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RADIO — ELECTRONICS

formerly RADIO CRAFT

UNUSUAL TECHNIQUES IN SOUND RECORDING

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MAY 1950

30¢ U.S. and CANADA

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Cover Feature

UNUSUAL TECHNIQUES IN SOUND RECORDING

By
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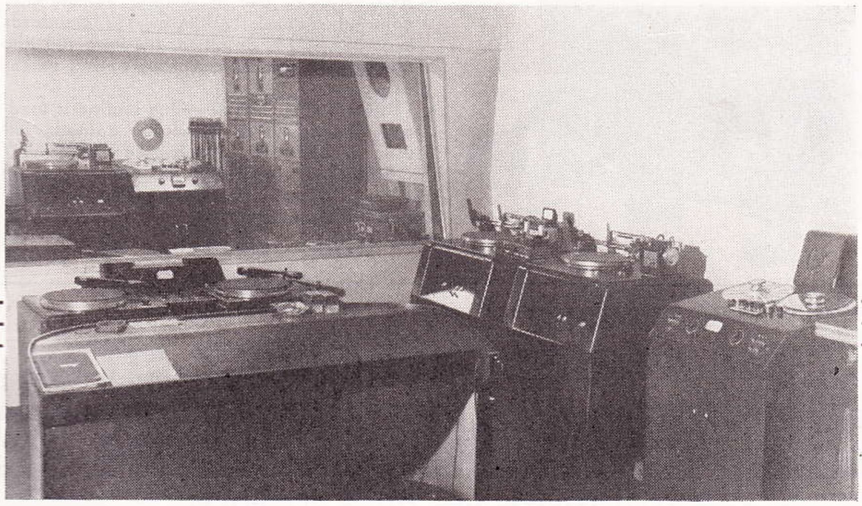


Recording room is in two parts separated by glass so that at least two operations can be carried on at once without having conflicting speakers going. All amplifying equipment is in 6-foot racks for maximum flexibility. Any of the dubbing tables or studios can be connected to any tape or disc machine.

LIKE many RADIO-ELECTRONICS readers, I have been greatly interested in amateur sound recording for a long time. When I had an opportunity recently to spend the best part of a day at Reeves Sound Studios in New York, I expected to feel very much like a spectator on an NBC studio tour who appreciates the intricate and efficient setup but finds nothing that is likely to have any real relation to his own work.

That isn't what happened. I saw practices, tricks, and techniques, many of which you or I can duplicate. I then realized that recording can be combined with imagination and ingenuity to produce highly distinctive work, and save time and labor.

As a very simple example, the playback tables used for dubbing are started by a switch on the recorder console permitting one man to do a dub job without having to run back and forth and make long run-in grooves. And even while I was sitting there, one engineer thought of an improvement on that—a spring and solenoid arrangement that eliminates even the second or so delay while the table gets up speed!

Reeves is the largest independent sound recording installation on the Eastern seaboard. Occupying a five-story building, it not only does straight sound recording, but has a big hand in producing sound tracks for motion pictures—television commercials and shorts, government training and information films, almost every conceivable type of movie except regular Hollywood features.

Today over half of the studio's activity is film work, but making discs of all kinds is a very important part of each day's work. The disc recording room (see photos) is a separate entity to which programs are fed from any of the five separate studios in the building. Here are located two tape recorders, four disc recorders, four playback tables, three 6-foot racks full of amplifying, switching, and control equipment, and miscellaneous other devices.

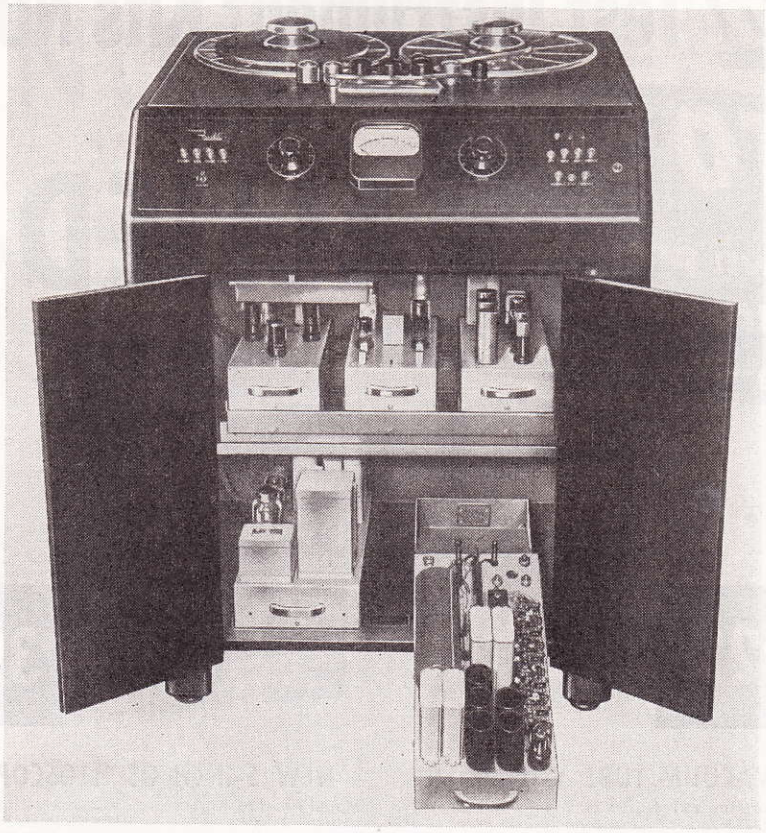
Why tape?

