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An Electronic Alarm device for use with Open Pan Evaporimeter

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ABSTRACT. The amount of evaporation measured from open pan type evaporimeter is incorrect due to considerable amount of extraneous losses caused by birds, especially during the hot summer months in tropics. Electronic alarm device is designed to prevent the birds drinking or disturbing the water from the evaporimeter and to get reliable data of evaporation. The comparative study of readings from two evaporimeters, one with the electronic attachment and the other without it, clearly indicates the utility of the arrangement.

1. Introduction

The daily evaporation from the exposed water surface is obtained with the help of evaporimeters, which are metallic pans 4 feet in diameter and 10 inches in depth. The water is filled in this and the height of the water surface is measured at intervals of three hours by means of the hook-gauge. The difference between two successive readings gives a measure of the quantity of evaporation during that period. It is observed that the readings taken in this way are incorrect as the birds drink away a considerable amount of water thus giving a value which is more than the actual amount of evaporation. The discrepancy is maximum during summer months. One of the ways of avoiding this is to cover the pan with a wire net, which would prevent the birds getting access to the water surface. This arrangement, however, is not quite satisfactory in so far as it results in an obstruction to the free exposure of the water surface and consequent reduction in the amount of evaporation at least to a very slight extent. The electronic bird scaring alarm is designed to keep away the birds and thus to provide a device by which it is possible to get more accurate estimates of evaporation.

2. Details of the instrument

The details of the device have been shown in a block diagram (Fig. 1). It will be seen that it consists of four stages. V_1 is a fixed frequency oscillator stage having a frequency of about 9·5 mc/s, V_2 another oscillator stage whose frequency is adjusted to a difference of 456 kc/s from that of oscillator V_1, V_3—mixer and V_4—detector. The details of the circuit used are shown in Fig. 5. It will be seen from Fig. 2 that rings are fixed on brackets, insulated from the pan, round the evaporimeter rim concentrically. The innermost and the outermost wires are connected together to form a capacitance with the central wire. This capacitance forms a part of the tuned circuit of the oscillator V_2 as it is connected across it and hence determines its frequency. The output from these two oscillators is fed to the mixer which gives an output at difference frequency. This signal is fed to the detector stage V_4 which develops a d.c. voltage proportional to the difference frequency input signal. This voltage is used as a negative bias on the next relay stage V_4. The coil of the relay is connected to the plate circuit of the relay tube. The alarm is connected to the 6 volts battery through the contact K of the relay as shown in Fig. 1.

The instrument works on 230 volts a.c. supply and has a power consumption of about 35 watts. It is housed in a metal shelter of size $2' \times 2' \times 1\frac{1}{2}'$.

The main design features of the instrument are as follows—

(*a*) Extreme sensitivity—so as to make the instrument operate even with

very small birds or very slight disturbance of the wire capacitance.

(*b*) Stability of operation—so that the alarm does not operate due to spurious causes.

(*c*) Ease of operation—The instrument has only one adjustment control for initial adjustment of the frequency of the oscillator V_2.

(*d*) The water surface has a free exposure without any obstruction on any side.

3. Operation

Normally the frequencies of the two oscillators are so adjusted that the difference is 456 kc/s. The mixer stage V_3 is tuned to 456 kc/s and gives the maximum output voltage at this frequency. Thus the signal fed to the detector V_4 is maximum and gives a maximum d.c. voltage at the output. Due to this large negative bias given to the next relay stage its plate current is very small and is insufficient to operate the relay. The contact K of the relay, therefore, remains open. When the bird sits on the wires fixed on the evaporimeter, the capacitance formed by the wires and hence the frequency of the oscillator V_2 is changed. This gives rise to a drift in difference of frequency from 456 kc/s and hence the output of the mixer stage V_3 drops suddenly. Consequently the d.c. bias produced by the detector also drops and the plate current of the relay tube V_4 increases suddenly. The increased plate current flowing through the relay coil operates the relay and the contact K is closed. This starts the alarm ringing which drives away the birds.

