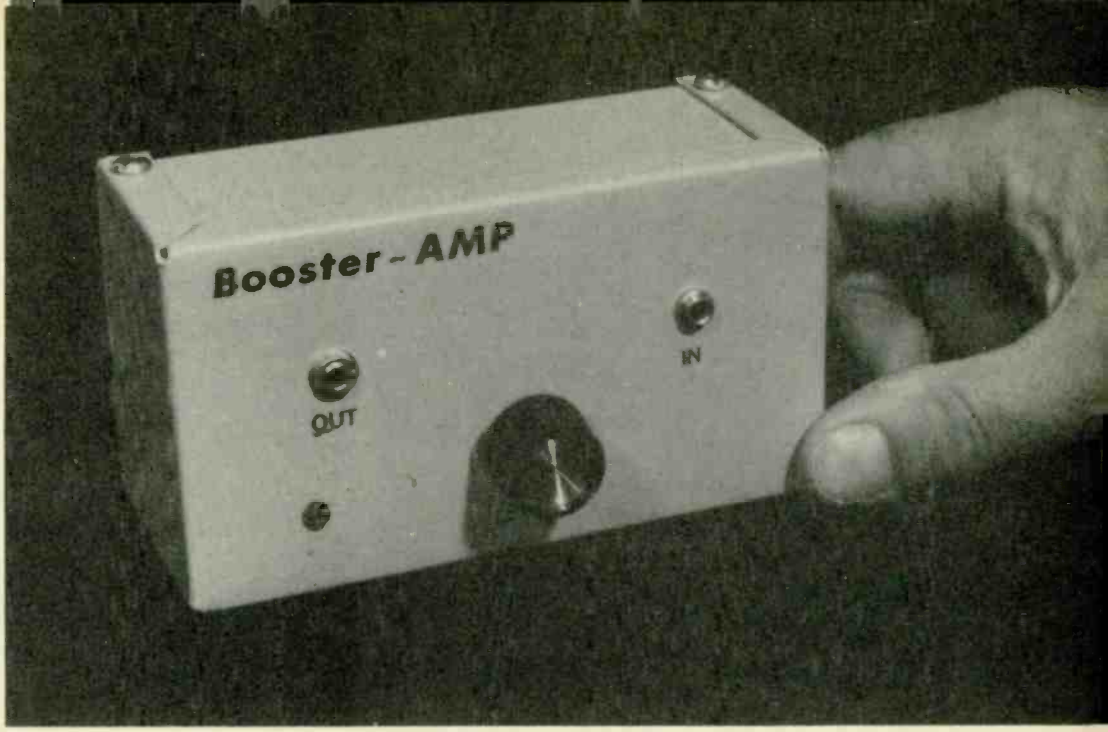

Build this 20-dB booster at almost no cost from parts in your junkbox!

AN AUDIO BOOSTER AMP IS A HANDY GADGET TO HAVE ON the work bench. It can be used to provide extra oomph for a microphone circuit when you're recording a conference; it will turn a high-level auxiliary (AUX) input into an extra microphone input; and it can even be used to convert a small utility amplifier into an audio-signal tracer.

For general and experimenter uses, a booster amplifier doesn't have to be made of gold-plated components. Even if your junkbox isn't crammed to overflowing with parts salvaged from a hundred discarded radio and TV sets, you'll probably find it has most of the stuff needed for our Audio Booster Amp.

The Audio Booster Amp has an input impedance of approximately 50,000 ohms, so it can be used with both Lo-Z (50-600 ohms) and Hi-Z (about 50,000 ohms) microphones. We have installed the booster amplifier assembly inside a small 5¼- × 3- × 2⅛-in. aluminum cabinet so the project can be used as a microphone or general purpose preamplifier. You can just as easily install the printed-circuit assembly directly inside another piece of equipment.

