High Power Beacon

Truly portable battery-operated unit generates immensely bright flashes about fifty times a minute for up to 20 hours.

ETI project 240

A COMPLETELY PORTABLE emergency flash unit has many applications — particularly as a rescue aid when boating or hiking in isolated areas.

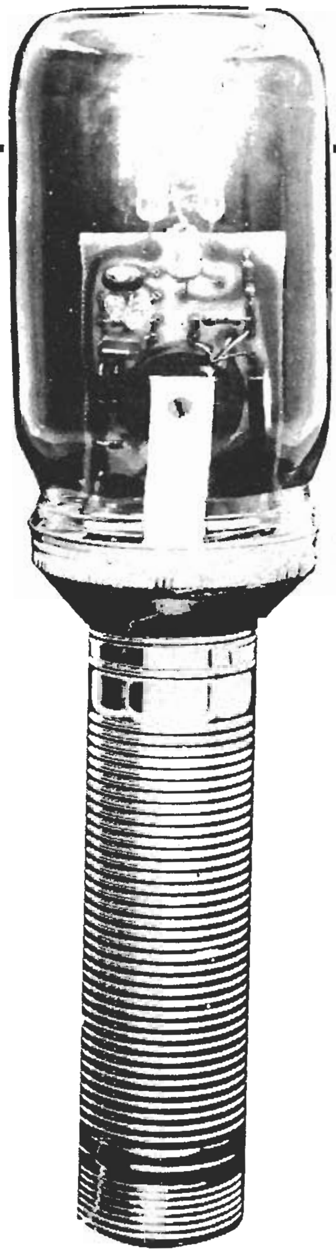
For such purposes it is essential that the unit be self-contained, compact and light in weight. It must above all produce a brilliant powerful flash that will attract attention over long distances, yet be capable of operating for at least eight hours from a couple of torch batteries.

The two requirements of high power and battery economy preclude the use of incandescent globes. However a xenon flash tube is capable of producing about fifty 0.6 joule flashes per minute for 20 hours or so if energised — via suitable circuitry — from a pair of alkaline "D" cells.

CONSTRUCTION

This may take any number of suitable forms. One approach is shown in the drawings and photos in this feature. No doubt readers will be able to construct individual housings to suit their own requirements.

Our unit was based on a metal-cased torch powered by two "D" cells. We discarded the torch globe and reflector but retained the switch mechanism. Regardless of the form of housing, construction should be based on the printed circuit board shown. All components should be mounted on the board as shown in the overlay drawing taking care that the diode, SCR, power transistor and pulse transformer are the correct way round.



The trigger lead of the pulse transformer is connected to a spiral of copper wire wound around the body of the flash tube to ensure reliable triggering. The inverter transformer is mounted to the board with a 4 BA or similar screw. This also secures the special bracket that contacts the positive terminal of the battery. This bracket is made from a piece of 18 gauge aluminium as shown in the side view diagram. The brass strip in the torch housing which normally makes contact with the reflector is soldered to the large pad provided for this purpose. This connection, as well as forming the negative battery connection, also holds the board down into the torch body.

We discarded the torch glass and the threaded flange which retains the glass, trimmed back the torch housing a little with tin snips, and then soldered the lid of a jam jar to the torch housing. The jar lid had previously had a hole cut through it to allow the electronics to protrude through into the jar. The jar should be kept over the unit whenever it is being operated as some parts of the circuit are at 400 volts or so and a nasty shock could be received.

The capacitor used for Cl is not rated at 300 V but has been found to be entirely suitable for such intermittent pulse operation. A capacitor rated at the full voltage would not only be much bigger and much more expensive, but would not add anything in the way of reliability.

PARTS LIST – ETI 240

Resistors				
R1,2*	–	220	½W	5%
R3,4	–	2M2	"	"
R5	–	10 k	"	"
Capacitors				
C1	–	10 μF	250 V polyester	
C2	–	0.1 μF	200 V	
Transistor				
Q1	–	TIP 3055		
Diode				
D1		1N4008		
SCR1		C106D		

Transformer

T1	See Table 1
T2	See Table 1

LP1, LP2, Neon Lamps NE2 (75 v)
LP3 Flash Tube (see Table 1)

PC Board ETI 240

Torch, Battery etc.

* For 6v operation change R1 to 470 ohm.

