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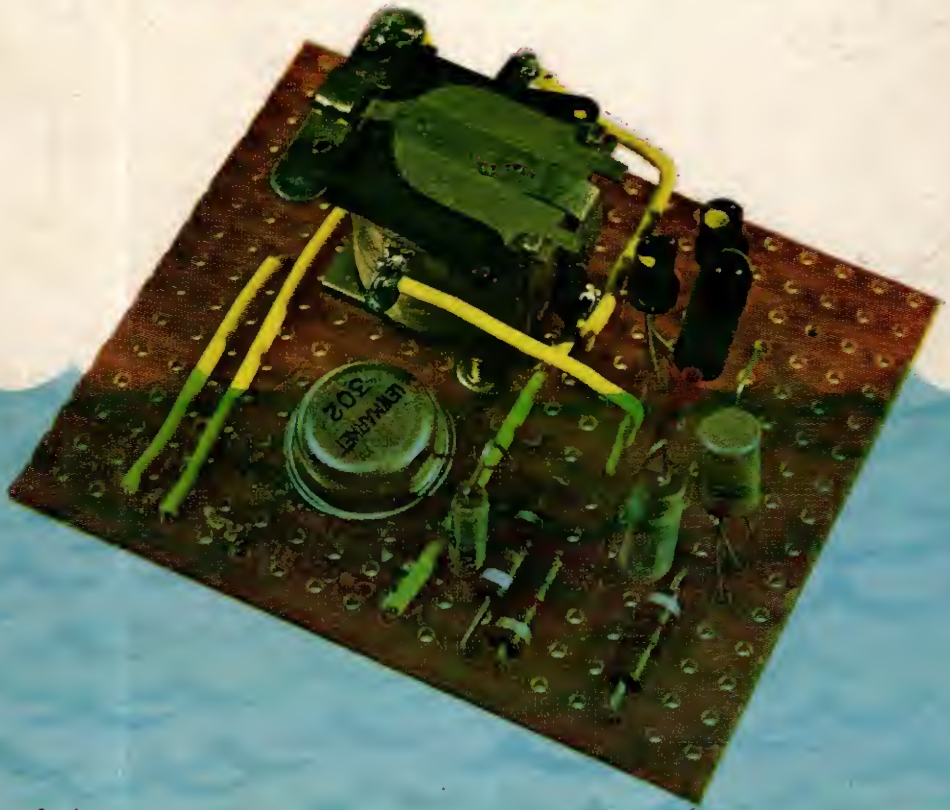
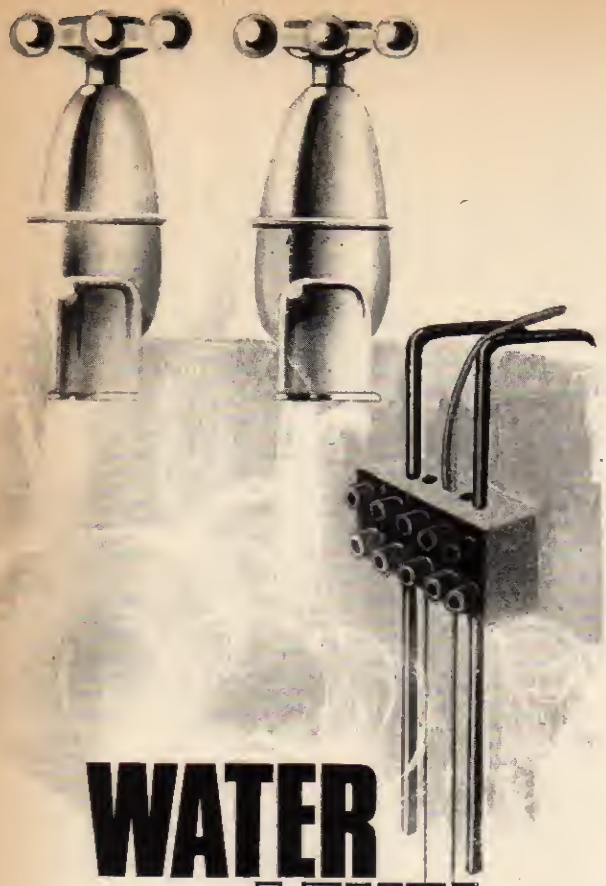
WATER LEVEL ALARM



a useful device having many applications where level or presence of water needs to be indicated



WATER LEVEL ALARM

By G.M. HARVEY

THIS article describes how a simple high gain, sensitive electronic relay can be employed as a bath water level indicator or flood alarm. Some additional applications are included to extend its usefulness.

