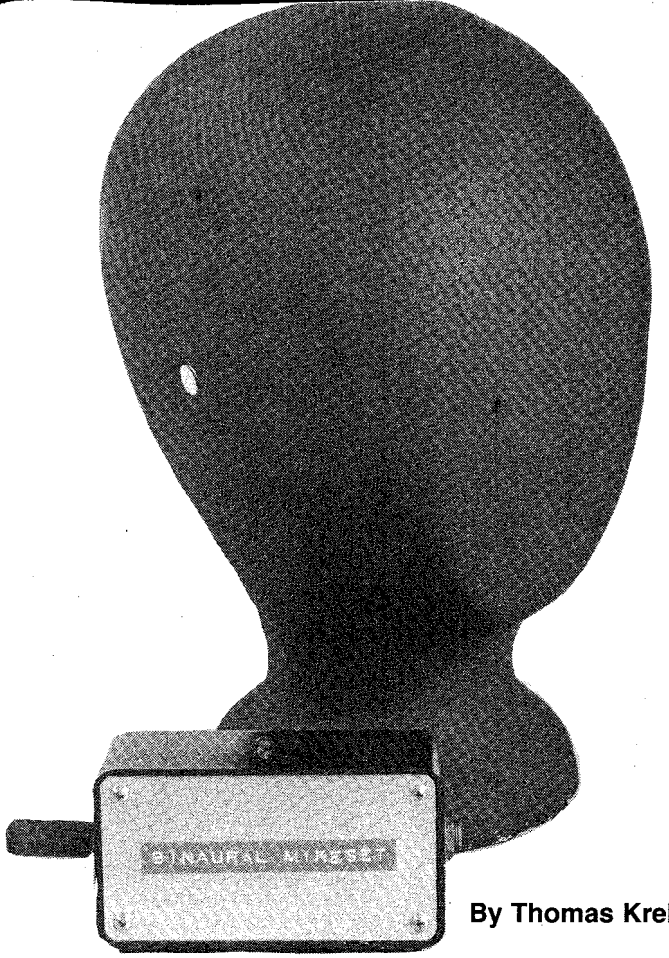


Build a BINAURAL MIKESET

For true, lifelike reproduction, the recording must be binaural rather than stereo. Here's how to make your own binaural mikeset.

By Thomas Krehbiel

NO MATTER HOW MUCH WE EQUALIZE, EXPAND, TIME align, or otherwise tweak our stereo systems, the instant we start the music playing our ears tell us that we are hearing reproduced rather than live sounds. Stereophonic reproduction seldom delivers the illusion of reality that it promises. Binaural sound, stereo's often-overlooked first cousin, can come much closer to fooling our hearing; so close in fact, that more often than not, the sound is truly lifelike.

Binaural recordings are made with two microphones that are positioned to simulate a pair of human ears. That is a somewhat different than a stereo recording, which can be made from two mikes in separate rooms. The signals from the binaural mikes are recorded on a standard two-channel (stereo) tape recorder or deck. When the recording is played back through headphones the listener is effectively transported through space and time to where and when the original sound occurred. That happens because the sounds that arrived at the mike's electronic ears are fed directly into the listener's auditory system.

It's an effect that must be experienced to be fully appreciated and understood, but there are very few binaural recordings available commercially. The most practical way to become familiar with the capabilities of binaural reproduction is to make some binaural recordings yourself.

Binaural Microphones

Anyone who owns a stereo tape recorder and a pair of stereo headphones has two out of the three parts that make up a complete binaural recording and reproducing outfit. The third requirement is the binaural microphone set which serves as a surrogate listener.

There are two commercially-produced binaural microphone configurations. In the more common, the microphones are mounted in place of the ears in a dummy head. In the other, the mikeset takes the form of a pair of headphones which the user places on his or her own head.

A headphone-style mikeset is handy for recording on-the-go, or for obscuring the fact that a recording is being made. (These days, most people take little notice of someone wearing headphones.) The primary problem with having the microphones built into a headset is that their placement changes whenever the wearer moves his or her head. If the wearer turns left the sound will be favored in the right microphone, and vice-versa.

Dummy-head mikesets are generally used in formal recording circumstances because they avoid the unusual effects that may occur when a binaural mikeset changes position during a recording.

Since both kinds of mikesets have their adherents, we'll show how to build both types of binaural mikesets using electret condenser-microphone capsules; the same kind of microphones usually built into portable cassette recorders. Although relatively inexpensive, the capsules are easy to obtain, have good frequency-response characteristics, and require only a simple power supply.

Construction

The first step is to build the power supply. For this you'll need a box large enough to hold a 9-volt battery, a terminal strip, two resistors, and input and output jacks. If you don't have anything suitable lying around the shop, use a Radio Shack model 270-231 Plastic Project Box.

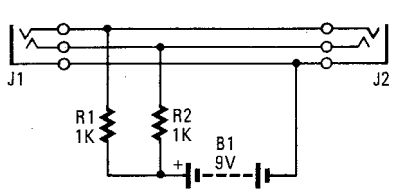


Fig. 1—A 9-volt battery and two resistors are all that are needed for the microphone power supply. Jacks J1 and J2 can be any kind of miniature or standard stereo phone jack.

