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Les Paul and Mary Ford

OCTOBER, 1954

35c



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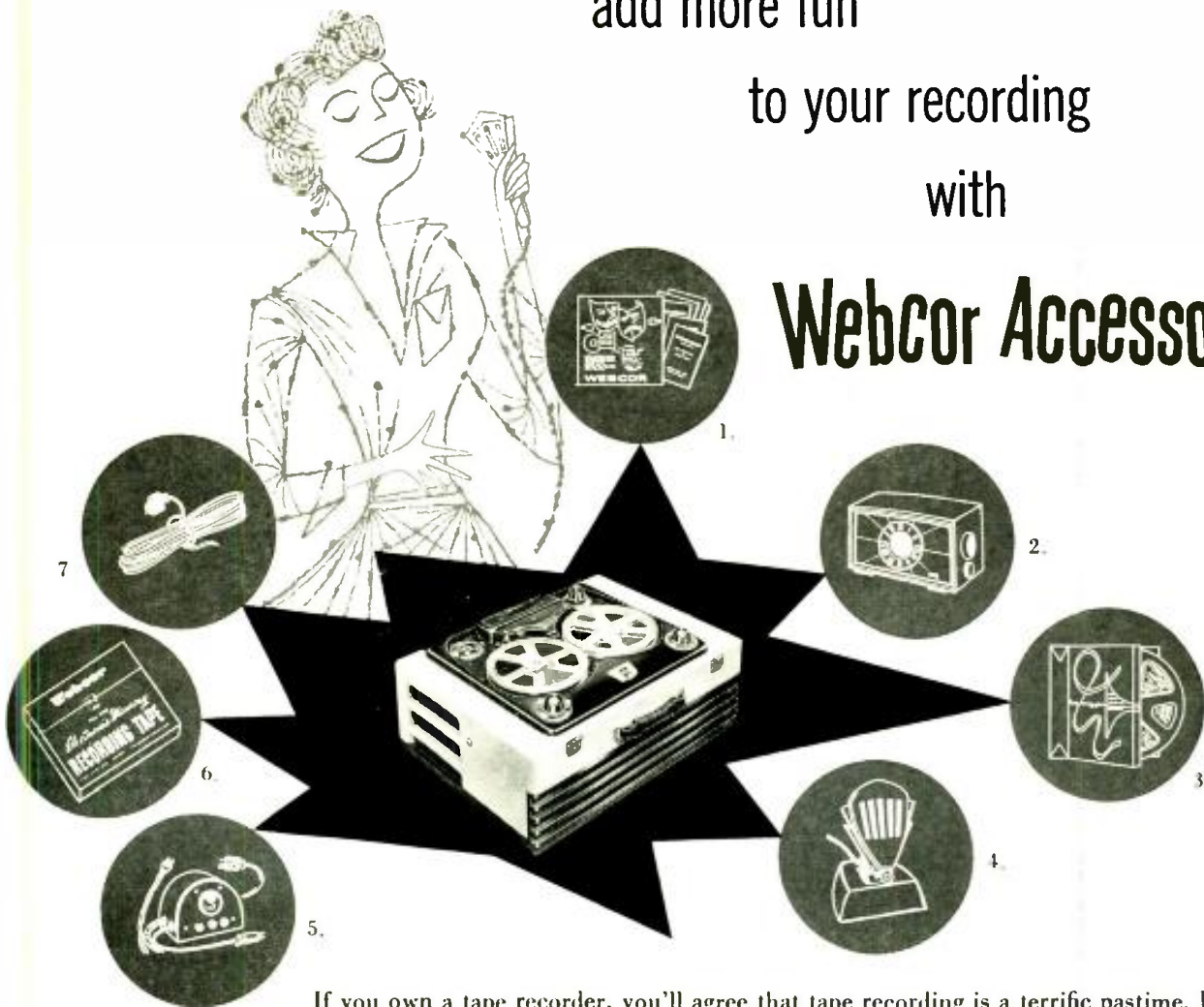
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Vol. I No. 5

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Hope to be hearing from you!

*Yours—
Hack*



MAGNETIC FILM &

TAPE RECORDING

VOL. 1 NO. 6

SEPTEMBER-OCTOBER, 1954

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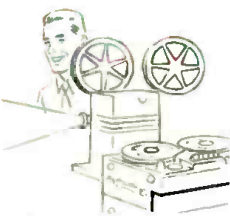


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the Voice  of Music

NEW TAPES

THE rapid rise in popularity of tape records and recorders, as well as enthusiastic statements made in this magazine, seems to be causing a mild furor in some quarters. Enough to elicit dissent in the pages of two of our eminent brethren, *Harpers* and the *Saturday Review of Literature*.

Both of them state the same thesis; tape will not replace disc. Both of them, curiously, propound the same arguments except that one critic, Edward Tatnall Canby, uses a fairly scholarly approach while the other, R. D. Darrell does not.

Both articles are apparently designed to divert a considerable group of wavering, potential tape buyers away from tape and toward discs. They may have some effect on people who believe this sort of thing in print but, for the most part, I don't think that they will stop the advance of tape any more than the wind stopped the steamboat.

It is reasonable, when a new advance presents itself, for opponents to express dissenting views with logical arguments to support their opinions. It is, conversely, unreasonable when the opposition stoops to calling proponents of the advance, credulous "fanatics" who "may outgrow their present juvenile idiosyncracies"! Name calling of this variety is usually resorted to only in moments of extreme desperation.

The Darrell piece suggested that, generally we haven't the mentality to distinguish the difference between Villa-Lobos and Frontal Lobotomy without being exposed to the latter before approaching the former.

To this my only reply is the word made famous at Bastogne.

It is Mr. Darrell's prerogative to defend his record library from the threatening tape invasion, but I question his attempt to create, in the minds of his readers, a class structure among musical hobbyists: the "discophile" at the head of the hierarchy, the "tape fanatic" somewhere between the cotter and the serf.

However, let us get back to that fellow, the music lover, the guy who is behind the current revolution. Is his name synonymous with discophile? I think not. I think he is a person who pays "sustained attention to meaningful musical contexts," live or recorded, and prefers not to be distracted by coughing, audience rustling, popping, hissing, rumble or pre-echo.

He is the person who dropped the 78 record when the LP made its appearance and will do the same thing again in favor of tape. He has no loyalty to any particular medium, only to music. The phonograph manufacturers didn't turn out a product to suit him so he lifted high fidelity from the hobbyist and elevated it to the rank of big business. Actually he went even further and elevated the hobbyist to the rank of music lover!

Mr. Darrell states that, "The serious home listener is primarily intent on gaining the maximum of rewarding musical experience with the minimum consciousness of electro-mechanical intermediaries."

As a music lover and converted discophile,

I say that this is *only* possible with tape.

To anyone even remotely familiar with tape and tape recorders the arguments of both gentlemen must seem strange, indeed. Resentment is obvious, the reasoning is not.

They both seem to feel that tape is too clumsy a medium for the average man to handle. Certainly not in this country of push-button conveniences; stoves, air conditioners, electric mixers, automobiles, et al. Tape-in-the-slot recorders require no threading and, with dual-track tape becoming the accepted standard, it is no longer even necessary to rewind.

Both of them declare that the cost factor is a strong argument against tape but, in a competitive market, this problem will be quickly overcome. The success of television

seems to disprove this point anyway. In fact, none of their arguments really possess any validity when exposed to minute examination.

Perhaps they feel that this upstart industry is a minor one, making too many extravagant claims. But lo, the voice of the cash register is heard in the land! The total, trade estimated, tape sales volume in 1954 is in excess of \$120,000,000. Compare this with the total record volume, in 1953 of \$225,000,000. Consider then the relative age difference between these two media. An upstart yes, a minor industry, no!

Both antagonists compromise near the end of their articles and opine that actually tapes and records should supplement one another; coexist in a peaceful world. This,

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- Wagner—Flying Dutchman Overture
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- Sibelius—Valse Triste
- 704-BN Debussy—Afternoon of a Faun
- Schumann—Manfred Overture
- Glinka—Kamarinskaja
- 705-BN Rossini—William Tell Overture
- Brahms—Academic Festival Overture
- Massenet — Under the Linden Trees

Young Vienna Choir

- 706-BN Strauss—Voices from Vienna—Vol. I
 - 707-BN—Voices from Vienna—Vol. II.
- Mail orders filled if your local dealer cannot supply you.

AUDIOSPHERE, INC.
Livingston, New Jersey

I feel, will happen. They will ultimately coexist, like the automobile and the horse.

One of the greater advantages of the tape recorder is its ability to record the human voice. Greater because some human voices have much to say, and say it in such a way that it should be recorded as it is said.

Imagine, for example, to be able to hear the voices of Lincoln, Jefferson, or Patrick Henry captured on tape at the moment of oration. This heritage, unfortunately, is not for us, all we can do is read the words and try to imagine how they must have sounded.

Future generations will be more fortunate, however, because now it is possible to preserve the voice forever. Not only the great public speakers, but voices of the individual family as well.

Anyone can record with a tape-recorder, anywhere, anytime. The disc-recorder, difficult to operate, difficult to dub on a small scale, was reserved for recording the most momentous words. Even the soft acetate recording was difficult to keep without surface damage. Tapes, on the other hand, are easy to store and can be reproduced countless times without loss of the original fidelity.

Because of this advantage, libraries of priceless recordings are being formed by many institutions given to the preservation of our history. One of these is the Charles G. Reigner Library of Recorded Sermons and Worship Services of the Union Theological Seminary of Richmond, Virginia.

Most unusual is the fact that this is a circulating library, as well as an archive. Tape recordings of great sermons of the immediate past and present are available to interested persons, both ministers and laymen. The impressive list includes such well-known theologians as Harry Emerson Fosdick, Peter Marshall, Reinhold Niebuhr, G. Bromley Oxnam, Norman Vincent Peale, Fulton J. Sheen and Stephen S. Wise, as well as readers Charles Laughton and Orson Welles. The Seminary will provide a complete catalogue upon request.

This great collection owes its existence and continuing support to Dr. Charles G. Reigner of Baltimore, Maryland.

Incidentally, the Library is on the constant search for master recordings of the more widely-known ministers of today. Anyone having such recordings and wishing to make them available to the Library, may secure full details on the procedure to be followed from:

Robert White Kirkpatrick
Professor of Homiletics
Union Theological Seminary
3401 Brook Road
Richmond 27, Virginia

An interesting device has just appeared on the market which we feel will have application in the field of tape records. It is the Mini-Music, made by the Television Associates of Indiana, East Michigan Street, Michigan City, Indiana. The unit is small, measuring under 3 inches, low in cost, and will enable tape recorders to compete with the 45 rpm. records.

The Mini-Music is loaded with a continuous loop of 1 mil Mylar, double-coated, unbreakable tape and needs only to be slipped over the feed spindle and the tape placed in the recorder slot. No adaptors or rewinding is required.

The playing time is from 3 to 10 minutes (the equivalent of one to three records). The firm will be glad to supply full details, for which we do not have the room here.

One of the factors which the critics of music on tape fail to take into consideration



This new continuous play reel has a playing time of 3 to 10 minutes (equivalent to 1 to 3 records). Loaded with unbreakable tape, it will enable recorders to compete with the 45 rpm record players.

is the rapidity of growth and the inventiveness of the manufacturers in the field. Before the echoes of a complaint, or a suggestion, die away, some alert manufacturer is on the market with an improvement or new device that provides the answer.

POPULAR MUSIC

This would seem to be the season for popular music on tapes, judging from the number received this month. A notable surprise was the introduction of new artists from the Hack Swain Studios, a happy trend, to say the least.

HACK SWAIN PRODUCTIONS

P. O. Box 2384
Sarasota, Florida
Musikon Tape #560—Tab Smith and his Orchestra

1. Because Of You
2. Hands Across The Table
3. Under A Blanket Of Blue
4. Rhumba Boogie
5. Cherry
6. A Bit Of Blues
7. Sunny Side Of The Street
8. Sin
9. Slow Motion
10. Auf Wiederseh'n

Any jazz collector lucky enough to have a fairly complete set of Luck Millender recordings is familiar with the superlative alto sax work of Tab Smith. Those of you who are not, may become so via this tape. His tonal quality and improvisations are surpassed by few and both are well represented in this half-hour.

Readers of the column are, by now, well aware of the fidelity of Hack Swain tapes so I won't go into the subject any further. However, I do have one small complaint: Tab is recorded *too* well. By the time I had heard the third selection I found myself wishing that he would step back a few feet. The alto sax is in the living room all right but at times I felt that the orchestra was in the kitchen!

Personally, I like my soloists well balanced with the orchestra, particularly when the



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By S. J. Begun

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group is as good as the one that Tab seems to have. As I said, it is a small complaint and probably in complete disagreement with jazz collectors and Smith fans; just thought I'd mention it.

- Reel #502
Two Guitars
La Petite Valse
Dancing Tambourine
Gold And Silver Waltz
Lady Of The Evening
La Comparsa
On The Isle Of May
From The Land Of The Sky Blue Water
Persian Market

Hack's regular technique, except that the third selection, "Dancing Tambourine," is recorded in the unique multiple-track technique labeled, Swain-A-Fonic, MULTETRACK.

"Presence" is a word being applied to the psycho-acoustical effect of having the musicians in your living-room, even though being reproduced through electronic equipment. All of Hack Swain's electric organ recordings have this presence effect, if reproduced on adequate equipment.

The Anne Mundy piano tapes, reviewed in the April issue of TAPE RECORDING, have it too, and I would not hesitate for one moment to recommend all of Hack Swain Production's catalogue as demonstration recordings for equipment dealers, or for the testing of home equipment.

Musikon Tape #520—The Metronomes

1. On The Alamo
2. Besame Mucho
3. Peg O' My Heart
4. Five Points
5. Nearness Of You
6. Out Of Nowhere
7. Dancing In The Dark
8. What'll I Tell My Heart
9. Laura
10. Play Fiddle Play

Musikon Tape #521

1. Miami Beach Rhumba
2. I Can't Believe That You're In Love With Me
3. Taboo
4. Tenderly
5. Jealousy
6. Street Of Dreams
7. Three O'Clock In The Morning
8. Laurel Street Blues
9. The One I Love Belongs To Somebody
10. I Surrender Dear
11. Someone To Watch Over Me

Three highly talented young men with a penchant for making you want to dance. This music is just right for a rumpus room party, nothing sensational, just solid. The trio consists of piano doubling on accordion, guitar, and bass. They play with a verve and enthusiasm that transmits to the hearer.

The balance between the instruments is good and the Hack Swain engineered presence effect places the group well into the living room and, except for the music, the tapes are silent.

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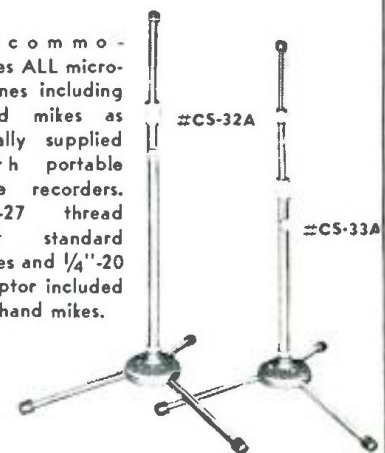
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PLACE your MIKE just RIGHT

— use ATLAS MIKE STANDS

Accommodates ALL microphones including hand mikes as usually supplied with portable tape recorders. 5/8"-27 thread for standard mikes and 1/4"-20 adaptor included for hand mikes.



All sections beautiful triple chrome finish. Rubber-tipped base legs easily removable without tools — permits compact, lightweight transportation.

Model CS-32A: 2-section adjustable from 36"-64". User net \$6.40

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ATLAS SOUND CORP.

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1. Let's Dance
2. Stardust
3. Tea For Two
4. The Very Thought Of You
5. Don't Be That Way
6. There's A Small Hotel
7. Try A Little Tenderness
8. Tenderly
9. Don't Get Around Much Anymore

Doug Duke is A-V's answer to Hack Swain. Electric organ and piano augmented by bass and drums playing popular tunes which make for easy listening or dancing.

Catalog # 1509—Show Music

1. Oklahoma
2. Kiss Me Kate
3. Show Boat

Here is fine music which should have great appeal for the light side of a classical collection or the heavy side of a popular collection. Robert Russell Bennett, who has an affinity for the music of Richard Rodgers a demonstrated on his magnificent arrangement of "Victory At Sea," here has richly orchestrated the score for "Oklahoma" and has upheld his excellent reputation by doing equally as well by Cole Porter's "Kiss me Kate." Rosario Bourdon holds up his end of the recording with a fine arrangement from the music of Jerome Kern's "Show-boat."

Throughout, this tape will have someone in the house humming, singing or whistling the tunes. The orchestra, although not identified, is an excellent one and well conducted. The tape is quiet and full-fidelity.

LIVINGSTON ELECTRONIC CORPORATION

Livingston, New Jersey

Speed 7 1/2 IPS, Full Track

Catalog # 1081—Barbara Carroll Trio

I found listening to Barbara Carroll Trio for the first time akin to the first hearing of Art Tatum. She plays jazz piano with all the feeling of a harpist with the Philharmonic. This is not only good but quietly sensational. Those collectors who are familiar with her work on RCA Victor records will certainly want to listen to this tape. Miss Carroll knows her way around the keyboard and the Livingston engineers know their way around the piano. The reproduction is excellent.

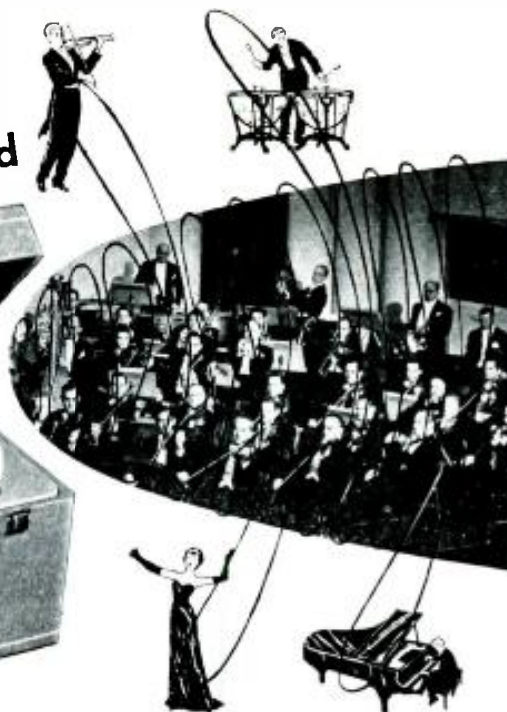
Catalog # 1083—Lenny Herman and Orchestra

The reproduction again is first class and Lenny Herman fans should enjoy the recording.

