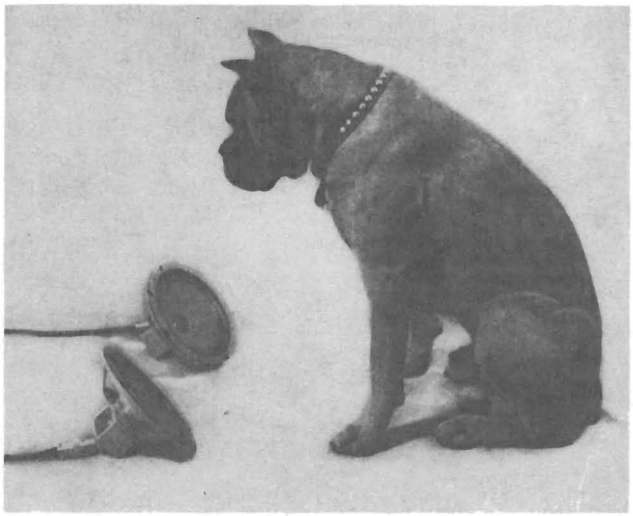
Two months ago we "Noted With Interest" that, although there was plenty of tape and broadcast experimentation with binaural sound, no one had yet put any stereophonic sound on disks. Now someone has and, much to the delight of all and sundry, it happens to be the maestro of the train-whistle and 15-kilocycle cricket, the producer of Sounds of Our Times.

Binaural Disks

By EMORY COOK

THE advent of the binaural tape machine as a working tool in sound studios has made inevitable the development of binaural LP disks. At Stamford, we have begun the production of masters for the Cook Laboratories BN (for binaural) Series. These are to be LP disks with twin sound tracks. They will cost no more, per record, than conventional disks. To play them, a standard playback system will need only moderate alteration.

Whatever rumors, pro or con, you have heard about binaural sound as compared with the conventional, single-source variety, depend on it, the two are not comparable on any reasonable basis. Coming from a binaural system, the simplest things in music take on a new and vivid life, making even the best wide range, low distortion monaural reproducer sound dry and harsh. The comparison — if one must be made — is most astounding in the case of small, low-cost systems, where single-channel reproduction is usually the least satisfactory by the criteria of dynamics and range. Binauralized (if the term may be used), such systems need work less hard; listening-ease is immediately and immensely increased.



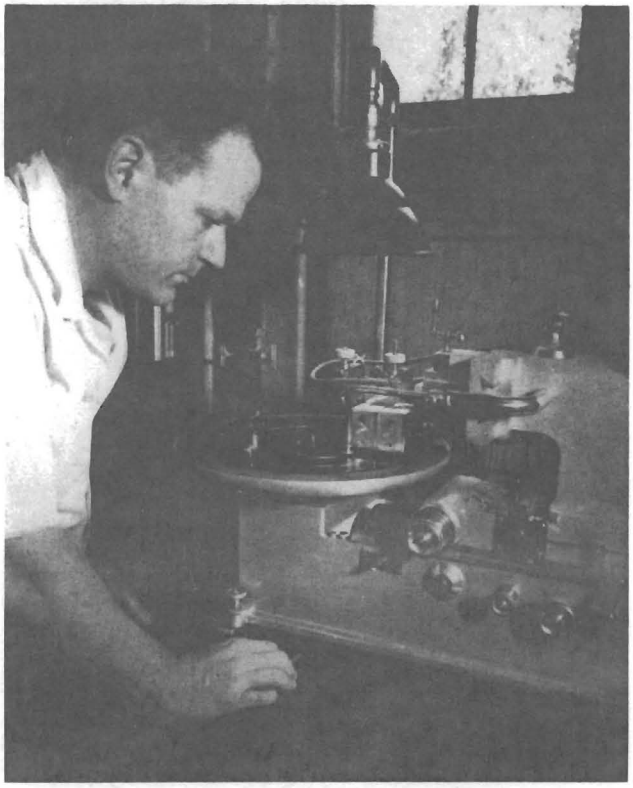
The basic theory, of course, is simple and has been described before. Two microphones, fairly well separated, pick up the sound to be recorded. What they "hear" is fed through completely separate channels and recorded separately. When it is played back, it comes out of loudspeakers spaced apart just as the microphones were in the first place. The result is the aural equivalent of the visual three-dimensional effect produced by a stereoscope — a lively illusion of space and perspective. A recorded orchestra no longer sounds either Lilliputian or as if it were being heard through a port hole. It actually seems to extend across the end of the listening room. The effect is dramatic, especially in view of the fairly simple components which produce it.

The Binaural Record

The binaural phonograph disk is simply a single 12-in. LP record with two bands of grooves recorded on it, one starting from the outside, the other from the midpoint — as sketched in Fig. 1. Each band corresponds to an "ear", *i.e.*, each band is the product of one of the two microphones used in the studio.

