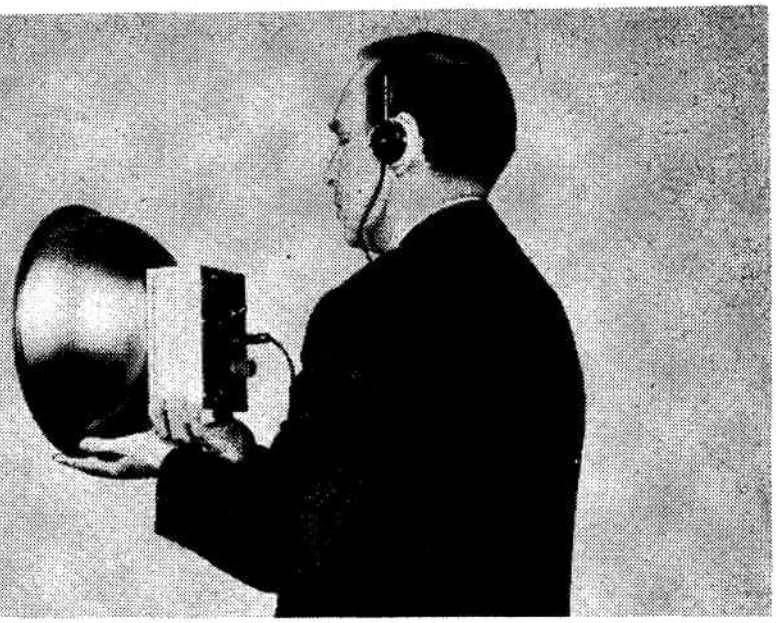
BIG EAR



By John Potter Shields

You, too, can be a Private Ear

. . . with our Electronic Eavesdropper

THOUGH it isn't likely that EI's readers want to take up international (or domestic) spying, our electronic eavesdropper is the type of equipment used in the trenchcoat-and-dagger trade. The Big Ear, as our staff has dubbed it, uses a combination of focused sound pickup and signal amplification which has the effect of transporting a listener to a distant point. Any sound in the area—whether a conversation or a bird singing—then comes to the ears of the listener as if he were right there.

The Big Ear does have some serious and entertaining uses, in addition to the questionable one of permitting you to eavesdrop on your neighbors while they're having a row in the backyard. Audubon groups and others interested in the sounds emanating from birds and other animals and insects will find the Big Ear especially useful. Its output can be fed into a tape recorder, preserving a bird's song or a cricket's chirp for future study.

The Big Ear's directional abilities permit you to locate the exact source of a distant sound, and its sensitivity, in effect, extends the hearing of a lifeguard or searcher, making audible a weak and distant voice. In the category of entertainment, the Big Ear simply is an interesting project for the experimenter and the possibilities it offers for family fun are unlimited. Many applications become obvious, once you've built the device.

The Big Ear is portable, with the entire device, including amplifier and battery, being small enough to carry around in your hands. Basically, it consists of a pickup microphone (actually a speaker) mounted in the center of a reflector. The reflector concentrates the received sound and focuses it on the mike, whose output is applied to a high-gain audio amplifier feeding a pair of headphones. Alternatively, the output may be fed to the input of a tape recorder. The reflector and mike assembly may be mounted on a camera tripod, if desired, so the unit can be swiveled to pinpoint a sound source.

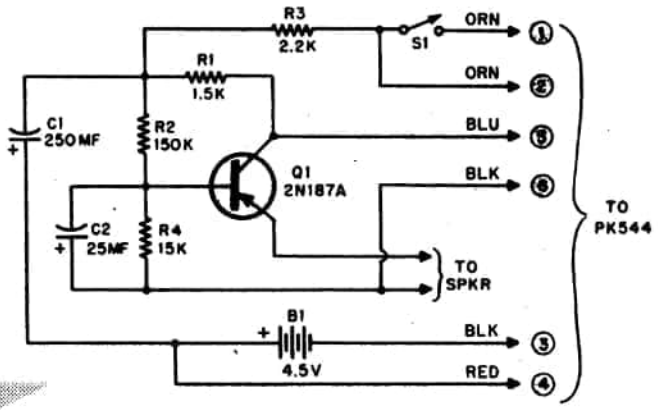
Construction. The Big Ear's amplifier is divided into a preamp and main amplifier. The preamp matches the pickup speaker's low-impedance voice coil to the main amplifier, as well as providing a modest amount of amplification. The preamp is built on a 1½x2-inch piece of perforated phenolic board. A 2N107, 2N109 or any general-purpose small-signal audio PNP transistor may be substituted for the 2N187A (Q1).

