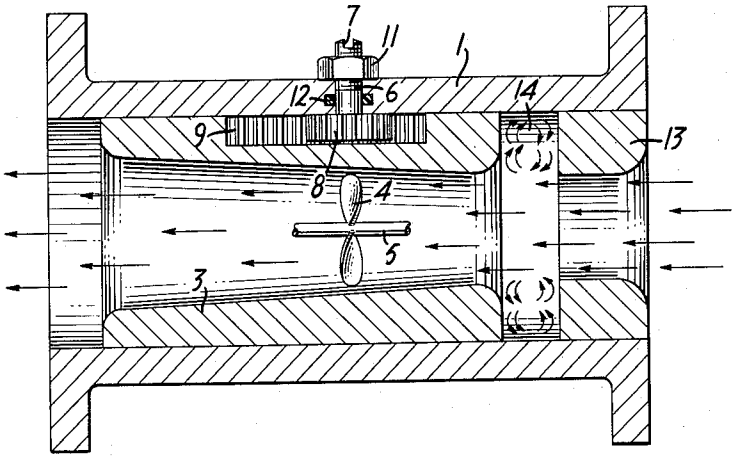


FIG. 1

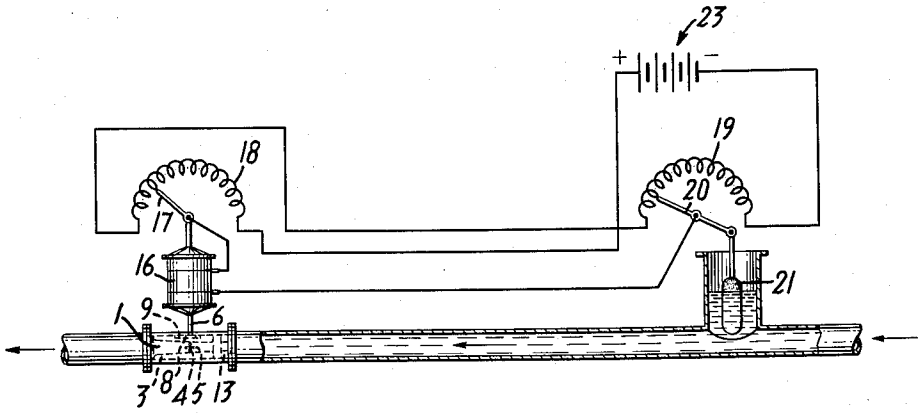


FIG. 2

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METER FOR LIQUID

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Meters for liquid are already known comprising a turbine such as a screw revolving at a speed proportional to the volume of the flow of the liquid.

It is also known to provide these meters with means for causing an outlet section of the nozzle of the turbine to vary as a function of the density of the liquid and various extrenal factors intervening on the value of this density such as temperature. This type of arrangement enables the speed of the turbine to be modified as a function of the density of the liquid, which enables the value of the aggregate flow of the liquid to be ascertained.

According to other known arragements, the turbine is placed in a cone-shaped nozzle. Means are provided to ensure axial displacement of the turbine relative to the nozzle so as to regulate the section of the nozzle cooperative with the turbine corresponding to a value representative of the density of the liquid of which the aggregate flow requires to be measured.

Again, according to other known characteristics the means for regulating the section of the nozzle of the turbine are, on the one hand, adjustable by hand as a function of the density of the liquid at a reference temperature, and on the other hand, automatically as a function of the temperature variation in relation to that of the reference temperature to allow for the variation in density of the liquid as a function of the temperature.

The present invention seeks to provide various improvements in manual controls ensuring the relative displacement of the turbine and cone-shaped nozzle along its longitudinal axis.

The invention also has the object of avoiding the thrust of the liquid on the cone-shaped nozzle and to ensure a correct distribution of laminary speeds in the passage section of the fluid about the turbine.

A meter for liquid enabling the afore-mentioned objects to be achieved possesses the characteristics which set out in the following description and more particularly in the attached claims.

A meter for liquid according to the invention is shown by way of example in the attached drawings, in which:

FIG. 1, is a cross-section elevation view of an embodiment of the meter for liquid according to the invention.

FIG. 2, is a diagram of an embodiment of remote control mechanism for displacing the cone-shaped nozzle of the meter, illustrated in FIG. 1, to the variation in density of the fluid whose aggregate flow is required to be measured.

A meter for liquid shown in FIG. 1 consists of a meter body member 1 connectable in a fluid channel or conduit and having an inlet and an outlet. A cone-shaped nozzle 3 is placed in this body, and can be moved axially along its longitudinal axis. The nozzle has a passageway with an inlet and diverging outlet for allowing fluid flow therethrough and through the meter.