The Specs

The amplifier's gain is nominally 20 dB. Its frequency response is determined primarily by the value of just a few components—primarily C1 and R1. The values in the schematic diagram and Parts List provide a response of ±3.0 dB

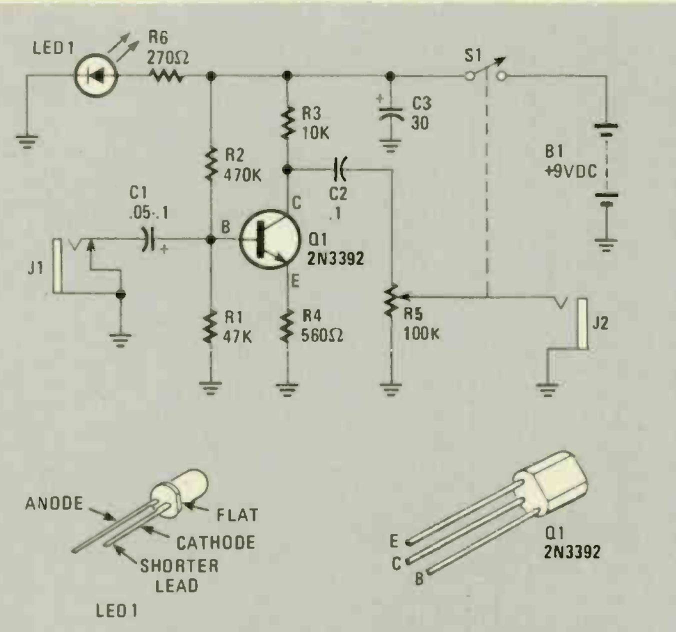

FIG. 1—THE SCHEMATIC DIAGRAM for the Audio Booster Amp could not be simpler unless some manufacturer provided a chip with input and output jacks mounted on the device. Resistor R6 limits the current through LED1. Using the larger value for C1 lowers the frequency bandpass.

PARTS LIST FOR AUDIO BOOSTER AMP

SEMICONDUCTORS

LED1—Light-emitting diode (see text)
Q1—2N3392 PNP transistor or equivalent (see text)

RESISTORS

(Use ¼-watt, 10% values unless otherwise specified.)
R1—47,000-ohm
R2—470,000-ohm (see text)
R3—10,000-ohm
R4—560-ohm
R5—100,000-ohm, audio-taper potentiometer with on/off switch S1 (Radio Shack 271-216, or equivalent)
R6—270-ohm

CAPACITORS

(Rated 10-WVDC or higher)
C1—0.05- or 0.1-µF (see text)
C2—0.1-µF
C3—30- to 50-µF, electrolytic

ADDITIONAL PARTS AND MATERIALS

B1—9-volt transistor battery, type 2U6 or equivalent
J1, J2—Miniature phone jacks (see text)
S1—SPST switch (part of R4)
Battery connector, battery mounting clip, cabinet, printed-circuit materials, wire, solder, hardware, etc.

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By Herb Friedman

from about 120 Hz to better than 20,000 Hz. Actually, the frequency response is *ruler flat* from about 170 Hz to well over 20,000 Hz; it's the low end that deviates from a flat frequency response. Refer to Fig. 1

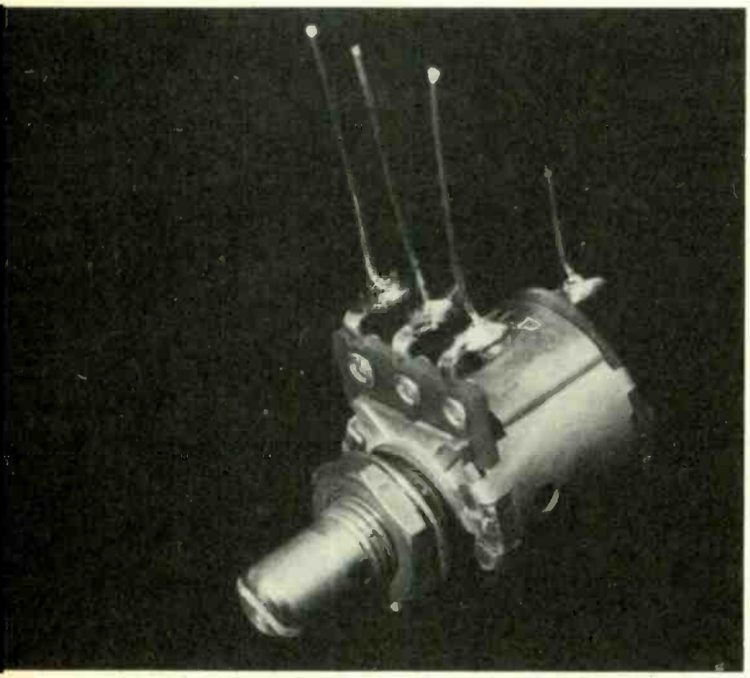
The low end's roll-off is primarily a function of capacitor C1 (since R1's resistive value is fixed). If C1's value is changed to 0.1 µF, the low end's *corner* frequency—the frequency at which the low-end roll-off starts—is reduced to about 70 Hz. If you need an even *deeper* low-end roll-off, change C1 to a 1.0-µF capacitor; if it's an electrolytic type, make certain that it's installed into the circuit with the correct polarity, with the positive terminal connected to Q1's base terminal.

