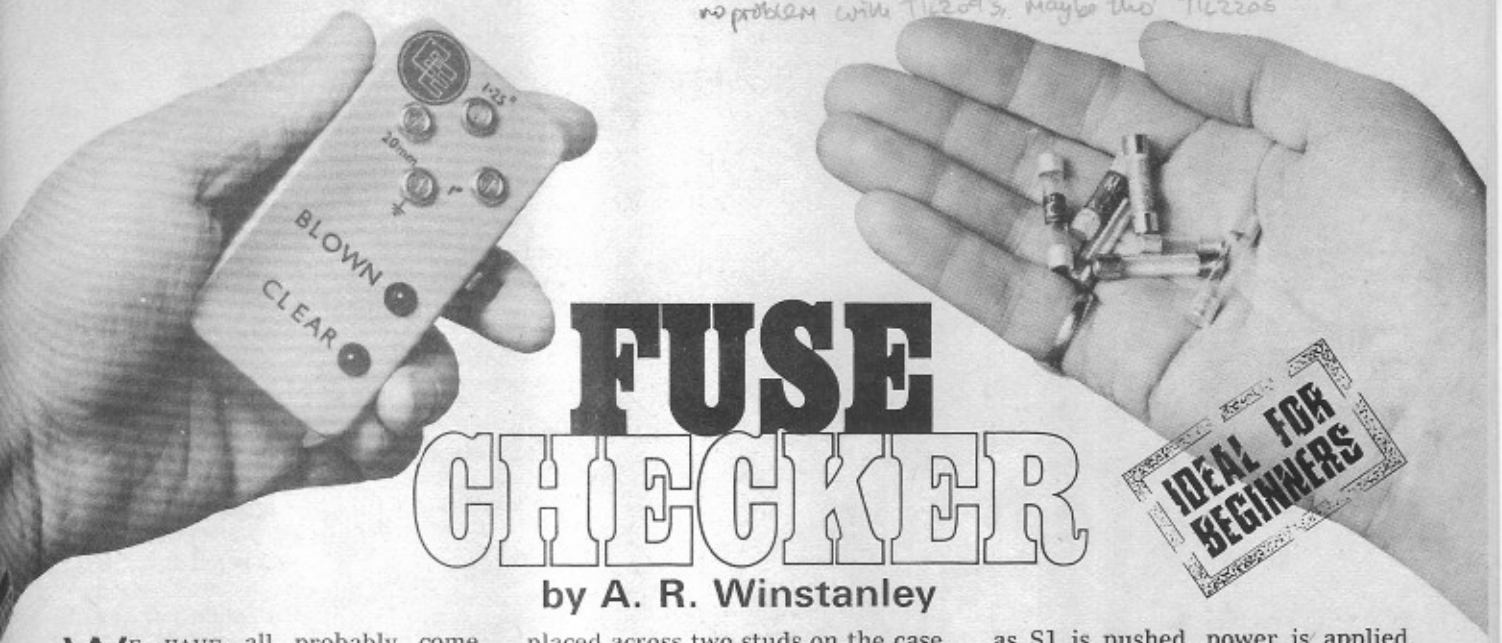
both LED's may illuminate - increase R to 680Ω
no problem with TIL209's. Maybe the TIL220's



FUSE CHECKER

IDEAL FOR BEGINNERS

by A. R. Winstanley

WE HAVE all probably come across the instance where we have a rather dubious fuse in our hand and we can not tell whether it is blown or not. This is especially the case with the ceramic types fitted in most plugs.

The normal course of action is to throw the fuse away and replace it with a new one, alternatively the more sophisticated of us might go for the good old battery and bulb or even the ohmeter. Normally by this time the fuse has rolled away into some inaccessible corner and so a new fuse might as well be fitted anyway! How many people have chased a fuse around the surface of a table with a pair of multimeter probes?

The unit described here has been designed to conveniently check all types of fuse generally used. These are the $1\frac{1}{4}$ inch and 20mm glass types, and the 1 inch ceramic fuse used in plugs.

Operation of the device is very simple; the fuse to be tested is placed across two studs on the case and a push button is pressed. If the fuse is intact then a light emitting diode designated CLEAR illuminates, and similarly if the fuse has blown, a corresponding light emitting diode glows (BLOWN).

There exists an argument that you do not need such a tester for glass fuses because you can see the fuse wire inside and tell whether it has melted or not. In certain cases this is of course perfectly true, but using the unit to be described is considerably easier and more certain than having to squint through a glass tube at a microscopically-thin strand of wire.