A turbine row comprising a screw 4 revolves freely around the spindle 5 at a position fixed in relation to the meter 1 and is driveable by the liquid flowing through the meter.

By shifting the cone-shaped nozzle 3 the diameter can be varied of the passage section in which the screw 4 rotates.

The movement of the nozzle 3 is controlled by a rod 6

disposed transversely of the nozzle 3. This rod has one end extending externally of the meter body 1 and is provided with a screwdriver slot 7.

The other or inner end of the rod 6 carries a pinion 8 meshed with a rack element 9 integral with the nozzle 3. An external nut 11 which cooperates with a threaded portion of the rod 6 permits locking the nozzle in the position obtained after the axial adjustment thereof. Plastic rings 12 ensure tightness during the adjusting operation, the nut 11 being then loosened.

This arrangement affords several advantages. More particularly, it enables the meter to be calibrated in a very handy manner, seeing that it is no longer necessary for this calibration operation to re-machine, during testing, the diameter of the passage section in which the screw is disposed, in order to obtain sufficient accuracy of the elementary metering volume.

The rod 6 can be rotatively driven manually by means of a screwdriver or by a servomotor.

This arrangement enables the positioning of the axial movable nozzle by rack and pinion which, on the one hand, allows a meter to be used graduated by weight, without automatic correcting mechanism and setting manually compensation for nominal densities of the liquids in the case where this density remains constant during metering.

According to the invention a tubular throttle member 13 is fixed upstream of the nozzle axially spaced therefrom. This throttle member concentrates the fluid jet towards the entrance to the nozzle, thus creating an annular zone 14 in which a pressure drop takes place and counter-balances the thrust on the nozzle 3. By varying the diameter of the throttle member 13, this acts on the value of the pressure drop of the zone 14, and at the same time on the speed and peripheral pressure of the liquid in the nozzle 3.

Thus, this entry throttle member, placed at a certain axial distance upstream of the cone-shaped nozzle 3 and with a reduced diameter slightly smaller than that of the small entry section of the latter downstream of the entry thereof, enables, on the one hand, a reduced pressure zone to be created neutralizing the thrust of the liquid on the cone-shaped nozzle 3, and on the other hand, to effect a variation in the distribution of laminary speeds in the passage section to render substantially uniform the velocity of the liquid in any cross section of the liquid flowing therethrough at any one time and thus to make the meter accurate within a range of liquid output readings.

The liquid meter according to the invention also comprises a device affording remote control, in the case of a variable density of the liquid. The device positions the cone-shaped nozzle 3 according to thermometer readings or directly in response to density sensing means such as a densimeter, placed at any point in the liquid circuit preferably upstream of the meter, by means of an electric transmission acting on a servo-motor.

To this end, FIG. 2, a reversible servomotor 16 directly engages the rod 6 of the driving pinion 8. The rotor of the motor 30 is integral with the slider 17 of a potentiometer 18 mounted as a Wheatstone bridge with a potentiometer 19. The slider 20 of the potentiometer 19 is directly connected to the position, for example, of the float of a densimeter 21. The electric motor 16 is connected to one of the diagonals of the Wheatstone bridge. The other diagonal has an electric source 23 connected therein. In these conditions, the rotor of the motor 16, and consequently, of the nozzle 3, is always stabilized in a position corresponding to that where the sliders of the potentiometers 18 and 19 balance the Wheatstone bridge. Owing to this face, the movements of the nozzle 3 are governed by those of the float of the densimeter 21.

The density sensing means 21 varies the ratio of one pair of arms of the bridge relative to the other pair of arms in response to density changes in the liquid. The servomotor moves the nozzle 3 to axial positions corresponding to balanced conditions in the bridge circuit, established by the servomotor so that continuous automatic compensation for density changes is provided and the liquid meter is accurate regardless of density changes.

What I claim is:

1. A liquid meter for measuring the volume of liquid passing through the meter comprising, a body member having an inlet and an outlet, a nozzle member disposed axially in said body member having a passageway provided with an inlet and a diverging outlet for allowing liquid flow therethrough, a turbine rotor disposed in said passageway in the nozzle member driveable by liquid flowing through the nozzle member, means for automatically displacing the nozzle member axially relative to the turbine rotor to compensate for changes in density of the liquid flowing through the meter comprising, a Wheatstone bridge comprising a parallel circuit having two pairs of arms, means for sensing density changes in the liquid upstream of the nozzle member connected to said Wheatstone bridge circuit to vary the ratio of one pair of arms relative to the other pair of arms, a reversible servomotor connected to said bridge circuit operably connected to said nozzle for displacing it axially relative to said turbine rotor in response to unbalanced conditions in said bridge circuit caused by said density sensing means and connected to the bridge circuit to position the nozzle member in positions corresponding to balanced conditions in said bridge circuit, and means cooperative with the motor and Wheatstone bridge circuit for causing the motor to position said nozzle member in said position corresponding to a balanced condition in said bridge circuit and to cause the motor to move said nozzle member axially in one of two opposite directions in dependence upon the unbalanced condition established in said bridge circuit by said density sensing means.

