rain warning ALARM

By Frank Brown

Protect the washing from rain, snow and damp with this simple device.

THE device to be described will provide an alert when rain or snow is falling or when the atmosphere is saturated as when steam or mist is forming. It can serve as a water level alarm with no modifications to the sensor input and, as it is sufficiently sensitive to detect a human breath at a foot range, it could find use as a novelty item at parties.

Two alarm circuits are offered; an audio tone generator pitched at 2·5kHz and a lamp flasher. While a tone is to be preferred for remote hailing a flashing lamp would be preferable to a person hard of hearing or if the device is used in a party role.

COMPOUND PAIR

The transistors TR1 and TR2 in Fig. 1. are so arranged to very much magnify any small current that might appear at the base/emitter junction of TR1. This compound pair configuration is a cheap way of making up what is, in effect, a very high gain transistor with an amplification factor that approximates to the product of the individual transistor gains.

The small current to be amplified is produced whenever snow, rain or moisture bridges the copper strips of a 0·1 in. matrix veroboard sensor which appears in the input circuit.

These strips are so connected (Fig. 2.) as to make the whole board area moisture sensitive.

The load of the compound pair is the alarm circuit comprising TR3 and TR4. Since the smallest of input currents to TR1 is capable of switching TR2 hard on, this means that nearly all of the line volts will appear at the junction of the collectors of the compound pair.

AUDIO ALARM

The audio alarm circuit consists of a *pnp/npn* free running multivibrator designed to produce a penetrating tone without recourse to a transformer.

The Fletcher-Munson curves of equal loudness show that the human ear is most sensitive to sounds between 2kHz and 4kHz. Using the components specified, the alarm will produce a note of approximately 2·5kHz and, although the power output from the alarm is relatively small the note produced is quite piercing.

With moisture completing the input circuit and TR2 switched on, C1 charges by way of R2, R3 and LS1 until the voltage it acquires is sufficient to switch on TR3 which, in turn, switches on TR4. The collector of TR4 is thus taken to a negative potential. The switching process is hastened by feedback through C1 so that TR4 is very rapidly bottomed.

This change cannot immediately be followed

Approximate cost of components

£ 1.80 excluding case

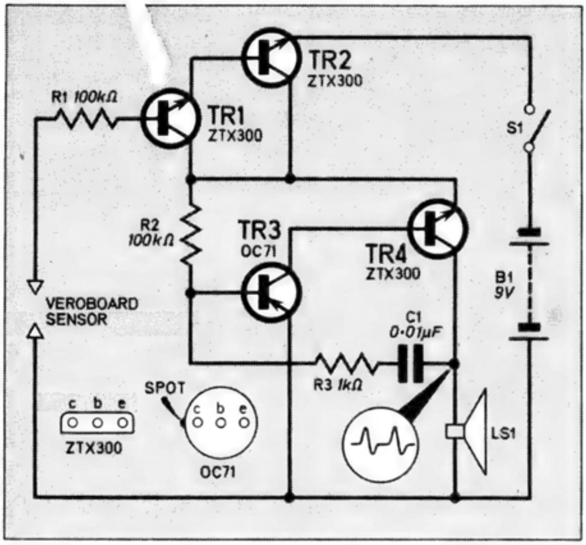


Fig. 1. Circuit diagram of the rain warning alarm.

by C1 which discharges via R3 and TR3 base/emitter. Having R3 in circuit increases the discharge time constant and therefore, the mean d.c. level to the loudspeaker which, of course, means a greater sound output.

With the discharge of C1 both TR3 and TR4 are cut off and the oscillator recycles. The frequency at which the transistors are turned on and off and therefore the frequency of the tone generated depends on the value of C1 and the resistance of its charge path; an increase in either means a decrease in frequency and vice-versa. The output waveform appearing across LS1 is shown in Fig. 1.

If at any time after the unit is built greater sound output is required a 0·47μF capacitor connected across the loudspeaker will prove a simple expedient rather than experimenting with different values for R3. It must be realised that any increase in output will mean a heavier current drain. With the components given, consumption with the oscillator functioning worked out at around 15mA.