The action of the alarm depends on the contact through water between two wire probes, which constitute the input circuit. The probes can be adjusted to any required water level and can be hung over the side of the bath. Connection from the probes is made to a portable alarm unit, which provides an audio note or visual winking indication when the water short-circuits the two probe wires. Since the whole device is battery powered there is no danger in its operation and no risks of electric shock.

"SUPER" TRANSISTOR

One of the most versatile and simple of direct coupled multi-stage circuits is the Darlington or super-alpha pair. The latter name describes what is in essence a "super" transistor, for in practice the pair, TR1 and TR2, can be considered as a single transistor with a combined gain approximating to the product of the two individual transistor gains. In theory then, the overall gain of this circuit would be 225^2 since the h_{fe} of each 2N2926 used is 225.

One shortcoming of this kind of circuit is the effect of leakage currents, since by transistor action the total leakage current of this compound stage would be a function of the product of the gains. If similar high gain germanium transistors were used, saturation would occur with no applied input, unless the first transistor of the pair is biased. In this particular circuit low leakage silicon types were used to reduce this trouble to negligible proportions.

The active terminals of this compound transistor are indicated by the reference C, B, and E (collector, base, and emitter). The input short from the water probe is applied to the base by current limiting resistor R1. A 330 ohm 6 volt relay provides the load, with its coil shunted by a diode for transient suppression.

The relay contacts RLA1 operate to supply power from the battery to an oscillating circuit TR3 and TR4, the time constants of which providing a pulse repetition frequency of about 50Hz with a 3:1 mark/space ratio. This gives to the speaker output an imperative boat horn quality that would alert anyone to stop it by turning the taps off and removing the probe.

WINKING LAMP

The construction of the main alarm unit is straightforward, most of the components being mounted on a piece of Veroboard (Fig. 2). A miniature jack socket, 3in loudspeaker, and battery switch are all fitted to a small box, which is easily made from plywood or hardboard and suitably decorated.

An alternative to the audible alarm is a winking lamp—especially useful for deaf persons. This does not require any rearrangement of component assembly. The coupling capacitors C1 and C2 should be changed to 100μF; the loudspeaker should be replaced by a 6 volt 60mA bulb, preferably housed in a red-lensed panel lampholder. This type of indicator would provide a considerable saving in battery power, the total consumption of the unit being about 80mA.

RAIN SENSOR

Some applications with suggested modifications will now be pursued. For use as a rain sensor the probes can be substituted by a piece of Veroboard or Lektrokit chassis plate No. 5 or 6. The copper strips can be wired so that the whole area of the board is used as a series of parallel copper sensors, alternate strips being connected together.

LATCHING

A simple latching arrangement is shown in Fig. 3. This could be employed where a wave action is set up on the water surface. One such application might be a swimming pool, or a private or public lido, where any unauthorised intrusion would provide the requisite wave action to complete the probe circuit. Although this water switch action is of short duration the relay will latch and the alarm will sound until the supply is disconnected.

