CASANOVA'S CANDLE

If Casanova were alive today he would have certainly approved of this project, history however does not record whether or not he could solder

IT WOULD SEEM that almost every electronics manufacturer has at one time or another produced some kind of light dimmer. In general they all fulfill the same need, that is to vary the intensity of an incandescent lamp (a normal light bulb to you and me) over the whole range of brightness. Our dimmer has the added capability of being able to reduce the brightness of a lamp over the greater part of its range, over a period that can be from just one or two minutes to nearly one hour. At this point it's probably unnecessary to explain the title, however the unit could just as easily be used as a child's bedroom lamp, or indeed a reading lamp for any bedroom.

The type of switch used is unimportant, it must, however be of the double pole changeover type.

The Light Fantastic

Because only two wires protrude from the average light switch, certain constraints are placed upon the design, it is almost impossible to get the light to dim from full intensity for reasons that will become apparent later (see How It Works).

The final design managed to achieve a gradual reduction in brightness from about half-brightness to almost zero: using the components specified this will take about forty minutes.

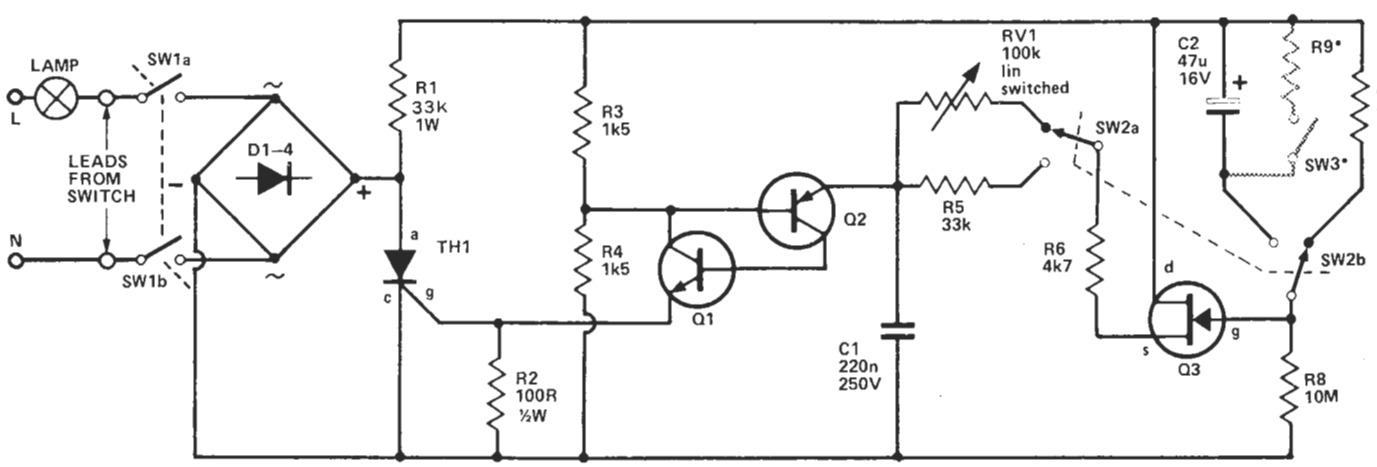


Fig. 1. Circuit of Casanova's Candle **See text for notes on discharge switch SW3.**

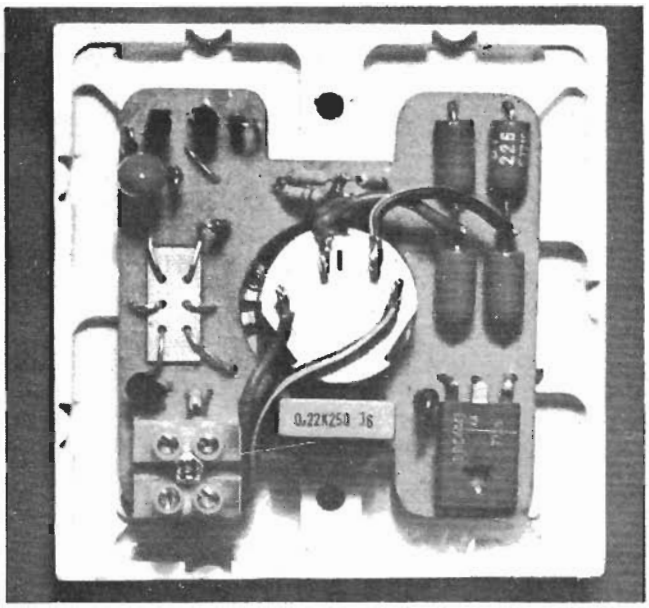
NOTE:
Q1 IS 2N3904
Q2 IS MPS6523
Q3 IS 2N5458
D1 –4 ARE IN4004 diodes
TH1 IS C106D
*SEE TEXT