Background Music Growing

The use of tape for supplying background music in factories, shops, railway and bus stations, airports, etc. is growing by leaps and bounds. Magnecord has set up a separate division to service the expanding market and has the RCA Thesaurus Library of music to draw upon. Magnetrronics is using the Capitol Records transcription library with distribution through the Graybar Electric Company. Other firms, such as A-V Tape Libraries and Hack Swain are also in the field. The famous Muzak service has switched from discs to tape also. With tape it will be possible to supply music to many smaller outlets that could not be serviced before.

a new world
of living sound



Original Sound Quality
with low-cost Crestwood 303

Daystrom firmly believes that *true, faithful* sound reproduction is the all-important characteristic of a quality tape recorder. This was the guiding principle followed in designing and developing CRESTWOOD Tape Recorders. As a result, with higher fidelity than comparably priced tape recorders, CRESTWOOD offers sound that virtually matches the original. Along with its wide range and low cost, CRESTWOOD offers:

Ease of operation —

- Push button controls located front and center.
- Safety lock prevents accidental erasure.
- Rear plug-ins for microphone, radio, headphones, etc.—avoid wire jumbling.
- Rewind is 20 times faster than recording.
- Light weight and compact design for portability.

Quality performance —

- Professional recorder "Red Heads" provide faithful sound reproduction.
- Dual speeds of 7 1/2" and 3 3/4" per second.
- 10 watt output from 6" x 9" oval dynamic speaker—double the volume of comparable tape recorders—fills large rooms with *Living Sound*.
- Three outputs: internal speaker; external speaker; special output to bypass internal power amplifier to feed a high fidelity system.

The CRESTWOOD 303 comes complete with microphone and cord, radio and TV connection cable, power cable and empty reel.

We can't put sound in print. As you know, you must hear for yourself the quality of any tape recorder. But we will be glad to send you the complete CRESTWOOD story—and tell you where you can conveniently hear one.



Hi-Fi Crestwood 400's
Model 401 (Recorder) \$199.50
(Frequency response: 30 to 13,000 cycles + or - 2db at 7 1/2" per second tape-speed)
Model 402 (Power Amplifier and Speaker) \$100.00

Crestwood Model 303
Tape Recorder \$199.50

(Slightly higher in Denver and West.

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- Tape Recorder only

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The **ONLY** 2-speed, dual-track
tape recorder with so many
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FEDERAL'S NEW FME Tape Recorder



\$139.95

*Slightly higher
on West Coast*

Highlight Features

- DUAL TRACK**
 - COMPACT AND PORTABLE**
 - 2 SPEEDS** — 3¾ IPS, 7½ IPS
 - SINGLE KNOB CONTROL**
 - SEPARATE VOLUME AND TONE CONTROLS**, with full range from bass to treble
 - HIGH FIDELITY — NATURAL TONE**
 - FAST REWIND** — 20 to 1 ratio
 - FAST FORWARD** — Push-button control
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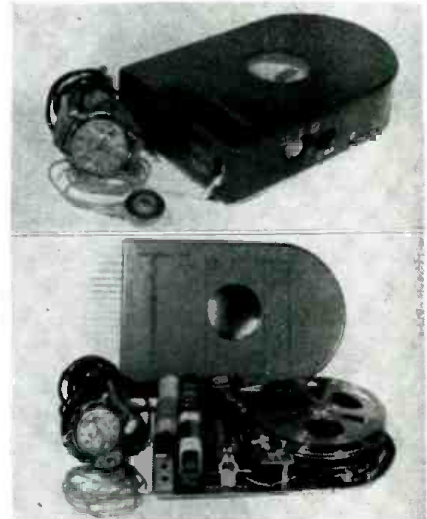
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NEW PRODUCTS

POCKET RECORDER

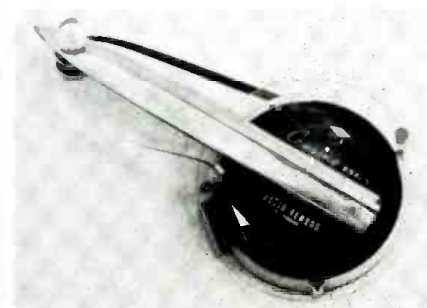


So small that it only reaches from the butt of the hand to the fingertips, the Tapette is now going into production at Broadcast Equipment Specialties, 135-01 Libery Avenue, Richmond Hill 19, Long Island, N. Y.

This tiny tape recorder is 6½ inches long, 4½ inches wide and 1½ inches thick. It holds 600 feet of tape and will record at either 1⅞ or 3¾ inches per second. The weight is 2 pounds 4 ounces. At the 3¾ ips speed the recording time is 30 minutes per track and at 1⅞ ips, one hour on each of the dual tracks. A speed of 15/16" is also available which gives 2 hours per track. Special reels are used to hold the ½ mil Mylar tape but have standard holes so they can be used on a regular recorder. Three controls are provided. Forward, off and reverse are dialed by a slider. The volume control rolls in a recess and is color marked for recording conditions. The record-play switch is also a slider. Monitoring is done with earphone. Machine will record, playback and rewind. Accidental erasure or "double-exposure" is mechanically impossible.

The unit is completely self-contained, including batteries. A wristwatch mike is available with the unit. Price will be approximately \$298. Full details from the manufacturer.

AUDIO VENDOR



Cousino Inc. 2451 Madison Ave.,

Toledo 2, Ohio is marketing the Audio Vendor an automatic tape loop of specially lubricated unbreakable tape. The magazine cuts on any standard recorder and will repeat tones or messages from 15 seconds to 15 minutes in duration. It is adaptable to a wide variety of uses including the voicing of sales displays, safety warnings to employees, weather reports, control of automatic machinery, timing of voice and display features, etc.

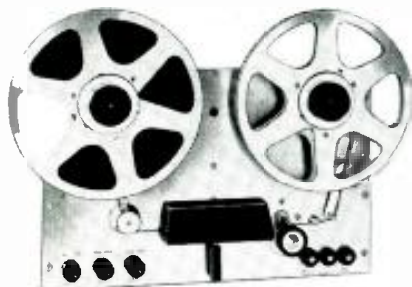
A free brochure on the unit and the price will be sent on request. Write to the address given above.

2 SPEED AMPRO



Ampro Corporation, 2835 N. Western Avenue, Chicago, has announced the introduction of a two speed model #757. Heretofore the Ampro machines were obtainable in one speed only, either 3 3/4 or 7 1/2. At the 7 1/2 inch speed the frequency response is 40 to 12,000 cycles per second. The recorder is similar in appearance to the other models with a lined oak finish and basket-weave grill. The price is \$239.95. With radio at \$34.50 additional.

DYNACORD RECORDER



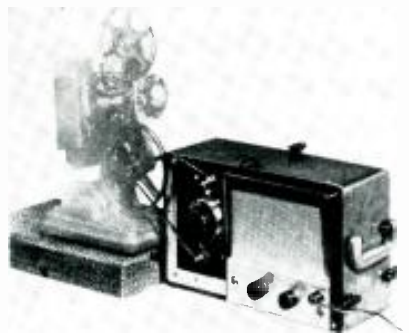
Pentron Corporation, 777 S. Tripp Ave., Chicago, is now manufacturing the Dynacord professional recorder. It conforms to NARTB standards and may be rack mounted. It features dynamic braking, straight-line threading, 3 head construction, interlock safety switch to prevent accidental erasure and an instantaneous emergency stop which automatically turns off the tape transport unit if the tape breaks or runs out during operation. It will accommodate the 10 1/2 inch reels. Tape speeds are 15 and 7 1/2 ips. Full details from Pentron.

NEW E-V CATALOG

Electro-Voice, Buchanan, Michigan has just issued their new condensed catalog No. 119. This new booklet gives, in condensed form the basic facts about the Electro-Voice line which includes microphones, speakers,

2, 3 and 4 way reproducing systems, phono cartridges for hi-fi use, VFH, FM and UHF boosters, public address loudspeaker systems, etc. In addition it also lists microphone accessories and other items of interest to the recordist. You may have a free copy by writing to the address above or from any E-V distributor.

SOUND ON FILM



Remsel Industries, 2427 S. Calumer Ave., Chicago 16, Ill. has announced the Film-Harmonic, a record-playback unit that will add sound to either 8 or 16 mm silent films. The unit is not attached to the projector and may be used with any type machine. The picture shows how the film is looped through the unit. The Film Harmonic is self-powered assuring better quality sound as it does not depend upon the projector to provide the film movement over the sound head. The unit includes microphone, speaker, amplifier and sound equipment in one case. Full details and price from Remsel Industries.

MIKE DESK STAND



The Turner 50D Aristocrat Dynamic microphone is now available in a satin black finish with matching desk stand for TV use. The microphone is non-directional, has a response from 50 to 15,000 cps and can be had in either high or low impedance. The price is \$125.00 including stand. Full details from the Turner Company, 17th Street, N.E., Cedar Rapids, Iowa.

SCOTCH TAPE ON NEW BASE

Minnesota Mining and Manufacturing Company announces that its Scotch Brand Tape, both regular 111 A and High Output 120 are available with the new polyester backing. The new tape is labeled "AM" to distinguish it from the regular tape. The price of the polyester back 111 AM is \$9.75 for the 1200 foot reel compared to \$5.50 for regular acetate.

New 4-Speed Magnemite*



for Unmatched Versatility in Field Recording!

Designed for nature sounds, music, street sounds, interviews, conferences, courtroom reporting, missionary work and field reports. All of these may be recorded on a single 4-speed portable, battery-operated spring-wound tape recorder. Features quick speed change with automatic equalization.

Model 610 EM meets both primary and secondary NARTB standards and operates at tape speeds of 15, 7 1/2, 3 3/4, 1 7/8 ips. Records and plays back frequencies up to 15,000 cycles. Model 610 DM operates at tape speeds of 7 1/2, 3 3/4, 1 7/8, 1 1/8 ips.

These tiny recorders weigh only 17 lbs. with self-contained batteries that last 100 operating hours and include built-in monitoring and headphone playback facilities. Designed for extreme simplicity of operation. Meets the most grueling field tests. May be operated anywhere. Measures only 7 x 10 x 11 inches.

Write for complete technical literature and direct factory prices to Dept. TR:

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Your Tape and Film Productions need

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**make your car,
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a "rolling
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for changing your storage battery current to A. C. Household ELECTRICITY

Anywhere . . .

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ATR INVERTERS . . . especially designed for operating standard 110 volt A. C. . . .

- TAPE RECORDERS
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NEW MODELS ✓ NEW DESIGNS ✓ NEW LITERATURE
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**EASY TO INSTALL
EASY TO OPERATE**

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V-M RECORDER



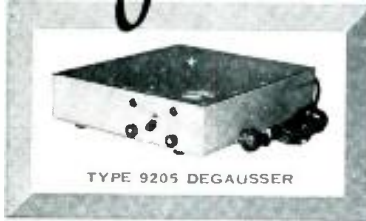
The V-M Corporation, Benton Harbor, Michigan, famous makers of phonograph and record changers has entered the tape market with their Model 700 Tape-o-matic recorder. The machine is push-button operated and has dual speakers, a 5 x 7" woofer and a 3½" tweeter to give 40 to 15,000 cps range. It is equipped with a tone control, monitor switch, volume control and a pause button which stops tape noiselessly. May be locked in position if desired. Jacks include mike, radio-phonograph and magnetic-phonograph. Two output jacks provide connection for external speakers, one disconnects the recorder speakers, the other does not. A good quality mike is furnished. The machine also has a tape timer and it may be used as an amplifier for phonograph or a PA system. The automatic shutoff feature turns off both motors and amplifier at the end of a reel. The case is rose and gray. Prices and full details from the V-M Corporation.

4 SPEED MAGNEMITE



Latest member of the family of portable self-contained recorders is this four speed Magnemite made by the Amplifier Corporation of America, 398 Broadway, New York. Two models are available one having speeds of 15-1½-3¾ and 17/8 and the other speeds of 7½-3¾-17/8 and 15/16 ips. The recorders measure 7" wide by 10" high by 11" long. Weight is 15 pounds including self-contained inexpensive flashlight batteries that last 100 operating hours. The drive is governor controlled from the spring motor, and is made practically flutter free by the flywheel. Tapes made on the machine may be played on any recorder that operates at the same speed. Recording may be done while in motion and playback can be had through headphones or through an amplifier. The motor may be rewound while the tape is running without affecting the tape speed. A warning light indicates when rewinding is necessary. Full details and price from the firm.

CINEMA'S
TAPE AND FILM
Degausser
CLEAN ERASURE OF MAGNETIC TAPE & FILM



Noise & program erasure. Use the best. Cinema's Bulk-Tank Type Degausser 9205. Economically priced. Buy yours today.



PENTRON TR-4



Pentron, Inc., 777 South Tripp Avenue, Chicago 24, Ill., has announced the TR-4 which supercedes the 9T-3C. It is dual speed, 3¾ and 7½ ips and dual track but is available with single track heads if desired. All controls are within the span of a hand. The four jacks, mike input, radio input, external speaker and external amplifier are all mounted on the front. Heads have removable pole pieces. The case is covered in two-toned brown. It has a 6 inch speaker with 5 watts output. Frequency range is 50 to 9500 cps at 7½ inch speed. Price is \$189.50. Write for details.

NEW IRISH REEL



Radio Industries, T-120 Marvyn Road, Opelika, Alabama, announces that their Irish tape will henceforth be supplied on a plastic reel having a 2¼" hub. The

hub size was decided upon as a result of a poll taken among sound recording engineers who preferred it because it improves program timing. The new reel is sturdier and uses only one slot on the hub to secure the end of the tape. The new reel is supplied at no extra charge as was the case with the old 2¾" hub reel.

TAPE SPLICER



Cousino Visual Education Services, 2325 Madison Ave., Toledo 2, Ohio, is selling the Cousino Magnetic Tape Splicer. The unit is provided with adhesive on the back to hold it to the working surface. The tape is pressed into the groove and edge friction holds it in place. Drawing a single-edged blade through the slot cuts the miter joint. Splicing tape is then applied to the splice. The splicer sells for \$1.50 and is available at dealers or from Cousino.

ENGLISH IMPORT



Hudson Radio and Television Corp., 48 W 48th Street, New York 36, N. Y., is the United States distributor for the "Ferrograph" recorder which is made in England. The machine features three independent drive motors, automatic cutoff, separate bass and treble adjustments, instantaneous start and stop control and wide frequency response. It uses standard ¼" tape and has two speeds, 3¾ and 7½ inches per second with a rewind time of one minute. It is dual track. Audio output is 2.5 watts. It has built in speakers or an external speaker may be used. It measures 18½ inches by 17½ inches by 9¾ inches and weighs 50 pounds. Net price is \$349.50. Full details from Hudson radio.

NEW CATALOG

Goody Audio Center, 235 W. 49th Street, New York 19, N. Y. has issued a new audio catalog which may be had upon request. It is 88 pages and features all kinds of audio components, including recorders,



"It's"
'SONODYNE'
MULTI-IMPEDANCE DYNAMIC MICROPHONE
at Recording Time"

— say actual users* in the field
and here are a few reasons why . . .



"This microphone has been used for tape recording 15-minute shows for future airing on a nearby radio station. We like it fine, and it does take a beating."
Speech and Drama Director, Ind.



"We are using this microphone with good results on our recorder."
Audio-Visual Librarian, Va.



"Wonderful for wire recording purposes and P.A. use. I use it mainly for recording."
Sound Service, Massachusetts



"Used for recording organ music. Performance is very satisfactory; especially good on highs."
Recording Professional, Colorado



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Producer and Director, Canada



"Excellent results in recording and for comments in the showing of motion pictures."
Amateur, New York

Model "51" Sonodyne • List Price \$45.00

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WEB BACKGROUND ORGAN MUSIC TAPE

1200' 7½ips • FULL HOUR • dual track. 20 numbers ALL brand NEW possible future "hits" (new Web Policy enables WEB TAPE OWNERS to "preview" all its NEW numbers on WEB BACKGROUND ORGAN MUSIC TAPES before release to radio, TV and public performance).

Enjoy relaxing, soothing, (and occasionally a little lively) strains of the ORGAN while dining, at gatherings and on other occasions where the use of background music is desirable.

May also be used by Restaurants, Hotels, Motels, etc., for there are no ASCAP or BMI fees to be considered. This music is licensed for YOUR use. Tape player *only* is required (with suitable amplifier if establishments are roomy) —and we shall be glad to recommend and quote on equipment without charge.

Perfect for Gym classes in schools.

Enter our "future hits" contest. Details with each tape. Valuable prizes awarded.

This tape (No. 102) is our first release. The second release of a 20 number, one hour tape, which may be spliced by users that have 2100' reels, will be ready October 1st, 1954. This will be No. 104. Orders accepted for 104 after that date. Third release is scheduled for release by December 1st. Others will follow each two months. Start your collection of WEB BACKGROUND ORGAN MUSIC TAPES now, with 102 and follow it up with each future release.

\$9.85 ppd.

At leading electronic, department, music or record stores. If not available in your locality, we will ship postpaid on receipt of remittance. (NYC, please add 3% tax.)

WEB MUSIC PUBLISHING CO.
149 W. 48th St., New York 36, N. Y.

SPLICES MAGNETIC TAPE

Neatly - Quickly - Easily

Kit includes plastic splicer which adheres to recorder or worktable, generous supply of pre-cut tape splicing tabs, handy blade, instructions and plastic case. Only \$1.50 postpaid. If your dealer can't supply you, order from

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FOLKWAYS RECORDS

World's Largest Producer of Authentic Folk Music on Records
Announces new releases now available on tape.

Write for free catalog to:

FOLKWAYS RECORDS & SERVICE CORP.
117 West 46th Street, New York, N. Y.



NEW

LOW PRICE on Irish Professional #211 Plastic Tape!