When the probe circuit is made by the wave action, RLA1 closes, activating the 8 volt bell alarm. Diode D2, which normally blocks any collector current through the bell alarm, is now forward biased with the relay contacts closed, and will keep the relay latched

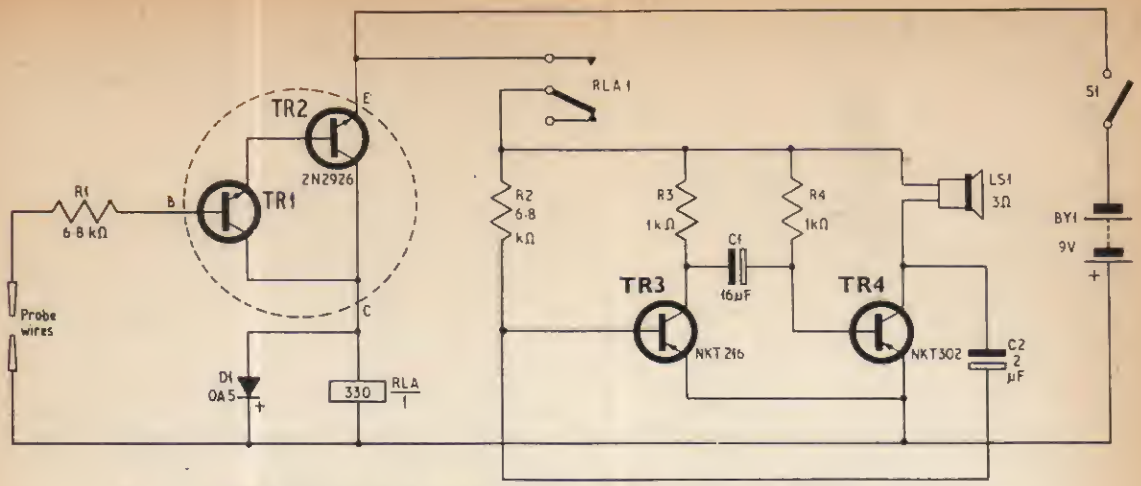


Fig. 1. Complete circuit of the water alarm. The dotted circle encloses the super-alpha pair

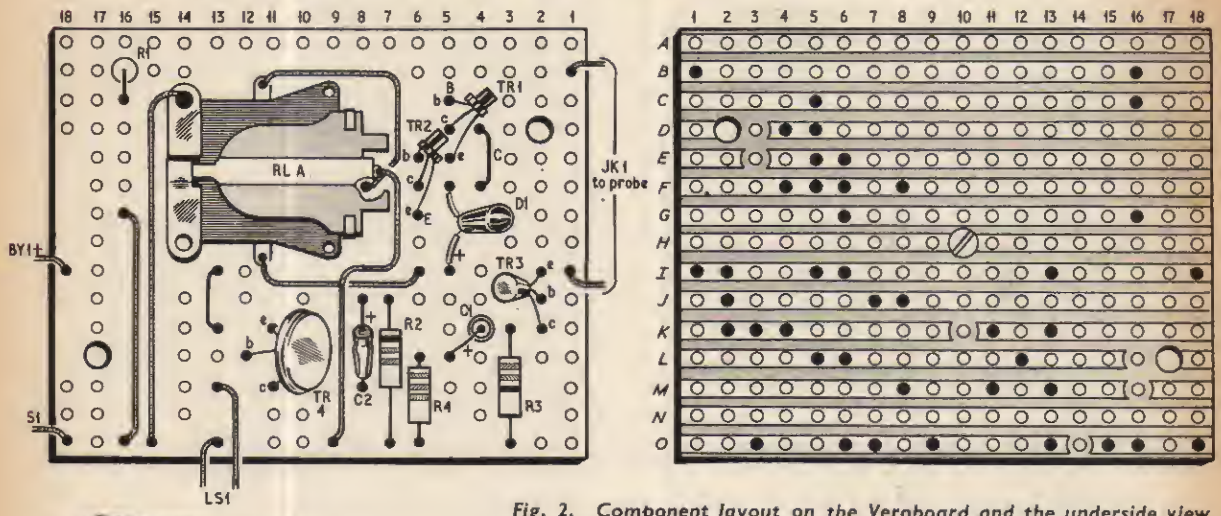
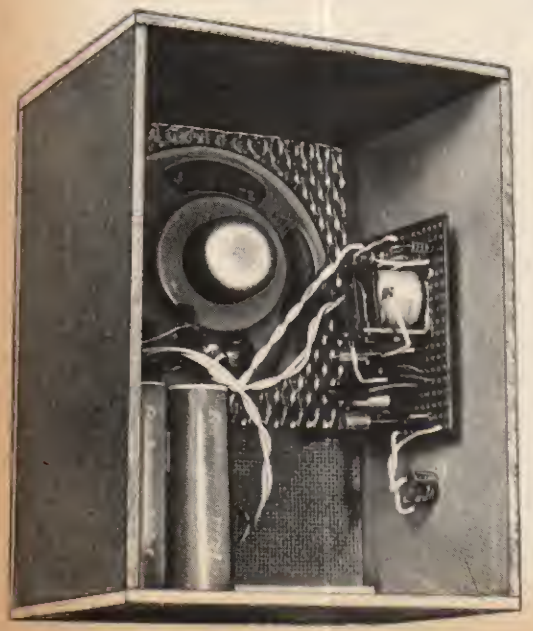