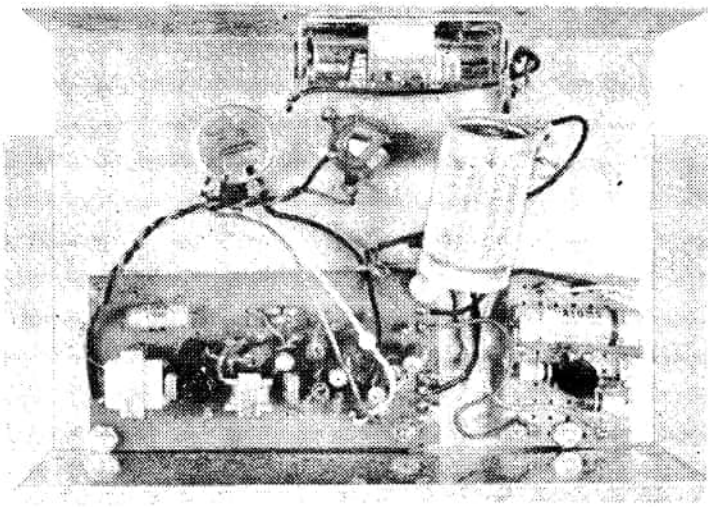
If you do make a substitution, choose a value of R2 which provides maximum signal amplification.

The main amplifier is a preassembled five-transistor unit. While it is intended

Only preamp appears in schematic, main amp is prefab. Color code and numbers show tiepoints.