- 1200 ft. Reel 3.30 NET
- 2400 ft. Reel 7.71 NET

ALSO 5 OTHER NATIONALLY FAMOUS BRANDS IN STOCK.

New empty plastic reels in boxes for easy labeling. 3" 10c; 4" 22c; 5" 24c; 7" 29c; 7" Professional reel (2¼" hub) 39c ea. EMPTY BOXES: 3" 3c; 4" 5c; 5" 5c; 7" 10c ea.

We carry all brands of new tape, recording blanks, tape recorders, etc. PLEASE INCLUDE SUFFICIENT POSTAGE.

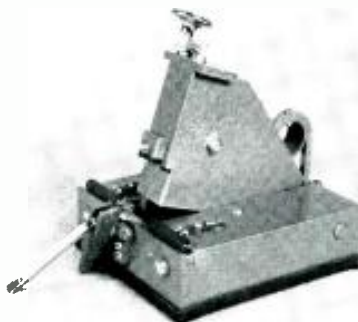
COMMISSIONED ELECTRONICS CO.
2503 Champlain St., N.W., Washington 9, D.C.

MITCHELL RECORDER



Mitchell Manufacturing Company, 2525 Clybourn Avenue, Chicago is manufacturing the Mitchell, a low cost portable recorder that features a 6 inch speaker, 50 kilocycle erase oscillator and is said to be essentially flat from 60 to 10,000 cps. The recorder is dual track and will take a seven inch reel. Rewinding of the 7 inch reel is accomplished in 90 seconds. The power output is two watts. It has two inputs, one for mike and one for radio-phonos. Provision is also made for connecting an external speaker or amplifier. The weight is 18 pounds and the price is \$139.95.

AUTOMATIC SPLICER



A completely automatic splicer which cuts, applies the splicing tape and trims the splice has been announced by F. Reiter Company, 3340 Bonnie Hill Drive, Hollywood 28, Cal. The splicer takes only three operations to make a complete splice: 1—the tape is inserted in the channel, 2—it is cut by pulling the carboly cutting wheel across the tape, 3—press down on the knob which causes the mechanism to eject, apply, cut off and press into place the correct amount of splicing tape to make the joint. During the third operation a very small amount of magnetic tape is removed from one edge to prevent the tape from hanging up on the machine guides. The adhesive tape does not quite come to the other edge of the tape so there is no need to cut there. The entire tape path is non-magnetic. Full details from the company. Price is \$69.75.

DIMINUETTE SPEAKER



The Diminnette Speaker is a new product of the Permoflux Corporation, 4900 West Grand Avenue, Chicago 39, Ill. Dual 6 inch speakers deliver the bass while a super tweeter provides smooth highs for balanced high fidelity reproduction. It has been designed for small rooms and apartments and will deliver the sound at the proper listening level wherever it is placed. Due to the three speaker arrangement, low volume can be enjoyed with no sacrifice in the frequency range. May be used in pairs for binaural listening. It is 23½ inches wide, 11½ inches high and 12 inches deep. It is available in blonde or mahogany at \$49.50. Full details from Permoflux.

24 WATT AMPLIFIER



Allied Radio Corporation, 100 N. Western Avenue, Chicago 80, Ill. has announced the Golden Knight 24 watt High fidelity amplifier. Frequency response at 24 watts output is 20 to 40,000 cycles, plus or minus 0.75 db. Harmonic distortion is less than 1%. It has four inputs, one for magnetic cartridges, one for a high impedance microphone and the remaining two for tape recorder, radio tuner, etc. It has separate bass and treble controls calibrated from minus 16 db to plus 16 db. The amplifier complete with tubes is priced at \$79.50. For additional details including specifications and response curves write to Allied.

REEL THREADER

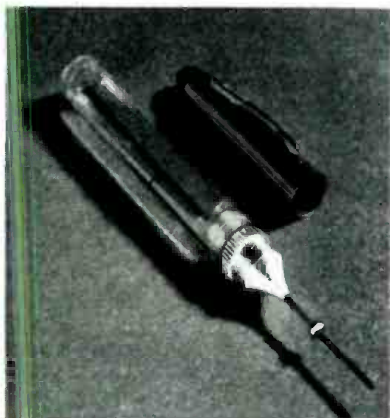
Flahan Sound Equipment Company, 7517 Pelham Drive, Parma 29, Ohio has just introduced a magnetic recording tape threader. The device holds the tape to the reel for the first few turns after which it can easily be removed or it may be left in position to serve as a crank. It will function on any size reel up to 7" and saves time and temper getting the tape started. It fits all makes and models of recorders which have standard reel spindles. The list price is \$98.

LAPEL MIKE



The Turner Company, 909 17th Street N.E., Cedar Rapids, Iowa is marketing the Model L-100 lapel microphone. The new crystal microphone weighs only one ounce without the cable. The frequency response is from 50 to 10,000 cycles per second. It is non-directional, is furnished with a 20 foot single conductor shielded cable. The case is light gray plastic with the red Turner seal. An exclusive rubber-padded clip permits the mike to be clipped anywhere and the cord always is straight down. List price is \$12.50. Model 100, without the clip lists for \$8.00. Full details from Turner.

PELL-I-CAN OILER



The Lofthouse Company, Box 832, Binghamton, New York is manufacturing the Pell-i-can oiler, a pen sized oiler with a long narrow beak suitable for applying oil to movie cameras, projectors, tape recorders, etc. It is easy to refill, leakproof and unbreakable in normal use. The price is \$1.49 postpaid.

"If you Tape for Fun"

DICK KENNY

(The Crazy Tapeworm)

41 Bank St., Stamford, Conn.

Invites tapespondence with anyone interested in swapping nonsense— weird—unusual and novel tapes 3¾—7½ dual.

DON'T WRITE—TAPESPOND

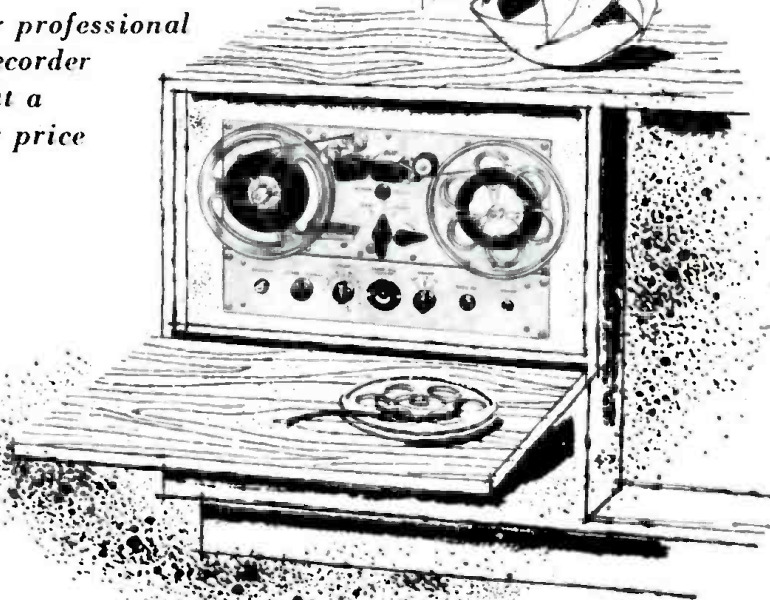
*there's tape recording
and there's*

Magnecording

Just listen . . . you'll realize immediately that the new M30 and M33 Magnecorders are unrivalled for sheer range and brilliance, yet they cost no more. For home, business, and school, you'll want the "old pro," the Magnecorder — the most widely used professional tape recorder in the world.

Your Magnecord dealer is listed in the classified telephone directory — see "recorders."

*the only professional
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MF-9

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the only tape recorder
that SURROUNDS
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High Fidelity
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Unique "Roving Speaker" Adds New Dimension to Sound!

Pentron offers this new listening thrill—the first tape recorder with true stereophonic sound. Separate roving tweeter adds musical realism and sparkling voice play-back. Mounted in the lid, this third speaker can be placed anywhere in the room. It supplements the 2 internal, matched speakers which give life and beauty to middle and bass tones.

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City _____ Zone _____ State _____

TAPES TO THE EDITOR

When sending tapes to the editor please use the 3" reel and indicate the speed at which it was recorded and whether it is dual or single track. We will listen to your tape, make notes from it for use in this column and then reply on your tape. Please keep tapes reasonably brief.

If you do not own a recorder a letter will be acceptable. Address tapes or letters to: The Editor, Film and TAPE RECORDING, Severna Park, Md.

To the Editor:

I note in the August issue, page 14, in reply to one of your readers you state, "about the only book on tape recording is the one "Magnetic Recording," by S. J. Begun.

I should like to remind you of our publication, *Fundamentals of Magnetic Recording*. This 44 page booklet with more than 40 illustrations gives a very readable explanation of how magnetic recording works and many fundamental suggestions on recording techniques. We have distributed well over 150,000 of these booklets and many readers have written us most enthusiastically about this publication. Single copies of the booklet are available on request without charge.—Bryce Haynes, Vice President, Audio Devices, 444 Madison Ave., New York, N. Y.

To the Editor:

Due to the incongruity of the terms "twin-track," "dual-track," "double-track," and "single-track," many of us prefer the terms "full-track" and "half-track." Magnetic uses this latter terminology. Many people, including dealers are not sure whether dual-track and such terms means that two separate tracks are recorded on either the top or bottom of the tape or whether the recording is twice the width of a half-track recording. Does "single-track" mean that the machine uses the full width of the tape in a single pass or half the tape at a time?—Paul M. Gerhard, Beverly, Mass.

To us single track means the machine records the full width of the tape in a single pass. The "full-track" and "half-track" terms are probably the least confusing but reader Gerhard and others will be glad to learn that the Magnetic Recording Industry Association to which most of the tape and recorder manufacturers belong, has set up a standards committee to look into engineering standards and will doubtless define terminology as well. Ed.

To the Editor:

I was very much interested in your story of the "CBS Night Watch" program described in your August issue.

In August of 1948, when I was General Manager of KONO in San Antonio, we inaugurated a show called "So You Want to Be a Cup!" Except for the change in locale, the "Night Watch" appears to be similar. We used a specially rebuilt 403 Brush, which was about all that was available at the time. We used low impedance mikes and a 200 foot cable reel.

Power was supplied by 24 volts of storage batteries and a Jannette Converter. And I can assure you there were plenty of headaches. All equipment was contained in a

station wagon operated by a police driver. An interviewer and an engineer also went along. Later we supplemented the equipment with a Minitape but on most calls the Western Electric "saltshaker" mike and the Brush did the best job. Using two-way and later 3-way police radio, the unit cruised the town on Friday and Saturday nights. The best stories were edited down into a 30 minute show and aired Sunday night at 9:00-9:30.

At its peak, Hooper ratings were in the high 30's which meant as high as 87% of the available audience. Over five years later when I bought my own station and left KONO, the show was still on the air and going strong.—Jack Pink, Owner/Manager KWCO, Chickasha, Okla.

To the Editor:

I would very much like to contact many of my American friends who were overseas in the last war and who worked on the LST's with me. It was chiefly Navy personnel and I would like to tape correspond with them.—Gordon Harris, Hartland, Milford Haven, S. Wales.

To the Editor:

I have been getting the issues of your magazine since it has been coming out and it is because of what you have been doing with your magazine that I have fallen in love with tape recording.

At the present time I am in the market for a machine that will both suit my budget and my requirements for a tape recorder.

Is there any way that an individual can have assurance of the quality of a machine before he makes the investment or must he rely on the word of the manufacturer?

I hope you can give me the answers to these questions as they would be very helpful. Thank you very much for your work in making the many new vistas of tape recording open to so many. Fredric S. Krupnick, Philadelphia, Pa.

Trying to tell a man which recorder to buy is a little like telling him which girl he should marry. While frequency response may vary from machine to machine of the same brand, reputable manufacturers will stick by their published figures. Another link in the chain is the dealer. If you purchase your machine from a reliable dealer he will see that you are satisfied with your purchase and that you get what you want. That's his business. You can conduct your own tests using test tapes and thus also be sure of the machine. However, we feel that if you buy a machine of a reputable make through a reliable dealer, you will have no worries. Ed.

QUESTIONS & ANSWERS

Questions for this department may be sent on tape or by means of a postcard or letter. Please address your queries to, "Questions and Answers," Film and TAPE RECORDING, Severna Park, Maryland. The most interesting and widely applicable questions will be used in this department and all inquiries will receive a tape or letter reply.

Q—Regarding the three-channel Mike Mixer in the February issue: is there any reason why this cannot be made a four or five channel mixer? Also, do you have any information in the way of a hook-up for a 4 channel mike mixer using transistors?

A—I am using a Pentron Mike Mixer with four #241-S Astatic Crystal mikes. The mixer has a 1 megohm resistor across the input of each channel but the Astatic instruction sheet advises the use of a 5 megohm resistor. The Ekotape recorder I have uses a 510,000 resistor across the mike input. What are your comments?—H. B., Philadelphia, Pa.

A—There is no reason why the mixer cannot be made with four or five channels. Should this be done the bridge divider resistor values would be different in proportion to the number of inputs.

We do not have a transistor hookup for a mixer. Regarding the resistors, the grid leak resistor value is not critical, in fact, the circuitry of the outfit and the tubes have more of an effect than the resistor. The grid input is a nominal value from 1/4 megohm to 5 megohms without noticeable effect, except in gain. It will have less gain for the lower value grid shunt.

Q—I have just become interested in tape recording and therefore know very little about it. I would like to have the following questions answered. My tape recorder lists the following: Power input—117 volts, 60 cycles, 110 watts, 1.25 amperes. Power output, 2.5 watts at 5% distortion, 400 cycles. Signal input for normal recording .02 volts RMS minimum. Frequency response, 60-4000 cycles. Speaker 5 x 7 oval, PM, 3.2 ohms impedance. As I do not know anything about electronics I would like to have the above translated for me.—A. L. G., Bronx, N. Y.

A—The power input tells you to use the machine on regular household current and that it draws a little more current than a 100 watt light bulb. The power output tells you how much energy is expended in producing the sound—how loud it will play without distortion. The 5% distortion means that at 400 cycles, which is about middle C on the piano, the sound of the note will be off no more than 5%. The signal input figures tell you how much power must be fed into the recorder to get a good recording. The frequency response almost covers the range of the piano and is adequate for voice but it is not high enough to record the overtones of instruments which will run to 10,000 cycles. The speaker figures give you the size and shape of the loudspeaker and the PM means a permanent magnet is used in the speaker. The impedance is the "resistance" of the voice coil of the speaker.

Q—Please tell me what steps I should take to have a tape recording transcribed to a disc recording. I recorded on my Webcor 210, dual track, 600 feet of tape at 3 3/4 ips. The whole recording lasts one hour when played back. There is voice, singing and music recorded. Could I have this recorded on a disc without leaving out any of it? Also, are there any tape lending libraries and how do they operate?—J. V. O., Lyons, N. J.

A—You can have your tapes transferred to discs by a number of firms, some of whom advertise in this magazine. Depending on the speed and type of disc you want, your one hour tape will have to be broken up into a number of "sides" however, none of it need be omitted.

There are a number of firms marketing pre-recorded tapes but there are no commercial tape libraries where you can borrow tapes as yet. A number of universities have tape libraries where, for a small fee, they will dupe a program on the tape you send in to them. This service is principally for the use of school teachers although some of them may accommodate individuals.

The only non-commercial tape library of which we know is that maintained by the Union Theological Seminary of Richmond, Va., who will lend tapes of sermons free of charge.

Q—I followed your instructions in the article "Recording Vocals with Piano" but still do not get good vocal recording results. What do you suggest can be done? I have difficulty recording a soft, weak, crooning-type voice well. Too much breath noise. Also, how can I give a voice that hasn't good tone quality a good recorded sound beside putting the tone control on bass? Can I use a filter or mike device to do this?—K. C., Buffalo, N. Y.

A—We would suggest that you have your singer work across the mike or secure a mike that has a blast filter or an acoustic grill over it. You might try putting a handkerchief over the mike you have. We're sorry but there is little to be done in the direction of making a good recording of a voice that doesn't have the necessary quality.

Q—Is it possible to record the music first on the tape and then record the voice over it?—B. K., Chicago, Ill.

A—It can be done provided the eraser head does not contact the tape or is shut off while the second recording is made. But this a poor way to do it. It is better to use a mixer and feed the voice and music in together so that you can control the volume of each and know what you are getting.

