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AN APPLIANCE "OFF" REMINDER

A low-cost project provides an audible alert when an appliance indicator light goes off

IT IS often useful—sometimes vital—for the user of an appliance to know if and when it ceases to operate, whether by design or due to a power failure. Usually, this is not difficult to accomplish, since most appliances are equipped with indicator lights that show when they are working. But if the appliance is not in direct view, keeping track of it can be a great annoyance.

One solution to this problem is to use an electronic "eye" that senses the radiation from the indicator light and sounds an alarm when it is interrupted. For convenience, only the sensor is required to be physically at the monitoring point; the alarm can be located where it is easily heard.

The Lights-Out Alert described here provides the answer. It is battery powered and reliable; can be built from low-cost components; and is usable with almost any sort of power-on light indicator.

Circuit Operation. As shown in Fig. 1, phototransistor *Q1* and Darlington-connected *Q2* form a high-gain optical-to-electrical transducer that drives a charge pump made up of *Q3* and *Q4* and associated components.

When no light strikes *Q1*, its resistance should be high enough so that *Q2* is cut off. Any slight leakage from *Q2* should produce less than 0.7 volt across *R1*—not enough to turn on *Q3*. Assuming that capacitor *C1* has been discharged by the operation of *S1*, *Q4* also lacks the voltage required to turn it on. Thus, all four transistors are off and current from the battery is almost nil.

When light strikes *Q1*, its resistance drops, depending on the illumination level, and *Q2* is turned on. The voltage developed across *R1* turns *Q3* on provided *C1* is discharged. Thus *Q4* is driven deeper into cutoff. Current flows through *Q3* and *R2* to charge *C1*. When the voltage across *C1* rises to within 0.7 volt of that across *R1*, *Q3* is cut off. This condition will last as long as transistor *Q1* is illuminated.

When the illumination ceases, the voltage across *R1* drops. Since *C1* is charged high enough to reverse-bias *Q3*, this transistor cuts off and turns on *Q4*. Discharge current from *C1* now flows through *R2* and *Q4* to drive alarm *A1*.

After some time (about one minute per 10,000 microfarads of *C1*), *C1* becomes discharged and the alarm turns off. The circuit is then ready for the next illumination period, with no current drawn from *B1*. Switch *S1*, in conjunction with *R3*, provides manual silencing of the alarm. This switch should not be operated during the charging cycle of *C1* because this will tend to deplete the battery's charge.

Construction. The circuit consists of two physically independent sections—the light-sensitive portion and the alarm/power package, with the two interconnected by a length of flexible four-conductor cable.

The four transistors and two resistors that form the photosensor can be assembled on a small piece of perforated board or a small printed-circuit board. Make sure that the sensitive face of *Q1* is in the clear so that light can pass through a hole in the case and shine on this surface. Select a low-leakage device for *Q2*. If phototransistor *Q1* is a low-gain device (units vary with manufacturer), increase the value of *R1*. However, to avoid false alarms do not make the circuit too sensitive.

The board can be mounted in a small enclosure having a hole drilled so that external light can fall on the sensitive face of *Q1*. Another small hole can be used for the four-conductor cable. The alarm/power elements are mounted in a separate enclosure with holes near the alarm so that it can be heard.

To test the project, expose the photosensitive surface of *Q1* to an ordinary household light bulb at a distance of about 18 inches. When the light source is removed, the alarm should sound for approximately one minute. Changing the value of *C1* changes the alarm-on time. The alarm can be silenced by operating switch *S1*. ◇

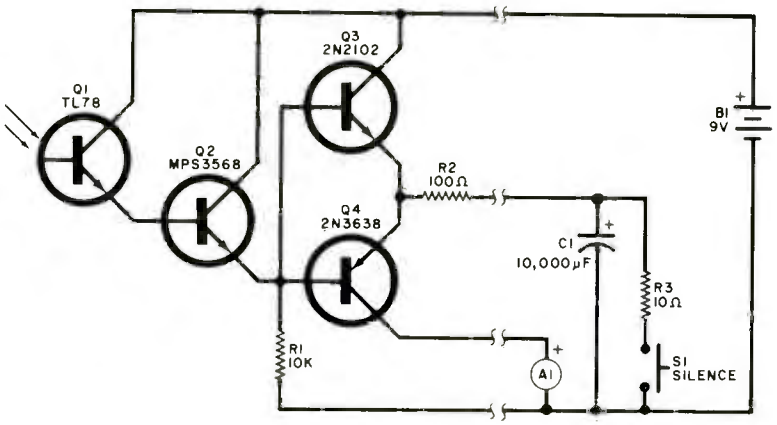

Fig. 1. Phototransistor Q1 senses when the light impinging on it goes off. The signal is then amplified to energize alarm A1.

PARTS LIST

A1—Alarm (Sonalert SC628 or similar)
B1—9-volt battery
C1—10,000-μF, 10-V capacitor (see text)
Q1—TL78 phototransistor (Radio Shack FPR-100)
Q2—MPS3568 transistor (Radio Shack S0015)
Q3—2N2102 transistor (Radio Shack S5026)
Q4—2N3638 transistor (Radio Shack S0029)
R1—10,000-Ω, 1/4-W resistor
R2—100-Ω, 1/4-W resistor
R3—10-Ω, 1/4-W resistor
S1—Normally open pushbutton switch
Misc.—Length of four-conductor cable, suitable enclosures, perf board, printed-circuit board, mounting hardware, etc.

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