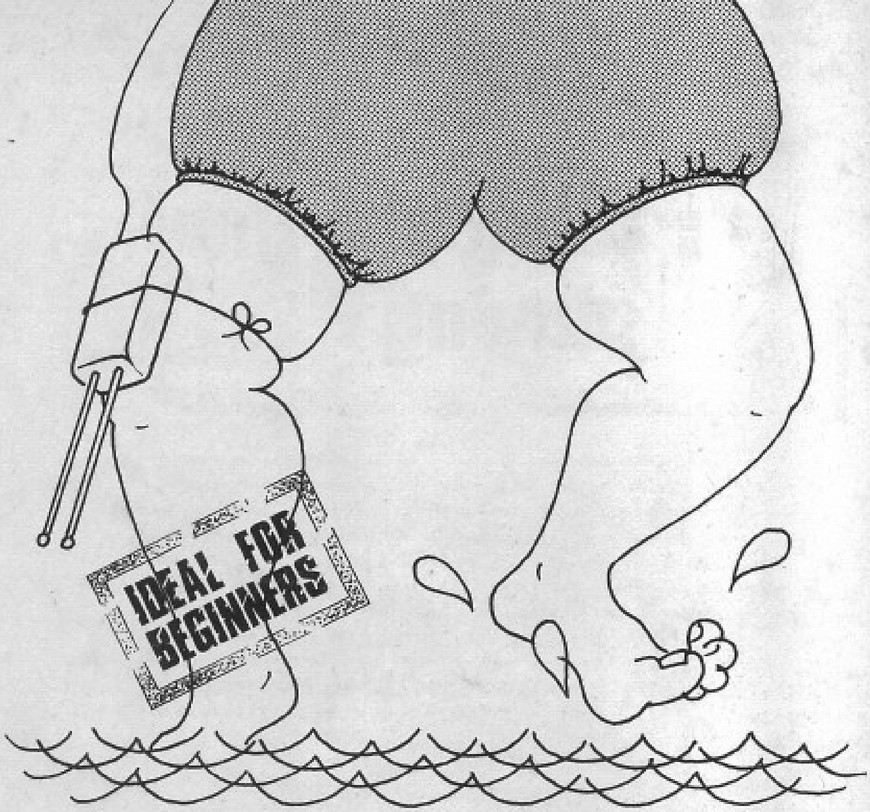


Water Level Alert

Another masterpiece

By A. R. Winstanley

NO DOUBT we have all at one time or another been somewhat unpopular with the other members of the household because all of the available hot water has been consumed by a certain person whilst taking a bath!

Possibly one of the safer ploys here is to ardently deny using up the hot water and blame the inherent inefficiency of the water heating system, but somehow this does not seem to work.

Whilst the device to be described would not indicate how much hot water is left it will tell you in no uncertain terms when to let up on the taps, and thus hopefully keep the peace.

A specially designed sensor is placed inside the bath, and when the rising water touches the sensor, an alarm tone sounds. At this point you should turn off the taps or continue to draw water at your peril! On a slightly more serious note though, its main use, of course, is to enable the user to run a bath and leave it unattended, the alarm sounding when the water has reached the required level.

APPEARANCE

This device is a little different from others previously described in that the actual physical appearance of it has been kept as aesthetic as possible. In particular the design of the sensor has, in the author's opinion, been greatly improved. After all, the appearance of a unit which is to be used in a domestic environment *is* important.

It is recognised that Veroboard-type sensors, where the water bridges adjacent strips of copper, thus sounding the alarm, are quite cheap and effective, but their appearance is none too pleasing and the actual construction does not make them suitable for use in the bathroom. On the other hand, custom designed printed circuit board sensors look very pleasing, but it is reckoned that not too many people have printed-circuit etching facilities.

One of the design criteria, therefore, was to come up with a water level sensor which could be assembled out of readily available materials, but which was quite cheap, durable and most of all attractive.

CIRCUIT DESCRIPTION

The complete circuit diagram of the Water Level Alert appears in Fig. 1.

When water bridges the two probes, C1 charges up very quickly and turns on TR1 and TR2, which form a high-gain transistor switch. Each *npn* transistor requires the base to be about 0·6V more positive than the emitter for the device to switch hard on.

Thus when the base of TR1 is at 1·2V both transistors will switch on. The emitter current of TR1 becomes the base current of TR2, and so only a very tiny current is required in the base of TR1 to switch TR2 hard on.