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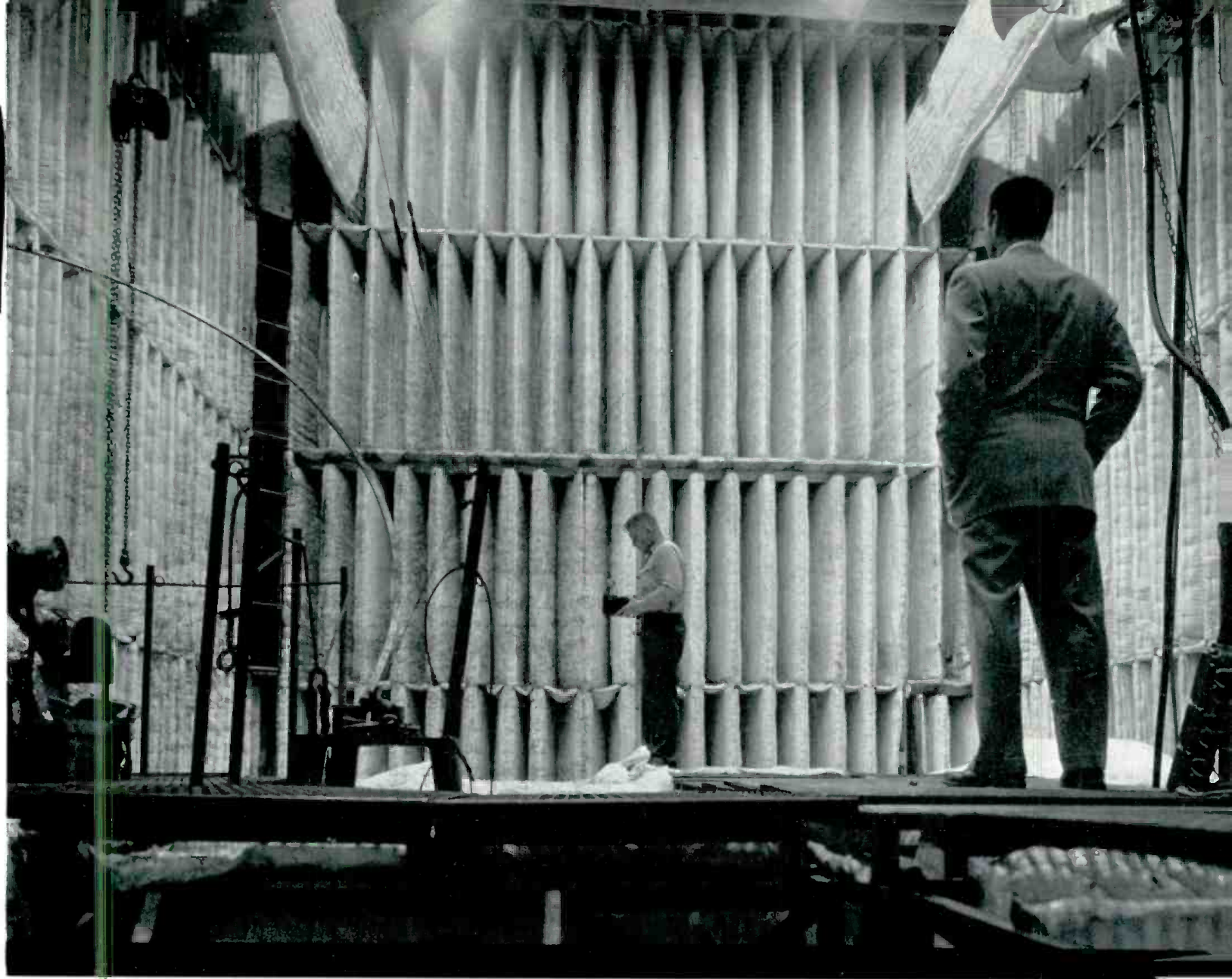
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RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION

CAMDEN, NEW JERSEY



SILENCE *is our business*

by Edward M. Herrmann

*Head, Acoustics Branch, Wave Mechanics Laboratory
U. S. Naval Experiment Station, Annapolis, Md.*

with Burton Davis

THE average tape recordist would find the laboratories of the Naval Engineering Experiment Station at Annapolis, Maryland a very fascinating place.

But we doubt that he would be in agreement with the fondest hopes of the engineers and physicists. Their dream of the perfect tape would be his nightmare . . . a tape, fully recorded—with absolute silence.

There is a good reason for the engineers' search for silence. Lives may depend upon it.

One of the most important characteristics of the modern submarine is that every piece of equipment, every moving part, every machinery component be as quiet as possible.

The slightest sound, transmitted into the surrounding water through the hull and picked up by the sensitive hydrophones of enemy warships in time of conflict, can bring depth charges crashing down on her to send her to the bottom towards a grim death for the crew.

In addition, every sound within the sub cripples the hearing ability of her own sound detection equipment, rendering her own destructive powers less efficient and per-

Above: the huge anechoic test chamber at the Naval Engineering Experiment Station at Annapolis, Maryland. Vertical wedges of fibrous-glass absorb all sound. The room measures 40' x 30' x 30'.



Photo by A. Aubrey Bodine

The U.S.S. Turbot a fully equipped submarine which is used for field tests. Note the booms erected over the deck from which the sensitive hydrophones are suspended for running tests. The sound they pick up is recorded on tape in the shack shown amidships.

haps permitting enemy submarines to slip unmolested into a convoy with disastrous results.

In many cases, the job of silencing submarine equipment begins with extensive test procedures at the Waves Mechanics Laboratory at the Station. Here, in a specially constructed building, technicians are constantly checking and rechecking to make Uncle Sam's undersea fleet the quietest and most efficient in the world.

Since outside noise could be carried into the building's test chambers by the structure itself, an especially non-sound-conductive building was erected. The walls are poured concrete, sixteen inches thick to bar all air-borne outside

noise from its interior. In the wall are "soft patches," brick sections which can be removed and replaced.

The inside walls are lined with vertically mounted fibrous glass wedges that serve as absorbers and baffles for all sound.

The floor is also specially constructed. It is independent of the walls and is based on pylons that go down 90 feet.

The test room, or anechoic chamber, to give it its proper name, is the "deadest" room that engineers know how to construct. The human voice has none of the resonance and timbre that is present in an ordinary room for all sounds are absorbed after they leave the source. There are no reflections or reverberations that would mar the tape recordings for the engineers want only the sound of the machine under test—and nothing else. A bathroom baritone would feel crushed and deflated should he attempt to sing in it.

Machinery to be tested is moved into the test room through large specially treated doors. The power source remains outside the anechoic chamber so that the only sound within will be made by the unit under test. Microphones are rigged to catch the noise and these are connected to tape recorders. In many cases, ordinary recorders are used but in some instances specially constructed recorders must be brought into play, such as the seven-channel Ampex machine that will record from 0 (DC.) to 50,000 cycles.

The engineers have found that tape reduces the actual testing time and by making an endless loop of the sound on tape, the sound can be run for hours, if necessary, to make a complete analysis.

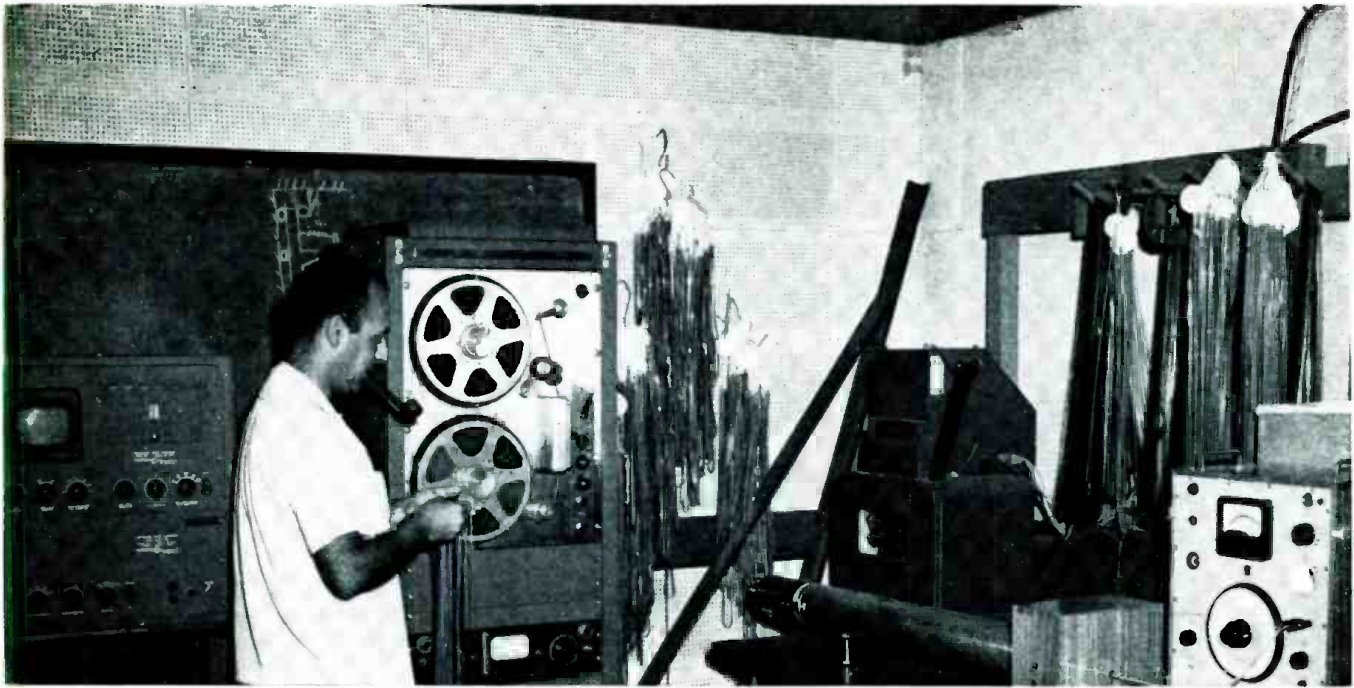
Without the tape, it would be necessary to run the test machine itself and make a direct analysis of the sounds. Since some projects require many hours of work, it would be necessary to operate the test machine during the entire period.

The use of tape recording equipment has allowed a more effective use of manpower by reducing the number of men



Official U. S. Navy Photo

Interior of the recording shack on the submarine. Magnecorders can be seen at the left of the picture while on the right is a sound analyzer for immediate analysis of sounds while the ship is underway. John Donald of the staff is operating the analyzer.



Official U. S. Navy Photo

The recording and playback room at the Station is used mainly for storage, editing and general recording. Each batch of endless tape loops is tagged and stored for future reference. On the bench at right is a sound absorption test instrument for testing materials.

We understand that commercial fishermen have found a use for this nuisance. By using a tape recorder and playing into the water the feeding sounds of schools of small fish, the larger fish are attracted and come swimming into their nets. Hydrophones with an amplifier can also be used to guide fishermen to schools of fish.

If you would like to try underwater recording, you can do it with your present equipment. Wrap your microphone in any thin waterproof material, such as Saran wrap or Pliofilm or thin sheet rubber. Be sure to seal with tape and shellac all joints in your wrapping. You can even get results by putting the mike in the toe of a rubber boot and

required to make a given set of recordings. For example, in one particularly intricate test on a reduction gear assembly, it is necessary to make seven recordings simultaneously. Prior to the installation of tape equipment, it required the services of seven men with disc recording equipment. With the seven-channel recorder only one man is required.

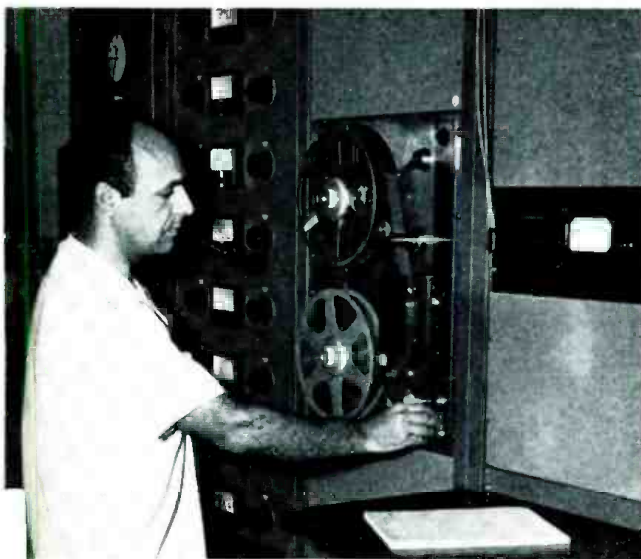
After the recordings are made they are analyzed by machines that present the noise in graphic form. Then the real work begins. Mechanical engineers and physicists must determine the reasons for the noise and figure out how to reduce it. Often it means structural changes in the machines themselves to get rid of resonances from gears or casings.

When the changes have been made, the units are returned to the lab and the whole process begins over again.

Moored near the acoustics laboratory is a full-size submarine the U.S.S. *Turbot* which is used as a field laboratory. Overhead booms are provided from which the sensitive hydrophones, or underwater microphones, are suspended in the water to pick up the sounds of the sub in actual operation. The output of the hydrophones is fed to recorders housed in a "shack" on the deck of the sub. As all the machinery is below waterline, there is no need for her to be run submerged.

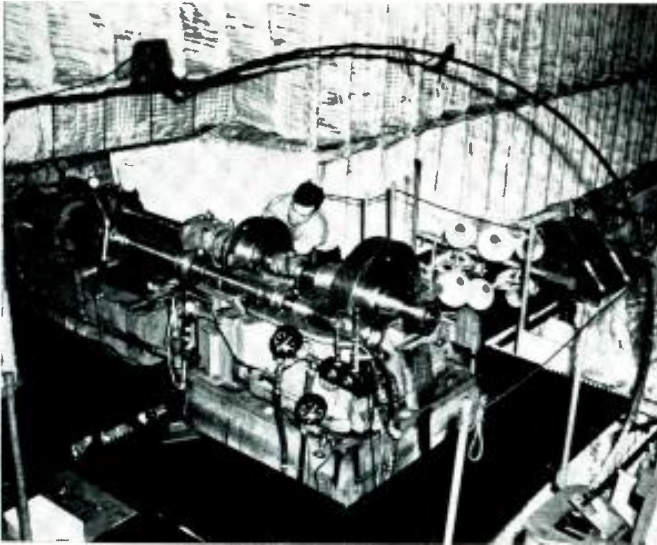
For years, fiction writers have been overworking the cliché "the cool, quiet depths of the ocean." On the coolness and the depth we will concede the point but the ocean and the bays are far from quiet.

It was with operating submarines that the fish interfered. It may come as a surprise to some folks to know that ocean-going fish are noisy—so noisy they actually impeded the sound tests. The croakers that feed along the oyster beds in the Chesapeake bay make grunting sounds, the tiny snapping shrimp sound like a multitude of the ratchet rattles used at Halloween and we have heard barkings and grunts emerge from the "quiet" depths.



Official U. S. Navy Photo

Larry Argiro, Supervisory Engineer, starts the seven-channel Ampex in operation. This machine uses one-inch wide tape and has seven separate recording and playback heads, each with its own amplifiers.



Official U. S. Navy Photo

A reduction gear undergoing tests in the lab. Tests are made at various loads and speeds to determine noise effect of materials. The recordings are made outside the test chamber. Structure-borne sounds are recorded through cable leading from front right corner of machine; air borne sounds by the mike on the arc shaped arm that swings over the unit during testing. Right: physicist Anne Slaven, head of the sound analysis group, operates the wave band analyzer that graphs the noises recorded on the tape loop.

putting it overside. While the results will not be as good as when using a hydrophone, made for the purpose, you will be able to pick up the sounds of boats, people diving or rowing. It seems the fish noises are limited to the ocean variety, which feed in schools. The solitary brook trout and other inland fishes are not known to make noises, although they probably do.

Because water is denser than the air, sound carries through it much better. You probably have had the experience, while swimming, of having someone click together two rocks underwater. You know how loud that sounded to your ears, yet the same sound when air-borne is nothing more than a click.

Due to the better carrying power of the sound in the water, your underwater microphone should pick up sounds from some distance away, especially rather loud noises such as are made by motorboats.

Submarine listening devices depend upon the water-borne sounds to alert the sub to other boats and, as we men-

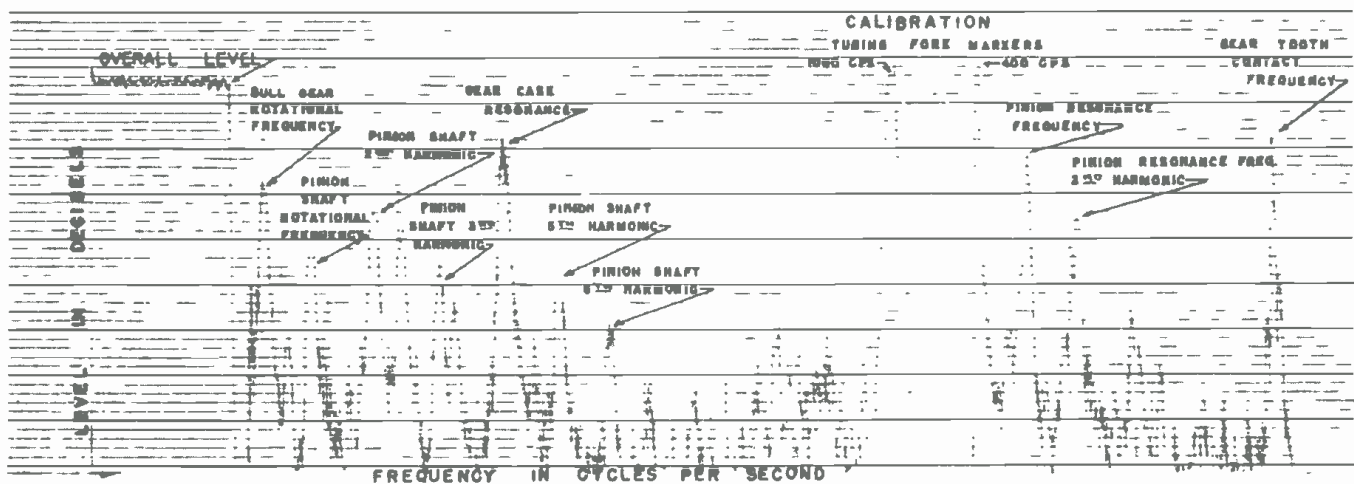
tioned before, any noise within the sub interferes with her own efficiency.

The Engineering Experiment Station just recently completed its 50th year of operation. It was set up in 1904 "to test the suitability of certain steam machinery for use in naval vessels." Since that time it has grown to be a \$12,000,000 plant with mechanical, electrical, metallurgical, chemical, internal combustion engine and wave mechanics (acoustics and vibration) laboratories all devoted to carrying out the station's engineering service to the fleet.

In the acoustics lab, the eternal search is for silence—silence that can save lives. The endless loops of tape that feed noise to the analyzers are a far cry from the founding father's original ideas of "testing certain steam machinery" but someday we hope to be able to come up with the perfect tape—a fully recorded loop of absolute quiet.

The opinions and assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department.

GEAR TEST NOISE



A chart drawn by the wave band analyzer looks like this. Peaks denote loudness of sound in db, while the frequency is indicated along the bottom of the chart. This chart not only reveals the fundamental frequencies and what causes them but the overtones, or harmonics, that also add to the noise level. The safety of a sub and her crew depends upon the silencing of machinery noise.



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THE GREAT DUB

by Mildred Stagg *New York Editor*

... when Les Paul and Mary Ford turned to tape they created new sounds that have taken them to the heights of success. Here, for the first time, are the methods they use.

WHEN you listen to a Les Paul-Mary Ford record you hear a voice and guitar in one to twenty part harmony with all the parts played by the same voice and guitar. As you know the voice belongs to Mary Ford, and the guitar is played by her husband, Les Paul. Les is the wizard who's responsible for the multiple harmony "new sound," an audio effect that has sold 2,500,000 copies of "Vaya Con Dios" and the sales record is still climbing.