HOW IT WORKS – ETI 240

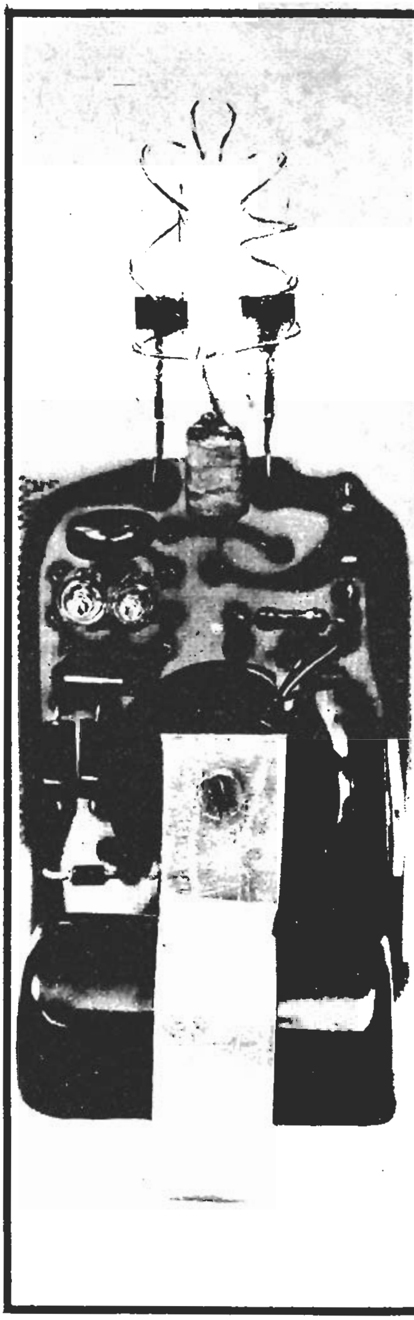
The flash tube requires about 300 to 350 volts to supply the flash energy, and about 4000 volts to trigger it into conduction. The 300 volts is generated from a three-volt battery supply via a blocking oscillator. The oscillator works as follows.

On switch-on the transistor Q1 is biased on by R1 and R2 and a small voltage is generated across the primary of transformer T1. Due to the action of the transformer a voltage is induced in the feedback winding of the transformer which turns on Q1 hard. The current in the primary therefore increases sharply until the transformer core-material saturates. At this time normal transformer action stops, the feedback voltage disappears and the transistor turns off. The polarity of the voltage on the primary reverses and the energy stored in the core must be dissipated. In effect the energy is dumped into capacitor C1 via the diode D1 causing C1 to change to the 300 volts or so required. If the capacitor was not present the voltage on the collector of the transistor would be high (60 volts or more) and the secondary voltage would be well over 1000 volts. Therefore it is essential that the oscillator never be run without the load connected. It is also essential that the polarity of the windings be correct as marked on the circuit diagram (PS for primary start etc).

When the energy in the core has been dumped into C1 the transistor turns on again and the cycle is repeated. The repetition rate depends on the voltage across C1 but is typically within the range 8 to 15 kHz.

When the voltage across C1 reaches 300 to 350 volts the voltage across the scr is about 150 volts and at this point the two neon lamps conduct thus triggering the 'SCR. The SCR now discharges C2 via the primary of the pulse transformer thus generating a pulse of about 4000 volts amplitude on the secondary. The pulse is applied to the trigger electrode of the xenon tube causing it to strike. The flash tube then discharges capacitor C1 in about 10 microseconds giving a very intense and high-speed flash of light. The peak current in the flash tube is about 350 amps.

The SCR turns off automatically due to ringing of the pulse transformer and the low amount of current available through R3.



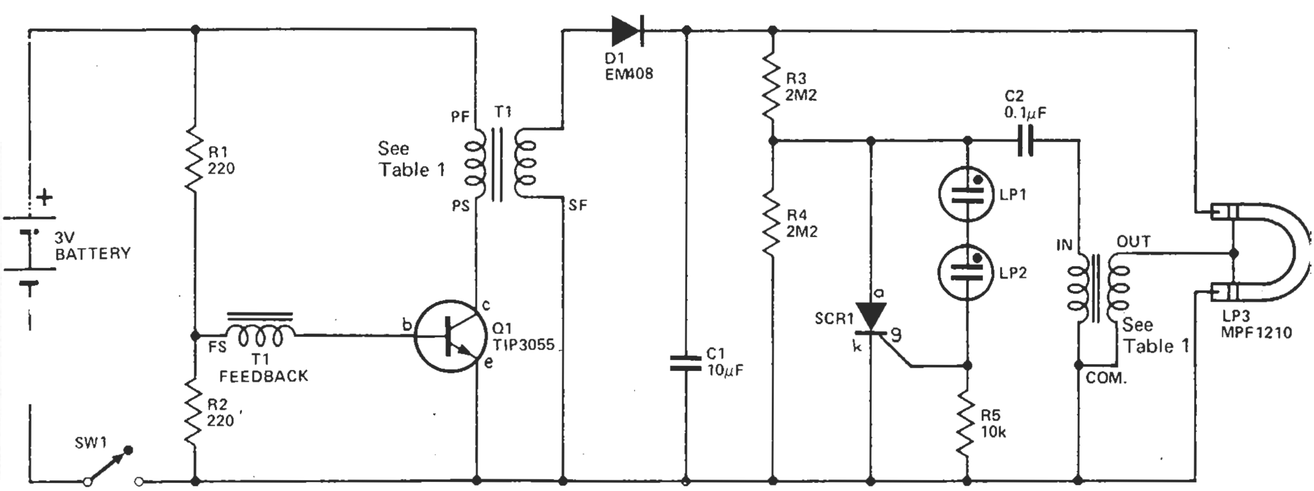


Fig. 1. Circuit diagram of the portable emergency flash.

