

Build the Bug Shoo

*Greaseless,
odorless
mosquito
repellent*

BY LYMAN E. GREENLEE

THROUGH OBSERVATION and scientific study of the habits of mosquitoes, certain facts have been compiled leading to the design of an electronic repellent for the little beasts. It has been determined that the male mosquito is attracted by a humming noise at a frequency of about 2000 Hz. But the male mosquito does not sting; it is the female of the species that creates all the discomfort.

The female mosquito is said to be repelled by the same sound that attracts the male. And since it is the female mosquito you want to ward off, having a device that will "repel" her is mighty handy. The trick is to ward off the female without attracting too many male mosquitoes, and the "Bug-Shoo," a simple cigarette-package-size device, has proven itself to be quite effective since female mosquitoes usually avoid the male "humming" area.



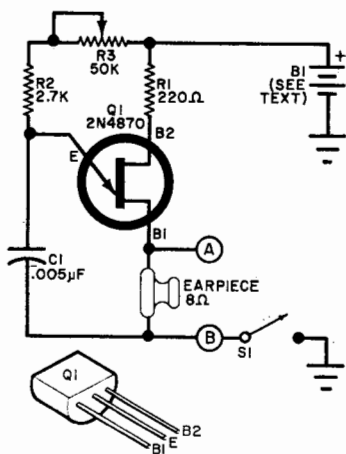


Fig. 1. Simple UJT relaxation oscillator makes up repeller; output is from earpiece.

PARTS LIST

- B1—9-volt transistor or 22.5-volt miniature battery (see text)
- C1—0.005- μ F disc capacitor
- Q1—Transistor (Motorola 2N4870 or HEP 310)
- R1—220-ohm, $\frac{1}{2}$ -watt resistor
- R2—2700-ohm, $\frac{1}{2}$ -watt resistor
- R3—50,000-ohm miniature P.C. potentiometer
- S1—S.p.s.t. slide or miniature toggle switch
- I—8-ohm miniature earpiece (from transistor radio)
- I—3 $\frac{1}{4}$ " x 2 $\frac{1}{8}$ " x 1 $\frac{1}{8}$ " aluminum utility box
- Misc.—Brass shim stock; 22-gauge aluminum (or old money clip) for pocket clip; 2-56 machine hardware; 1"-square piece of fiber paper insulator; perforated phenolic or Bakelite board; hookup wire; solder; etc.

About The Circuit. A simple UJT relaxation oscillator (see Fig. 1) is the heart of the Bug-Shoo. Unijunction transistor Q1 is the active element in the circuit, while capacitor C1 and the combined resistances of R2 and potentiometer R3 form the frequency-determining RC network. Potentiometer R3 provides control over a wide frequency range.

Resistor R1 is the B2 load for Q1. The output transducer for the Bug-Shoo is an inexpensive miniature earpiece with an impedance of 8 ohms. Power for the circuit is not critical and can be anywhere between 9 and 22 volts, using a small transistor radio battery.

Construction. Due to the simplicity of the circuit, assembly is best performed

as shown in Fig. 2 on a piece of Bakelite or perforated phenolic board. The board should measure no more than 1 $\frac{3}{4}$ " x 1 $\frac{1}{2}$ " if you wish the entire project to fit inside a 3 $\frac{1}{4}$ " x 2 $\frac{1}{8}$ " x 1 $\frac{1}{4}$ " metal utility box. You can assemble the circuit on the board by drilling holes for and routing cross-connecting wiring under the board. Control R3 also mounts to the underside of the board.

Next, machine the top half of the utility box so that the opening of the earpiece and control slot for R3 are accessible from the outside. Then mount the circuit board with 2-56 machine hardware and $\frac{1}{4}$ "-long spacers. Switch S1 mounts near the board with 6-32 screws.

If you are using a miniature 22.5-volt battery for B1, you can mount it in place as follows. Make an indentation (centered $\frac{3}{8}$ " in from one end of the bottom half of the utility box) to accommodate the negative contact of the battery. Then cement a 1"-square piece of black fiber paper on the opposite wall of the half section (see Fig. 3). Solder the free end of the positive hookup wire to a $\frac{1}{2}$ "-square piece of brass shim stock and wedge the shim between the positive contact of the battery and fiber paper. (If

AN EXPERIMENTAL DEVICE

The Bug-Shoo is an experimental device. As such, it makes an excellent research project. The fact that sounds attract or repel mosquitoes has been proved in laboratory experiments. Recordings have been made of the mating calls of mosquitoes, and playbacks of these recordings have proved effective in luring mosquitoes into traps where they could be conveniently destroyed.

Just because you are wearing the Bug-Shoo, there is no absolute guarantee that you will not be attacked and stung by mosquitoes. But then the application of greasy or odorous "repellents" or powders is no guarantee against stings either. One method works about as well as the other, but the Bug-Shoo is not goeey, greasy, or smelly.

There are a number of outstanding patents on devices of this nature. The most important are U.S.A. Patents 1,700,450; 1,870,778; 2,922,999; and 2,928,204. There is a British Patent (705,921) that is worth reading and an Italian Patent (426,491) on repelling mosquitoes with ultrasonic sound. There are several books and papers on this subject available in major libraries.