The effortless sweetness of Mary's voice and the virtuoso performance of Les on guitar are the fundamental assets of the pair. To these, Les adds a thorough knowledge of sound techniques and the sum total equals enough records to reach the moon, no matter how high.

Right from the start the Les Paul-Mary Ford hits have been recorded on tape. Their tape recording equipment makes it unnecessary for them to leave their home in New Jersey in order to record in a New York studio. They simply adjourn to their garage—or kitchen—and record the song on tape.

The actual recording process is neither lengthy nor complicated. The most intricate arrangement is sometimes finished in less than an hour and a half. But the preparatory thinking that goes into an arrangement make take several hours of steady concentration and hard driving. Les does all the arranging and he thinks best behind the wheel of a car. While he rolls along he works out the individual harmonies

None of the arrangements is written! There's a reason for this omission. Les and Mary might be called musical illiterates. Neither can read music, to say nothing of writing it. The folk quality that permeates their records is authentic. They might be compared to Grandma Moses, they're genuine musical primitives.

But Les Paul *is* an expert on recording devices and tape. The unique sounds that characterize his recordings are the result of a keen musical ear and unique sound engineering. He uses two Ampex recorders nowadays when he makes a tape. However when Les and Mary made "How High The Moon," a classic that will probably sell forever, they owned only one portable recorder.

Their recorders are in the control room between the kitchen and the two studios. This glassed-in room enables Les to watch Mary when she's singing whether she's in one of the studios or baking a cake. They use standard microphones. There are four English mikes, one German, one RCA, one Altec and one Western Electric. Neither star has a favorite among the mikes. They pick whichever is handiest.

The tapes are all made at the same speed, 15 inches per second, on regular 1/4 inch tape. The studios are already very special but Les is constantly trying to improve them. There are double walls around each studio and no two walls are parallel. The ceilings are insulated against outside noises. One studio has a 15 foot ceiling while the other is twice the average room height. The larger studio is 50 by 35 while the smaller one is 30 feet square. In spite of all this special construction the studios aren't necessarily the best acoustically. An ordinary garage in the backyard was the setting for "All The World Is Waiting For The Sunrise" . . . "Nola" . . . "How High The Moon." Another million record seller, "Mocking Bird Hill," was recorded in the kitchen while Mary was cooking.

Mary doesn't cuddle up to the mike as crooners do for radio performances but she does work closer than she can in front of TV cameras. She crowds the mike when the sound is soft and backs off when she's singing louder. Les doesn't use a mike at all for his electric guitar. He goes right on the tape with the instrument.

The biggest Les Paul-Mary Ford seller to date, "Vaya Con Dios," is typical of the way they work. Mary wears ear-phones while a recording session is going on. Les doesn't need phones because he's in the control room and can hear her over a loud speaker. Mary has such a tremendous ear for musical harmony that she knows exactly what to do after she's heard the initial guitar background.

"Vaya" has seven parts in all. The first dub was made by Les playing his guitar in the control room. Mary then sang her first part into the mike. Then while she listened to a playing of the first two dubs together she added the third harmony while Les accompanied her on his guitar. The same harmony is repeated until all the harmony has been taped.

The echo chamber that has become almost a trademark on a Les Paul-Mary Ford record works this way. There's a real echo chamber carved out of the side of a mountain on their property. This room is hard surfaced and it has irregular walls. Its effect is somewhat like a tiled bathroom. It creates a hard echo that, in turn, produces an illusion of vast space. When Mary sings into the mike in the studio, the sound is fed into an amplifier. Wires pipe the expanded sound into the echo chamber. There the song is released at one end of the room and picked up by a mike at the far



Facing page: Mary Ford and Les Paul in their control room. Through the window can be seen one of the recording studios. Two Ampexes are used to produce the tapes later made into discs. Above: this shot, made by Mary Ford, shows hubby Les Paul hard at work making a recording. The guitar music is fed directly to the tape.

end. This echo is then wired back to the studio where Mary is singing. The time-lapse between the note that Mary is singing and the echo is controlled by large folding doors. See sketch.

Les mixes the echo with the live singing in the control room. After his initial guitar solo Les plays right along with Mary to keep the dubs at a minimum. Although he is the acknowledged master of the technique of multiple dubbing on tape, Les said that his ambition is to make a record with a single sound track. "That would be terrific," he declared fervently. "You lose some quality and definition with every succeeding dub no matter how careful you are. There's more noise from the repeated running of the tape and any flaw in your equipment is multiplied. For instance," he continued, "if there should be a slight dip in frequency it would hardly be noticed on a single track. But when that dip is repeated it multiplies in geometric progression. The same thing is true of any blurring or distortion."

Until some way can be found (and don't bet that Les won't find one) he intends to carry on with the multiple dub technique. The two recording machines do save them from redoing an entire tape when a mistake occurs. By recording one part on one machine and the next part on the other, they can go back just one dub if something goes wrong instead of ruining the whole tape.



Disc cutting equipment is also part of the studio gear. Here Mary Ford and Les Paul watch the cutting of a disc on the lathe.

In spite of their care and the special buildings and sound proofing, Les still has to cope with nature and nature abhors perfection as much as she does a vacuum. The echo chamber was dug out of the mountain in order to be as free as possible from outside interference. But every once in awhile they hear a foreign sound mixed in with Mary's voice and Les' guitar. That means one of two things, a bird or animal has gotten into the echo chamber or some of the workmen who are building the new studio in the garage have stopped to chat on top of the echo chamber. Then the part has to be sung and played again. But with a second recorder that's the full extent of the damage.

Les has a rather startling answer to make to the question of whether or not erasing affects the quality of a tape. Not only is he a staunch believer in the superiority of tape over

any other method of recording but he declared "It's always good to run the whole tape through before you make a recording. Then erase and start the music. The quality is improved by the initial erasure."

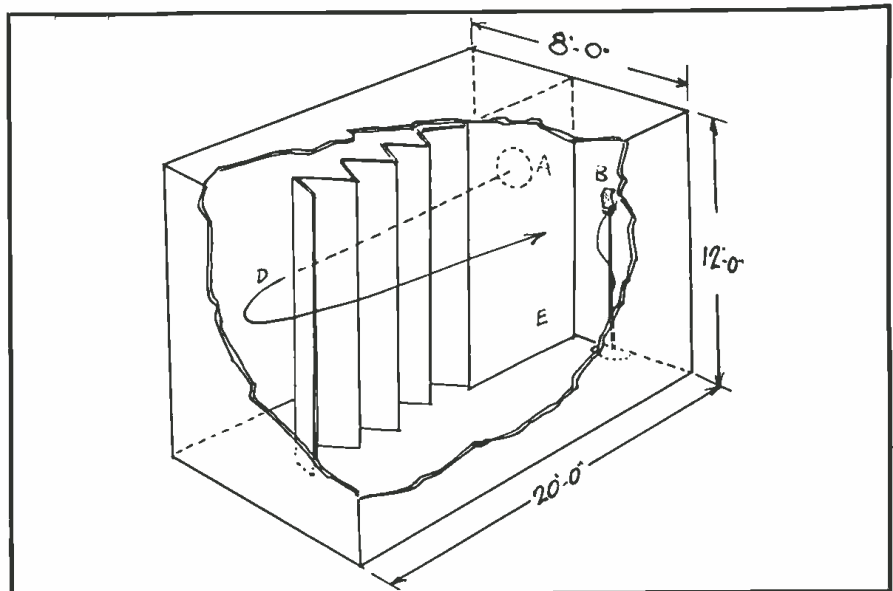
His interest in "new sound" didn't start with the technique that brought him fame. Les' first instrument was a harmonica. Before he'd learned to play many tunes on it he grew tired of the sound. He soaked it in a pail of water for a few hours before playing it. When he removed it, still dripping, he created his first new sound. This dripping rhythm antedated Shep Fields' rippling rhythm which was produced by bubbling water through a straw.

When Les had mastered the harmonica he added a guitar to his musical equipment. He became a one boy twosome by strapping the harmonica around his neck and playing it while he also fingered the guitar. By the time he teamed up with Mary Ford, professionally and matrimonially, he had already backed great names from Andrews to Crosby and earned a great name himself as a guitar player and accompanist. Dissatisfied with the way his guitar sounded on acetate records he began to study sound. He bought books on engineering, physics, electronics, recording and other audio phenomena. Soon his studies provided him with better apparatus for recording. He built a studio in his garage, made turntables from a couple of Cadillac fly wheels he found in a junkyard, and drove them with dental belts. Some of his inventions of that period are still being sold commercially.

When he first heard Mary's voice he knew just how to make the most of it. Then, with their records selling in the millions, he had to figure out how to simulate the sound of the numerous dubs in a live performance. He licked that problem too. Mary sings and Les plays a guitar on the stage. The orchestra adds other parts to the harmony and the result is as close as possible to the recording that was made in the basement, kitchen or studio. But they enjoy the shocked faces when the audience counts two people on the stage while hearing about a dozen. They also enjoy the comments. "It's done with a switch on the guitar. I saw her push it with my own eyes." "She had an operation on her vocal chords and it makes her sound that way." "They're not really playing at all. There's a phonograph off stage."

But live or on tape, Les Paul and Mary Ford have changed the meaning of the word "dub" from an insult to an art.

This specially built echo chamber, with a controllable time delay gives the faraway effect used in many numbers. The sound from the mike is fed to an amplifier and thence to the speaker in the chamber. After echoing from the walls, it is picked up by the mike and returned to the tape where it is mixed with the voice or guitar. The dimensions are shown on the sketch. The loudspeaker is at A and the microphone to pick up the reflected sound can be seen at B. The folding doors E control the length of the sound path D.



Recording Dramatic Skits

by L. L. Farkas

. . . the second part of a two-part article on recording your own shows. Here's a short script for you to try.

Example of one microphone being used for both sound effects and voice. Evelyn Jester speaks and also does the footwork to create the sound of footsteps on stairs. Sound man Otto Bond handles the door, crashes, hits and other sounds.

ONCE you know something about microphone technique you will want to apply its principles to the production and recording of a dramatic scene. To illustrate how this is done in practice, the following scene was prepared to include as many examples of the technique as possible.

MUSIC: FANFARE
ANNCR: Mysteries of the Air!
MUSIC: THEME UP, FADE FOR:
ANNCR: This week we present another thrilling mystery of the air . . . GHOSTS IN THE WOODS!

NARRATOR: It is night. (SOUND OF CRICKETS FADED IN) Way up on a bluff overlooking the lonely shores of Lake Kawonah stands an old dilapidated cabin. A dim light flickers inside its dismal walls and in one corner, across a battered table, two men are facing each other menacingly . . .

SOUND: CRICKETS UP; THEN FADE UNDER:
KARPIC: This is your last chance, Malen. Either you go my way or else . . .

MALEN: You can't scare me with threats. I didn't kill the old man and you know it.

KARPIC: Sure, that's fine; you didn't do it. You're going to tell 'em, just like that.

MALEN: I'll tell 'em all right; I'll let 'em know everything.

KARPIC: You won't have a chance because I'm going to prove that you did it.

MALEN: You wouldn't dare!

KARPIC: Wouldn't I? I'll bring 'em evidence, witnesses . . .

MALEN: You and your dirty hoodlums—

SOUND: POUNDING ON DOOR
KARPIC: (IN HARSH WHISPER) What's that?
MALEN: Ho! So now you're worried. Your conscience bothers you, eh? You're going—

KARPIC: Shut up, will you!



CBS Radio photo

MALEN: Oh, I've got to keep quiet to save that precious skin of yours? Well, you're singing a different tune now.

KARPIC: Another word out of you and I'll blow you wide open.

SOUND: POUNDING RESUMED (PAUSE).
HERBST: (THROUGH THE DOOR) Let me in.
KARPIC: (CALLS) Who's there?
HERBST: (STILL OFFMIKE) It's me, Herbst. Let me in, quick.

KARPIC: Open the door for him.

SOUND: FOOTSTEPS—DOOR IS OPENED.
HERBST: (CLOSER BUT STILL OFFMIKE) Karpic! What are you doing here?

KARPIC: Lock that door, Malen.

SOUND: DOOR IS CLOSED AND LOCKED.
KARPIC: Now you two, get over there against the wall.

HERBST: (ON MIKE) Say, what is this?
KARPIC: Shut up and get over there or I'll let you have it.

SOUND: FOOTSTEPS
HERBST: Good heavens! the old man.
KARPIC: Yep, it's the old man. And that's where you'll be if you and this fine pal of yours don't do what I say.

MALEN: You're going to regret this, Karpic.
KARPIC: Cut out the sermon. Now you two, pick him up. (PAUSE) Did you hear me? Pick him up.

SOUND: SOMETHING HEAVY LIFTED FROM FLOOR—GRUNTS FROM TWO MEN.

HERBST: If I'd thought for a moment—
 KARPIC: You haven't been asked to think. You, Malen, open that door. Make it snappy.

SOUND: DOOR SQUEAKS OPEN.
 MALEN: What's the idea?
 KARPIC: Get down those stairs.
 SOUND: MEN GOING DOWNSTAIRS—BRING HOLLOW SOUND IN.

HERBST: So you're going to hide the body! You know you can't get away with it.
 KARPIC: Can't I? You wouldn't want to kid me, would you? And come to think of it, I may have a few more things to hide before I get through. (SHARPLY) Put him down.

SOUND: HEAVY OBJECT AGAINST STONE FLOORING.
 KARPIC: Now get back against the wall.
 MALEN: Well, go on, why don't you shoot us?
 HERBST: Yea, what are you waiting for? Make a good job of it.

KARPIC: That's enough out of you two guys. I don't soil my hands on mugs.
 MALEN: No, you don't have the nerve.
 KARPIC: Nerve? Hahaha! We'll see about that. Just now though I'm going to take a little walk.

SOUND: FOOTSTEPS ON STAIRS.
 KARPIC: (FADING) I've never liked this place, too unhealthy.

HERBST: Run, get out of here, you white-livered rat.
 KARPIC: (SHOUTING DOWN) Sure, I'll get out; but you two are going to stay down there—until you rot. You'll soon be crawling and spitting out your life—just like the old man. Now laugh that one off. Hahaha—

SOUND: HEAVY DOOR CLOSED AND BARRED.
 KARPIC: (OFFMIKE) Hahahahaha — hahahahaha! (FADE INTO):
 MUSIC: BRIDGE

An examination of the script discloses that there are four elements in this scene: an announcer and narrator (who may be combined), a dramatic cast, sound effects, and music. To pick these up you may use one microphone, although two microphones will help to prevent crowding. If two units are used, one microphone serves for both the cast and the announcer, while the other can handle sound effects. The music can be supplied by a phonograph set close to one of the microphones, with one of the cast designated to set up the required records and also to adjust the volume of the player. These details should be set during rehearsal. Now, with the announcer and cast ready, the producer gives the signal and the recording session is on.

First comes the fanfare. The volume is boosted by the person handling the volume control of the record player so that we hear a solid blast of sound; then the volume is turned down quickly under the opening announcement. The announcer, standing about two feet away from the microphone and projecting his voice, makes the opening. ANNCR: Mysteries of the Air! The volume on the music is then brought up sharply to form a short crescendo and again pulled down, not com-

pletely but so that it remains just loud enough to be heard under the voice. At this point the announcer makes his introduction on mike in a crisp and declamatory style. And slightly before he says: "GHOSTS IN THE WOODS!" the music is faded out so that the title of the drama stands out.

For the narration the announcer moves closer to the microphone in order to produce a more intimate on-mike tone. And when he says: "It is night—," the sound of crickets, loud enough to be recognizable, is faded in as background for his voice. This effect can be rendered either by playing a record of night sounds or by several members of the cast imitating crickets by whistling through their teeth while maintaining off-mike positions of different distances. At the end of the narration the sound of these crickets is brought up to establish the scene, then it is faded once more under the ensuing dialogue. When this is done carefully, the sound will create a picture of dismal surroundings in the minds of your listeners and thus set the mood for the play.

The action begins with Karpic and Malen both talking in the normal on-mike position and they continue thus until they hear the pounding on the door. As this noise should create the impression of being at some distance from our characters, either the control on the microphone used for sound effects is kept closed or a door in the far portion of the room is used. This produces a distant off-mike effect. Karpic now drops his voice and speaks in a whisper; Malen still uses his normal tone. This goes on for the following lines:

KARPIC: (IN HARSH WHISPER) What's that?
 MALEN: Ho! So now you're worried. Your conscience bothers you, eh? You're going—
 KARPIC: Shut up, will you!
 MALEN: Oh, I've got to keep quiet to save that precious skin of yours? Well, you're singing a different tune now.

In order to give the listeners the impression of a man whispering, Karpic must be quite close to the microphone. He prevents distortion by speaking across the face of the microphone from the side. At the same time, he introduces harshness into his voice by forcing a large amount of air through his lips as he speaks.

The pounding on the door is resumed, followed by a pause. In this pause the outdoor sounds may be brought up momentarily to set the scene more strongly and also to heighten the suspense. The dialogue then goes on as follows:

SOUND: POUNDING RESUMED (PAUSE).
 HERBST: (THROUGH THE DOOR) Let me in.
 KARPIC: (CALLS) Who's there?
 HERBST: (STILL OFF MIKE) It's me, Herbst. Let me in, quick.
 KARPIC: Open the door for him.
 SOUND: FOOTSTEPS—DOOR IS OPENED.

In the above excerpt, Herbst is supposed to be shouting from outside the cabin door. He produces the effect by holding his script about six inches in front of his mouth as he stands four feet from the cast microphone. His voice should be raised only slightly; the illusion is completed by the projection in his tone. Karpic's answer is made in a loud voice. He prevents distortion either by directing his lines to one side of the microphone, or by leaning back as he speaks. This will produce an "on mike" shout. When he tells Malen

to open the door, he drops his voice back to a conversational level. The sound effect man then brings in the sound of footsteps and that of a door opening by turning on the control of the microphone set close to these effects.

As previously explained, the perspective of the various elements—sounds and voices—are set during the rehearsal. The usual method is to keep the main character "on mike" while the other actors and sounds will shift in perspective as they move toward or away from him. If we assume that Karpic is our main character, then Malen's footsteps should fade as he goes toward the door and the door opening should be slightly "off mike."

However, in these changes of perspective, common sense plays an important part. If the action takes place in a small room, a door opened anywhere in the room cannot possibly sound very distant. Here again sounds and voices must be reproduced in a way that intelligently fits the illusioned scene.

