TECHNIQUES FOR AUDIO TAPE MASTERING

by John D. Harmer, President and Chief Engineer, Capital City Sound Recording Co., Columbus, Ohio—Some pointers to help the sound recording engineer produce a better product.

In the recording of original tape masters for phonograph records and tape duplicating, there are some techniques that are better than others for producing a quality product. The methods to be described have been developed over a number of years in the professional recording business.

Mastering

Better high-frequency response, ease of editing, and wider dynamic range are obtained when the master recording is made full track at a tape speed of 15 ips. Master tapes should be made only with first-line professional mastering tape. This may sound extravagant at first, since almost any tape will accept a signal, but experience shows the advisability of using such tape. Absolute perfection from both a technical and artistic point of view is difficult to attain. Conscientious artists and artist and repertory (A & R) men, when listening to playback monitor speakers—usually under high-level conditions—can often sense even the most minute tape-motion flaws and other disturbances possibly not even connected with the recording equipment. Thus the engineer must do everything possible to insure highest recorded quality, and the use of unspliced professional-grade mastering tape is essential to maintaining that quality.

To provide a "protection tape," a second tape recorder may be bridged across the program buss. This machine runs at 7.5 ips and provides a full-track "copy." This second tape is recorded at the same time as the master and can be thought of, therefore, not as a copy at all, but rather as a slow-speed, low-noise original. This method has proved to be a valuable time saver in case the client wants such a "copy" of the master material for audition purposes.

Splicing

When a splice must be made, perhaps the most important single factor is maintaining the two tape ends parallel. The tape splicer should be one having superb tape holding and aligning qualities, even if it is not as fast to use as others or requires some handling of the tape for trimming. However, the best rule to apply when making original or second- or third-generation recordings is to avoid splices if at all possible. Few things short of a tape break will ruin a good recording more quickly. Even carefully trimmed, well-made splices can cause a momentary "bump" or "flutter" when going over stabilizer flywheel drums or across heads and thereby perhaps ruin an otherwise "perfect" performance.

Equipment Considerations

Each recording session may (and often does) require a different equipment arrangement; however,

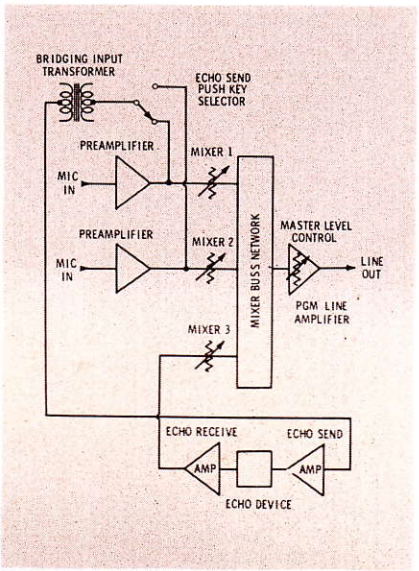

Fig. 1. A versatile arrangement for adding echo effects to the audio program.

the following general approach can usually be applied:

(A) Musical instruments and vocal artists should be separated whenever possible. This may require the use of portable sound-absorbing folding screens to increase the apparent distance of separation.

(B) A different microphone should be used for each group or individual so separated.

The purpose behind this separation is to gain more flexible and individual mixer control over the various portions of the entire recording group. This allows, for example, the A & R man to call for (and the engineer to supply) increased volume level for the vocalist without a corresponding increase in the level for the orchestra.

Microphone Equalization

The use of individual microphone equalizer controls is well established in many of the major recording companies because it is an extremely versatile tool. This may cause some raised eyebrows among readers accustomed to working with broadcast transmission systems having essentially flat frequency response. Broadcast systems are designed, by and large, to transmit, unaltered, signals they receive from microphones, lines, and reproducers. On the other hand, the purpose of a recording studio is to record a performance and to alter, if necessary, the characteristics of that performance to produce a more pleasing recorded sound. In addition to adjusting the relative levels, this might mean increasing the high-frequency response of one microphone to obtain a crystal-sharp piano "ring," reducing the low-frequency response of the voice track to retain clean, understandable dialogue, or introducing vari-

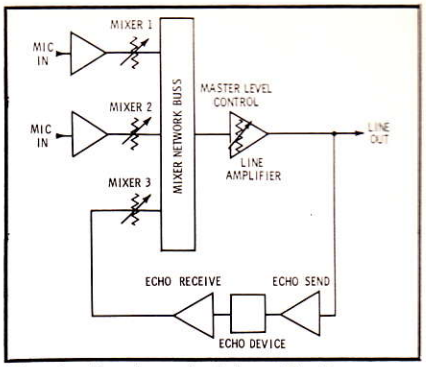

Fig. 2. Usual method has disadvantages.

ous degrees of echo into some of the microphone channels. All this results in a coloration of the original sound to produce a product in accordance with the wishes and desires of the producers, the A & R men, and the performers themselves.

