TAKE 20

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A series of simple transistor projects, each using less than twenty components and costing less than one pound to build.

No. 28
TOUCH ALARM

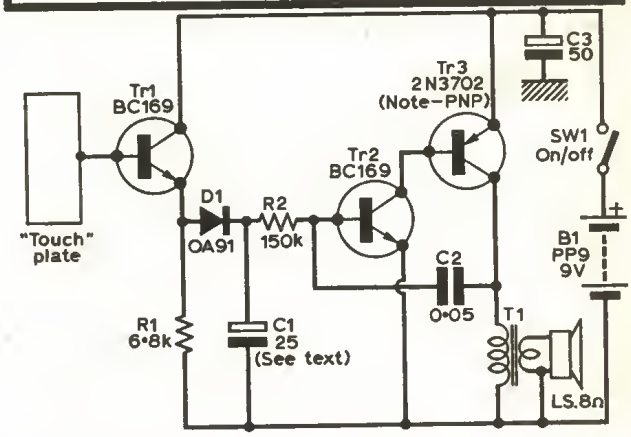

Fig. 1 : The circuit of the touch alarm

★ components list

Tr1	BC169	11p†
Tr2	BC169	11p†
Tr3	2N3702	13p†
D1	OA91	5p†
R1	6·8kΩ, 10%, ¼W	1p†
R2	150kΩ, 10%, ¼W	1p†
C1	25μF, 25V Mullard	6p†
C2	0·1μF Mullard	4p†
C3	50μF, 25V Mullard	6p†
SW1	D.P.S.T. Toggle switch	5p*
T1	Transistor output transformer, Eagle LT700	20p‡
LS	6 x 4in, 3Ω loudspeaker	15p*
		98p

† Electrovalue Ltd.

* Padgetts Radio Stores

‡ Henrys Radio Ltd.

Prices are those advertised in June 1971 and may have changed. No allowance is made for minimum order costs or for postage and packing; this should be checked before ordering.

THE CIRCUIT

The first transistor, Tr1, is coupled in the common-collector mode (also known as the emitter-follower mode) with the base wired to the touch plate. The characteristics of this configuration are very high input impedance and low output impedance and this is the key to the operation.

The input impedance is roughly equal to the gain of the transistor times the emitter load resistor (here 6·8kΩ). The BC169C has very high gain figures, up to 900, but a more common figure would be 400. Therefore on this basis the input impedance is 400×6,800 which equals nearly 3MΩ. As soon as anything touches this base it biases the transistor on and the same voltage which has been applied to the base at very high input impedance, appears at the emitter at the same voltage level but at a usable impedance.

Most of you have dabbed a damp figure at the input of an amplifier and heard the resulting sounds, made up from radio signals and hum. Here we are making the best use of these signals and putting them to use. All sorts of "muck" is picked up when the plate is touched and this appears at the emitter as an a.c. voltage. The detector diode rectifies the signals and applies them across the capacitor C1. This charges up so that a positive supply appears at the junction of D1, C1 and R2. This voltage applies a bias via the resistor to the base of Tr2 which conducts and in turn applies bias to Tr3 and a pulse passes through the primary of the output transformer. However C2 is connected in a manner which causes the second two transistors to oscillate.

The beauty about the values and configuration used here is that once the alarm oscillator has started it is self-holding. That is, the pulses through C2 themselves bias Tr2 to maintain the cycle necessary for a continually sounding alarm. So it will be seen that R2 is only necessary to start the alarm which can only be switched off by disconnecting the battery supply. C3, which decouples the supply, is not essential but with a low battery it does help the operation.

Current drain is important in all alarm circuits because if it is high, batteries, which are continually left on would rapidly run down. In the quiescent condition current consumption was measured as 1μA in the prototype as silicon transistors are used throughout, though when in operation this rises to over 20mA and a PP9 type battery has to be used.

C1 can be left out. If this is done the alarm is triggered by the slightest pulse—even by the switching on of fluorescent lights and this is a disadvantage. The inclusion of C2 has a slight delaying action as it takes time to charge up.

In certain locations the level of "muck" may be so high as to trigger the alarm *without* it being touched. In this case the value of R1 should be reduced to a suitable level which only triggers on touch; this also applies if a large touch plate is used. ■