Construction

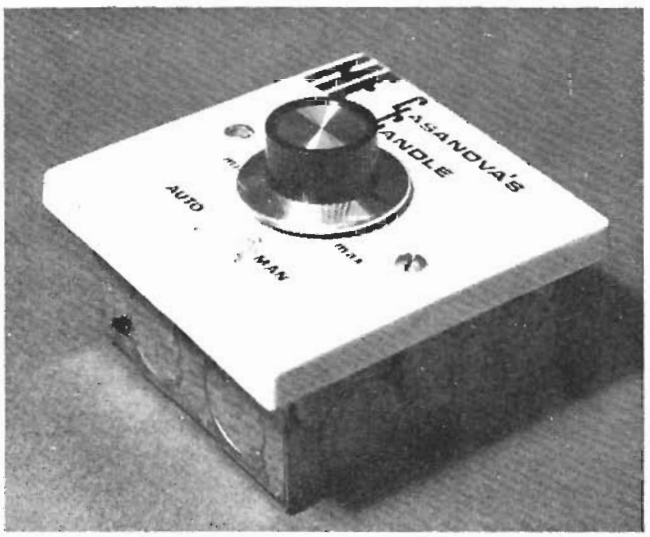
For ease of construction the unit is mounted on a shaped one-piece PCB. It is suggested that the board be cut to size and the central hole and cut-outs be completed before any etching is done.

The whole assembly relies upon the pot to mount the unit so care should be taken when soldering the pot to ensure a rigid joint between the pot and the board. Mounting the rest of the components should present no problems.

The Thyristor should be left slightly clear of the board to prevent any heat build-up.



Note the cut-outs on the PCB, these are to clear the lugs on the mounting box.



The dimmer assembly is mounted on a blank switch plate. The hole for the pot and the slot for the switch should be dirlled and filed with great care as the switch plate is made from an extremely brittle type of plastic and does not take too kindly to abuse.

How Fast Do You Work?

You may find that a discharge switch across C2 via R9 might be needed as the discharge time of C2 is somewhat prolonged. This however was not found to be necessary on the prototype.

HOW IT WORKS

This dimmer works in a rather unconventional way, most dimmers on the market use a TRIAC to switch both half-cycles of the cycles, this however was not practical for this application as the circuit requires a low voltage DC rail. To this end it was decided to use a fullwave bridge rectifier circuit with a thyristor across it's "DC" output to switch both half-cycles. The low voltage rail is provided by dropper resistor R1.

In each half-cycle, the thyristor will not conduct until it receives a trigger pulse from Q1. When this occurs, the thyristor will put a virtual short circuit across the bridge, causing maximum current to flow in the lamp. Hence the shorter the period between the start of the half-cycle and the firing of the thyristor, the brighter the bulb will burn.

The firing point of the thyristor is controlled by the comparator circuitry built around Q1, Q2. The DC rail carries an unsmoothed voltage with an amplitude of about 10 volts, which is applied to the base and emitter of Q2 by potential divider R3, R4 and CR network C1, RV1 and R6 respectively (assume for the moment that the FET Q3 is a short circuit). The CR network produces an out-of-phase signal at the Q2 emitter and whenever the voltage at this point rises above 0.6 V relative to the base, the transistor will conduct, thus Q1 will also be turned on, firing the thyristor.

The resistance of RV1 varies the amount of phase lag, and consequently the firing point of the thyristor, providing control of the lamp brightness. So far so good.

The delay circuitry comprises Q3 and the network C2, R8, and is switched in and out of circuit by switch SW2. The FET should be regarded as a purely resistive device, the degree of resistance being determined by the voltage on the Q3 gate. SW2 removes the pot RV1 from circuit and replaces it with R5 which gives approximately half-brightness until C2 begins to charge up.

The resistor R7 is used to keep the FET conducting during its normal operation so it becomes a virtual short circuit.