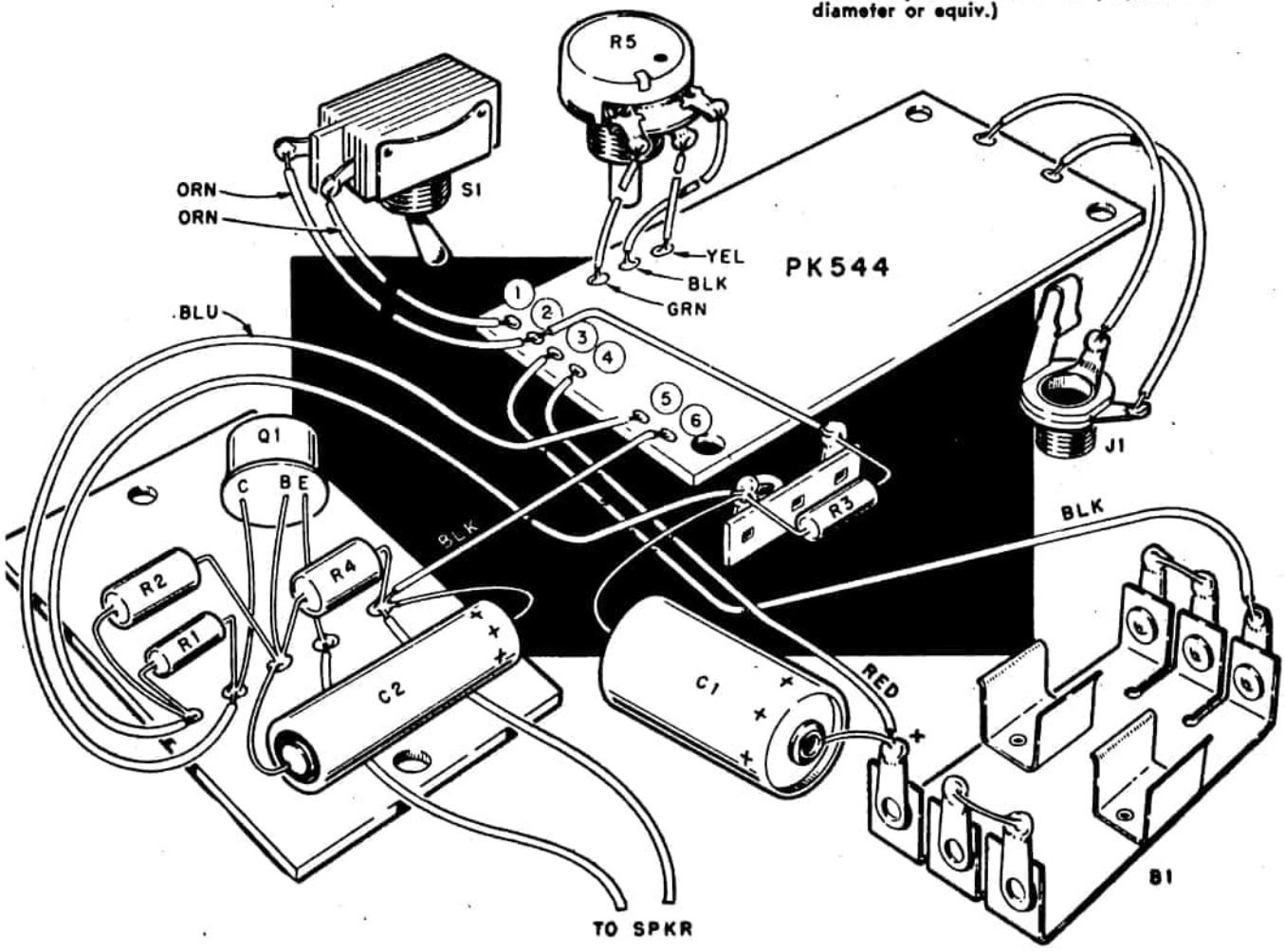
Parts in wiring guide not shown in original positions. Follow photograph for actual placement.