As soon as Malen opens the door, the outdoor sounds should be brought up, for they would become louder in reality. Herbst enters and, as he is still some distance away from Karpic when he first speaks, he must produce this effect by remaining at this original distance of four feet from the microphone; but this time, his script is not held in front of his mouth. He projects slightly to deliver his lines.

HERBST: (CLOSER BUT STILL OFFMIKE) Karpic! What are you doing here?

KARPIC: Lock that door, Malen.

SOUND: DOOR IS CLOSED AND LOCKED.

KARPIC: Now you two, get over there against the wall.

HERBST: (OFF MIKE) Say, what is this?

KARPIC: Shut up and get over there or I'll let you have it.

Here the sound of footsteps should be in close to create the impression of a person walking toward the main character. Herbst's next words must then be "on mike."

HERBST: Good Heavens! the old man.

KARPIC: Yep, it's the old man. And that's where you'll be if you and this fine pal of yours don't do what I say.

MAIEN: You're going to regret this, Karpic.

KARPIC: Cut out the sermon. Now you two, pick him up. (PAUSE) Did you hear me? Pick him up.

SOUND: SOMETHING HEAVY LIFTED FROM FLOOR—GRUNTS FROM TWO MEN.

HERBST: If I thought for a moment—

KARPIC: You haven't been asked to think. You, Malen, open that door. Make it snappy.

SOUND: DOOR SQUEAKS OPEN

MALEN: What's the idea?

KARPIC: Get down those stairs.

SOUND: MEN GOING DOWNSTAIRS—BRING HOLLOW SOUND IN.

As Malen and Herbst pick up the body, the actor handling the sound should make shuffling noises which the two men accompany by grunts. Then as they carry the old man, they must talk haltingly, catching their breath. Their footsteps should be fairly heavy. All sounds and voices should remain on mike.

A squeak is introduced during the door opening to differentiate it from the other door leading into the cabin. The

squeak can be made by rotating a tapered plug into a tight fitting hole in a piece of hardwood. When the men go down the stairs a hollow effect can be inserted by having the men speak partially into tall glasses which they hold so that the open end faces the microphone. The same can be done for the sound. This will make the voices and sound reverberate as they might in a deep and narrow cellar. The performers can make this effect even more realistic by working slightly away from the microphone, raising their voices, and using some projection. They should also supplement the script with ad lib comments such as: "Take it easy" . . . "Hold it!" . . . as well as heaves and grunts that fit their actions.

Once the actors reach the cellar, all voices remain on mike until Karpic says:

KARPIC: Nerve? Hahaha! We'll see about that. Just now though I'm going to take a little walk.

SOUND: FOOTSTEPS ON STAIRS.

KARPIC: (FADING) I've never liked this place, too unhealthy.

After the word "walk," footsteps should come in as indicated, but this time, instead of remaining "on mike," they start to fade. Since the main character is now the one making an exit, it is more effective in this particular scene to have him change his position in relation to the two men who stay "on mike." When Karpic speaks, he must give the impression that he is standing at the top of the cellar stairs. To do this he stands from five to six feet away from the microphone.

KARPIC: (SHOUTING DOWN) Sure, I'll get out; but you two are going to stay down there—until you rot. You'll soon be crawling and spitting out your life—just like the old man. Now laugh that one off. Hahaha—

Karpic may give an "off mike" quality to his voice by speaking from the dead side of the microphone. Whatever position he does use however should be set before the show goes on the air to insure maximum intelligibility of his words. Now for the end of the scene . . .

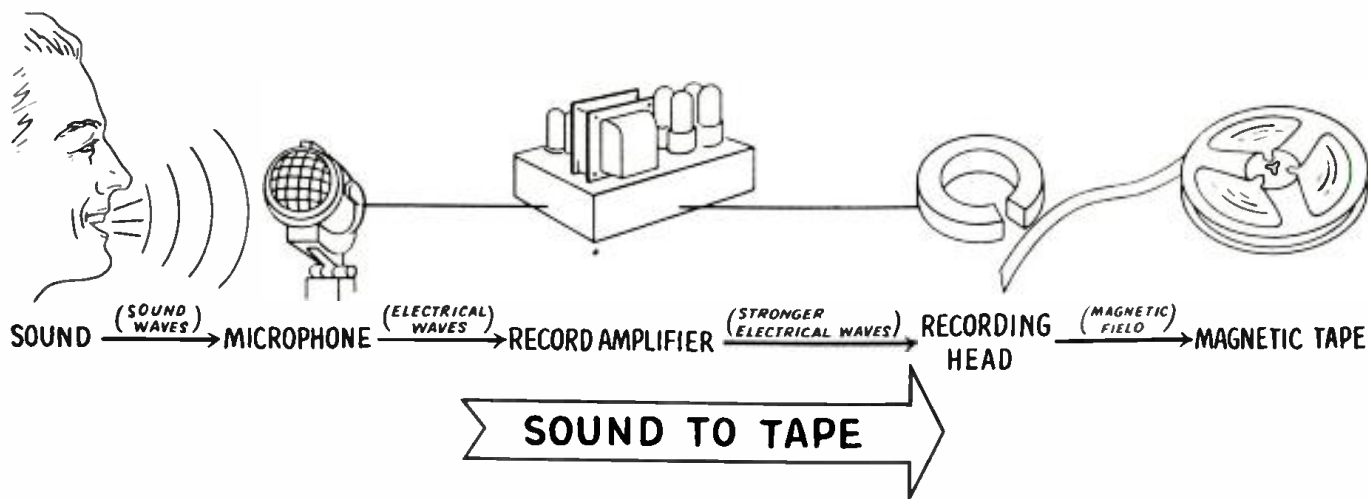
SOUND: HEAVY DOOR CLOSED AND BARRED.

KARPIC: (OFF MIKE) Hahahahaha — hahahahaha! (FADE INTO:)

MUSIC: BRIDGE.

The door is closed "off mike" as Karpic laughs. As soon as this is done, the laughter becomes muffled. The actor does this by putting his hand or script in front of his mouth. The final fade can then be made either by the actor moving away from the microphone or by slowly closing the control of the cast microphone. Both methods are equally effective so it will be up to you to decide, depending of course on the equipment available, which one to use. Then, as the laughter fades, bring in the music, swelling it until it covers all other sounds to form a bridge to the next scene of the show.

This of course is a very brief and incomplete example of how a dramatic scene is re-enacted for recording, but it does contain the main points of microphone technique in direct application. With a little practice you should have no difficulty in applying this technique to your own productions and thus be well on your way toward obtaining satisfactory recordings of any type of dramatic skit.



How Your Recorder Works

by
Ronald Anderson

... a knowledge of the "how" of tape recording can help you get better results.

"YOU push the button, we do the rest" was a slogan that helped make photography a national pastime. It made photographers—of one sort or another—of an entire nation.

Yet a number of amateur photographers were not content to be mere "button pushers," and as a result, started the still-growing cult of darkroom addicts and accessory bugs that have turned amateur photography into a challenging, but highly rewarding hobby.

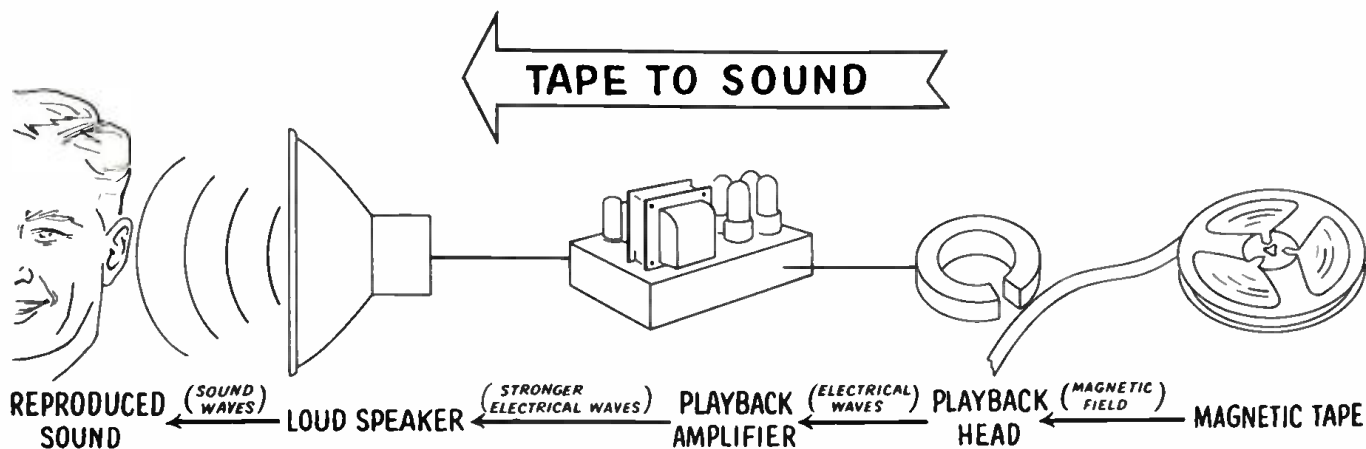
Tape recording, as such, might well be regarded as the "button pusher's delight." By the very nature of the tape recording process, as well as the manufacturer's efforts to make recording as simple as possible, it has appealed to a large number of people. No matter how inexperienced or inept the tape recorder operator may be, chances are he'll

come up with acceptable sound on his tape. He "pushes the button, the tape recorder does the rest."

But as the tape fan develops his ear and compares his tapes with those of other amateurs or with the results of the professionals, he invariably seeks to improve his technique.

And just as the camera fan soon improves his pictures by learning what happens when he clicks the shutter, the tape fan learns how to get the most out of his recorder when he learns how it works.

Many highly technical magazine articles and some books have been written on the principles and theories of magnetic recording. Physicists and engineers still are not in complete agreement on some of the finer points. To thoroughly understand the technical phase of tape recording requires a considerable amount of prior knowledge and experience in



electricity and magnetism. However, the basic principles are not too difficult to understand.

SOUND WAVES INTO ELECTRICAL WAVES

First, a word about the nature of sound. As discussed in the first two issues of *MAGNETIC FILM AND TAPE RECORDING* (Full Range Recording, by Harold D. Weiler), sound travels through the air in waves, or surges of energy.

A sound wave, and electrical wave, too, can be diagrammed in terms of amplitude, or height, of the wave and the number of times it repeats itself in a second as in Figure 1. The height of a sound wave determines the intensity, or loudness of a sound, while the number of complete wave cycles per second determines the pitch of a sound. The more wave cycles per second, the higher the pitch.

Intensity of a sound wave is measured in decibels (db's) while intensity of an electrical wave is measured in terms of voltage. The number of waves per second—the frequency of the wave—is measured in terms of cycles per second (cps) in the case of both sound and electricity.

A low-pitched tone, for example, causes the air to vibrate slowly—perhaps only 30 times a second. The frequency of the tone is therefore 30 cps.

When the vibrating air waves reach the sensitive diaphragm in a microphone (or in the human ear), they cause it to vibrate at the same frequency—30 times a second. As the diaphragm moves in, it creates a positive current, and as it moves out, it creates a negative current, or vice versa. In this way, the microphone "translates" the 30 cps sound wave into a 30 cps electrical wave called an audio frequency—a wave of current which alternates from positive to negative and back to positive 30 times a second.

The intensity of the sound wave's vibrations are also faithfully reproduced in terms of voltage or current. The microphone translates a loud sound into a strong current, while a softer sound results in a weaker current.

ELECTRICAL WAVES INTO MAGNETIC PATTERNS

The electrical waves of alternating current go from the microphone through several stages of amplification and then into the recording head, which is actually an electromagnet.

An electromagnet is made by wrapping a metal bar with wire to form a coil. When current flows through the wire, the bar becomes a magnet. One end, or pole, of the bar is a north pole. The other end is a south pole. If the direction of the current flow changes, the polarity of the electromagnet is reversed.

Around any magnet is an area of magnetic attraction, or "field," which is illustrated in a diagram in terms of lines of magnetic attraction. The more closely spaced are the lines, the stronger the magnetic attraction. These lines of magnetic force also have direction. Physicists have arbitrarily agreed that they go from north to south outside the magnet, then complete their circuit by going from south to north inside the magnet.

In the case of the recording head, the bar is bent into a circular shape with the poles almost touching—as little as .00025", or 1/4-mil, apart. This distance is referred to as the "gap" of the head.

Unlike a permanent magnet, or the oxide on the tape itself, which is made from a magnetically "hard" material so it will hold its magnetism for an indefinite period of time, the core of the recording head is magnetically "soft." There-

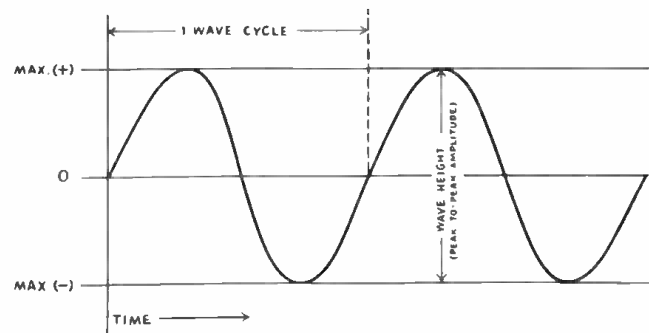


Figure 1. Both sound and alternating current waves are diagrammed as shown above. The number of wave cycles per second is referred to as the frequency in cycles per second. In the case of sound, or audio waves, the frequency determines the pitch. In electricity, it is the frequency at which the current alternates. The height of the sound wave on the chart shows the loudness or intensity of the sound. If an electrical wave is diagrammed, the height indicates the voltage or current.

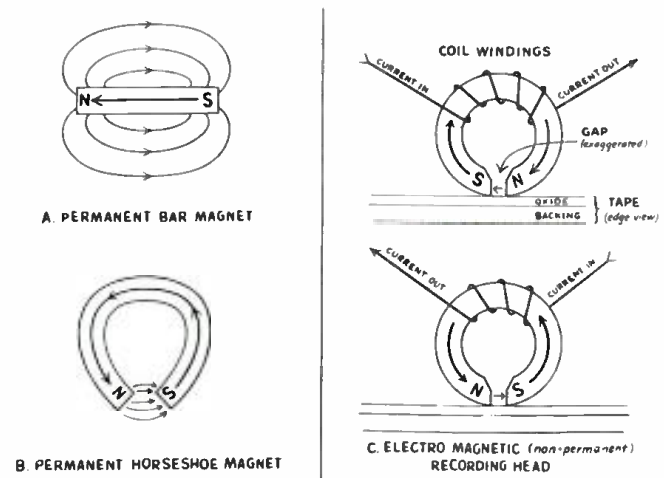


Figure 2. The arrangement of flux, or magnetic, lines in a permanent bar magnet are shown at A. Note that here, as in any magnet, the field points from south to north inside the magnet and points from north to south outside. At B the flux lines around a permanent horseshoe magnet are shown. Recording heads do not use permanent magnets but electromagnets which have no magnetic force except when a current is flowing through the coil. Top view at C shows the polarity of the magnet when the current is positive, while bottom view shows how polarity reverses when current is negative, or vice versa.



Figure 3. A greatly enlarged section of a recorded magnetic tape showing how the varying audio currents produced in the recording head have created tiny magnets in the tape coating. These magnets when run past the playback head will induce in the head coil a current that corresponds to the original current that created them during recording. The magnetic patterns are not visible to the naked eye.

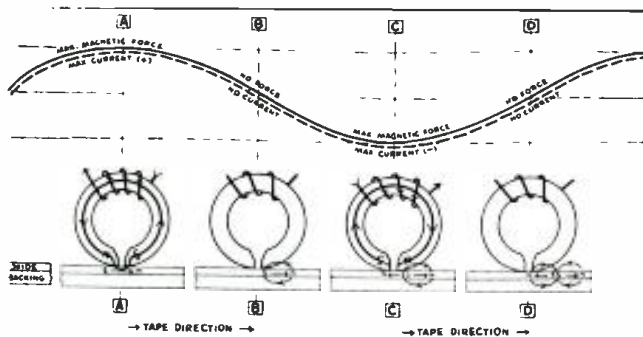


Figure 4. What happens when you record. The graph and sketches show the strength of the current and the magnetic force generated in the head as the tape moves along. The solid line in the graph represents the magnetic force while the broken line shows the current. Note that when the current is greatest the magnetic force is likewise at maximum. When the current drops, the magnetic force likewise becomes weaker. The alternation of the current changes the polarity of the head with each alternation as is shown.

fore it becomes magnetized easily and instantly when current flows into the coil, but—just as rapidly—loses its magnetism when the current stops.

A relatively strong current produces a relatively strong magnetic field, while a weaker current results in a correspondingly weaker field. Similarly, a high frequency (rapidly alternating) current causes each pole of the electromagnet to change through one complete cycle in polarity from north to south and back to north very rapidly, while a low frequency (slowly alternating) current causes the polarity to change more slowly.

Whenever a surge of positive current from the microphone goes through the coil, it magnetizes the recording head in one direction. When the current alternates and sends a surge of negative current into the coil in the opposite direction, the head is magnetized in the opposite direction. The polarity of the magnetized head must change with each alternation of current.

When the iron-oxide-coated tape is in contact with the recording head, it offers an easier path for the magnetic lines of force to follow, than does the air gap. Therefore, most of the magnetism gets across the gap by flowing through the iron-oxide-coated tape.

While the magnetically "soft" iron ring of the electromagnet loses its magnetism when the current stops, the magnetically "hard" coating on the tape retains its magnetism and the magnetized area becomes a small bar magnet itself. Because the lines of force left inside the tape point in one direction, that direction must necessarily be north. The other end, therefore, becomes south. This is shown in Figure 4 at A.

At B, the current entering the coil is zero at its point of alternation and consequently, does not create a magnetic field at that time. As a result, the tape moves a fraction of an inch without being magnetized any further.

However at C, when a surge of negative current comes into the coil, a magnetic field in the opposite direction is set up, causing the polarity of the electromagnet to reverse itself.

Again the lines of magnetic force at the poles find it easier to flow through the iron-oxide-coated tape than across the air gap, and again the tape is permanently magnetized, but this time, in the opposite direction.