No doubt this checker will prove a boon to those whose eyes are not what they used to be, or those who generally discard questionable fuses regardless.

CIRCUIT DESCRIPTION

The circuit diagram of the Fuse Checker appears in Fig. 1. As soon as S1 is pushed, power is applied to the circuit, and one of the l.e.d.s illuminates.

Which one it is that glows, depends on the fuse under test. Assume firstly that the fuse is blown, therefore D3 cannot illuminate because its cathode is not connected to 0V. Current can however flow through R1, D1 and D2, which illuminates to show that the fuse being tested is blown.

Because D1 is carrying current, about 0·6V appears across it. Similarly approximately 2V appears across the illuminated l.e.d.

VOLTAGE ANALYSIS

Referring to Fig. 2 this shows how the voltages are split up across the various components. It can be seen that 6·4V is left across the resistor which limits the current flowing through the l.e.d. to a safe value, 29mA.

In the case of an intact fuse diode D3 is now able to illuminate

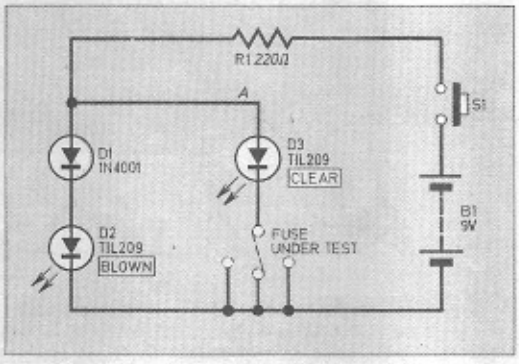


Fig. 1. Circuit diagram of the Fuse Checker.

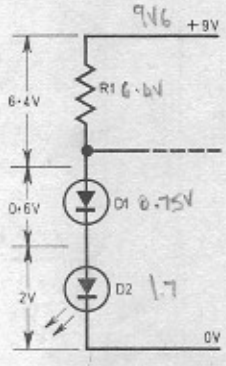


Fig. 2. Voltage analysis of the circuit with a blown fuse.

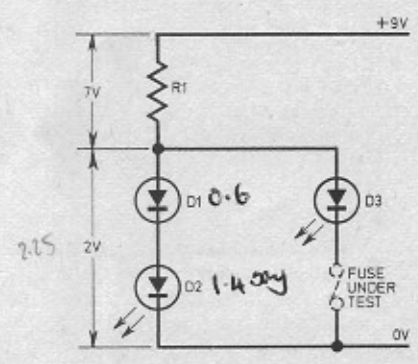
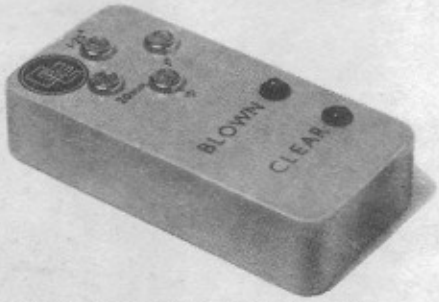


Fig. 3. Voltage analysis of the circuit with a good fuse.

FUSE CHECKER



COMPONENTS approximate cost £2.00

COMPONENTS

Resistors
R1 220Ω ½W carbon 5%

Semiconductors
D1 1N4001 silicon
D2 TIL209 red light emitting diode
D3 TIL209 green light emitting diode

Miscellaneous
S1 push-to-make release-to-break
B1 9V PP3 battery
Plastic case 100 × 50 × 25mm; 6BA hardware; four small screw cups; mounting clips for D2 and D3; connecting wire; battery clip to suit B1.