This month's cover is filled mainly with a tape recorder (we'll consider the young lady operator merely as a control device, if you don't mind) and you may wonder what a tape recorder has to do with a disc story. The answer is one reason for the musical perfection of many long-playing records.

No orchestra, quartet, or pianist ever has the good luck to turn in a full 40- or 50-minute performance with every note just the way it ought to be. The first ten minutes may be perfect, but one player may "hit a clinker" in the middle of the 339th bar and the tempo may be off just a shade at the start of the second movement. During a concert-hall performance, these things are quickly forgotten if the work as a whole is good. But a recording will be played back time and time again—and the "clinker" gets worse every time! In the "old days" a bad note during the recording meant doing over again at least one side of a disc, and the work had to be done in segments of no less than about 3 or 4 minutes—the time recorded on one side of a disc.

Then the tape recorder bowed in. The performance is recorded on tape, not on discs. If the conductor doesn't like the way things are going, he stops the orchestra and starts again a couple of bars before the unsatisfactory point. If he isn't sure, he stops and listens to the tape, then makes up his mind. (You can't listen to a disc, then use it as a master for pressing.) Or he may repeat a portion of the music at slightly different tempo, then decide later which is preferable.

The whole performance may be recorded in bits and pieces and not necessarily in the correct sequence. Just as long as all the music gets on the tape somehow and as long as each part has been given a good performance at least once, the job is done. (*Con't on p. 62*)



The Fairchild tape recorder produces higher-quality sound than most of the best disc recorders. Amplifiers and relays are housed in the console cabinet. The recorder plays for one hour. Reeves engineers use plastic tape because its thickness is more uniform than that of paper tape. Speed is 30 inches a second.

Then the conductor gets together with the engineers. They listen to the tape with a score in one hand and a pair of scissors in the other. They clip out the best performances of each part of the music—a few bars here, perhaps a single high trumpet note there. Then they splice it all together and throw away the second-rate bits. The result is a complete performance, each note of which is played at its best. The last step is to dub the tape to an LP master. Mercury records are made this way at Reeves and you can hear the result yourself if you happen to own a Mercury LP—one that was made here, not dubbed from European masters. RCA (and probably others) uses tape for its classical master records.

Engineer monitors the cutting of an LP with one hand on pitch control and his eyes on a cue sheet which indicates when the loud and soft passages will appear.

One disadvantage is inherent in LP records—the sound level fed to the cutter must be lower than with standard records to avoid overcutting (having the stylus cut through into adjacent grooves during loud peaks). Another disadvantage common to *all* discs is reduced range between the loudest and softest sounds that can be recorded—for the same reason, even with standard groove spacings.

Bob Fine's invention of the margin control technique has almost completely cured these troubles. It's very close to one of those why-didn't-I-think-of-it-myself ideas. The only time overcutting is a danger is during loud passages, and then only because the adjacent groove is so close.

The answer is to make the next groove not so close! So the control engineer *varies the pitch*—the number of grooves per inch—during the recording, rather than the sound level. In soft passages, the grooves are made very close together to get the maximum playing time. Just before a loud passage, the distance is increased to allow for the greater stylus swing. The total pitch range is from about 320 lines per inch for very soft music to approximately 160 lines for the loudest parts of the music.

The *depth* of the cut also must be varied so that on the loud passages, when the groove swings are wider, the playback stylus will not jump out. The engineer does this with a knob, not by manually adjusting the cutter. The depth control device is still in the developmental stage and details are not available.

The drawings show in a simple way how the pitch of the Fairchild recorder, which Reeves uses, can be varied continuously without changing the lead screw or any pulleys. A flat disc is driven by the motor. Between it and the sleeves fastened rigidly to the right end of the feed screw is a ball bearing which contacts both disc and sleeve. When the disc rotates, the motion is transmitted through the ball to the sleeve, which then rotates axially, carrying the feed screw, which is fixed to the sleeve, with it.

By simple mechanical law, the speed of the feed screw depends on the position of the ball. The direction in which the feed screw rotates depends on whether the ball is to right or left of the center of the disc.