A small light emitting diode (LED1) on the front panel illuminates as long as the power is on. The 3-mA pulled by LED1 is essentially the total current drain of the circuit, so battery B1 will deliver almost its *shelf life* in typical, or non-continuous, use.

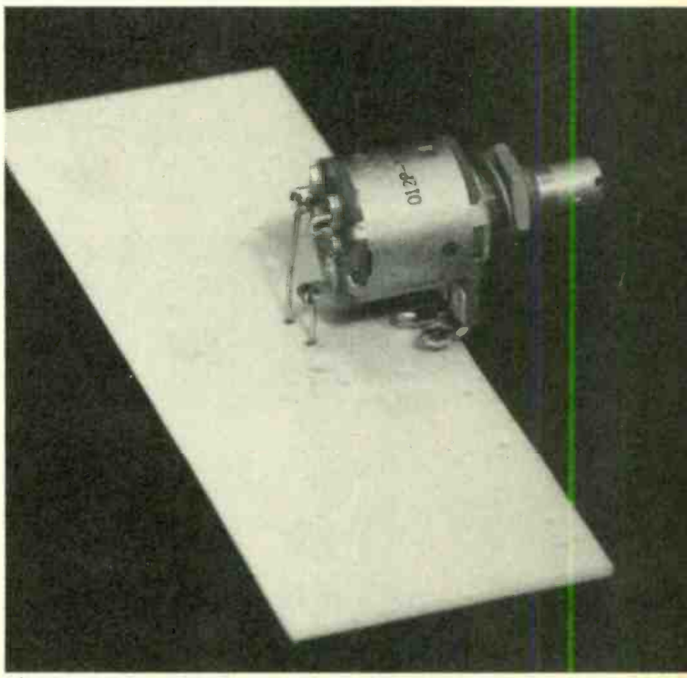
Construction

Except for the transistor's gain range, nothing is critical, so feel free to make any changes you would like in the printed-circuit foil layout, cabinet, jacks, etc. For example, the unit shown uses miniature input and output jacks, because they match the miniature plugs usually supplied with modern cassette-recorder microphones. If your equipment requires standard phone jacks, simply substitute them for the miniature jacks. Just be certain that the printed-circuit assembly's location leaves enough room for the larger phone jacks.

Transister Q1 is a 2N3392 type, which has a beta (DC gain) of 250. You can substitute any similar transistor as long as the gain is essentially that of the 2N3392. If you're not quite certain that the substitute Q1 is correct, you can *fine-tune* the circuit by adjusting R2's value. Measure the battery voltage (across C3) and then the DC voltage from Q1's collector to ground. If the voltage at Q1's collector ranges from about half to one-third the battery voltage, your parts' values are *on the mark*. If Q1's collector voltage is not within that range, trim down resistor R2's value until the collector voltage approximates half the battery voltage. Increasing R2's value will increase the collector voltage; decreasing R2's value will decrease the collector voltage.

