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APPARATUS FOR MEASURING THE LEVEL OF LIQUIDS

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The present invention relates to an apparatus for measuring the level of liquids.

The primary object of my invention is to provide an apparatus permitting to measure the level of a fluid with a greater accuracy than this was possible hitherto.

Another object of my invention is to provide an apparatus permitting to record with a great accuracy the variations of the level of a liquid.

Still another object of my invention is to combine two such apparatus for measuring the flow output of a liquid flowing through a channel having a cross section of known shape and size, the one of these apparatus measuring the level of the liquid in the channel, whilst the other apparatus measures the level of liquid indicating the hydrodynamic pressure of the moving liquid, further means responsive to these two apparatus indicating the flow velocity.

Other objects of my invention will appear hereinafter as the description of the invention proceeds, the novel features, combinations and construction being more particularly pointed out in the specification and the claims hereunto appended.

The annexed drawings diagrammatically illustrate several modifications of apparatus according to my invention.

Fig. 1 is a diagrammatical illustration of a first embodiment of the invention.

Fig. 2 is a diagrammatical, partly sectional illustration of a second embodiment.

Fig. 3 is a diagrammatical illustration of a third embodiment.

Fig. 4 represents a diagram of a physical function.

Fig. 5 is a diagrammatical, partly sectional view of an apparatus according to the invention.

Fig. 6 is an elevational illustration of the apparatus shown in Fig. 5.

Fig. 7 illustrates some characteristical curves recorded with an apparatus like that represented in Fig. 5.

In Fig. 1 of the drawings, a reservoir 1 is shown containing an electricity-conducting liquid 2 the level of which is to be measured for example before and after having fed a quantity of liquid to the reservoir.

The apparatus comprises a shaft 3 journalled in fixed bearings indicated at 4. A drum 5 of insulating material and a toothed wheel 6 of a worm gearing are both rigidly keyed onto the shaft 3. A metallic slip ring 7 is fixed to the drum 5 and connected with a fine metallic wire 8 which is rolled and unrolled as the drum 5 is

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rotated in one or other direction. A weight 9 is connected to the lower end of the wire 8 and traversed by a contact rod 10 electrically connected to said wire 8. A fixed brush 11 slipping on the ring 7 is connected to one end of the solenoid coil 13 of an ultra-sensitive relay, the other end being connected to one pole of the current source 12 the other pole being grounded at 14. The pivot of the spring-loaded armature lever 15 of said relay is connected by a conductor 16 to one phase of an alternating-current network, the other phase being connected by a conductor 17 to one of the terminals of a reversible electric motor 18. The other two terminals of the latter are connected by conductors 19 and 20, to fixed contacts 21, 22 alternatively cooperating with the movable contact 23 fixed to the armature lever 15. The shaft 24 of the motor 18 is connected by a revolution counter or recording device 25 with the shaft 26 to which the worm 27 of the already cited worm gearing is rigidly fixed.

The operation is as follows:

As long as the contact rod 10 does not touch the surface of the liquid 2, the energizing circuit of the relay winding 13, comprising said contact rod 10 and the liquid 2, is open. The spring-loaded armature lever 15 then urges its movable contact 23 onto the fixed contact 22, causing the motor 18 to revolve its shaft 24, the shaft 3 and the drum 5 in such a direction as to unroll the wire 8 and to lower the contact rod 10 onto the surface of the liquid 2. As soon as the rod 10 contacts the surface of the liquid, the energizing circuit of the relay 13 is established and causes the movable relay contact 23 to be moved onto the contact 21 and the motor 18 and consequently the drum 5 to rotate in the opposite direction. The wire 8 is then rolled up and the contact between the rod 10 and the liquid 2 cut off, so that the revolving direction of the motor shaft 24 and of the drum 5 is reversed once more. When the surface of the liquid does not vary, these alternative movements are continued. By proper design of the apparatus the extent of these movements can be made very small and consequently, the measuring accuracy very great. When the liquid level varies, the tip of the rod 10 follows these variations very closely. The amount of these variations is proportional to the number of revolutions of the shafts 24, 26, indicated by the device 25. The current passing through the contact rod 10 and the liquid 2 may be amplified in some appropriate electronic amplifier before passing the relay 13. Instead of using a reversible motor 18, a reversing gearing and a pair of electromagnetic clutches controlled