Echo Devices

Most recordings made today have some amount of artificial reverberation added. Artists and A & R men demand echo effects, and the engineer must supply them.

One method of producing echo effects that has been found to work well is the following: The recording console equipment is modified so that echo send signals are derived from the channel selector keys through a transformer bridging network (Fig. 1). The output of the echo receive amplifier is brought to a mixer control on the console. This arrangement allows the recording engineer to add any amount of echo at will. In general, reverberation devices are so connected that the input of the device is isolated from its own output to prevent feedback.

A one-shot "slap echo" can be obtained by the arrangement in Fig. 1 if the echo device is a tape machine (usually running at the 7½ ips speed) set up for tape monitoring. This effect is differentiated from the normal tape reverberation in that it is a one-time echo and does not decay as the echo produced by a re-entrant system does.

The conventional method of introducing reverberation (Fig. 2) has some inherent drawbacks. In this arrangement, the program amplifier and the echo section form a closed loop. Instability due to feedback appears before a substantial echo level can be obtained. A further disadvantage is that reverberation is applied to all signals after mixing, and selective echoing of indi-

vidual sources is thus impossible.

Pickups

A somewhat unique, though by no means original, method of picking up electrically-operated musical instruments is shown in Fig. 3. Instruments in this class include electric guitars, bass guitars (often accompanied by huge amplifier-speaker systems), electric organs, electric pianos, and electric bass pianos. In the arrangement of Fig. 3, a connection is bridged across the voice coil of the instrument speaker. This type of pickup has been used frequently with good success.

Use of this method has generated some interesting byproducts, however, not the least of which is a general increase in background noise level. Most of the noise energy is power-frequency hum and buzz; frequently, there may be as many as four instrument amplifiers operating at the same time in the studio, and each contributes noise.

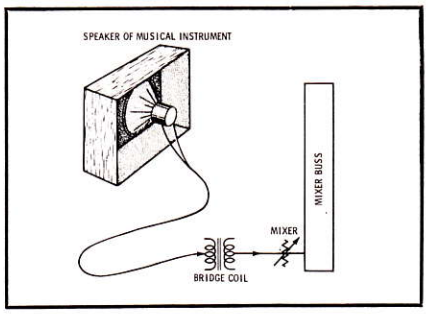

Fig. 3. A method for instrument pickup.

Unusual conditions sometimes arise. In one such instance that occurred with an electrically amplified guitar, there was an all-too-familiar ground-loop buzz, but no amount of power-cord reversing or experimentation with separate ground wires seemed to reduce the buzz. The noise persisted when the instrument was held or strapped about the musician, but it stopped when he laid the instrument down. When the engineer accidentally touched the musician while grounded, the noise was reduced. Several combinations of ground wires were then tried without totally satisfactory results. Finally, in desperation, the engineer tried having the musician stand on a large grounded sheet of metal. This reduced the noise enough to permit continuing the session.

Another form of noise is low-frequency disturbances caused by the musicians' fingers and hands on guitars or other instruments hung about the neck or otherwise in close proximity to the body. However, these are small technical difficulties that once explained and demonstrated to the A & R man can usually be cleared up with tactful instructions to the artists involved.

A further matter to consider is the relative studio sound levels from vocalists and instruments. Electrically operated and amplified instruments usually deliver better-quality sound when run below normal output, and this definitely should be encouraged by engineers and A & R men, since the direct-tap pickup allows the volume level to be restored by the mixer control. Moreover, lower instrument volume permits greater flexibility, since the sound issuing from instrument speakers in the studio is not so likely to be picked up on adjacent microphones.

The subject of piano pickup has

been discussed at length elsewhere, so it will be considered only briefly here. A satisfactory and pleasingly clean pickup from a vertical grand can be obtained by using the familiar ribbon-type microphone. With individual equalization in the piano-pickup microphone channel, the character of the pickup can be changed from bright stage-front pickup to a more mellowed background sound.

Experimentation with several pickup positions has shown that two such positions give best overall results in our studio environment. In one position, the microphone is placed 2′ to 3′ in front of the instrument at a point in line with C above high C on the keyboard. The microphone faces the sounding board, and the instrument front cover is removed. In the other position, the microphone is placed 2′ to 3′ directly above the piano at a point in line with highest C. The top lid of the piano is removed, and the microphone faces directly into the instrument.

Client Relations

Some of the toughest jobs for a recording studio occur when musical talent having no previous recording experience is encountered. These people may test the microphones by blowing into them, or they may insist on playing instruments with volume levels approaching the threshold of pain. It is a good idea to try to release the studio space to the client ½ hour in advance of the scheduled session to allow time for the client to become accustomed to the premises and facilities and to permit instrument set-up time. If the engineer is on duty during this advance period, he can make the musical-instrument pickup taps, if any, determine a general microphone placement, and give what advice may be helpful.

Conclusion

The techniques for making professional tape masters depend somewhat on the individual circumstances. It is hoped, however, that the general comments given here will be helpful to those who may be called upon to assume the technical responsibility for making such recordings. ▲