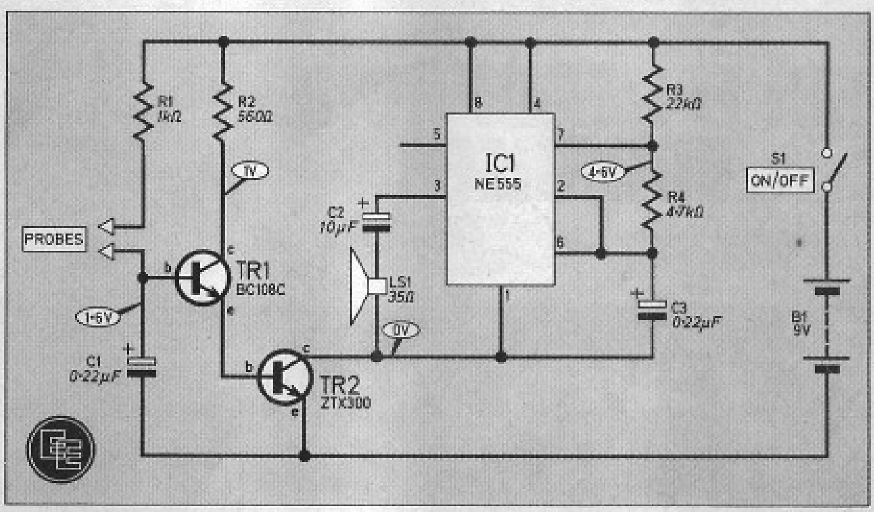
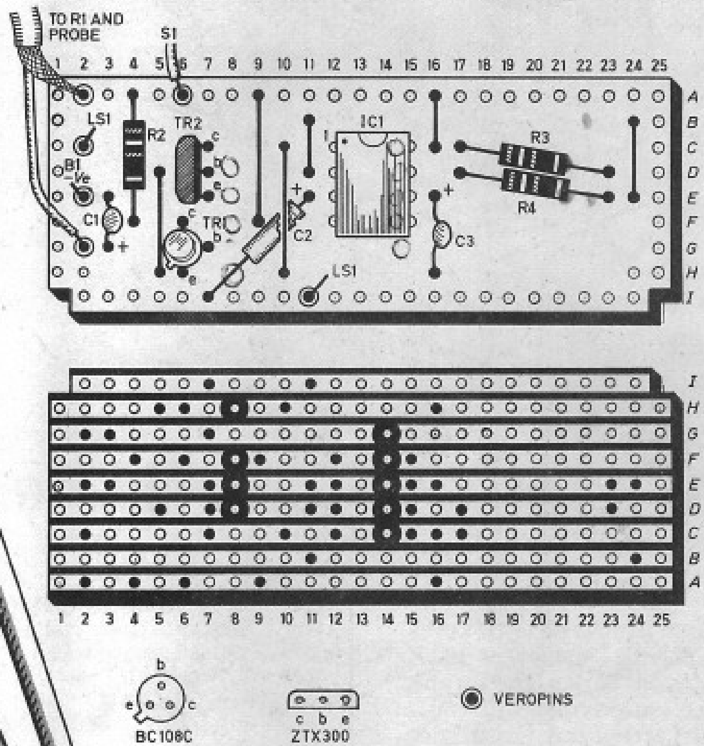


Fig. 1. Circuit diagram of the Water Level Alert.