See Shop Talk page 720

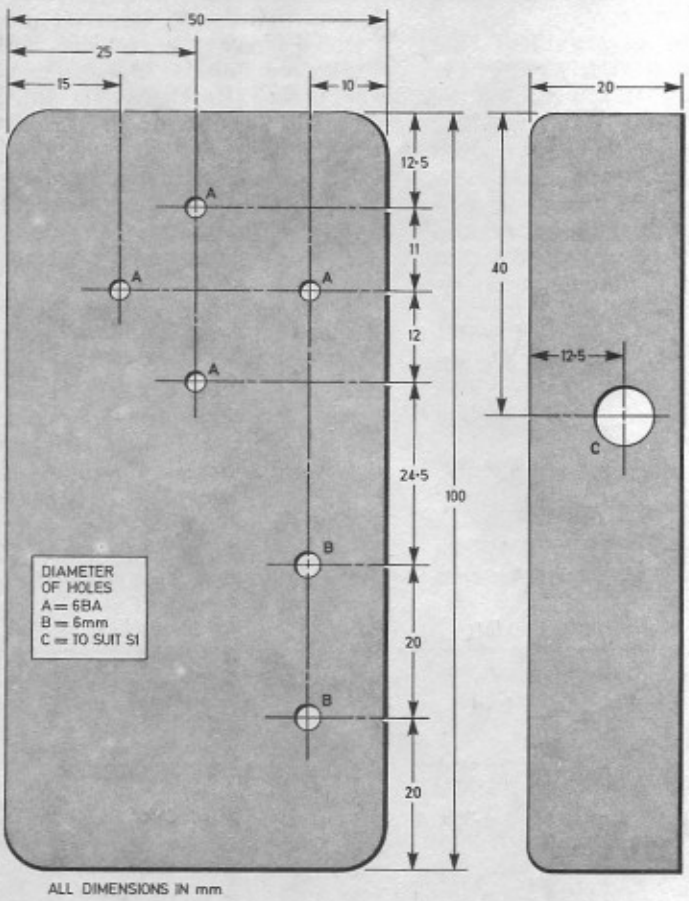


Fig. 4. Case drilling details. It is important that the distances between the four holes "A" are exact. Otherwise the fuses will not bridge them properly and may cause incorrect reading.