At D, the tape has again moved, but since the current is

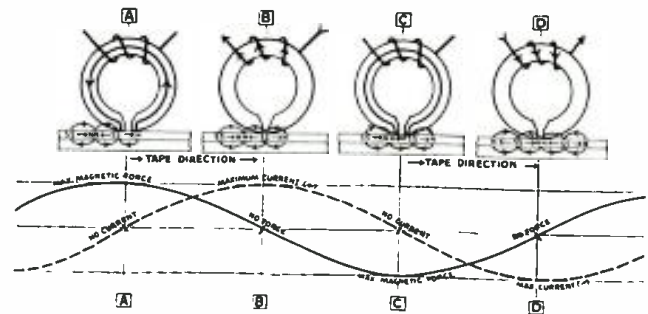


Figure 5. What happens on playback. Here the recorded tape moves past the playback head. The changing polarity in the magnetic patterns on the tape induce a current in the coil. This is fed to the amplifier and the amplified current is then fed to the speaker. Note that current is produced only when the magnetic field changes. The maximum magnetic force produces no current but as the force falls away toward zero maximum current is produced. This causes the current to be 90° out of phase with the magnetic force.

not flowing, no new lines of force are set up at that point.

As a result, the surges of alternating current leave the tape permanently magnetized by setting up a series of flux lines of opposite polarity, creating a series of bar magnets on the tape.

Because the tape is moving, the poles occur at recurring intervals along the tape, in a definite pattern. The frequency at which the current alternates, and the speed at which the tape moves, determines the distance between poles, while the strength of the current, or voltage, determines the magnetic strength of each pole.

As a result, when the 30 cps note reaches the recording head as 30 cps alternating current, it causes the polarity of the electromagnet to change from north to south to north 30 times a second.

The magnetic pattern on the tape therefore consists of 30 magnetic fields pointing toward south, alternated with 30 magnetic fields pointing toward north.

In effect, the oxide coating of the tape is broken up into 60 individual bar magnets, laid end to end, every second the tape moves across the gap. On a tape recorder operating at $7\frac{1}{2}$ inches per second, the 60 bar magnet patterns would cover a space of $7\frac{1}{2}$ inches on the tape. A 100 cps note would be represented on the tape as 200 such magnetic patterns in the same space of $7\frac{1}{2}$ inches.

The above is true only in the case of a steady tone. If the pitch changes, the magnetic pattern changes, as is true in normal recording. Some of the actual magnetic patterns on tape can be made visible by a simple process. A short piece of recorded tape is dipped in a solution of lighter fluid and carbonyl iron, then allowed to dry. As the lighter fluid evaporates, the very fine particles of carbonyl iron will remain magnetically attracted to the tape in definite patterns visible to the naked eye, although much more definitive through a microscope.

The heavily magnetized intervals on the tape—the poles—attract the most carbonyl iron particles and will appear as narrow lines across the tape. The stronger the pole, the heavier the line. The lower the frequency of the current, the greater distance between lines. The actual wave length of the original tone is equal to twice the distance between the lines.

Since sounds, other than a constant tone, are composed of

a series of shorter sounds—each with a different pitch and intensity—the magnetic pattern on a recorded tape shows a wide range of variation in both these dimensions. One of the most significant advantages of recording on tape is the ability of the tape to handle this wide range of sounds.

In summary, then, sound waves pulsate through the air, and cause the diaphragm in the microphone to vibrate accordingly. This produces corresponding electrical pulsations in the microphone which are boosted in strength by an amplifier. The amplified pulsations are then fed into the recording head where corresponding magnetic fields are created, which, in turn, leave their magnetic patterns on the tape.

PLAYBACK—MAGNETIC PATTERNS BACK INTO ELECTRICAL WAVES

In playing back a recorded tape, the recording process is more or less repeated, only in reverse. During the recording process, an electric current in a coil was used to create a magnetic field. In playback, a magnetic field moved through a coil is used to create an electric current.

A basic principle in electricity is that a surge of electrical current can be generated by moving a bar magnet (or its surrounding magnetic field) through a coil. By moving a series of magnets (or their fields) through a coil, a series of electrical currents will be produced. In the recording process, the tape was figuratively broken up into just such a series of short, permanent bar magnets.

What actually produces the current is the change in the magnetic field from positive to negative, or vice versa. The peak surge of current comes at the moment the polarity of the field is changing most rapidly. At the point where the polarity of the head is reversing, however, maximum current is produced.

In the playback process, the bar magnets on the tape are not actually moved through the coil of the electromagnet. Part of the magnetic field of each, however, is. What happens is that the iron ring of the electromagnet playback head temporarily routes the bar magnet's field through the coil.

In Figure No. 5 at A, it can be seen that a north pole and a south pole are on either side of the gap. Normally the lines of magnetic force stay close to the tape, but because it is easier for the magnetic field to follow the iron ring (a much better conductor) than jump the air space at the gap, it does just exactly that.

At A, therefore, the magnetic force in the head is maximum, but current is zero.

When the tape has moved a fraction of an inch farther, as at B, a strongly magnetized line—a south pole—this time is at the gap. The iron ring of the electro magnet serves no useful purpose to the field, so it ignores it, and magnetic strength in the head is reduced to zero. However since this is the point where polarity of the head changes most rapidly, maximum current is produced.

But at C, the situation again occurs where one pole is on one side of the gap, and an opposite pole on the other. As

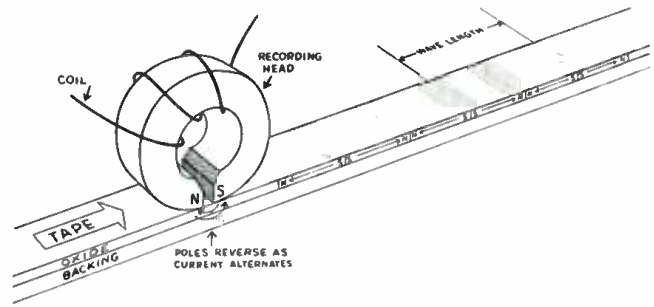


Figure 6. This shows in greatly exaggerated form how the bar magnets are laid down on the tape as it passes the head. The wave length of the sound can be measured as shown on the diagram. Note also the arrangement of the magnetic poles of the signal pattern.

in A, the magnetic field again takes the easiest route and flows through the soft iron ring, again causing maximum magnetic strength in the head, but no current, since this is the point of alternation in the current wave from positive to negative.

At D, polarity of the head is again at the point of reversal, and consequently this sudden change in magnetic force results in the maximum surge of current. Since the surges of current alternate between positive and negative with the same frequency as that which was recorded on the tape, they can be amplified and fed into a loudspeaker to once again produce the original sounds.

Those who are not very familiar with the behavior of electricity can find this current vs. magnetic force quite confusing. But a little study will quickly set things right.

As shown by the chart, the maximum current is created *only* when the magnetic force is *changing direction*. The maximum magnetic force flowing through the head from the tape creates no current because there is no change. It is the sudden switch from full magnetic force to zero and then back again in the opposite direction that starts the current flowing in the coil wires.

Engineers call this current 90° out of phase because the current and force do not match. During recording, the magnetic force and the current which provides it are in phase as the curves show. But on the playback, where the motion of the magnetic force must create the current, the shift in phase takes place.

Once you understand the theory you can see how it affects practical results. Dirty heads impede the flow of the magnetic force, lowering the current and giving poor results. Worn heads may increase the gap width, allowing one of the bar magnets on the tape to fall short of producing the maximum current flow, or allowing the magnetic head to span several at once.

This, then, is a basic explanation of the mechanics of recording an audio frequency on magnetic tape. No attempt has been made to cover other factors such as bias, transfer characteristics, or gap length in a magnetic recording system. It should, however, serve as a starting point for the tape hobbyist in understanding how the tape recording process works.



This is an actual photograph of the magnetic patterns made visible through the use of the carbonyl iron solution described in the text.

NEW PRODUCT REPORT

STAOKSTED

Product: FME Recorder Model 37-B

Price: \$139.95

Manufacturer: Federal Manufacturing and Engineering Corp., Brooklyn 5, N. Y.



THE FME RECORDER

... has provision for foot control for dictation,
two speed, dual track

THE FME recorder is a moderately priced portable with a 5 x 7 inch elliptical speaker that provides 4 watts of power under 5% distortion.

One of the features which we liked is the quick stop lever, to be found at the left of the control panel. This may be operated manually or with an accessory foot switch.

The quick start and stop provides an instant break in recording and when the lever is released the recording is resumed without clicks and with a surprisingly small amount of wow.

Both $3\frac{3}{4}$ and $7\frac{1}{2}$ inch per second speeds are provided. The speed change is effected by turning the small knob at the top of the case. The recorder is dual track using reel turnover, as in most recorders.

The frequency response at $7\frac{1}{2}$ inches per second fullfills the "A" program

requirements and the signal to noise ratio is satisfactory within the above mentioned program areas.

While all controls are grouped very conveniently, we found the control knob to be stiff on the machine we tested. However, we also discovered that if the quick stop lever is drawn back with one hand, the knob may be worked very easily.

Fast forward is accomplished by pulling the quick stop lever and then pressing the fast forward button. When stopping the procedure is reversed. The operations must be done in that sequence or the tape may break.

Threading is a simple, straight-line procedure and the braking on the reels is positive. There is no danger of spilling tape on this machine, nor is there any tendency for the reels to drift.

Two jacks are provided, one for the

connection of an external speaker and the other which serves as a microphone jack and also for recording from the radio or phonograph by means of an accessory patch cord.

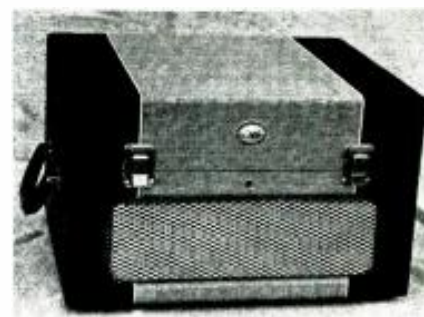
The recorder is equipped with separate volume and tone controls, the latter being very effective over a wide range. A small jeweled pilot light goes on when the recorder is turned on.

Recording level is shown by a neon lamp which is in a well and can be seen easily under normal lighting conditions.

The small size of the machine, 14" x 12" x 8½" and its light weight, about 25 pounds, will commend it to those who travel with a recorder.

We found the machine to be attractive, sturdily built and convenient to use.

While the machine cannot have, at its low price, some of the refinements on the more expensive machines, it does represent good value for the price asked.



The FME recorder with the top in place. It will take up to seven inch reels and has a storage compartment for extra tape and accessories as can be seen in the large illustration.

TAPE CLUB NEWS



... Voicispondent Schirmer to Germany.

John Schirmer, Secretary of the Voicispondence Club recently returned from his first visit to Germany since he came to America 26 years ago. He flew over for a two-week vacation and saw his mother and sister in Berlin. His German was a bit rusty after so many years but he had kept it in working condition by tape corresponding with his folks over the years.

He was quite surprised to be met by an Air-France photographer as he boarded the plane. The reason was the fact that he was the first sleepet-passenger out of Chicago to Paris.

Colorado Reel Neighbors

Limited to residents of the state of Colorado, the Colorado Reel Neighbors is looking for new members. Those interested should contact Walter M. Boraker, Box 287, Las Animas, Colo.

Goetz to Undergo Operation

Fred Goetz, prexy of Tape Respondents International is slated for a trip to the hospital very soon for a chest operation. Fred wants all his members and friends to know he will still be in there pitching despite the illness and asks that they forgive any delays in correspondence. As he puts it, "I'll ask them to sort of stick with me for a while and excuse the fact that for a while I won't be so quick on the trigger but I'll answer letters as best I can."

Reel Stuff

Art Rubin of Post Office Box 215, Cedarhurst, Long Island, N. Y. is starting a club that is called International Tapeworms.

ROSTER OF CLUBS

Write to the club of your choice for full details and dues. Corresponding via tape is a heartwarming experience. Try it.

The secretaries of the tape correspondence clubs will deeply appreciate receiving a self-addressed stamped envelope from those making inquiries about membership. As most of the clubs' expenses are caused by postage anything that will lessen the burden will be helpful. So when writing, slip in some extra stamps.

TAPE RESPONDENTS INTERNATIONAL

Fred Goetz, Secretary
P. O. Box 1404T, San Francisco, Cal.

THE VOICESPONDENCE CLUB

John M. Schirmer, Secretary
1614 N. Mango Ave., Chicago 39, Ill.

WORLD TAPE PALS

Harry Matthews, Secretary
P. O. Box 9211, Dallas, Texas

GLOBAL RECORDING FRIENDS

Alfred L. Sferra, D.D.S., Secretary
125 Hamilton Street, Bound Brook, N. J.

RECORD-O-CLUB

c/o Accessory Office Service
Dolores Franco, Sponsor

111 W. 23rd St., New York 11, N. Y.

NEW BOOKS

How to Service Tape Recorders, by C. A. Tuthill. John F. Rider, Publisher. 480 Canal Street, New York 13, N. Y. 5½ x 8½. paper bound. 154 pages including complete index. Illustrated. \$2.90

Starting with a chapter on Basic Magnetic Principles, this book moves through the subjects of Magnetic Recording, Tape Recording Mechanisms, Circuitry, and Maintenance and Repair.

This, to our knowledge, is the first book devoted to the servicing of recorders and as such should be on the library shelf of every radio repairman or tape recorder dealer. An understanding of the workings of a tape recorder, and the servicing, can mean better customer relations when recorders are brought in for repair.

The book is also useful to the recorder owner and is written in such fashion that the average person can understand it. For

the maintenance and repair sections, the author has selected more or less typical recorders in each class from the portable self-contained unit to the professional studio models. Obviously, with the great number of recorders on the market it would have been impossible to cover them all. As most recorders are similar in basic construction, the directions given can, in many cases, be applied to other recorders.

A thorough study of this volume should enable a person to tackle a recorder that needs repair. We think you'll like the book.

Hifi Manual by Donald C. Hoefler. Fawcett Publications, Greenwich, Conn. 6½ x 9¼. paper bound. 144 pages. illustrated. \$.75

This is available at your nearest newsstand and contains a chapter on Tape Recording. It is very well done and a bargain at the price.

ORDER BOOKS FOR AUDIO FANS...

HOW TO SERVICE TAPE RECORDERS

by C. A. Tuthill

Everything audio enthusiasts or audio engineers need to know about what is inside a tape recorder—operation of the recording head, types of electronic circuits, kinds of drive mechanisms used, trouble-shooting — and how to service the many types of tape recorders with practical examples.

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Courtesy CBS Radio

Choosing and Using a Microphone

by Jeffery Grant

Part 1 of two parts

. . . Your recorder can't record it if your mike doesn't pick it up. Here are the reasons for using a better microphone, the vital first link in the recording chain.

TOPPING the list of things the owner of a good tape recorder covets most is a first-rate microphone. Always a delicate question, there is a noticeable lack of general, objective information concerning microphones. While the amount of material that has been published has reached encyclopedia proportions, it is difficult for the tape recorder owner to gather practical information on how to evaluate and select a microphone. Traditionally, the theory of microphone construction and design has been obscured in a cloud of such extreme technicality that only few electrical engineers and advanced physicists have been able to stride with confidence through the labyrinth of applied theory.

One of the simplest and most obvious methods of selecting a microphone is by the criteria of price. Normally, a higher price is no absolute guarantee of quality, whether you are buying a car, walking shoes or a new suit. However, without exception, the better the microphone the higher its cost. The first and second steps down from the very best save the buyer the major portion of the expense. There is also a gain in adaptability and versatility, while losing somewhat in potential response.

Even the least expensive home-type tape recorder with a limited frequency response, not exceeding 7,500 cycles, will gain decidedly by the use of a good microphone. Obviously, a recorder cannot perform in excess of its limiting factor, whether it be its magnetic heads or loudspeaker. But by bolstering one weak element, the entire recording system will benefit. Generally speaking, the two weakest links of any home-type tape recorder are the speaker and microphone that is furnished as original equipment.

Once equipped with a new and expensive microphone, the tape recording enthusiast literally drools in anticipation and excitement. He may speculate on such delights as picking up the sound of corn growing in a Midwest farm field or, almost, a mosquito sharpening his proboscis 30 feet away in any direction. Considering the lack of basic information, his assumption that a more expensive microphone is also more sensitive is a common error. At this point it would probably be unwise to suggest to the recording enthusiast that his expensive microphone would not pick up sound at a distance as well as a cheap microphone. Recovering from his amazement, he might logically ask, "Why? Didn't you just say that the more expensive the microphone the better its quality?"

When purchasing a more expensive microphone, the buyer is paying for just two things: flatter, more uniform frequency response characteristics. Secondly, an expensive microphone assures a substantially broader band of response over the spectrum of audio frequencies. And naturally they are made of finer materials with superb workmanship.

Sensitivity is totally unrelated in judging the criteria of a good microphone. As the manufacturer improves the flatness of the microphone's frequency response, the output or electrical signal from it is being proportionately decreased. Consequently, this means that a cheap microphone will, generally, yield a much stronger signal than more expensive microphones.

The first and primary task for any professional microphone is to have good frequency response. Consequently, the professional recording engineer is willing to use micro-

phones with low sensitivity. As a result, he has at his disposal carefully designed recorders with very high amplification and very low noise to restore the microphone's weak output to a usable level.

Naturally, there are many characteristics that are desirable in a microphone. Everyone would like a microphone with a maximum signal output, saving a number of tubes in the recorder amplifier, and thus reducing the possibility of noise pick up. It would be desirable, too, for a microphone to be rugged, impervious to shock, insensitive to temperature and humidity. In addition, the smaller and less conspicuous its size the better, making it easier to locate without hiding the performer.

All of these qualities are desirable. In addition to this limited list could be added many more features. But in an imperfect world, it is rarely possible to get something for nothing. The recording engineer would gladly trade all these advantages: high sensitivity, durability, inconspicuous size for the most important feature of all, flatness of frequency response. Fortunately he doesn't have to trade for modern microphones combine most of them. The entire tape recording system can never reproduce sound better than the microphone does. The microphone is the starting point for the entire chain of magnetic recording.

Every tape recorder owner wants, naturally, an even broader frequency response band with lower lows and higher highs. But in the clamor for higher and higher frequency response, high fidelity fans have overlooked the most basic fundamental of all—uniformity.