Fig. 2. Component layout on the Veroboard and the underside view. The transistor connections are shown below right. The lower two TR3 and TR4 are shown looking at the wire ends



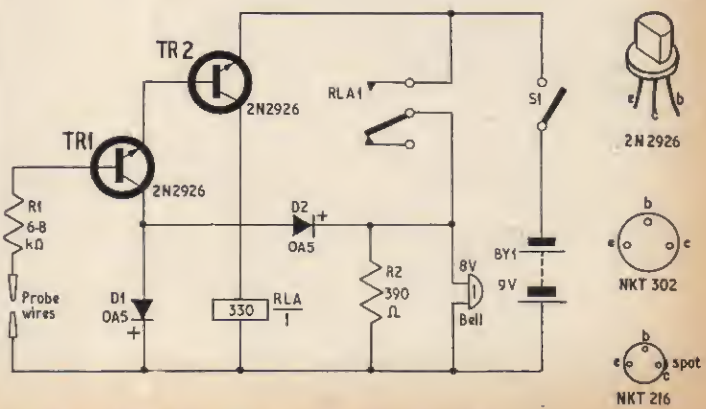


Fig. 3. Simple latching to overcome wave action

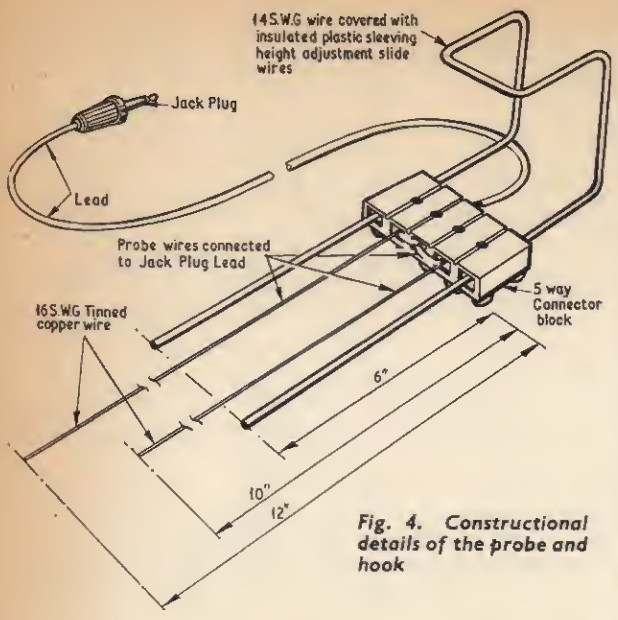


Fig. 4. Constructional details of the probe and hook

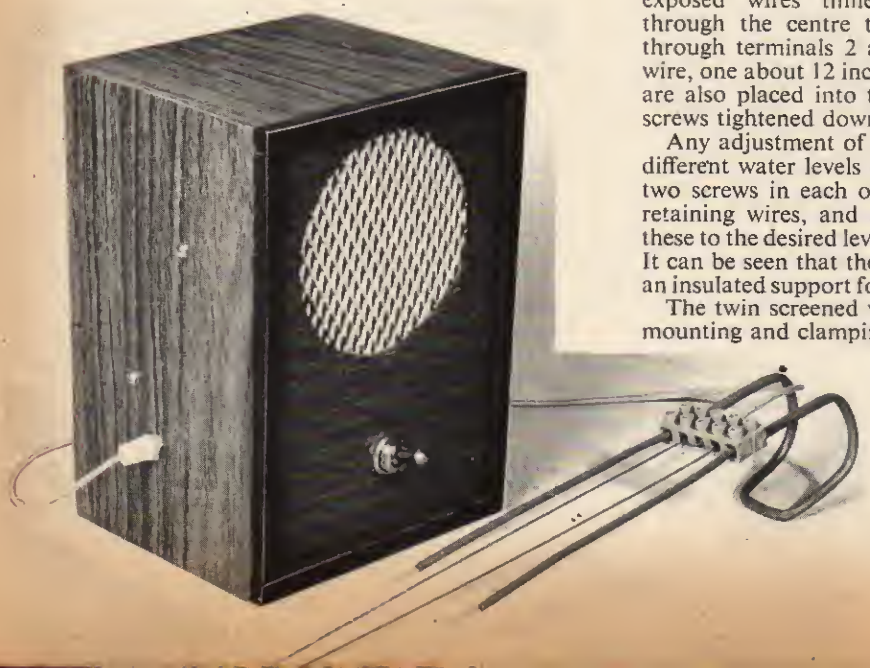
on with the passing of the wave. To de-energise the relay it will be necessary to flick the supply switch momentarily to return the relay contacts to standby.

The contacts on the relay will not carry sufficient current to switch a water pump but a supplementary relay of adequate rating can be placed in series with the contacts RLA1.

The maximum rating of the miniature open type relay used in this circuit is 115V a.c. 2A.

WATER SWITCH FOR BOATS

Another application that could usefully be explored is the use of the unit as an automatic water switch for electric motors in model boats. Here any mechanical switch could be dispensed with as the total leakage of the compound pair TR1 and TR2 is only about 20μA.



COMPONENTS . . .

Resistors

R1	6·8kΩ	R3	1kΩ
R2	6·8kΩ	R4	1kΩ

All 10%, $\frac{1}{4}$W carbon

Capacitors

C1 16μF elect. 15V
C2 ·2μF elect. 15V

Semiconductors

TR1 2N2926 } high beta gain (see text)
TR2 2N2926 }
TR3 NKT216
TR4 NKT302
D1 OA5

Relay

RLA Miniature open type 6V 330Ω (Radiospares)

Switch

S1 Single pole on/off toggle

Miscellaneous

LS1 3 ohm, 3$\frac{3}{8}$in dia. (Radiospares)