LAMP FLASHER

Since this type of multivibrator circuit provides periodic short bursts of power (see output waveform) to a load it is ideal for flashing a lamp.

To change the alarm circuit of Fig. 1. for lamp operation means the change of only three components. A 6V 0·06A lamp replaces LS1, and R2 and C1 are changed to 470 kilohms, and 2·2μF respectively. If an electrolytic is used for C1, the positive side must be connected to the collector of TR4.

For the timing components given above the flash rate is about two flashes every second. Since the flash interval is very brief battery power taken is small compared to the audio alarm.

CONSTRUCTION

The majority of components are mounted on a 2½ inch x 1 inch, 0·15 inch matrix piece of

Components....

Resistors
R1 100kΩ (or 500kΩ lin. potentiometer—see text)
R2 100kΩ
R3 1kΩ
All ½ watt ±10% carbon

Shop Talk refers

Capacitor
C1 0·01μF

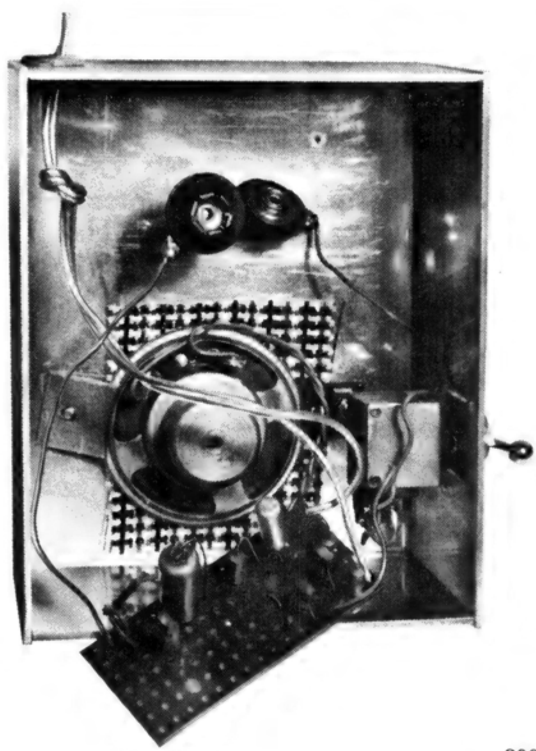
Transistors
TR1, TR2, TR4 ZTX 300 silicon *npn* (3 off)
TR3 OC71 germanium *pnp*

Loudspeaker
LS1 8Ω 2in diameter (or similar small speaker—see text)

Switch
S1 Single pole on/off toggle

Miscellaneous
B1 PP9 battery, 5in x 4in x 2½in aluminium chassis, Veroboard 16 holes x 7 strips 0·15 matrix (see text), 4in x 3in x 0·1in matrix (for sensor), wire, 4 BA fixings.

Prototype construction of the Rain Warning Alarm.



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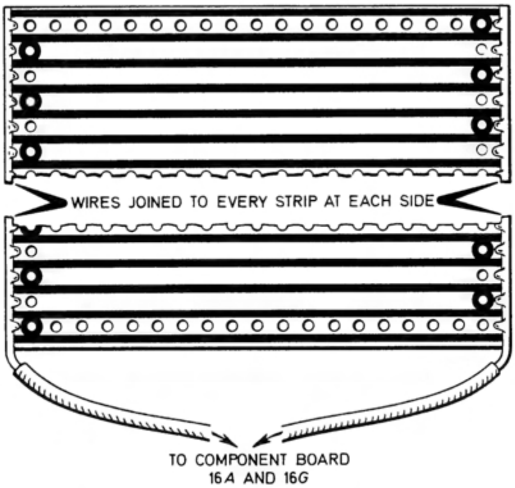


