Superimposed Tape Recording

WILLIAM D. BELL*

One way to save tape at the possible expense of quality provides an interesting experiment in geometry. At least it is not too much trouble to try out—with a little ingenuity.

WHAT WOULD YOU SAY to making 10 different recordings, one on top of the other, on a ¼-inch magnetic tape with a conventional single-track head? And then playing *any* of the recordings at will? Sounds impossible, doesn't it? Yet, at least two computing-machine laboratories have independently discovered this recording trick—a method you can try for yourself on your own tape machine.

Recording multiple tracks on the same section of tape is easy, of course, if separate heads are employed and the tracks are kept separate. This was the method used in an elaborate system, built by Ampex for Les Paul and Mary Ford, which recorded eight tracks on one-inch tape. With separate record, erase, and playback controls for each track, this Ampex-built machine was ideal for the multiple recording techniques for which Les Paul is famous.

However, recording separate and distinct tracks on different parts of the tape is not the method I am describing here. Rather, one track is recorded right on top of another, as stated before.

The guided-missile people also record several separate channels of data on one track. Each measuring transducer modulates an audio tone of restricted band width. A number of transducer signals are then mixed and the composite signal radioed to a ground receiving station. The tape-recorded signal can then be played back through appropriate filters and each separate signal isolated. Thus, this telemetry method works because there is no overlap of the frequencies of the various channels. Again, this is not the method described here.

What, then, is the method that permits multiple recordings to be made on top of each other? The answer, quite simply, is to change the angular orientation of the head gap with respect to the tape for each recording. To play back, a recording is selected by choosing the same angular position for the head as was used for the original recording.

Alignment

In normal operation, the head gap is accurately aligned at right angles to the tape. Ampex claims in its literature that this azimuth angle is held to plus or minus a single minute of arc.

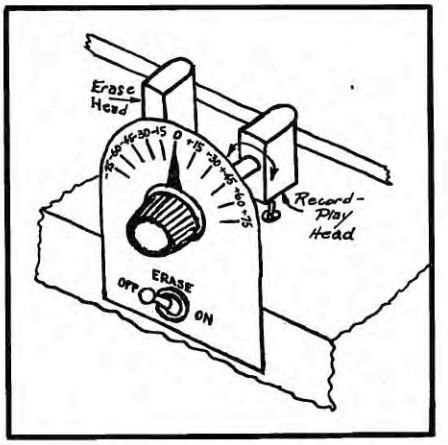

Fig. 1. Diagram of the basic arrangement of the tiltable head. It would be preferable if the head were mounted closer to the indicating scale, however.

Why is such an accurate manufacturing specification imposed? What if the head is not accurately perpendicular to the tape?

In reply, if a tape recorded on an accurate machine is played back on one with a bad azimuth angle adjustment, the signal strength will be reduced. Worse yet, there will be distortion. In fact, if the azimuth angle is deliberately increased, the output will become increasingly garbled until it finally can no longer be heard.

These are the reasons a recorded tape can sound horrible when played on a home machine. While you can indignantly return the tape to the dealer, it may be that the playback machine is the villain. If the azimuth angle of the playback head is out of adjustment, then it can't possibly sound right. By the same token, if the head on the machine that made the original recording is out of adjustment, then the tape will sound poor on any well-aligned playback equipment.

Recognizing this alignment problem, a logical question is: what happens if a tape is both recorded and played back on the *same* machine, when the azimuth is not critically adjusted? As the great number of inexpensive tape machines clearly shows, reproduction is surprisingly good.

Just how far the azimuth angle can be modified is demonstrated by a special modification supplied by Rangertone, Inc. An extra head is mounted on stock machines with the gap *parallel* to the tape! The head is used to record 60 cps along with either single-channel or two-channel material on ¼-inch tape. Although the 60 cps track is in the middle of the tape, the standard heads, perpendicular to the tape, don't even "see" the special track. The purpose of this third track is to synchronize tape playback exactly for movie making.

How to do it—

The above facts furnish a background for understanding the phenomenon of superimposed tape recording. If you'd like to experiment yourself, do this:

1. Mount the record-playback head on a pivot along with an angular pointer or indicator. *Figure* 1 is a suggested plan, although the head should be closer to its mount.
2. Fix the erase circuit so it can be disabled with a switch. Obviously, re-recordings can't be made if the previous information is erased.

That's all there is to it! Recording procedure is as follows:

1. Erase the tape.
2. Disable the erase circuit.
3. In separate steps, record different material, always rewinding and starting over at the beginning of the tape. In doing this, remember to set the azimuth angle to a *new* position for *each* recording.

What angles should be used? That depends upon your heads, tape speed, and other factors. A good trial value is increments of 15 deg. Thus, if we call the perpendicular position 0°, then we can record at −75°, −60°, −45°, −30°, −15°, 0°, +15°, +30°, +45°, +60°, and +75°.

After a tape has been multiple-recorded, how is playback accomplished?

1. Set the indicator on the head to the angular position that will select one of recordings.
2. Play back and listen!

"Tune in" the Program You Want

You'll soon discover that on playback you can "tune" the head to an accurate

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* *Route 8, Box 923, Tucson, Arizona.*

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setting. The effect is very much like tuning a station on a radio. As the angular position of the head gap approaches one of the settings used for recording, sound will begin to be heard. As the position gets closer, the sound becomes clearer and clearer.

How is the fidelity? Surprisingly good in view of the mad things we have done to the magnetic oxide on the tape. But, the results are definitely *not* high fidelity. However, the results are good enough that it's reasonable to believe that technique and equipment could be improved

to a point of satisfying high-fidelity standards. If that could be done, then very interesting possibilities exist.

A seven-inch reel of long-play tape runs for a full hour at 3¾ ips. With ten recordings on the tape, it would play for a full ten hours! This is not only competitive with LP records—it is superior on a straight dollar-and-cents basis. The cost of reproduction should not increase, since multiple heads could be placed "in-line" and all recordings made in a single pass of the tape.

Intriguing? Æ