The Pickup

The two bands are played back separately but simultaneously through a pair of cartridges spaced 1 11/16-ins. apart on a radius. We have used slightly modified Pickerings for the purpose. Location of the pivot point of the arm is very important: bad pivot-placement could cause one cartridge to play "ahead" of the other, yielding remarkably unmusical results. The cartridges may be mounted on sep-



Emory Cook cuts a binaural disk on a Special Scully lathe.

arate independent arms, or on a single arm. In the latter case, they must be individually suspended from the arm, allowing each free vertical motion, so that they may follow individually the warp of the record. No record is without *some* warp, and the degree of warp is never the same at the two points of contact. Such an arm is being produced commercially, by Livingston Electronics, and there is no need for home-made experiments along that line if binaural is to be set up.

The Amplifier(s)

Many an audio enthusiast has a second unused amplifier around the premises, which can be rescued and put back into service. Or, a "push-pull throughout" amplifier can be easily converted to serve the binaural purpose by itself alone by splitting the two sides of the push-pull channel into the two cartridge outputs, bypassing all cathodes to ground if they are "common" cathodes, and treating the output stage as if it were two single-ended outputs instead of a push-pull. The existing output transformer may be used for one side, a similar one added for the other side. However, if such a "conversion" amplifier has an interstage transformer along the line somewhere, the scheme will *not* work.

Power Capacity

In passing, it may be well to mention a strange characteristic of binaural systems. They sound louder for the same power level in the room than regular single-channel equipment. Two 10-watt binaural channels seem to sound much louder than a 50-watt single channel. Correspondingly, hiss noise level is also reduced.

The Speakers

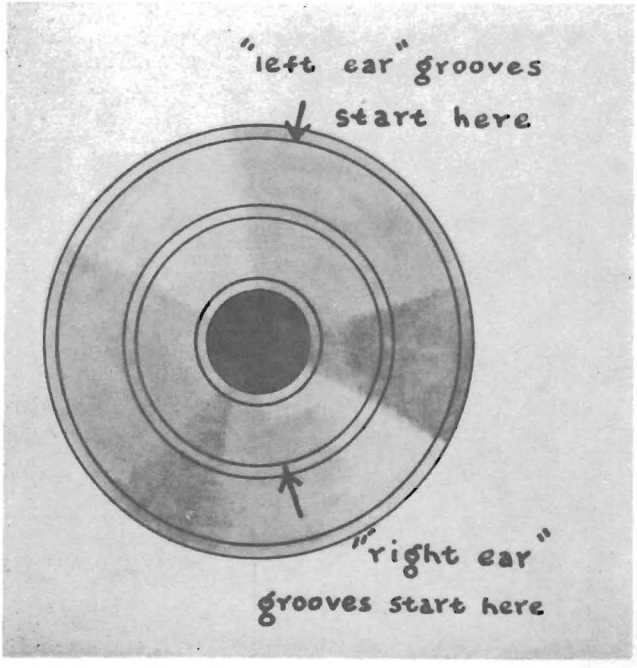
The next step is that of reproduction in the living room. Since (fortunately) the "average" living room (14 by 16 ft.) is an abstraction rarely met in practice, it is impossible to reduce speaker placement to an exactitude, and we must all resort to the pleasant procedure of experiment. The two speakers should be as alike as possible, and if the distaff side objects to the second speaker in the room (in addition to the TV set and six record cabinets), then it may be disguised behind some piece of furniture. Generally speaking, if speakers are against a wall, 10 feet or more apart, and perhaps equidistant at least 6 to 10 ft. from the listening area, we have a basis for binaural effect.

Room Acoustics

An intelligent decision as to where to place the speakers must be influenced, if not entirely determined, by room acoustics. Since few of us are in the bachelor's position of feeling free to adjust the room's furnishings to suit the sound, then the tail must instead wag the dog, and the speaker locations sandwiched in by ingenuity, tact, skill, and luck.

Reference to Fig. 2 will give a basic idea of what is required if the speakers and the room acoustics are to get along together harmoniously. By "hard" acoustic material is meant plaster, tile, brick, varnished or painted wood panelling, etc. "Soft" means rugs, heavy curtains, Celotex or other soft wallboard, monks' cloth, and the like. In principle it is always best if two opposing surfaces (walls, or floor — and — ceiling) are not both hard.

Fig. 1. Sketch of a stereophonic disk: twin groove bands both track inward toward center, can be played singly.



A large percentage of the wall opposite the speakers must be soft for the best effect, and preferably also a substantial portion of the side wall area, otherwise reflection from the hard area may be so pronounced that the three-dimensional effect is reduced. Ordinarily, since most floors carry rugs over much of their area, the hard ceiling is not a problem.