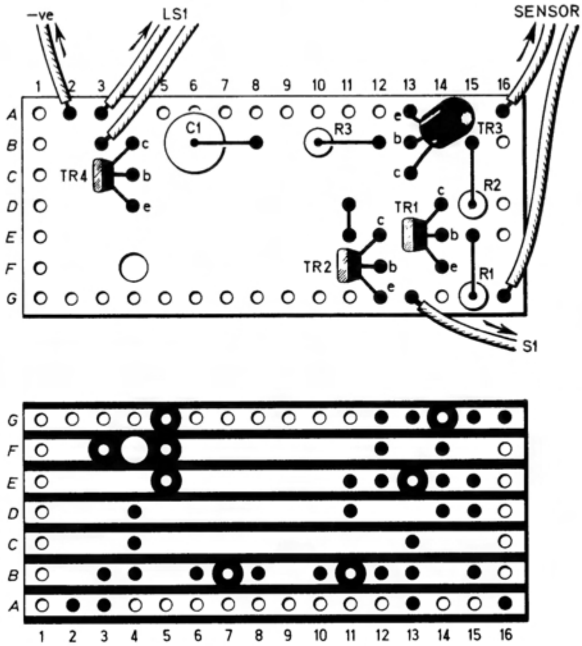
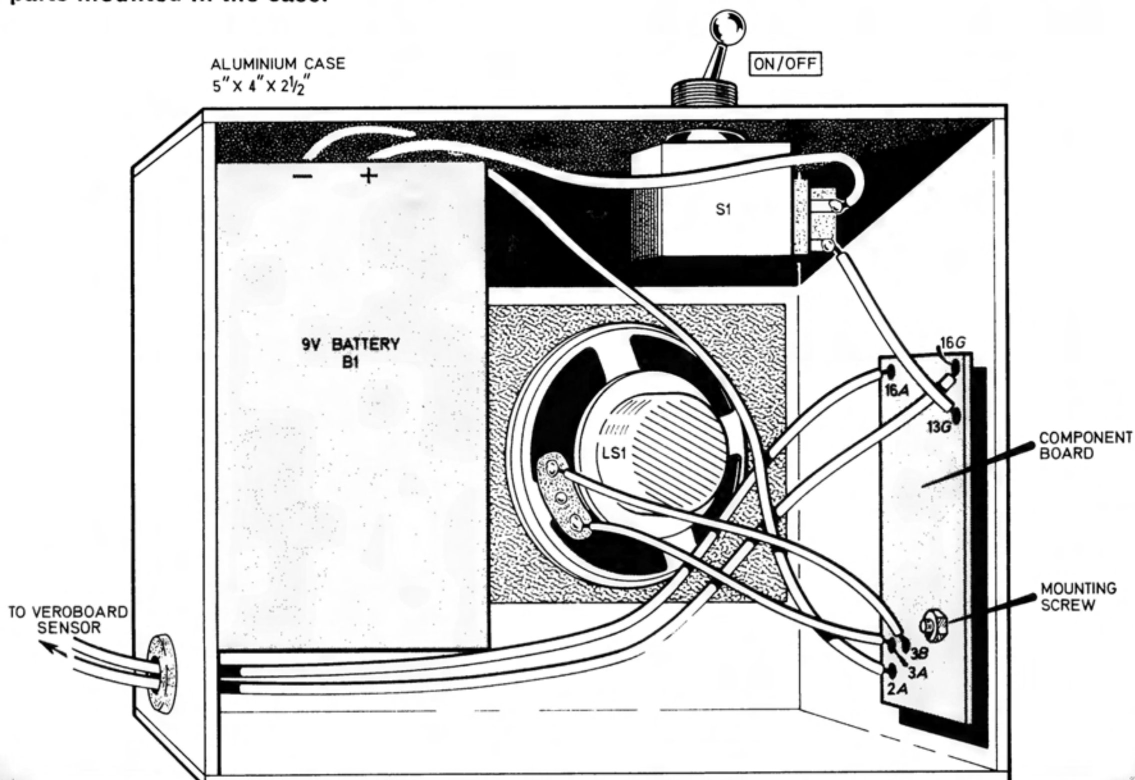
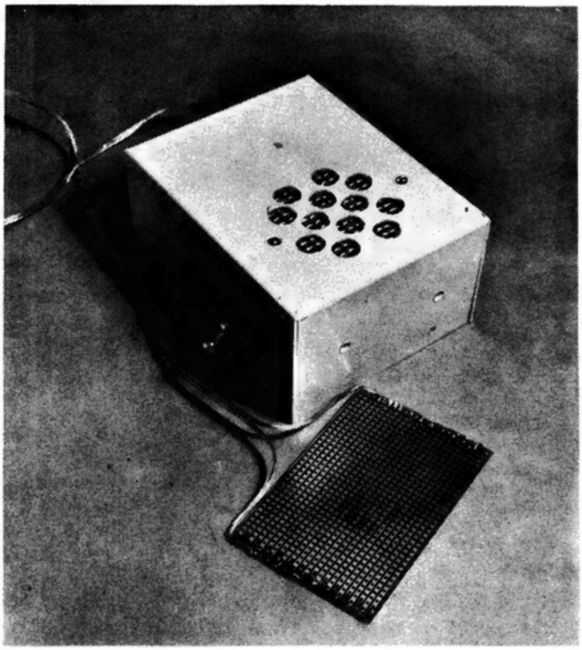