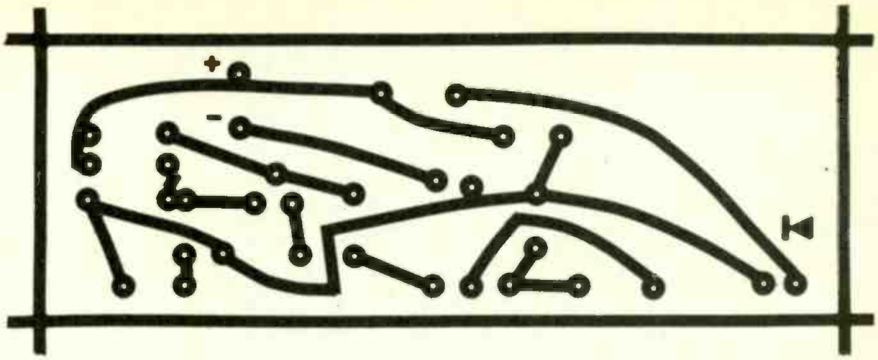


SINCE AUDIO-TAPER potentiometers for printed-circuit assembly are hard to come by, you'll have to make your own by soldering short, solid bare wires to the specified potentiometer's solder lugs. Bend the wires so that they are perpendicular to the body of the control.



PASS THE WIRES from the potentiometer through the drilled holes in the printed-circuit board, then pull the potentiometer up tight to the board and solder the wires to the copper foils. It will all go together, as if the potentiometer were originally a printed-circuit type.

FIG. 2—HERE'S the author's pattern for the printed-circuit board's foil surface. It is presented same-size so that you can copy it and produce your own board quickly. Drill holes for #22 wire.



If you substitute for the 2N3392, make certain that the printed-circuit foil pattern matches the transistor's terminal positions. The foil pattern shown in Fig. 2 is for the 2N3392, which has an ECB (*e*mitter, *c*ollector, *b*ase) lead arrangement. A substitute transistor might have an EBC layout. If so, simply change the printed-circuit foil layout accordingly.

The required audio-level control, R5, is not generally available with printed-circuit wire connections, so a standard miniature potentiometer must be adapted for the printed-circuit assembly. The potentiometer shown in the photographs is a miniature volume control with switch (Radio Shack 271-216 type) having an 100,000-ohm audio taper. Solder a 1-inch bare, solid, #20 or #22 wire to each of the three potentiometer lugs, and a like wire to the common switch lug. (The remaining switch lug will be connected later.) Bend the four wires so that they are at right angle (perpendicular) to control and slip the wires into their respective holes in the printed-circuit board. Push the control as close as possible to the board, carefully position the control, and solder the four wires to the printed-circuit foils. Then, using an ohmmeter or other continuity-tester, determine which of the two remaining switch terminals closes a circuit when the control's shaft is advanced. Connect a wire from that terminal to the appropriate printed-circuit foil. (Looking at the back of the switch, directly at the switch contacts with the common terminal at the bottom, the left-hand terminal is the one that's on when the shaft is rotated from the off position.

Install the remaining components—except LED1—after level-control R5 is fully secured to the printed-circuit board. LED1 is installed after the printed-circuit assembly is mounted in the cabinet. If LED1 is installed earlier, it will probably be damaged when you try to push it through its panel hole. To keep the battery drain as low as possible, LED1 works at very low current and it isn't all that bright. To insure that LED1 can be seen in a brightly lit room, use an unit with a Fresnel lens that focuses the light so tat it appears to be very bright when viewed straight in. If you're pinching pennies on this project, substitute any light-emitting diode you have in stock.

