AN ILLUMINATED RAT-LEVER USING AN ELECTROLUMINESCENT LAMP¹

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An inexpensive and easily constructed rat-lever that can be illuminated uniformly without undue lighting of other parts of the enclosure is described. The lever consists of an electroluminescent lamp in the form of a thin (.03-in. thick) sheet which is inserted into a deep, band-sawed slit in a piece of plastic. The plastic is mounted on a hinge, and some means of actuating electrical contacts is provided.

The lever shown in Fig. 1 uses a General Electric flexible plastic electroluminescent lamp. The lamp has a rating of 120 v ac, a nominal size of 2 in. by 2 in., and a $1\frac{3}{4}$ by $1\frac{3}{4}$ in. lighted area. The lever is made from a piece of clear plastic, $2\frac{1}{8}$ in. long, 2 in. wide, $\frac{1}{4}$ in. thick, and sawed as shown. Sandpaper can be used to roughen the top surface and round the front edge of the plastic.

A simple hinge-and-contacts assembly, shown in Fig. 1, can be made from a short telephone relay (Crowder and Wilkes, 1964). The lever, with the lamp in place, is attached by a flat-headed machine screw to the underside of the relay armature, the coil of which has been removed. The relay frame in turn is attached to the cage by means of a wooden block. A wood screw serves to limit the travel of the lever. The force needed to operate the lever may be adjusted by bending the relay contact-springs, or, in multiple-contact relays, by removing some of the contact springs. In the arrangement shown, two contact springs have been bent upward and used as tie points for the lamp leads.

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The brightness of these electroluminescent lamps varies with voltage, frequency, and lamp color. When operated at 120 v, 60 cycles, initial brightness is approximately 7 ft-lamberts for green lamps, 2.5 ft-lamberts for white or yellow lamps, and 1.2 ft-lamberts for blue lamps. Brightness may also be controlled over wide limits by varying the voltage (from 24 to 240 v) or the frequency (from 50 to 500 cycles). Unlike incandescent lamps, these lamps show very little change in their color as brightness is altered.

There is some possibility of failure when the lamps are operated at voltages much in excess of their rated 120 v, although four of them have been tested for over 8000 hr at 230 v without failure. Apparently, most lamps that

Fig. 1. Photograph of illuminated rat-lever.

fail from overvoltage do so within the first 100 hr, making is easy to reject them.

When operated at rated voltage, these lamps do not fail suddenly, but gradually decrease in brightness over at least 20,000 hr. The brightness-decrement curve is negatively accelerated, with perhaps half the decrement occurring within the first 2000 hr. A simple method for holding brightness constant over thousands of hours is to use 230 v with a variable resistor in series with the lamp and to decrease the series resistance occasionally, in order to bring the lamp up to its original brightness.

Due to moisture absorption, these lamps cannot be expected to last more than three years, regardless of the duty cycle. If the lamp is cut or punched or if the unlighted edges are trimmed at all, moisture absorption will be accelerated and the lamp's life will be greatly shortened.

A second use for electroluminescent lamps is as large-area light sources to replace lamp enclosures having opal-glass diffusers. The chief advantages of electroluminescent over opal-glass light sources are convenience, flat shape, uniformity of illumination, ease of varying brightness, and the minuteness of the heat

generated (less than .03 w per sq in. at 120 v, 60 cycles).

Electroluminescent lamps are sold by Allied Electronics, Chicago, and by Miniature Lamp Department, General Electric Company, Nela Park, Cleveland. The 2 by 2 in. lamp in use is priced by Allied at \$2.22 each, or at \$.77 each if purchased in quantities of 50 or more. Other sizes stocked by Allied are 4 by 5 in., 8 by 10 in., and 12 by 12 in. Still other sizes may be obtained from General Electric; their largest lamp is 12 by 14 in. and is listed at \$14.00 in small quantities.

The plastic used is Homalite 911, which is similar to Plexiglas but is claimed to be 30 times more resistant to abrasion. It is sold by the Homalite Corp., Wilmington, Delaware. The minimum order is \$20.00. Presumably, clear Plexiglas could be used, or the lamp could be imbedded in a block of Castolite, a pouring plastic sold in hobby shops. One possible advantage of encapsulation in plastic is the prolonged lamp life that might result from retarding moisture absorption.

REFERENCE

- Crowder, W. F. and Wilkes, W. P. An easily constructed rat lever. *J. exp. Anal. Behav.*, 1964, 7, 292.