AUTOMATIC RECORDING RAIN GAUGE

This invention relates to apparatus for automatically recording rainfall.

Various mechanical methods of measuring rainfall automatically are known, for example the 'tipping bucket' method, in which a specially shaped bucket is pivoted such that when it is empty it is positioned in an equilibrium position. When the rain, collected in the bucket reaches a given level, the center of gravity of the bucket and water system moves and produces a turning moment about the pivot. The bucket tips up and in so doing discharges the rain water and returns to its empty equilibrium position. The number of tipping actions is this seen to be directly proportional to the amount of rainfall.

The object of the present invention is to provide alternative apparatus for automatically recording rainfall.

According to the present invention a rain gauge comprises a container for collecting rain, a pump operative to pump rain water from the container, an electrical sensor responsive to the level of rain water in the container and operative to make and break the supply of power to the pump and means responsive to the drive motion of the pump for affording a measure of rain water collected in and pumped from the container.

In order that the amount of rain water pumped, during each revolution of the pump, is repeatable to a very high accuracy a peristaltic pump may be used.

Indicator means, for example a revolution counter or an electronic counter, may be provided to record the drive motion of the pump. The indicator means may be remote from the rain gauge, the pump revolution information being transmitted to it e.g. by telemetry. A number of such rain gauges at different remote out-stations can thus be monitored at a central measuring station.

In a preferred arrangement the electrical sensor means is connected to an electronic switching unit which is operative to make and break the supply of power to an electric motor which drives the pump.

During use, rain is collected in the container. When the rain level rises to a predetermined level in this container the electrical sensor means operates on the electronic switching unit which connects the electrical power supply to the electric motor. The electric motor drives the pump which pumps the rain water in the container away to waste. As the rain level in the container falls below a lower predetermined level in the container the electrical sensor means operates on the electronic switching unit which disconnects the electrical power supply to the electric motor, which stops. The pumping action thus ceases, until further rainfall causes the cycle to be repeated. The number of revolutions of the pump drive shaft, as recorded by a revolution counter connected to it, is thus seen to be directly proportional to the amount of rain falling.

An automatic recording rain gauge constructed in accordance with the invention will now be described by way of example only, and with reference to the accompanying diagrammatic drawings of which:

FIG. 1 is a general layout diagram of the rain gauge,

FIG. 2 is a circuit diagram of one form of electrical sensor means and electronic switching unit,

FIG. 3 is another form of electrical sensor means, and

FIG. 4 is a circuit diagram of another form of electronic switching unit for use with the electrical sensor means shown at FIG. 3.

FIG. 1 shows an atuomatic recording rain gauge including essentially a rain collecting funnel 1, a container 2, a peristaltic pump 3 with associated d.c. electric drive motor 4, gearbox 5 and revolution counter 6, a d.c. electrical power supply 7, an electronic switching unit 8, a relay contact 9A of a relay 9 and an electrical sensor 10 which is mounted in the container 2.

At FIG. 2 one form of the electronic switching unit, shown at 8 in FIG. 1, has an amplifier 11 having a tuned output load comprising a capacitor 12 and a primary winding 13A of a transformer 13. The input circuit of amplifier 11 is a capacitance bridge, consisting of a secondary winding 14B of a transformer 14, a capacitor 15 and a variable capacitor sensor 10. The output phase of the bridge depends on the value of the variable capacitor sensor 10, which is one form of the electrical sensor means shown at 10 in FIG. 1. A feedback path 16 is included between a secondary winding 13B of the transformer 13 and a primary winding 14A of the transformer 14. The output of the amplifier 11 is also coupled by means of a capacitor 17 to a rectifier circuit comprising a diode 18 and a smoothing circuit comprising a resistor 19 and a capacitor 20. The smoothing circuit is connected to a transistor switch comprising a transistor 21, a transistor 22 and a resistor 23. The collector of transistor 22 is connected to the relay 9 (also shown at FIG. 1). The transistor 22 is protected by a diode 24. The electronic switching unit, shown at 8 in FIG. 1 can be connected to the d.c. electrical power supply, shown at 7 in FIG. 1 or to a separate d.c. electrical power supply.

The d.c. electric motor 4 shown at FIG. 1 is connected through the contact 9A of the relay shown at 9 in FIG. 2 to the d.c. electrical power supply shown at 7 in FIG. 1.

The whole rain gauge is mounted in a suitable container shown at 26 in FIG. 1.

The operation of the rain gauge will now be described with reference to FIGS. 1 and 3.

In operation the rain gauge is mounted in an exposed position at the place at which it is required to measure the rainfall. Rain is collected by means of the rain collecting funnel 1 in the container 2. As the rain level in the container 2 rises the capacitance of the variable capacitor liquid level sensor 10 will increase. When the capacitance of the sensor 10 exceeds that of capacitor 15 by a predetermined amount the feedback through the feedback path 16 becomes positive and the circuit including the amplifier 11 will oscillate. The diode 18 rectifies the alternating output and the resistors 19 and the capacitor 20 smooths the resultant positive d.c. voltage. This voltage is applied to the base of the transistor 21 causing it to conduct. The transistors 21 and 22 form a double emitter follower, hence when the transistor 21 conducts the transistor 22 also conducts. The Resistor 23 limits the base current of transistor 22 when it conducts. The collector potential of the transistor 22 thus falls to near Ov. The relay 9 is thus energized and the d.c. electrical power supply 7 is connected to the d.c. electric motor 4. The motor drives the peristaltic pump 3 which pumps away the rain water in the container 2 to waste. As the level of rain water in the container falls, the capacitance of the sen-