Compatibility

There are several ways in which to produce binaural records. The one chosen here is especially planned to yield complete compatibility with existing records and record players. The BN series is recorded outside-in at 33 ⅓ rpm. It may be played back successfully on an ordinary phonograph with a single cartridge, the same as any LP, one band or "ear" at a time, until such time as a binaural phonograph conversion is made. After conversion, the binaural arm still can be made to play ordinary records simply by raising one of the two cartridges off the record.

The Invisible Clock

The whole idea of three-dimensional sound was originally predicated primarily on the use of earphones for listening. This practice being both uncomfortable and anti-social, it was also short-lived, but it lasted long enough to cause a confusion of recording technique. Obviously, while earphones were considered as the listening medium, everything was beautifully simple. A recording would be made using two microphones spaced six inches apart, located at a point in the studio where the balance of sound was satisfactory to a pair of human ears. (Six inches is the approximate effective spacing of human ears.) Then we could record each microphone separately, play them back synchronously, each into one of the earphones, and the system was complete. No trouble.

Using loudspeakers instead of earphones changes binaural sound at once from a tinkerer's hobby into a potentially popular medium. But it also complicates the technical approach: we must abandon any idea of microphone spacing at six inches, and build a new technique which correlates the spacing and positioning of the recording microphones with those of the reproducing loudspeakers. This means that the makers of a recording must keep their spacing of microphones down as nearly as possible to measurements which can be duplicated in a living room. The eventual fine adjustments, however, must be made by the owner of the living room and the loudspeakers. To help him place the latter just right, we have made a test disk — a binaural recording of a grandfather clock. When the listener has his speakers placed and spaced exactly right against one wall of his room, a phantom clock will seem to be ticking precisely halfway between them. All our BN records will be made to reproduce properly through speakers placed according to the test record.

It seer to us by no means impossible that the advent of binaural disk recording may have important, even revolutionary effects. Binaural sound is so good that it is bound to bring other record companies into its manufacture through pressure of demand. Two, besides ourselves, are in action already. Polymusic is preparing a binaural disk of a piano recital by Jesus San Roma; Atlantic is making one of a jazz band. Our own output thus far, aside from the clock-tick, consists of a double pipe-organ offering. There is no way, of course, in which a taped monaural recording can be doctored to come out binaurally on disks. Each binaural recording requires a new performance. Not all such need be expensive, however. Recorded binaurally, we have found, many a commonplace abstract sound can be an attention getter. And recorded drama benefits notably from binaural recording.

Binaurally as monaurally, disks have certain advantages over tape for home listeners, in convenience, in economy, in plain availability. The future of binaural is up to the record companies. They have had opportunity to discover, through microgroove, that if they but furnished the records, the customers would contrive or acquire equipment to play them on. Once the equipment exists in quantity, the FM-AM broadcasters and tape-machine makers will also begin to benefit.

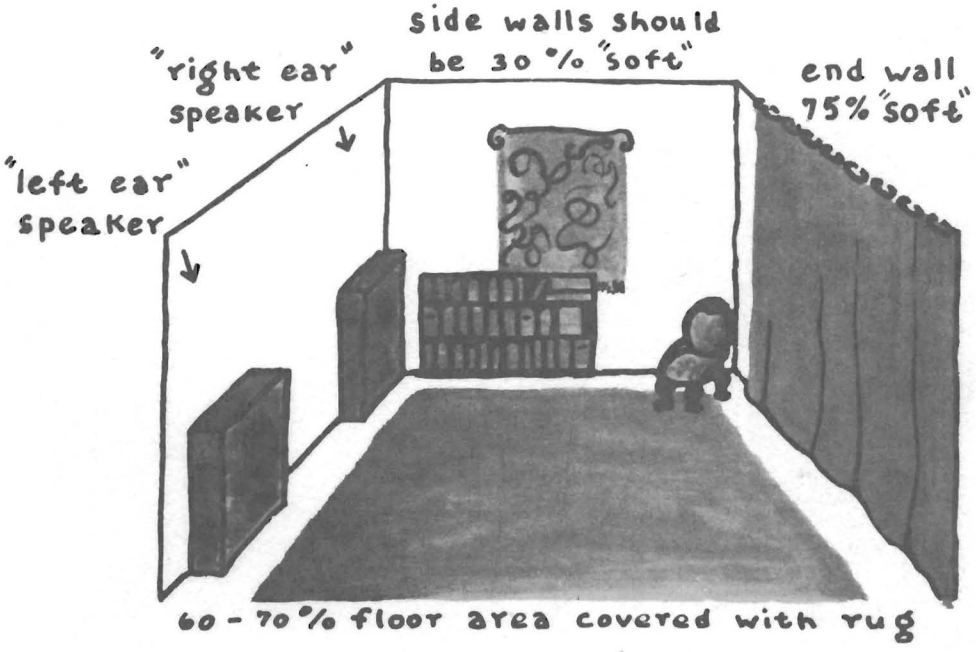


Fig. 2. Most rooms will adapt readily to binaural reproduction. Note that both speakers face directly forward; putting them in corners would interfere with binaural perspective.