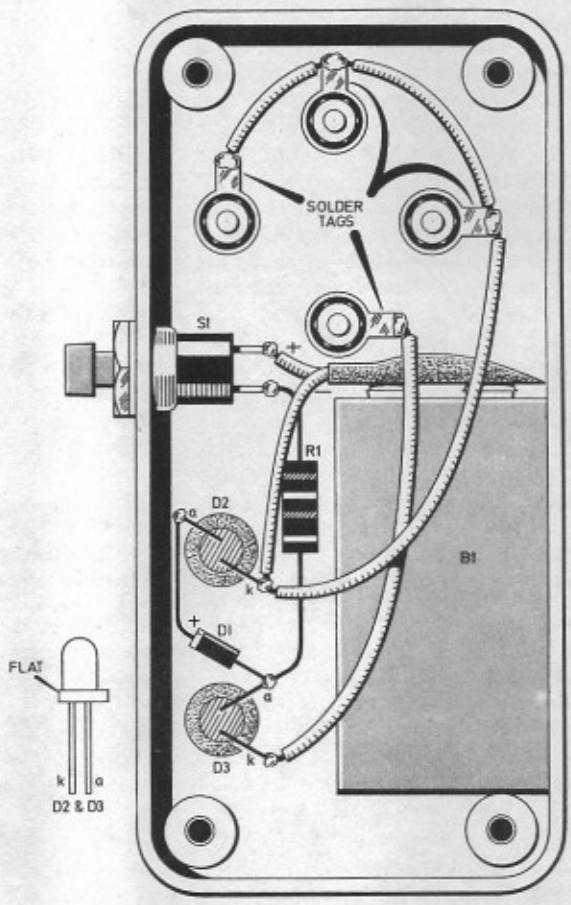


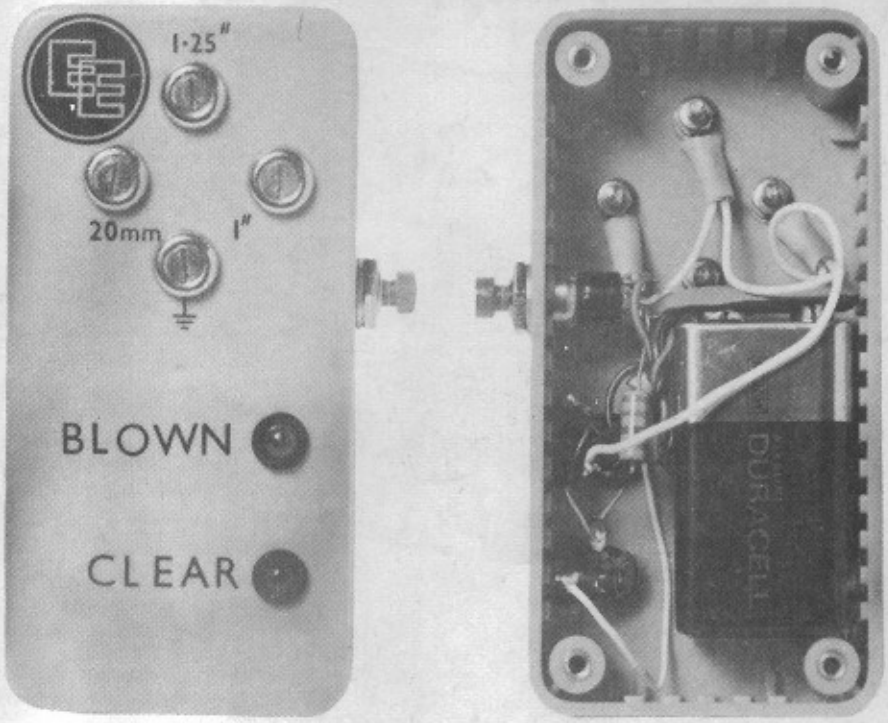
Fig. 5. Complete wiring details for the unit. Remember to solder the solder tags on to the wires before fitting them finally in place, otherwise the plastic case will melt from the heat of the iron.

because its cathode is taken through the fuse to 0V. As it is glowing, about 2V appears across it Fig. 3. But for D2 to glow, 2V must appear across it and a further 0·6V across D1, that is point *A*, Fig. 1 must be at 2·6V with respect to 0V.

However, with D3 glowing, point *A* is only at 2V and this of course is not enough to forward-bias D1 and D2. So if an intact fuse is checked, D3 illuminates and D2 is forced to extinguish, using a method called "current shunting" —D3 shunts current away from D1 and D2.

It will be seen from Fig 3 that the voltage appearing across R1 is now 7V and so a current of 31mA now flows through D3. As only 29mA flows through D2 when a blown fuse is connected, the CLEAR indicator will glow more brightly than the BLOWN lamp.

This effect will become more noticeable as the battery begins to age.



External and interior photographs of the completed Fuse Checker.

CONSTRUCTION starts here

The prototype was built into an orange ABS box measuring 100 x 50 x 25mm. This was a convenient size which slipped neatly into the palm of the hand. Of course, any other case could be used, but in this particular instance it must be made of plastic or similar non-conducting material.

CASE DRILLING

Construction starts with the case which is drilled to take the four studs, the switch and two indicators Fig. 4. All necessary lettering should be carried out at this stage, and the case should then be sprayed with clear lacquer.

Fix the push switch onto the side of the case, and then mount the two l.e.d.s using the special clips provided with each one. The leads will need to be cut back to about 25mm. Also once the l.e.d.s are in place, it will not be possible to see the cathode identification notches on the bodies, and so the cathode lead must be identified with a mark before mounting onto the case. You could, for example, cut the cathode lead shorter than the anode lead.

WIRING

Next carry out all of the interwiring as shown in Fig. 5. Be careful not to overheat any of the components, especially the semiconductors. Constructors who do not have too much experience soldering semiconductors are advised to use a heatshunt on the necessary leads.

If there is any danger of wires shorting out, they can be insulated with p.v.c. sleeving, which is slipped over one of the leads before soldering, and then slid over the soldered joint.

There are four studs on the case which allow the testing of the three common sizes of fuse (one stud is common). The studs consist of 6BA countersunk screws with a small screw cup fitted under each head.

Connections to the studs are made by 6BA solder tags placed under the nuts. The connection to the solder tag should be soldered before the tag is placed under the nut, otherwise the heated solder tag would melt the case.

Finally check all of the wiring for any mistakes, making sure that the l.e.d.s have been soldered the right way round. Clip on the battery and push the battery into the case, where it fits snugly. A piece of foam rubber glued onto the inside of the removable lid of the case will hold the battery tightly in place when the lid is screwed down.

TESTING

Press the pushbutton without placing a fuse across the terminals; this will cause the BLOWN indicator to glow. Now hold a good fuse across the appropriately-spaced terminals. For example the common and one inch terminal for ceramic fuses, and press the switch. The CLEAR indicator will illuminate but of course the BLOWN l.e.d. should not. This completes the testing of the unit which is now ready for use.

A battery life in excess of one year could possibly be expected, but it would be wise to check the battery condition occasionally if the tester is not used for a long period. If neither l.e.d. illuminates, then this is a sure sign of battery failure. ⌑