VINOD KUMAR & S. P. JAIN*

Manual spraying of water at fixed timings for cooling buildings by ROOF SURFACE EVAPORATION does not meet the actual requirement of the system under the varying intensity of various outdoor climatic elements from time to time. Therefore an automatic water actuated switch for the supply of water to the sprayers has been designed and developed for keeping the water retentive material always wet, as per requirement of this system. The switch has been fully tested at the roof terrace of Physics-Laboratory of this institute, under the actual field conditions and was found to work satisfactorily.

Automatic Water Actuated Switch for Cooling Buildings by Roof Surface Evaporation

Introduction

In the newly developed process of cooling, buildings by ROOF SURFACE EVAPORATION [1,2,3], the water is required to be sprayed on water retentive materials, meeting the following major requirements :

i) The water retentive material on roof should remain just wet throughout the day to maintain a water film on roof terrace.

ii) Stopping of undesirable accumulation of water on the water retentive material beyond its saturation limit.

iii) To spray water at that instant only whenever the water retentive material becomes dry.

Manual control for the operation of the spraying device has been found difficult and non-practicable. Besides being cumbersome, the manual operation of leads to wastage of water, and reduces the efficiency of the system due to excess spraying and accumulation of water on the roof. An automatic device, has therefore, been developed, to automatically control the working of roof sprayers. The sprayers are allowed to work only upto a certain limit of moisture content in the water retentive materials and when the water retentive material is fully soaked these are stopped automatically.

A typical one day rate of water evaporation in summer from the roof terrace indicates that the water requirement is not uniform throughout the day and varies from time to time (Table 1).

Table 1
Rate of Evaporation Under Actual Conditions

Time period (hours)	Evaporated water to litres from roof top size (13.6 sqm.) in litres
0600 to 0900	9.18
0900 to 1100	17.53
1100 to 1300	25.31
1300 to 1500	36.11
1500 to 1900	18.86
1900 to 0600	13.79

It also varies from month to month and day to day due to change in the intensity of various outdoor climatic elements. As such control of sprayers manually or by intermittent spraying device at fixed intervals or at fixed times has not been a possible solution. In the proposed automatic device a water (moisture) actuated unit is used to control the water supplied to the sprayers as per actual requirement of the spraying system.

*The authors are with Central Building Research Institute, Roorkee (U.P).

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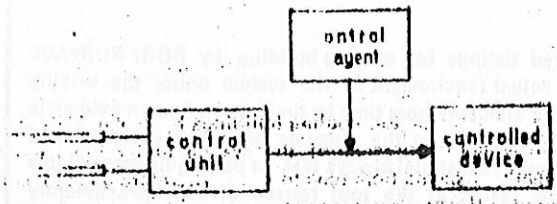

Fig. 1 : Block Diagram of Control System

Principle of Working

Two copper or stainless steel probes wrapped in a suitable water absorbtive pad are mounted at the point of the roof which is selected as an optimum position, to monitor the water contents in the water retentive material at the roof. The unit works basically on the change of electrical resistance which has an absolute value of about 150 to 300 ohms for operation when it is in dry or wet condition. An adjustment has been provided with the device to control the working of sprayers for different water contents in the retentive material.

Design

The unit operation can be visualised on the block diagram given in Fig. 1. The sensor probes (Fig. 2) which are mounted on the water retentive material at the roof is connected to the control unit which monitors the water contents and the control unit actuates the really accordingly so as to control the water supply through a solenoid valve if the water head is available or through a booster pump in case of inadequate water pressure.

Circuit Design and Performance

A switching circuit which is based for its switching operation on the change of resistance at the probe point (when the probes are wrapped in a suitable water absorption pad and placed in the water retentive material which may remain sometimes dry or in wet condition and thereby having different electrical resistances) is used for the control. The circuit diagram of the control unit is given in Fig. 3. The base of the driving transistor is being driven through a zeener diode whose voltage can be selected by the variable resistance R2 which provides the adjustment for the moisture contents in the water retentive material. The relay is used to drive the solenoid valve of water pump as the case may be.

Field Trial Under Actual Conditions

The automatic water actuated switch Fig. 3 has been tested under the actual field conditions Fig. 4 during the *Hot-Dry* periods of the current year continuously for more than a month. The system has been found to work satisfactorily except that it does not work, properly when these are Salt Deposits on the probes from the water, which should be cleaned as and when required for the efficient working of the system.

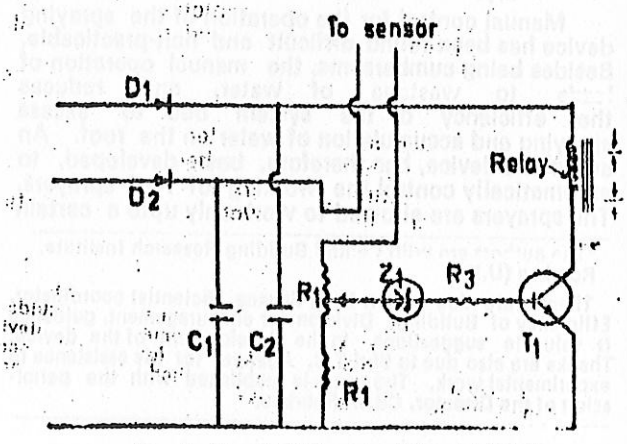

Fig. 3 : Circuit Diagram of Control Unit

Conclusion

The installation of the automatic water actuated switch permits automatic control of the sprayers and brings about saving in water by avoiding excess water flow which normally happens in manually controlled systems. Since the operation of the devices like valve or pump is electrically controlled, the optimum operation of these devices conserve electrical energy and provides maximum efficiency for cooling. Since the water requirement varies from hour to hour, day to day and month to month, due to changes in the intensity various outdoor climatic elements the system would always ensure the adequate quantity of water supply for maintaining a water film on the roof surface.

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