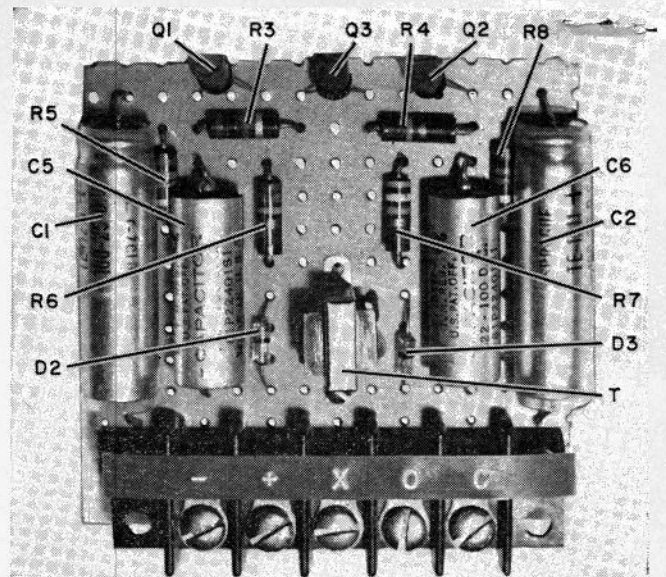


Assembled solid-state timer-indicator fits into a meter box.



Components in transistor timer mount on perforated board.

settings of R1 and R2. As an example, the following values of resistance vs. repetition rate apply when R1 and R2 are equal and the duty-cycle is 1:1.

R1, R2 in ohms	Time in sec
8K	0.5
10K	0.7
15K	1.7
22K	3.3
33K	6.0
47K	8.0
68K	12
100K	16-17

Fig. 4 is the schematic of the combined timer and audio indicator. D1 damps out induced transients in the relay coil. Diodes D2 and D3 isolate the two circuits being activated by the relay.

It's often convenient to power the timer and indicator from the external circuit which it controls. If 12 volts dc is easily obtainable, fine. The specified 2N2716 transistor has a V_{CE0} breakdown rating of 18 volts. For a higher-voltage supply, you could substitute a 2N3404, which has similar h_{fe} transfer characteristics but a 50-volt V_{CE0} rating. For portable use, a self-contained supply would be useful, and a pair of 6-volt batteries, such as Burgess Z4, Eveready 724 or RCA VS068 will do nicely.

C3 and C4 aren't specified, since their value, as shown in Fig. 3, depends on load impedances. Likewise, values of R6 and R7 depend on your particular requirement. Their resistances determine the pitch of the indicator tone, so you may want to use adjustable pots.

The model shown here was used in the following hookup: The common relay terminal was connected to a 12-volt supply. The normally closed and normally open terminals of the relay were connected to the signal lamps (Fig. 3).

Type 53 lamps, rated at 0.12 amp at 14 volts, were used. C3 and C4 were connected between the relay terminals and the audio-indicator input terminals. By trial and error, it was found that $2 \mu\text{F}$ produced a tone burst of about 0.1-sec duration. R6 was made 38K, and R7 18K, to produce different tones for each lamp. Later, for continuous tones, the capacitors were omitted and R6 and R7 were increased to 47K and 68K.

This timer can easily be adapted for darkroom use, as Fig. 5 illustrates. A dpdt relay is used, and the lamps are replaced with 470-ohm resistors.

To operate, open enlarger lamp switch S before turning on the timer. Adjust pots R1 and R2 so the closed time is the desired printing interval, with the open time about 5 seconds. With the darkroom lights off and the timer beeping away, wait for that moment when the open-circuit tone comes on. When it does, close the enlarger-lamp switch. After a pause, the closed-circuit tone will sound and the lamp will turn on. At the end of the exposure time, the lamp will go out with the return of the open-circuit tone. Don't forget to open the enlarger switch! END

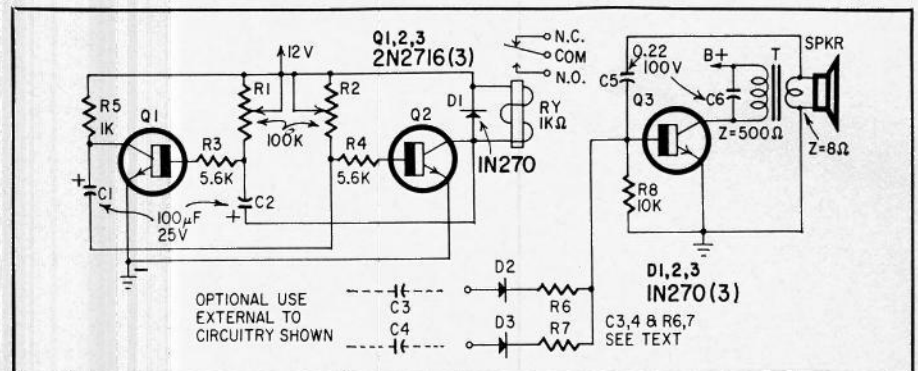


Fig. 4—Complete diagram of solid-state timer and indicator. C3 and C4 are optional.

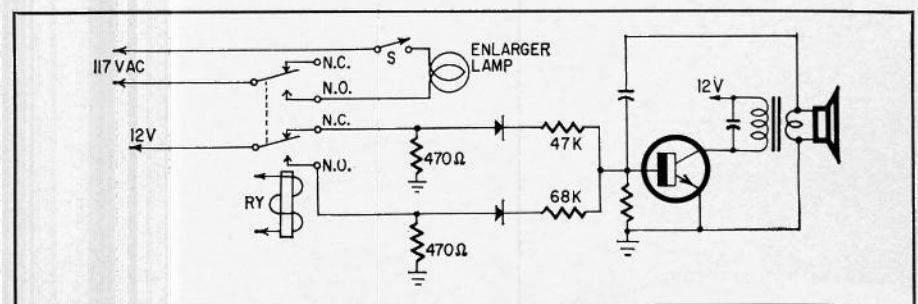


Fig. 5—An example of the versatility of the timer—in the photographer's darkroom.