COMPONENTS approximate cost £3.00 excluding cases



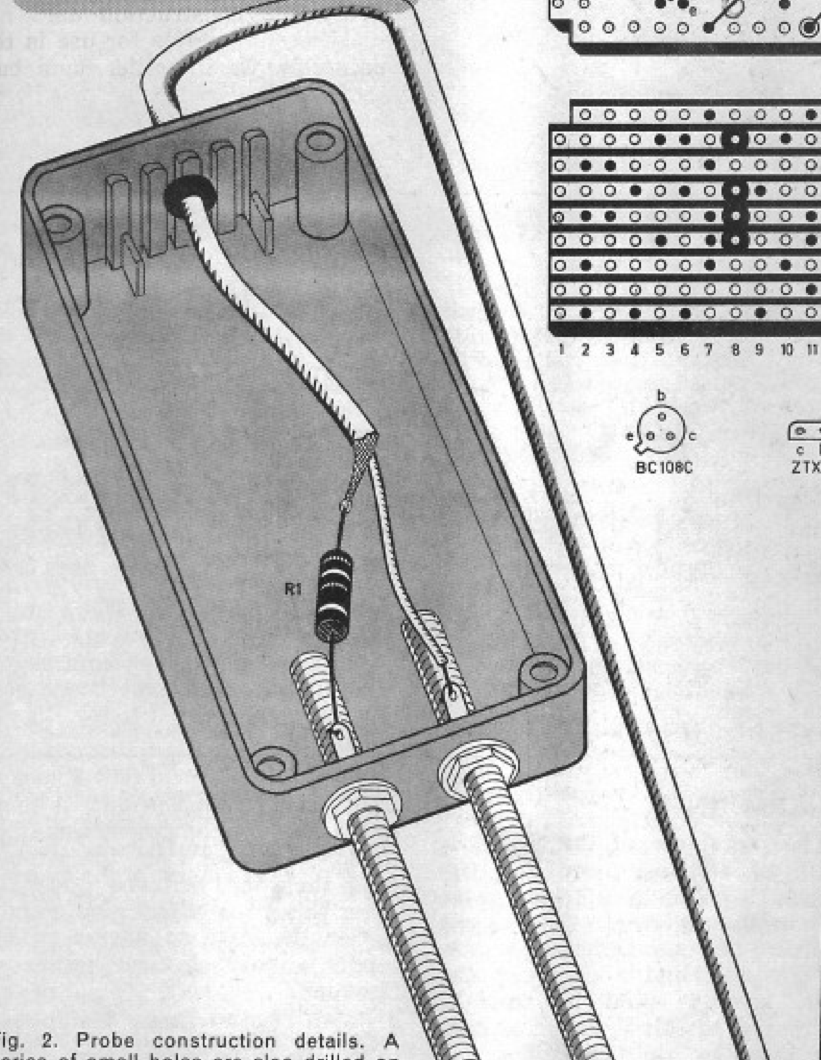
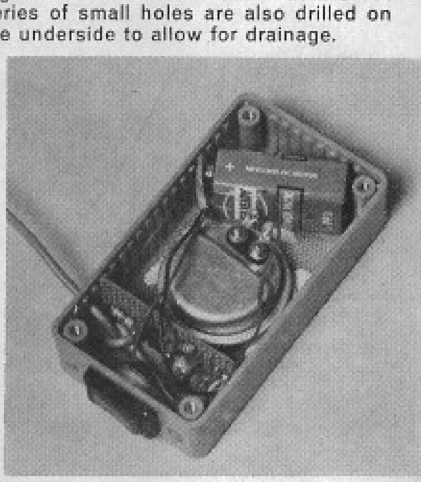


Fig. 2. Probe construction details. A series of small holes are also drilled on the underside to allow for drainage.



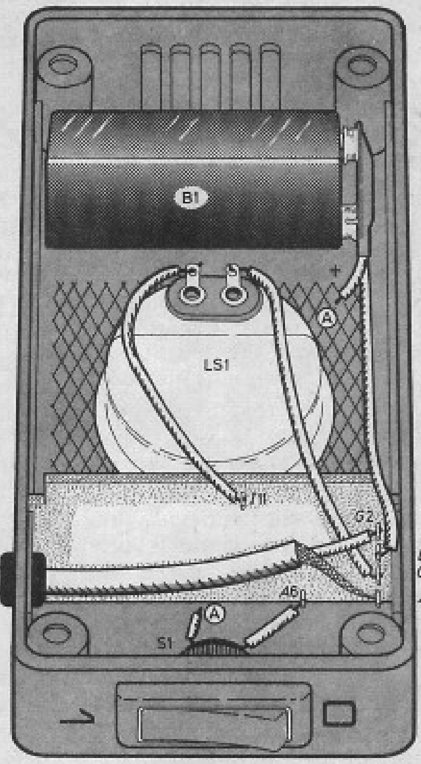
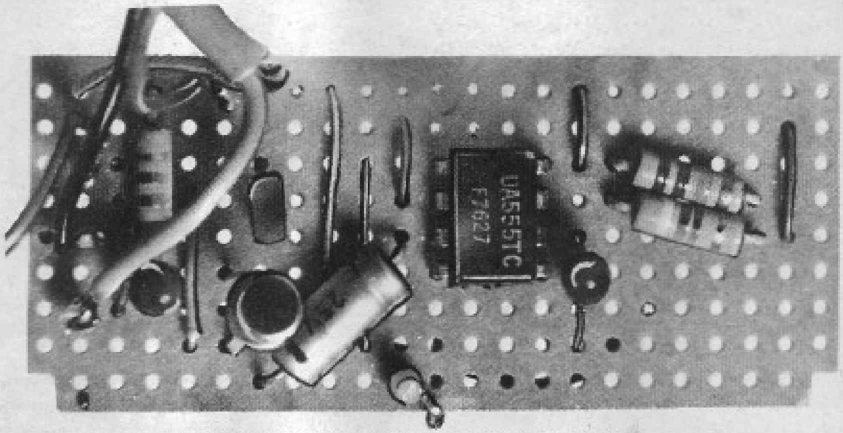