—Lyman E. Greenlee

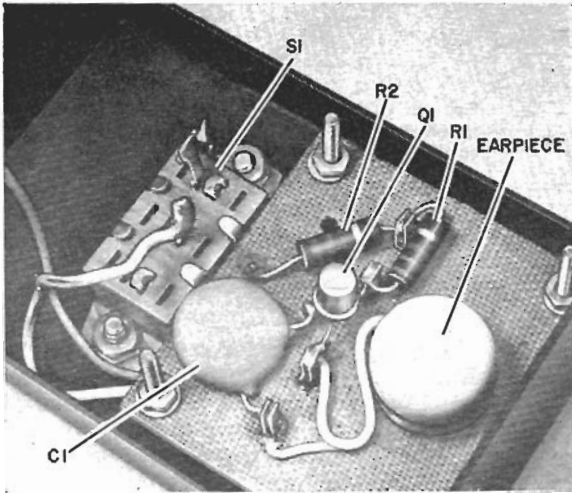


Fig. 2. All components except switch and battery are on circuit board. Interconnecting wiring is routed on bottom of board; earpiece is cemented in place.

If you have difficulty in achieving efficient operation always try a different earphone. Some earphones work much better than others and the author has found surprising differences in earphone sensitivity and audio output.

you use a 9-volt battery, there is no need to dimple the side or use fiber paper; the usual snap-on connector will serve as a wedge.) The battery can then be held in place with a small L bracket and 2-56 machine hardware.

Finally, bolt to the outside surface of the bottom of the utility box a pocket clip. The clip can be made from an old money clip or from 22-gauge aluminum stock. Assemble the box.

Use. You can "tune" the Bug-Shoo oscillator by ear or by comparison with the output signal heard from a loudspeaker from an audio generator. A frequency between 2000 and 2500 Hz seems to work best as a repellent. However, it is inter-

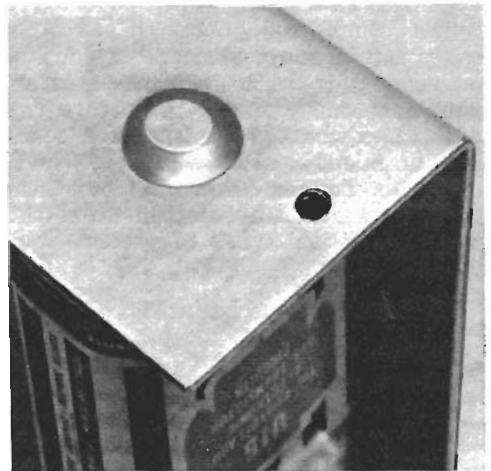
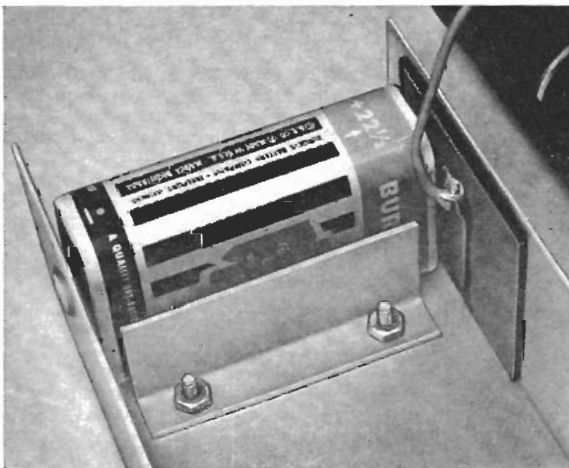


Fig. 3. For installation of 22.5-volt battery, one side of chassis box must be dimpled to accept negative contact (above). Positive pole connection consists of brass shim (left), insulated from box with fiber paper. Small L-bracket holds battery in upright position. Note the wire connected to shim.



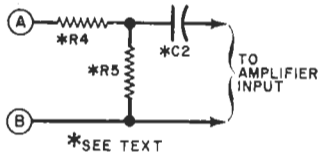


Fig. 4. Optional add-on allows Bug-Shoo to be used with amplifier for larger area coverage. Points A and B connect to respective points in main schematic diagram.

esting to note that *all* mosquitoes seem to be repelled by a high frequency, above 10,000 Hz. If you set R_3 so that the oscillator produces the highest pitched squeal you can hear, and then turn it just slightly into the ultrasonic range, the sound will be unnoticeable to you but will be detected by mosquitoes. But your dog might hate you!

The Bug-Shoo's observed effective range is 3' or more. Hence, it is not recommended for beach use where most of your epidermis (that's skin in case you don't know what epidermis is) is exposed as a succulent meal for a passing female mosquito. You should use the Bug-Shoo when you are fully clothed from the waist down and want to protect your upper body.

If you want greater coverage from the Bug-Shoo, you can connect it to an audio amplifier. In this case you will need an add-on circuit as shown in Fig. 4; points A and B indicate the connections to be made to the basic oscillator circuit in Fig. 1. In the add-on circuit, capacitor C_2 can have any value between 0.05 and 0.1 μF . Resistors R_4 and R_5 serve as a volume reducing pad for the input signal to the amplifier. For a 10:1 reduction in signal amplitude, try using 10 ohms for R_4 and 100 ohms for R_5 .

By using an amplifier with your Bug-Shoo, it is possible to increase greatly the area of coverage against mosquito attacks. But there is a practical limit to the coverage area—especially if there are a lot of dogs in the vicinity. —30—



For carrying convenience, you can fashion pocket clip from 22-gauge aluminum stock and bolt it to rear of chassis box. An old money clip can also be used if available.