BY1 4·5V flat pack batteries (2 off)
16 s.w.g. and 14 s.w.g. tinned copper wire
Miniature jack plug and socket
Veroboard 2in × 2$\frac{3}{4}$in, 0·15in matrix
Five-way terminal block
Miniature twin screened cable

With the model placed on the water surface the motor would immediately start and stop on its removal.

PROBE

The probe was made up from a 5-way terminal block. The probe suspension hook is made from 14 s.w.g. wire shaped to hook on to the side of the bath and then sleeved. This is then pushed home into the two outer terminals and clamped by the retaining screws.

The centre terminal was used to hold the miniature twin screened cable but, before insertion of this, about an inch of the insulation should be stripped and the exposed wires tinned. When these wires appear through the centre terminal they are doubled back through terminals 2 and 4. Two lengths of 16 s.w.g. wire, one about 12 inches and the other about 10 inches are also placed into these terminals and the retaining screws tightened down.

Any adjustment of probe height for the detection of different water levels can be achieved by loosening the two screws in each outer terminal, holding the probe retaining wires, and sliding the terminal block along these to the desired level. The screws are then tightened. It can be seen that the moulded polythene block forms an insulated support for the probes at any desired height.

The twin screened wire was used for convenience of mounting and clamping in the terminal block. ★