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TABLE 1

Winding details transformer T1.

CORE	FX2240 (2 halves) plus single section bobbin to suit
SECONDARY (wound first)	see below
PRIMARY	4 turns 0.5 mm wire (or two 0.315 mm in parallel)
FEEDBACK	4 turns 0.315 mm wire

Mark the start of all windings clearly as polarity is important
Add a layer of Sellotape over the secondary for insulation.
Note that for six volt operation primary should be wound with eight turns of 0.315 mm.

With Philips 126048 or MPF1210 the TR-4KN trigger transformer should be used, but with the Tandy 272 1145 the secondary of T1 should be reduced to 110 turns and the matching trigger transformer 272 1146 used.

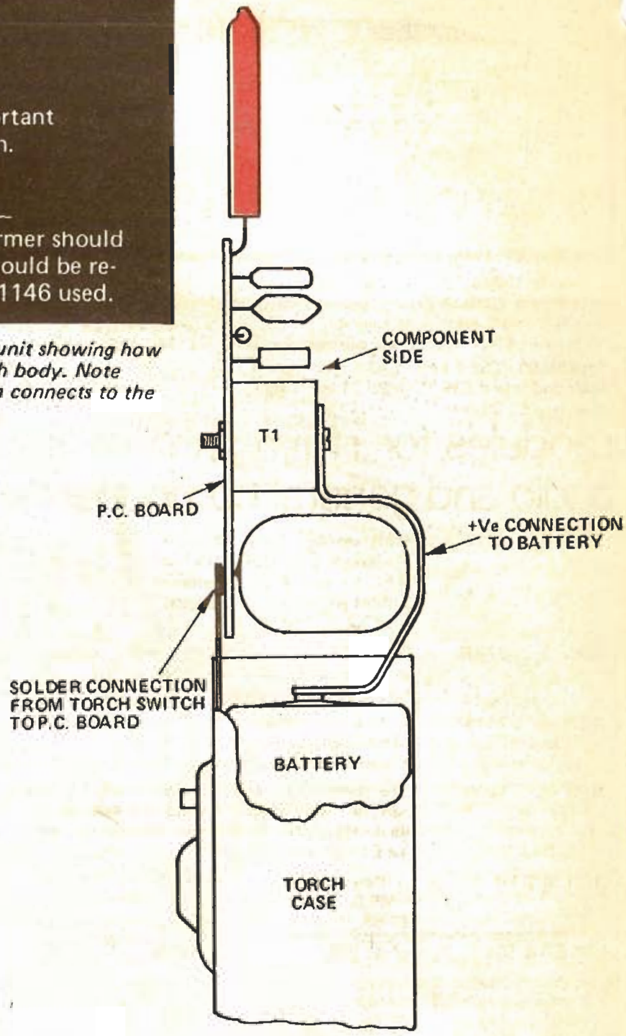

Fig. 3. Side view of the flash unit showing how board is secured into the torch body. Note particularly the bracket which connects to the battery positive terminal.

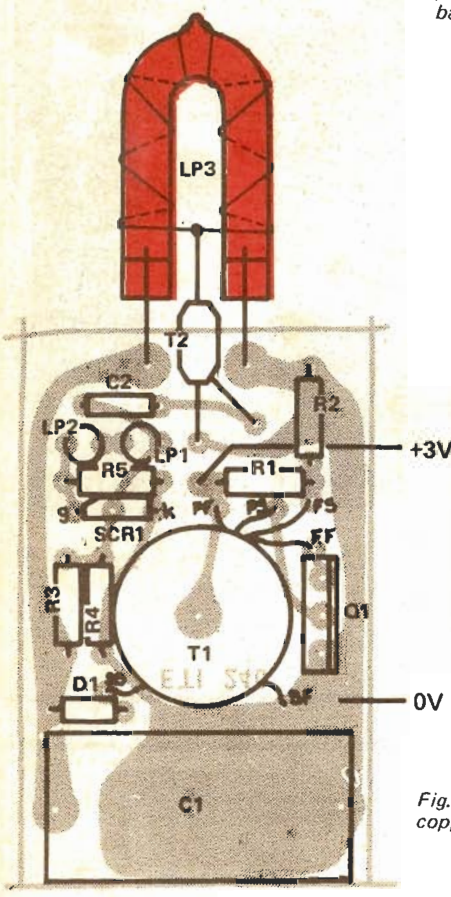

Fig. 2. Component overlay. Note copper wire spiral around flash tube.

SPECIFICATION ETI 240

INPUT	
Voltage	3 volts (nominal)
Current	400 to 450 mA at 3 volts
Power	1.25 watts
OUTPUT POWER	0.6 joules/flash
FLASH RATE	1.2 seconds per flash typical
EXPECTED BATTERY LIFE (2 D size cells)	
Alkaline	20 hours
Normal	8 hours
Nickel cadmium	10 hours

Fig. 4. Printed-circuit layout for the flash. Full size 73 x 47 mm.