PARTS LIST FOR BINAURAL MIKESET

B1—9-volt transistor-radio battery
J1, J2—Stereo phone jack (see text)
MIC1, MIC2—Electret microphone capsule, Radio Shack 270-090
P1—Stereo phone plug (see text)
R1, R2—1000-ohm, ¼-watt, resistor
Misc.—Styrofoam wig stand or miniature stereo headset (or both), battery holder, plastic project box, two-lug terminal strip, miniature shielded cable, hookup wire

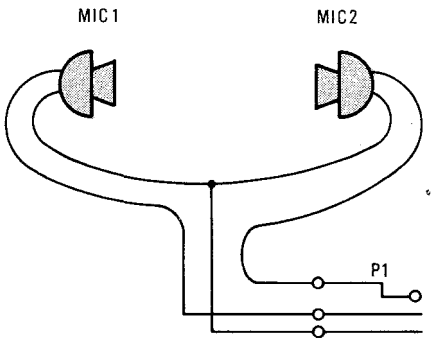
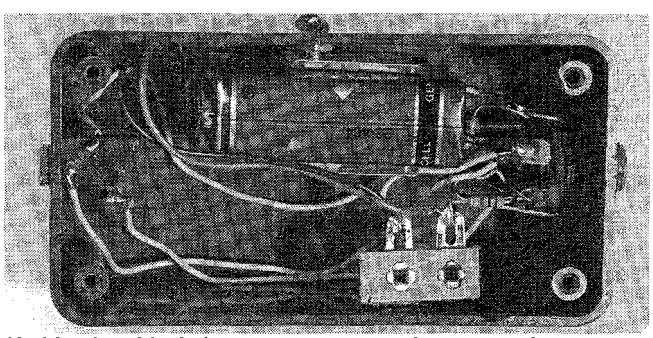


Fig. 2—Whether the microphones are installed in a headset or a dummy head, the wiring is the same. Make certain the common connection is wired to P1's *sleeve*.

Start by drilling appropriate holes in each end and then mount the input and output jacks. I used three-conductor phone jacks, one miniature and the other standard-sized, because that's what I had in stock. It really makes no difference whether standard or miniature jacks are used.

Mount a battery holder and a 2-lug terminal strip along the sides of the box. Connect the red wire from a battery clip to one of the terminal lugs; then connect one end of resistors R1 and R2 to that same lug. The other ends of the resistors go to the signal-carrying contacts of one of the jacks. It doesn't matter which one; use whichever one is easier to reach.

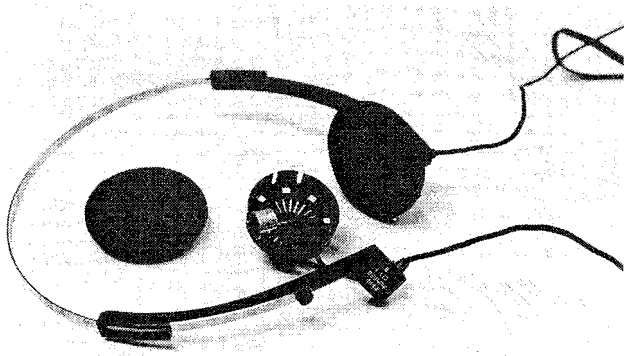
The black battery wire goes to the remaining terminal strip lug, and a length of wire runs from there to either J1 or J2's grounding lug. Next, run three wires from each of the lugs of one jack to the corresponding lugs of the other and solder all connections. Clip a 9-volt battery in place and close up the box.



Nothing is critical about the power supply; use any layout and any kind of suitable cabinet. The two-lug terminal strip serves only as a power source for the resistors.

There is no need for an on-off switch since the battery is disconnected when nothing is plugged into either jack.

It is also not necessary to identify one jack as *input* and the other as *output* because the power module is symmetrical.



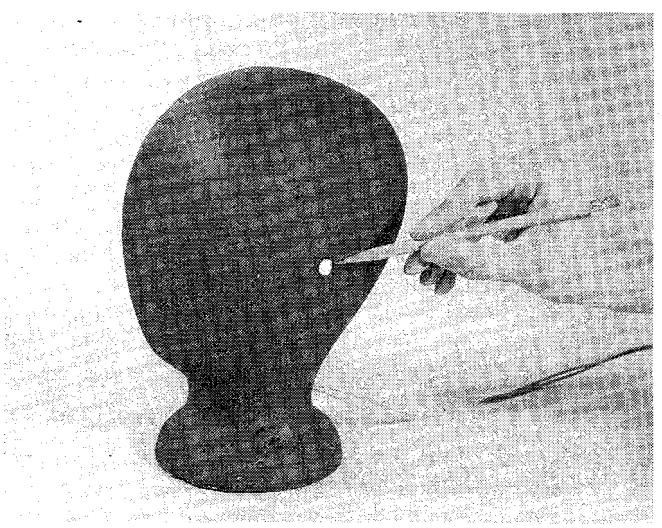
A microphone capsule fits neatly into the space that's left when the speaker element is removed from the earpiece of a miniature (lightweight) stereo headset.