2. A liquid meter for measuring the volume of liquid passing through the meter comprising, a body member having an inlet and an outlet, a nozzle member disposed axially in said body member having a passageway provided with an inlet and a diverging outlet for allowing liquid flow therethrough, a turbine rotor disposed in said passageway in the nozzle member driveable by liquid flowing through the nozzle member, means for automatically displacing the nozzle member axially relative to the turbine rotor to compensate for changes in density of the liquid flowing through the meter comprising, a Wheatstone bridge comprising a parallel circuit having two pairs of arms, means for sensing density changes in the liquid upstream of the nozzle member connected to said Wheatstone bridge circuit to vary the ratio of one pair of arms relative to the other pair of arms, a reversible servomotor connected to said bridge circuit operably connected to said nozzle for displacing it axially relative to said turbine rotor in response to unbalanced conditions in said bridge circuit caused by said density sensing means and connected to the bridge circuit to position the nozzle member in positions corresponding to balanced conditions in said bridge circuit, means cooperative with the motor and Wheatstone bridge circuit for causing the motor to position said nozzle member in said position corresponding to a balanced condition in said bridge circuit and to cause the motor to move said nozzle member axially in one of two opposite directions in dependence upon the unbalanced condition established in said bridge circuit by said density sensing means, and a tubular throttle member disposed upstream of said nozzle member axially spaced therefrom and having an inlet and outlet opening to allow fluid flow therethrough thereby to create a zone of reduced liquid pressure in a space between said nozzle member and said throttle member to compensate for axial thrust on said nozzle member.

3. A liquid meter for measuring the volume of liquid passing through the meter comprising, a body member having an inlet and an outlet, a nozzle member disposed axially in said body member having a passageway provided with an inlet and a diverging outlet for allowing liquid flow therethrough, a turbine rotor disposed in said passageway in the nozzle member driveable by liquid flowing through the nozzle member, means for automatically displacing the nozzle member axially relative to the turbine rotor to compensate for changes in density of the liquid flowing through the meter comprising, a Wheatstone bridge comprising a parallel circuit having two pairs of arms, means for sensing density changes in the liquid upstream of the nozzle member connected to said Wheatstone bridge circuit to vary the ratio of one pair of arms relative to the other pair of arms, a reversible servomotor connected to said bridge circuit operably connected to said nozzle for displacing it axially relative to said turbine rotor in response to unbalanced conditions in said bridge circuit caused by said density sensing means and connected to the bridge circuit to position the nozzle member in positions corresponding to balanced conditions in said bridge circuit, means cooperative with the motor and Wheatstone bridge circuit for causing the motor to position said nozzle member in said position corresponding to a balanced condition in said bridge circuit and to cause the motor to move said nozzle member axially in one of two opposite directions in dependence upon the unbalanced condition established in said bridge circuit by said density sensing means, a tubular throttle member disposed upstream of said nozzle member axially spaced therefrom and having an inlet and outlet opening to allow liquid flow therethrough, said throttle member having an internal reduced diameter downstream of said inlet opening thereby to render substantially uniform the velocity of the liquid in any cross section of the liquid flowing therethrough at any one time so as to render the meter more accurate within a range of liquid output readings, and said reduced internal diameter being substantially equal to an internal diameter of the nozzle member downstream of its inlet and adjacent thereto.

4. A liquid meter for measuring the volume of liquid passing through the meter comprising, a body member having an inlet and an outlet, a nozzle member disposed axially in said body member having a passageway provided with an inlet and a diverging outlet for allowing liquid flow therethrough, a turbine rotor disposed in said passageway in the nozzle driveable by liquid flowing through the nozzle, means for automatically displacing the nozzle axially relative to the turbine rotor to compensate for changes in density of the liquid flowing through the meter nozzle including means for sensing density changes in the liquid upstream of the nozzle, a tubular throttle member disposed upstream of said nozzle member axially spaced therefrom and having an inlet and outlet opening to allow liquid flow therethrough, said throttle member having an internal reduced diameter downstream of said inlet opening thereby to render substantially uniform the velocity of the liquid in any cross section of the liquid flowing therethrough at any one time so as to render the meter more accurate within a range of liquid output readings, and said reduced internal diameter being substantially equal to an internal diameter of the nozzle member downstream of its inlet and adjacent thereto.

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