4. Observation

In order to test the instrument for its utility and reliability, the following arrangement was made. Four evaporimeters were installed side by side for observation. Two of these were connected to the device in parallel, one was kept without the instrument and the fourth one was covered with the wire net. Fig. 3 shows the photograph of two evaporimeters connected in parallel. The instrument was kept in operation from early morning to 2000 hrs. The daily evaporation readings for these four evaporimeters were compared. These are shown plotted on the graph in Fig. 4. The following points are observed from this—

(*a*) The readings for the two evaporimeters with alarm agree quite closely showing that the water from these must have remained undisturbed, as the possibility of the water from both being disturbed or drunk equally is very remote.

(*b*) The readings for that without the alarm and uncovered differ very much from the above—as much as 100 to 150 per cent or more.

(*c*) The readings for the one covered with the wire net also agree within limits with those mentioned at (*a*), as the water therein is not likely to be disturbed as much as in an open pan evaporimeter.

This clearly shows the utility of this instrument for obtaining the correct readings of evaporation from the evaporimeter.

5. Acknowledgement

Our thanks are due to Dr. S. Mull and Shri H. Mitra for giving the necessary facilities to work and for giving helpful suggestions.

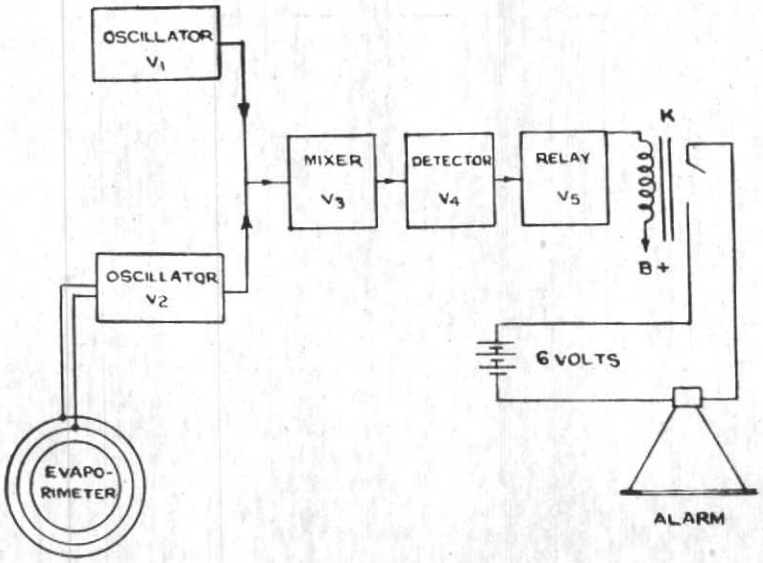

Fig. 1. Block schematic diagram

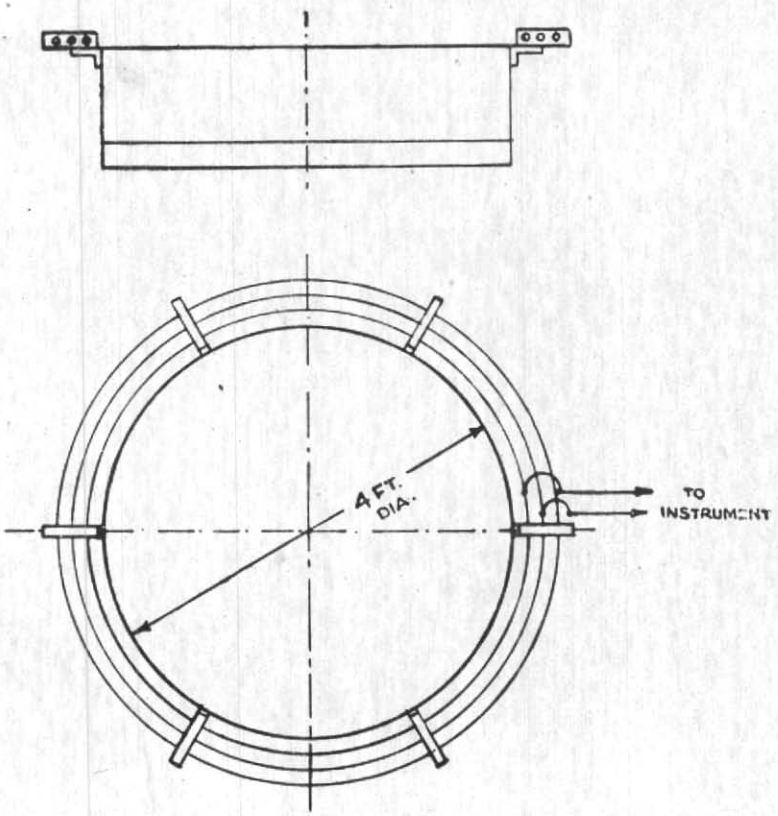

Fig. 2. Evaporimeter pan with three wires forming capacitance

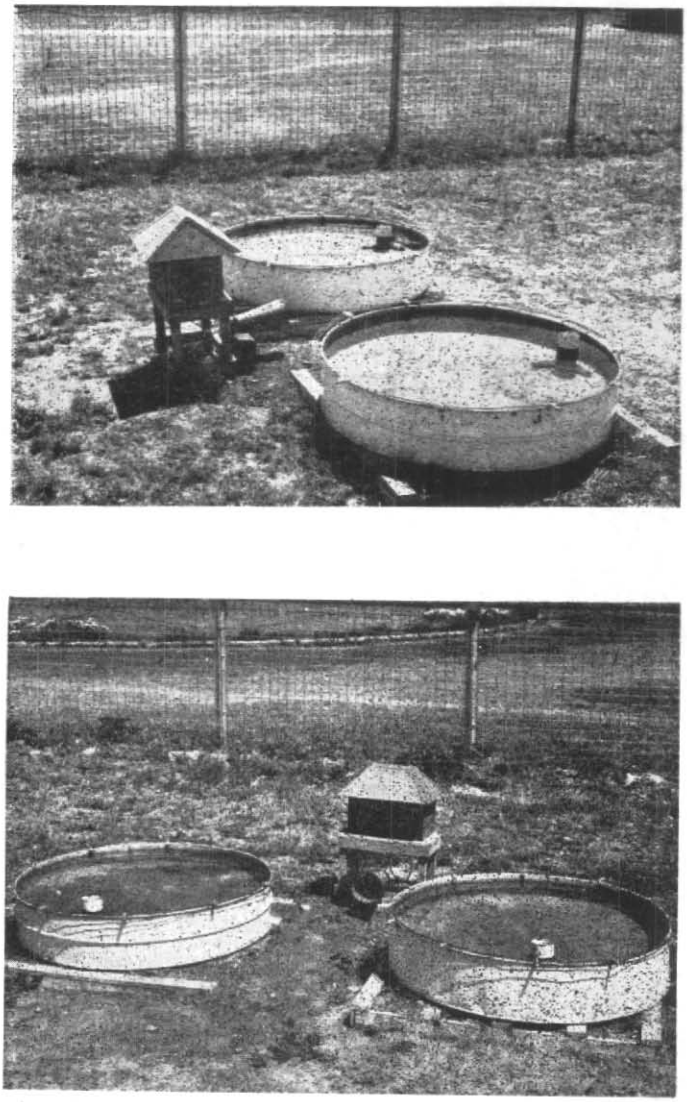

Fig. 3. Photcgraphs of two evaporimeters connected in parallel

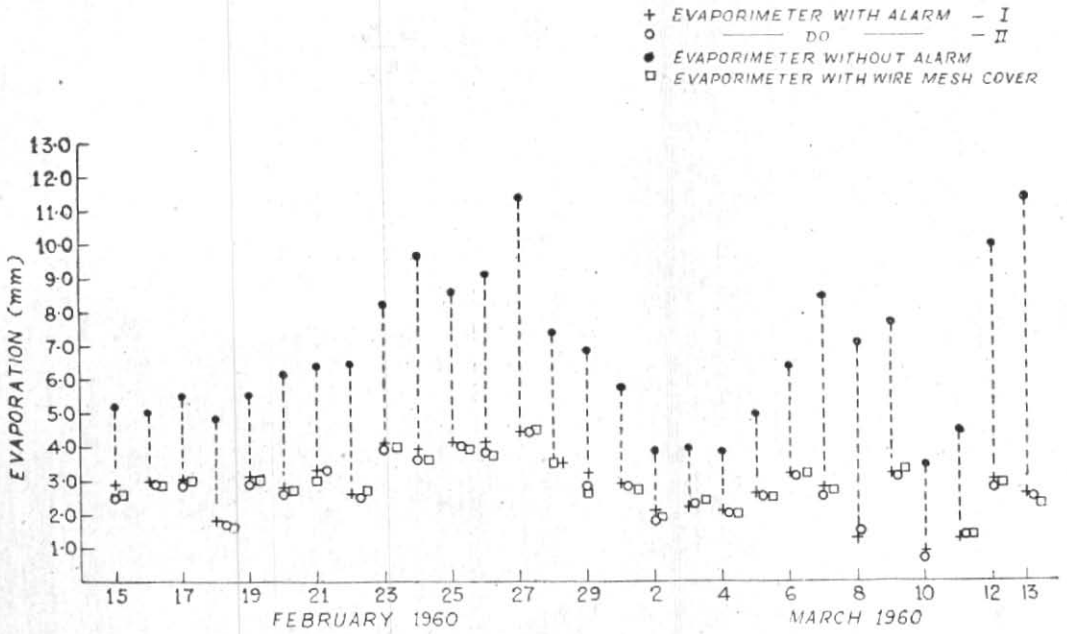

Fig. 4

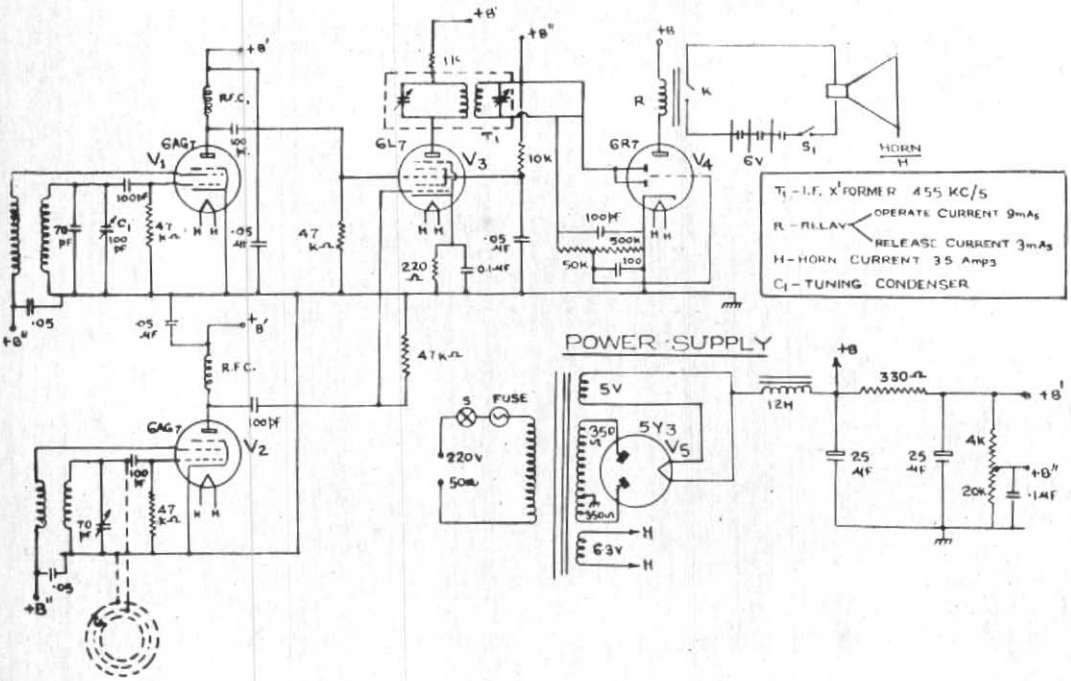

Fig. 5. Circuit diagram of the Evaporimeter—Alarm