Fig. 3. Complete wiring details for the unit. Veropins are used as required.

Integrated circuit, IC1 and its associated components form an astable oscillator, and power is applied to this when TR2 switches on. The output, pin 3, is differentiated by C2 and LS1 which converts the rough square wave into a positive and negative spie.



Component layout for the alarm circuit board.

COMPONENTS

Resistors		Capacitors		Semiconductors	
R1	1kΩ	C1	0·22μF 25V tantalum	IC1	NE555V timer i.c.
R2	560Ω	C2	10μF 25V elect.	TR1	BC108C *npn* silicon
R3	22kΩ	C3	0·22μF 25V tantalum	TR2	ZTX300 *npn* silicon
R4	4·7kΩ				

All ¼W carbon ±5%

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Miscellaneous

LS1 35 ohm earpiece (or similar moving coil loudspeaker approx. 40mm diameter)
S1 single pole, single throw rocker switch
B1 9V PP3 battery
Stripboard 0·1 inch matrix 23 holes by 9 strips; clip to suit battery; two 150mm lengths of 2BA studding; 2BA hardware; 8 pin socket to suit IC1; length of screened cable; piece of aluminium speaker grille; one plastic case 100 × 50 × 25mm, one plastic case 110 × 60 × 30mm; epoxy glue; connecting wire.

CONSTRUCTION starts here

The system is housed in two plastic boxes. The first measures 100×50×25mm and forms the probe; the second measures 110×60×30mm and carries the electronics.

PROBE

The construction of the probe unit is illustrated in Fig. 2. Two 2BA threaded brass rods are used, each 150mm in length, and these are bolted to the case so that two 130mm probes protrude outwards. Connections to the rods are made by using a couple of 2BA solder tags, and a length of single core screened cable connects them to the other case. Note how R1 is included in the sensor unit.

DRAINAGE

Finish off the sensor by lettering it as necessary. Then glue two end pieces onto the ends of the brass rods. This will prevent the rods from scratching the bath enamel, and it will further enhance the appearance. Two plastic caps from some discarded Biro refill tubes were used on the prototype.

If water does manage to get into the sensor case, it will accumulate inside at the bottom and eventually short the probes, sounding the alarm tone. To counter this, a series of 1mm holes are drilled near the bottom of the back panel to allow the water to drain away. The use of brass rods in the manner described has resulted in a quite attractive and very strong probe unit.

ALARM UNIT

The remainder of the circuit is built on a small piece of stripboard 23 holes by 9 trips. These dimensions allowed the circuit board to be retained by the guides in the case, and a different size (and layout) could be used if necessary, to suit the type of case purchased by the constructor.

The stripboard arrangement and other wiring is shown in Fig. 3. During construction, make certain that the capacitors are soldered in the right way round. Tantalum capacitors are used for C1 and C3 because of their small size, but they are very polarity sensitive.

It is recommended that an 8 pin d.i.l. socket is used with IC1. This will prevent damage being caused to the NE555 through excessive heating during soldering.

In particular observe the orientation of the transistor leads.

Drill the larger case to take the on/off switch and cable entry from the sensor. A 30mm cut-out was made for the loudspeaker. A small piece of aluminium mesh was stuck inside the case over the cut-out, and then the earpiece was fixed over this using epoxy glue. Finally letter the case as necessary and apply a coat of clear protective lacquer.

With both cases completed, and all interconnections made, thoroughly check out the circuit board for mistakes. Look out for reversed polarities of components, whiskers of solder bridging adjacent strips, etc.

If all is well, connect the battery and switch on. Bridge the probes with a finger and thumb, this should cause the alarm to sound. Release the sensor and the tone should cease.

The device is now completed and ready for use. The probe can be stuck inside the bath using double-sided adhesive strip. The main unit should be positioned where it can be heard with the bath running. ⌑