Either jack may be used for the mikeset: the remaining jack connects to the recorder.

Installing the Capsules

(Note, the parts values shown are those required by the Radio Shack capsule given in the parts list. Other microphone capsules may require additional parts, different resistor values, or different battery polarity. If you substitute for the recommended capsule, be sure to follow its manufacturer's recommendations.)

Now you're ready to mount and wire the microphone capsules. To make the dummy-head version, you'll need a plastic-foam wig head to hold the mikes. A new one is fine, but you can find serviceable used heads at many thrift and second-hand stores at very low prices. A coat of flat-black spray paint gives a fresh appearance and covers minor scrapes.



The white dot pointed to by the pencil is actually one of the small electret microphones which is mounted on the sides of the dummy head. A corresponding microphone is mounted on the opposite side of the foam form.

To prepare the wig head to receive the mikes, start by using a ¼-in. twist-drill bit to ream holes at ear level on both sides of the head. Do this by hand. If you make the holes just a bit smaller than the microphone capsules the capsules will be held in place securely without adhesives (by friction).

Solder a suitable length of flexible shielded cable to each of the capsules. Be sure to observe polarity.

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BINAURAL MIKESET

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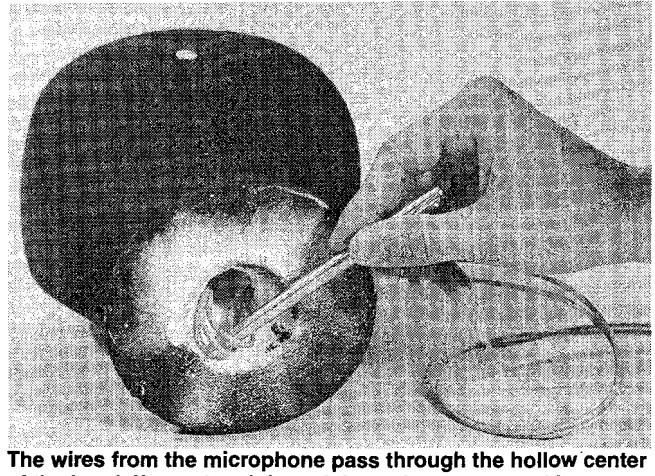
Insert each cable into an ear hole and fish them both out the bottom. (Most wig heads have a tapering cavity inside. If yours doesn't, you'll have to provide the exit.) Make a hole at the back just above the base to feed the cables through so the set will sit nicely on a flat surface.

Press the capsules firmly into the ear holes until they are flush with the sides of the head. Strip the free ends of the wires, twist the shields together, and connect the wires to a plug that matches the jack arrangement at one end of the power supply box. That's all there is; the dummy-head mikeset is ready for use.



The wires from the microphone pass through the hollow center of the head. If your head doesn't have the space, you'll have to carve it out yourself with a long, thin knife.

Headphone Mikeset

A handy way to make a headphone-type binaural mikeset is to rebuild a pair of miniature headphones. If you keep your eyes open you should be able to pick up a suitable pair for under $5.00. All you have to do is remove the speaker elements and substitute mike capsules. Even a defective pair of phones will serve this purpose as long as the wiring harness and plug are still intact.

First, remove the foam covers from the earpieces. Gently stretch the foam and lift it away from the tiny teeth that hold it in place. Pry out the speaker elements and snip the wires attached to them.

Using a small, sharp knife, cut an opening in the plastic body of each earpiece to receive a mike capsule. The openings should be located so that the mikes will face forward when the set is placed on the head. Solder the original headphone wires to the microphone capsules, then secure the capsules in the earpiece openings with a dab of glue and replace the foam covers.

If you make a headphone mikeset, be sure to select a miniature three-conductor jack for at least one end of the power supply to match the plug supplied on the headset.

To use the mikeset, simply plug it into one end of the power supply box and feed the output from the other end into the mike inputs of your stereo tape recorder. For your first binaural experiment, I recommend taping household conversation and noise with the mikeset located at a usual seating location. After getting a number of minutes of sound on tape, listen to what you recorded through a pair of stereo headphones while seated right where the mike was placed.

You will also find that binaural sound is unsurpassed for making intelligible recordings of speech and conversation under difficult acoustic conditions. Try it at a conference, a lecture, or a party.

When you record live music, using a binaural mike eliminates any need for multiple mikes, mixers, and the like. Place the mikeset at a good location for live listening and tape the two channels. If you can, position the mikeset in "the best seat in the house." That would be wonderful, but you can make a realistic binaural recording even at lesser locations.

Recording music and speech is only scratching the surface. Other interesting binaural applications might be recording realistic sound effects, creating lifelike dramatic performances on tape, or (with the headphone-style mike and a battery-operated portable recorder) documenting a stroll down a city street or through the countryside. ■