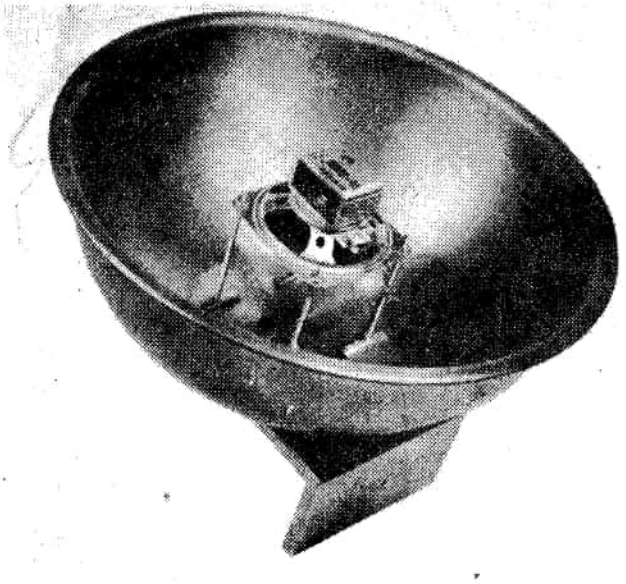




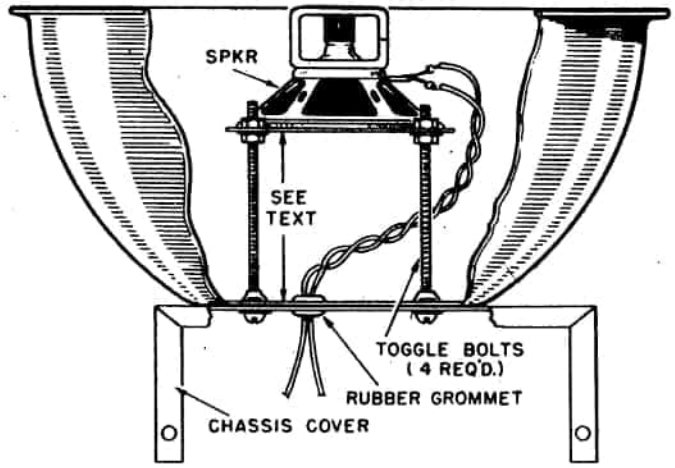
PARTS LIST

Resistors: ½-watt, 20% unless otherwise indicated
R1—1,500 ohms R3—2,200 ohms
R2—150,000 ohms R4—15,000 ohms
R5—10,000-ohm potentiometer
Capacitors: 15-volt, electrolytic
C1—250 mf C2—25 mf
Q1—2N187A transistor
B1—4.5-V battery (3 size AA cells)
J1—Phone jack
S1—SPST toggle switch
SPKR—45-ohm speaker, 3"
Misc.—Preassembled amplifier (Lafayette PK-544); 2-lug terminal strip; aluminum case 4¾"x 3"x7"; four 6/32 toggle bolts approx. 4" long; perforated phenolic board 1½"x2"; reflector (stainless steel bowl, approx. 12" diameter or equiv.)





Speaker is mounted on 4 toggle bolts. Note that paper cone faces toward the inside of the reflector.



SPEAKER MOUNTING DETAIL

Before speaker is finally tightened in place, adjust its mounting position, as described in text.

to be operated from a miniature 9-volt battery, three penlite cells (4.5 volts) provide a much lower noise level and longer battery life. A low-noise amplifier is important when you are trying to pick up faint sounds.

Both the preamp and main amplifier are mounted on ¼-inch insulated spacers so their underside wiring will not short out to the metal case.

The 45-ohm speaker is a standard unit available at most electronic parts distributors, such as Olson, Lafayette, Allied, etc. However a 3.2- or 8-ohm speaker can be substituted for the 45-ohm unit with a small loss in sensitivity.

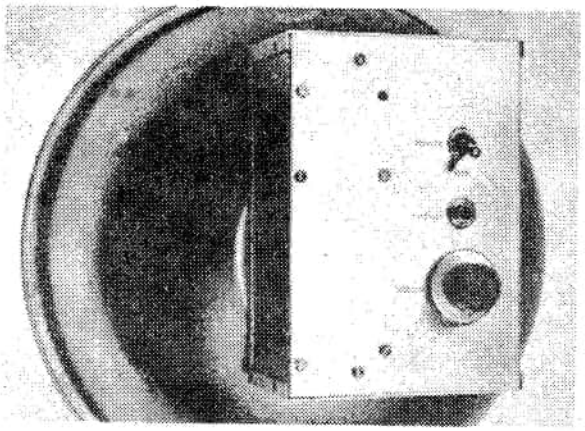
The reflector used by the author is a stainless-steel mixing bowl. Almost any type of large wooden, plastic or metal bowl is satisfactory. The larger the bowl, the greater will be the sensitivity and bass response.

The pickup speaker is mounted in the reflector with four 6/32 toggle bolts, available at hardware stores.

The bowl functions as a parabolic reflector. In our application, distant sounds are focused at a spot in the bowl determined by its curve. For optimum results the speaker-microphone should be adjusted by moving it back and forth until the point of optimum focus is found. This can be done best by aiming the reflector at a continuous sound source (such as a playing radio) and determining at what distance from the bowl's center optimum pickup is attained. If sufficiently long toggle bolts are not available to mount the speaker at the optimum focus point, you can use thin threaded rod instead.

Note that the same bolts mount both Minibox and speaker to the reflector. The best size for the reflector depends on the application of the unit. As the diameter is increased, sensitivity and low-frequency response improve. The 12-inch reflector shown here is fine for picking up the high-frequency tones of bird calls. It also performs well on the human voice whose important tones lie at the higher freqencies.

Good low-frequency response, useful for hearing low-pitch animal sounds, requires a reflector about two or three times larger in diameter.



Rear-panel operating controls: power switch, S1 (top); phone jack, J1 (middle); and control R5.