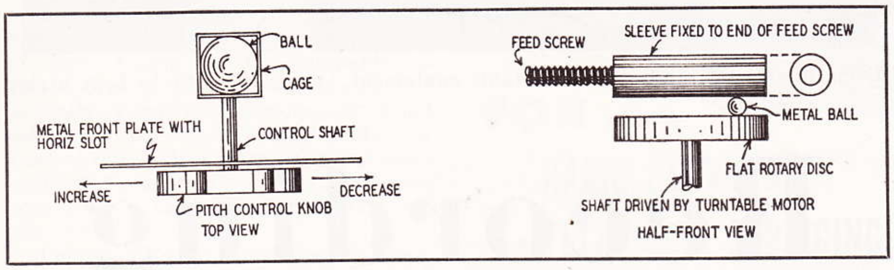
The top-view drawing shows how the position of the ball is controlled. The ball is enclosed in a metal frame (without top or bottom, of course). The frame is moved right and left by a knob, taking the ball with it. A vertical metal plate under the knob is calibrated in lines per inch with separate scales at right and left for outside-in and inside-out.

Interestingly, this scheme was devised long before microgroove records were on the market. It just happened to be adaptable to making LP's, the only change necessary being the addition of calibration marks on the metal plate. The possible pitch variation is from 80 to a theoretical infinity. Actual records have been made at pitches as high as 500 lines.

The volume of work at the studios surprised me. The recording room is in business approximately 90 hours a week making discs for Mercury and other independent companies; radio commercials (including jingles, of course); sound effects for radio programs; frequency test records; and programs for the Department of State and other independent producers.

One of the most interesting and unusual discs was made on special order for an ingenious householder who wanted a burglar alarm. The burglar's entrance turns on a record player which sends the sound of a barking dog to a loudspeaker, then generates a subaudible tone which operates a relay to turn on the lights.

Many recorded slide lectures are made, with an 8-kc tone on the disc to trigger the slide projector automatically at the proper places.



How pitch is varied continuously in the Fairchild disc recorder. Precision ball couples rotary disc driven by motor to feed screw sleeve. Position of ball determines pitch and direction. The knob and cage move ball to the right or left.

A three-speed dub

Children like stories with elves or fairies, and Golden records try to satisfy them. But the tiny elfin voice is too high for any human to produce. Here's how Reeves did it.

The orchestra was recorded at 78 r.p.m. It was played back at 33 1/3 r.p.m. and the voice sang with the playback. This combination was fed to a recorder at 33 1/3 r.p.m. When the result was played back at 78 onto the final master, the orchestra was returned to its original pitch, but the voice pitch was very much higher—and sounded just like the elf the children want. In another, similar record, *two* elfin voices were wanted, and their pitches had to be different so they could be told apart. That was done by using 33 1/3 for one voice and 45 r.p.m. for the other.

At the moment, Reeves is the only studio other than RCA making 45-r.p.m. masters. To get the new speed, they change the power-supply frequency from 60 to 81.008 cycles and set the Fairchild recording table to the 33 1/3-r.p.m. position. The new frequency is generated by a Hewlett-Packard a.f. oscillator and stepped up by a high-power audio amplifier with 845's in the output stage.

Just about all the recording equipment in use at Reeves is made by Fairchild. The tape recorders are in console cabinets with amplifying equipment inside. Some of it can be seen in the cover photo and more in the picture on these pages. Pushbuttons and signal lights give quick and easy control, essential for accurate recording of tricky material. Response is flat within 1 db from 50 to 15,000 cycles.

While I was at the studio, the engineers made an LP disc master from a tape of piano music. The record was an instructional one, designed to show how the piano developed, and several early and modern pianos and harpsichords were recorded on it. The last selection was played by Edith Weiss-Mann, world-famous harpsichordist, on four different instruments, one quarter of the piece on each instrument. Then the four strips of tape were spliced together and played back. The change of instruments took place, not in musical pauses, but right in the middle of the selection—when the music was going fast. But so perfect was the cutting and splicing job that there was not the slightest falter in tempo when the instruments changed. If Bob Fine, Reeves' chief engineer and inventor of most of the special techniques and gadgets, had not given me his word that it was a splice job, I would have been absolutely sure that four different players had made the recording at the same time.

The Fairchild disc recorders have a frequency response of ± 2 db to 8 kc, but they are cut off at around 6 kc when making LP's. Fine says the usual playback stylus simply will not track anything higher than that, especially toward the inner diameter of a fine-groove disc, and he can see no reason why higher frequencies should be put on the record at all. According to him, "psychological" wide range is much more important than what the meter says. If the recording is made in a suitably reverberant studio or hall, if the microphone placements are correct, if there is little harmonic or intermodulation distortion and record noise, the ear thinks the recording is beautiful.