If for any reason the time taken to dim the lamp is either too long (or too short) the value of R8 can be changed to suit (C2 can be altered, but its physical size may prove to be a limitation).

Finally a safety point, using the values suggested the lamp will never completely extinguish, so in theory at least it can never be left in the "auto" position accidently. Don't forget that line power is potentially fatal stuff to play around with, we would hate to lose any of our readers.●

PARTS LIST

RESISTORS

R1	33k 1W
R2	100R ½W
R3	1k5
R4	1k5
R5	33k
R6	4k7
R7	1M
R8	10M
R9	470R (see text)
RV1	100k Lin. switched

(R 3-R9 all ¼W, 5%)

CAPACITORS

C1 220n	250V Polyester
C2 47u	16V Tantalum

SEMICONDUCTORS

Q1	2N3904
Q2	MPS6523
Q3	2N5458 FET
TH1	C106D
D1-D4	IN4004

Miscellaneous

SW2 Miniature slide or rocker switch. (double pole, changeover)
Blank MK switchplate
Terminal block
Wall box (see text)
PCB

Note that R1 and R2 need to be of a higher wattage than normal but these and the semiconductors are all available from the larger mail order companies. The thyristor is not particularly critical and most 400 V, 2 A devices will do although the leadouts may vary. The bridge rectifier is made up from common rectifier diodes but other 400 V, 1 A components can be used.

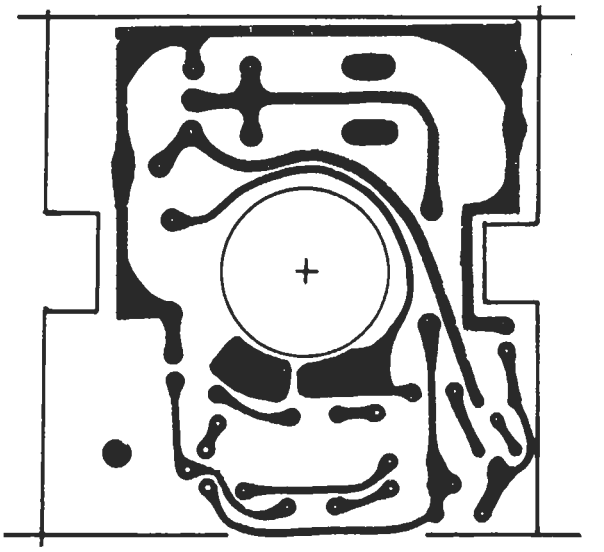


Fig. 2. PCB foil pattern, the pot RV1 and switch SW2 are mounted on the foil side of the board.

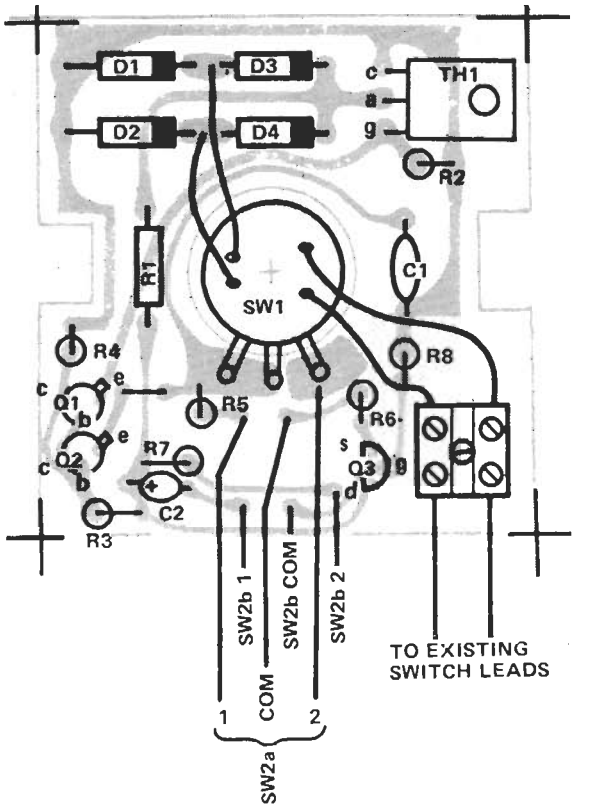


Fig. 3. Component overlay, note the position of the terminal block, and connections to the switch SW1.