Fig. 2. (above) Wiring of the Veroboard strips to form the sensor.

Fig. 3. (right) Layout and wiring of the components mounted on the Veroboard.

Fig. 4. (below) Layout and wiring of all parts mounted in the case.





The completed unit with the sensor

Veroboard (the same size as that given away with the first issue), with the speaker and switch arranged on a small aluminium case.

The circuit performance will not suffer from alternative forms of layout so tag-strip or Cir-kit can be used.

The Veroboard layout and wiring diagram is shown in Fig. 3. The size of the piece of board used could be reduced slightly if a very compact unit is required, however since the battery used should be fairly large for a long life, reduction in size of the Veroboard was not considered advantageous. Construct the board as shown in Fig. 3 taking care when soldering the transistors not to overheat them. This particularly applies to the OC71 which is a germanium device and which should be soldered in, using a heat shunt, after all other components and leads have been attached.

After checking the board for mistakes, mount it in the case and connect up S1, LS1 B1 and the sensor (Fig. 4). Finally check the circuit and the battery polarity and switch on. A quick operational check can be made by touching the copper strips on the sensor with one finger, the unit should immediately give the warning signal. Test the sensitivity of the alarm by blowing on the sensor.

If required a small two-way socket may be included in the lead to the sensor (which is not polarity conscious) so that the sensor could be disconnected from the unit for installation.

When making up the Veroboard sensor simply solder on two lengths of wire at either end of a 4 inch x 3 inch piece of 0·1 inch matrix Veroboard so that the wire bridges all the copper tracks. Then, with a spot-face cutter or twist drill, make breaks on either side to alternate tracks as in Fig. 2. If high sensitivity is not required the size of the piece of Veroboard used may be reduced. The 0·1 inch matrix board is however most suitable.

If other values of loudspeaker are to hand, such as 3 or 15 ohm types, these can be used but it will mean experimenting with the value of C1 since substitution will produce frequency change.

APPLICATIONS

When siting the sensor the only requirement is that it should be placed on a flat surface. The length of lead to the sensor will not affect circuit performance.

If a 500 kilohm potentiometer is substituted for R1 the input sensitivity can be made variable. Since the base/emitter breakdown voltage of the ZTX 300 is 5V there is no danger of transistor destruction for the condition of maximum sensitivity with little resistance in the input line.

For use as a water level alarm the sensor should be arranged vertically with the lower two tracks at the required height. Obviously, rising water bridging these tracks will trigger the alarm.

As a novelty item the Veroboard could be attached to the top of the aluminium chassis. For this the lamp flasher circuit is used so that anyone breathing or blowing on the sensor literally blows the lamp on. ■