Here's how to handle LED1. First, install the printed-

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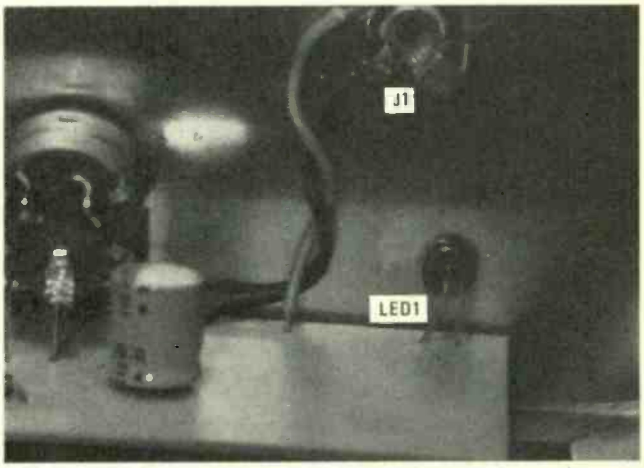
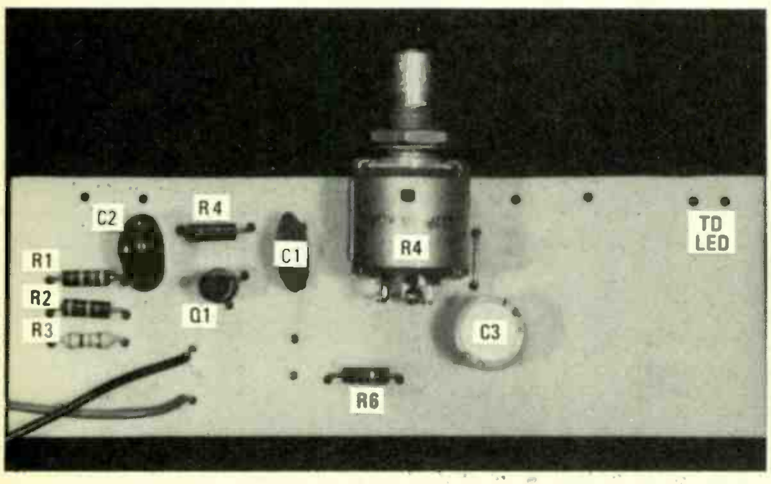
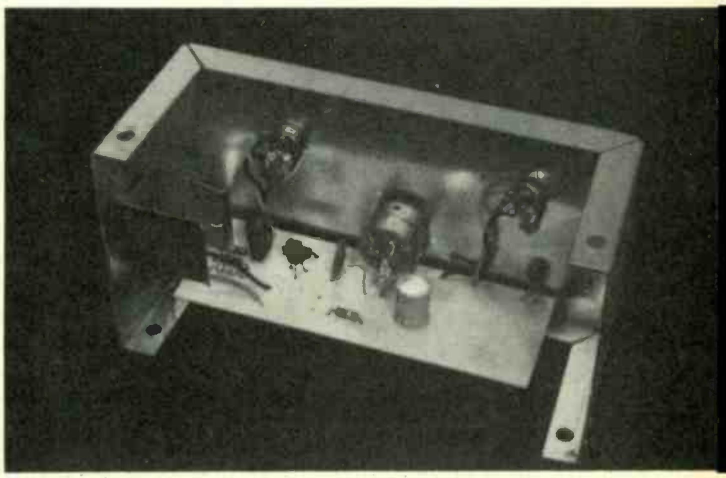


THIS IS HOW LED1 is mounted. Bend the two leads perpendicular to the body. Slip the leads into the board, push the LED into the hole in the panel—now solder them.



THIS IS HOW the printed-circuit assembly appears when it's ready for installation in the cabinet. The only things missing are the jacks and the power indicator, LED1.



THE PRINTED-CIRCUIT ASSEMBLY is held to the top panel by the potentiometer's mounting nut. The battery is secured by the clip on the left side of the cabinet.

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circuit assembly in the cabinet, but not the jacks. Next, determine which of the two LED leads is the anode (see Fig. 1). That wire must fit into the LED hole closest to the side of the printed-circuit board. Decide which LED lead is which and then grasp the leads directly behind the body of the LED with the tips of long nose pliers. Fold the leads at right angle to the LED. Slip the LED into the printed-circuit board and push it down, so that the LED is about ½-inch above the board, and mark the LED's location on the cabinet. Remove the printed-circuit assembly, drill the appropriate size hole in the panel (usually 3/16-in.), then reinstall the printed-circuit assembly; position the LED so it protrudes through the hole in the front panel, and then solder the LED leads to their respective foils solder pads. Now check your wiring.

Finishing Up

The battery is held in place by a battery mounting-clip. Note that in the unit shown we have positioned the clip so that the battery normally rests on the printed-circuit board. If you plan to give the project some rough handling, simply place a strip of masking tape around the battery and sides of the clip.

No checkout is needed. If you haven't made a wiring error, or used a defective component, the project will work straight-off. About the only difficulty you might have is with LED1 because it's not unusual to get the wires reversed. If LED1 doesn't light, remove the solder from each lead with solder wick and reverse the leads. If the LED still doesn't light, it's probably defective. The failure rate on 10-for-a-$1 LED's is very high. ■