More important than the width of a microphone's frequency range is the uniformity of response within its range. Often in the cheaper microphone there are many resonant peaks. This non-uniform response over the pass band is caused by an electrical signal far stronger at some frequencies than at others for a given sound intensity.

Electrical resonance results from the combination of a coil and condenser. At certain frequencies, when in combination, they will be resonant, either passing more current at certain frequencies or rejecting current at certain frequencies. At times resonance performs a useful work load. When tuning a radio to different stations, one is adjusting the resonance condition of the radio to the frequency the station is broadcasting. But in magnetic recording systems, the microphone must be sensitive to sounds and create an electrical signal *in proportion* to the sound *irrespective* of the frequency. If a microphone is resonant at 200 cycles it will produce a much stronger signal at 200 cycles than it will, say, at 1,000. This causes humps or peaks in the response curve, resulting in a very unnatural type of sound. If the resonance is at the low frequencies, the result will be a booming sound. If the resonance is at high frequencies, the sibilants will be objectionable. A hollow, telephone-like sound quality will be caused if the resonance is in the middle frequencies. In all cases, resonance in a microphone is to be avoided. If the condition does exist, it should be as far to either end of the audio spectrum as possible, eliminating interference within the band, the region the recordist is interested in.

There is a growing feeling among recording engineers that if a compromise must be made, it would be better to have a microphone somewhat limited in response, not going out as far on either the high or low end. The good microphone has a uniform, flat response within the existing band. Regardless of the frequency, its output is the same.

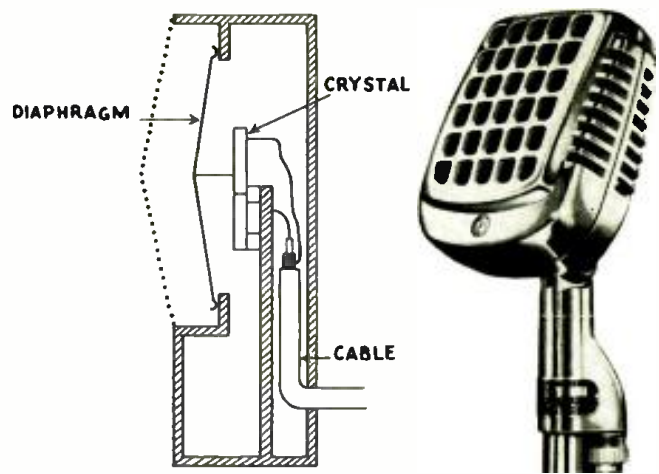


Figure 1. At the left is a cross section of a crystal mike. It will be seen that the apex of the diaphragm is coupled to the crystal. The crystal is attached to the microphone case. The motion of the diaphragm deforms the crystal, producing an alternating voltage. Right: a crystal mike, the Shure 737A Monoplex. Its output is sufficient to drive any recorder and it is high impedance to match recorder inputs.

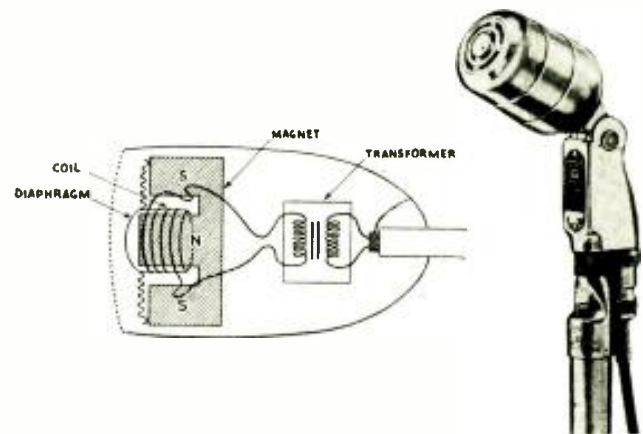


Figure 2. Cross section of a dynamic mike. The output results from the motion of a conductor in a magnetic field. The coil is suspended within the magnet and is attached to the diaphragm. As the diaphragm moves it moves the coil and causes a current to be generated. Right: the Electro-Voice 630 Dynamic Microphone. Its output is about the same as a crystal mike and enough to drive a recorder.

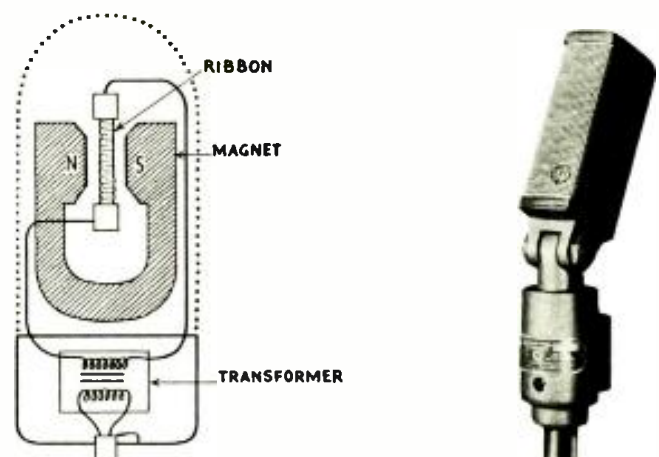


Figure 3. The velocity or ribbon microphone. It uses a metallic foil ribbon suspended in a magnetic field with both sides of the ribbon accessible to the air. The ribbon is vibrated by the difference in sound pressure on the two sides, causing a current to flow. Right: Shure 333 Ribbon Microphone. This is an expensive studio-type microphone with low sensitivity but excellent frequency response. It can be used with recorders that have high gain and low noise level.

To determine band uniformity, the curve of output, generally expressed in volts converted to decibels, is compared to frequency. Thus, for a given frequency, a microphone will have a given output in db. The better the microphone, for a constant amplitude sound source, the more constant its output over the audio band. Therefore, if the characteristic frequency response curve of the ideal microphone were plotted, it would be a straight line. On the other hand, a cheap microphone might reproduce 200 cycles very well and give a relative output of 50 db, but at 500 cycles it might give a relative output of only 30 db, while at 1,000 cycles the output could be 40 db. Consequently, the response curve of the cheap microphone, when plotted, would be full of peaks and valleys, the peaks indicating resonant conditions.

To hold the price of home recorders at a realistic level, machine manufacturers furnish adequate, durable microphones. The microphones are more than satisfactory for many voice applications. But as the tape recorder owner graduates to more expensive equipment, he will require a microphone with new features and characteristics.

The inexpensive microphone furnished as original equipment has a strong output. In this way, weight and bulk of many portable home recorders are minimized, eliminating the need of having to use increased amplification and more complex low noise amplifier circuits. Consequently, the possibility exists an occasional tape recorder will not have a sufficiently strong amplifier to satisfactorily boost the low output of an expensive microphone when a substitution is made. Microphone output should be greater than 55 db below one volt per microbar for home-type tape recorder use. Some of the older recorders require even more output, unless, of course, a high gain mixer or preamplifier is employed.

It is simple to quickly ascertain whether or not the output of a microphone is too low for the recorder's amplifier system. The output of all microphones is specified in number of decibels from a known reference for a given sound level. By glancing at the specifications of the output of different microphones it is possible to tell the relative output.

Before making a final purchase, the prospective buyer would do well to make a tape recording with the microphone he is considering. When making the recording on a home-type recorder, one need simply adjust the volume control so that the volume indicator shows the recording is fully modulated. It is preferable, however, to use a volume indicator. If the microphone is insensitive, it will not be possible, even by turning the volume control all the way up, to record the tape with sufficient intensity.

Most home-type tape recorders have ample reserve gain. Lacking the sensitivity of the cheap microphone, it is necessary to advance the volume control and use more amplification when recording with expensive microphones. If there is noise, hum, and hiss in the amplifier of the tape recorder, a substantially worse signal-to-noise ratio will result despite the fact a better frequency response is being obtained. Thus, the recording enthusiast runs the risk of picking up noise in the tape recorder amplifier when using expensive, improved microphones.

From the humblest home tape recorder to the console model professional machine, an expensive microphone will produce improved recording results providing the signal-to-noise ratio does not appreciably suffer. The advantage of a good microphone is that all recordings will be more natural. The typical characteristic of cheap microphones is a "tinny"

sound quality. A voice pleasing to the ear with a pleasant, smooth bass with sharp, well defined highs will sound hollow, shrill and "spitty." In musical recording, a cheap microphone will not reproduce the low frequencies such as the critical, all-important, low notes of a piano and organ. With the lower frequencies gone, coupled together with resonant peaks, cheaper microphones cause music to sound unnatural, harsh and irritating. When music is distorted out of its true character, the screechy sound quality has the effect of rubbing sandpaper on the nerve endings of listeners.

In recording there are five main types of microphones: crystal, variable reluctance, dynamic, ribbon (sometimes referred to as velocity), and condenser. Each of these microphones serves a distinct and separate purpose, having both inherent advantages and disadvantages. The type of microphone should be selected with a specific recording problem in mind.

It is interesting to note that the carbon microphone, not included in this discussion, is the most widely used microphone in the world. Today every telephone uses a carbon microphone, and during the thirties it was used extensively in broadcast stations. The carbon microphone has poor frequency response and is undependable for critical recording since its frequency characteristics change from day to day, depending upon the position of the carbon granules. It is no longer used in any serious professional recording work.

The average tape recorder is equipped with either a crystal or variable reluctance microphone. The crystal microphone is more common, although the variable reluctance microphone is growing in popularity with many recorder manufacturers including it as original equipment. Low in cost and varying in quality, the inexpensive crystal microphone included with most home recorders has a frequency range of about 100 to 8,000 cps (range of the human voice.)

A crystal microphone may be best described as a microphone which depends upon the generation of a voltage by the deformation of a crystal having piezoelectric properties. A piezoelectric crystal generates a voltage when it is deformed, changing acoustical energy into electrical energy. The several common piezoelectric materials which are used in the crystal microphone are rochelle salt, barium titanate, and ammonium dihydrogen phosphate. Barium titanate is being used increasingly in crystal microphones because of its better frequency response, although its output is lower.

Shown in Figure 1 is a cross-sectional view of a crystal microphone. It will be seen the apex of the diaphragm is coupled to the crystal. The crystal is attached to the case of the microphone. The motion of the diaphragm due to an impinging sound wave deforms the crystal, producing an alternating voltage which corresponds to the pressure undulations in the sound wave.

Among the more serious disadvantages of the crystal microphone is that it is particularly susceptible to high temperatures and variations in humidity. The crystal microphone, using rochelle salt, can be permanently damaged by being exposed to heat as high as 122 degrees F. Particular care must be taken to avoid leaving a recorder, together with its crystal microphone, in a closed car during a hot summer day. A crystal microphone should never be exposed to direct rays of the sun.

The electrical properties of a crystal microphone are affected by variations of both temperature and humidity. If the temperature and humidity change, the frequency response and output of the crystal microphone also change. Although fairly rugged in construction, the crystal micro-

phone is susceptible to shock damage such as dropping on the floor. It can, however, be freely transported, handled by many people, subjected to the usual vibrations of being carried about in a car. Although all crystal microphones will deteriorate over a period of time, generally their useful recording life will be ended through some other cause such as traumatic shock or exposure to excessive heat.

One advantage of the crystal microphone is that it has a high sensitivity. Thus, for a given sound level, the crystal microphone gives a strong electrical signal, requiring less gain in the amplifier. The inexpensive crystal microphones furnished with home recorders are sufficiently sensitive to pick up a weak sound some distance away and still supply a strong signal to the recorder. Of all the types of microphones listed in the radio parts house catalogs, the crystal microphone is likely to have the strongest output.

The variable reluctance microphone is being issued as original equipment with an increasing number of new tape recorders, especially in the \$180 through \$300 range. The variable reluctance microphone is a moving armature type microphone. In a magnetic field, the armature moves in a coil wire, creating a current in the coil as it moves. The armature is attached by a coupling through a diaphragm that is operated by sound waves. This microphone has many advantages over a crystal since it is not affected by temperature or humidity. It can also withstand considerable shock. The reluctance, as contrasted to crystal microphones, has better low frequency response. As a general rule, variable reluctance microphones furnished with home tape recorders are superior in sound reproduction characteristics to crystal microphones supplied with comparable quality recorders. It is interesting to note that any type microphone, whether crystal, reluctance, dynamic, ribbon, condenser, can be built to be excellent in quality, but each has its limitations and advantages.

In a dynamic microphone, the output results from the

motion of a conductor in a magnetic field. The conductor, a coil, is attached to a diaphragm, suspended in the magnetic field. When sound waves hit the diaphragm, it vibrates back and forth, moving the coil in the magnetic field, generating an alternating voltage across the coil. The voltage generated is proportional to the number of magnetic flux lines which are cut per second.

In the cross-sectional views, Figure 2—construction of the dynamic microphone is clearly illustrated. The dynamic microphone is rugged, unaffected by variations in temperature or humidity, and generally is of high quality.

The response of the ribbon or velocity microphone is unlike that of the crystal, variable reluctance and dynamic microphones which correspond to pressure variations in a sound wave. The response of a ribbon microphone corresponds to the particle velocity in a sound wave. Shown in Figure 3 the velocity microphone consists of a metallic foil ribbon suspended in a magnetic field with both sides of the ribbon freely accessible to the surrounding air. The ribbon is vibrated by the difference in sound pressure on the two sides, causing an electrical current. Since the motion of the ribbon is proportional to the particle velocity in the sound wave, the motion of the ribbon produces a voltage which corresponds to the particle velocity in the sound wave.

While crystal microphones will vary in price from only a few dollars to \$40, all ribbon microphones are fairly expensive, ranging from \$40 to princely sums of \$300 and more. The ribbon microphone is used extensively in professional recording work under controlled conditions. While it is not affected by either temperature or humidity, the ribbon microphone is extremely susceptible to damage by shock and wind. Even breathing directly into the ribbon microphone can, in certain circumstances, permanently damage its performance by stretching the ribbon.

to be continued

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- ✓ FAST, INSTANT POWER REWINDING
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Tape Recording
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OFF THE TAPE



. . . Lucy loves 'em too.

Viewers of a recent "I Love Lucy" show were treated to some know-how on the use of a tape recorder which was used during the program. The recorder is a Crestwood. The entire show was built around the use of the recorder.

Lot of Tape

Audio Devices has announced that it has received a contract from the Air Force to supply 15 million feet of three-inch wide magnetic recording tape—enough to reach from New York to San Francisco. It is one of the largest single contracts for recording tape ever awarded by any branch of the government.

Color Music

Revere Camera Company, makers of the Revere Tape Recorder will demonstrate an Electronic Color Frequency Indicator at the Sight and Sound Exposition to be held at the Palmer House, Chicago from September 30 to October 2, 1954.

The indicator flashes bands of vivid color on a screen as notes of different frequencies are sounded. With the aid of this instrument its inventor claims, it is possible to listen to musical passages and see, in color, how the music is constructed of basic frequencies.

The device is operated by a series of sharp band pass filters that separate the multitude of frequencies in music into channels. The signal of each channel then operates electronic switches to turn off and on banks of twenty small colored lights.

It is believed that the color indicator will have use in teaching the deaf to appreciate music and the instrument adds a new dimension and animation to favorite symphonies.

Like to Read?

The Case of the Green-Eyed Sister will prove good reading for tape recordists who enjoy the Perry Mason mysteries by Erle Stanley Gardner. Mr. Gardner, incidentally, is a subscriber to Tape Recording.

The story involves a spool of recording tape on which a conversation led to downright blackmail—but read it yourself. It's good.

SHOP OR SWAP

Advertising in this section is open to both amateur and commercial ads. TAPE RECORDING does not guarantee any offer advertised in this column and all swaps, etc. are strictly between individuals.

RATES: Commercial ads, \$.30 per word. Individual ads, non-commercial, \$.05 a word.

Remittances in full should accompany copy. Ads will be inserted in next available issue. Please print or type your copy to avoid error. Address ads to: Swap or Shop, Tape Recording Magazine, Severna Park, Md.

WANTED: Tape (3¾ or 7½) dual track of BBC radio's "Old Time Ball Room"—German Band Music—and Orson Welles "Men from Mars." Will exchange similar and novel recordings. Richard Kenny, 41 Bank Street, Stamford, Conn.

FOR SALE: Webcor 2030-1A, three speaker tape recorder. Brand New. Received two as gifts. \$175.00. J. Jabbour, 20 Woodbine Street, Pawtucket Rhode Island.

FOR SALE: Brush Soundmirror, Model BK443, \$190.00. Write Raymond Wilson, 58 Morton Place, East Orange, N. J.

FOR SALE: Revere T-700 deluxe, push-button Tape Recorder. New Condition. \$150.00. Robert Wolfe, 2506 E. Hoffman Street, Baltimore 13, Md.

LP DISCS made from tapes. Both sides: 10 inch—30 minutes, \$4.25; 12 inch—45 minutes, \$5.75. Also free bulletin—"Make Money with Your Recorder." Artistic Sound, 24110 Rensselaer Oak Park, Michigan.

TAPE Recorders, Tapes and Accessories. Nationally advertised brands. Unusual values. Check with us before you buy. Dressner, Box 66A, Peter Stuyvesant Station, New York 9, N. Y.

HAVE your tapes professionally transferred to Hi-Fi LP Discs. Both sides 10 inch, \$4.25; 12 inch, \$5.75. Send to: Fay Recording Co., 153 S. Highland St., W. Hartford, Conn.

FOR SALE: Slightly used Ekotape 101. Reasonable price. Norman M. Paulson, P. O. Box 301, Danville, Ill.

RECORDED MUSIC-ON-TAPE Programs: For added enjoyment from your tape recorder, build a library of Recorded Tape programs. Send for FREE CATALOGUE listing programs by Hack Swain, A-V Tape Libraries, others. SWENSON'S, Box 391, Mankato, Minnesota.

WANTED: A tape recording of a story called "The Well" which played on the program called "The Web" over the TV during the month of January. Will pay \$35.00 for first tape accepted provided it is without "crow call" sound effects. Gaspar Nicolini, 862 E. 215th Street, Bronx 67, New York.

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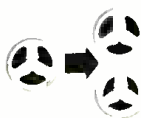
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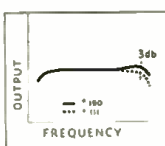
50% more recording time with new *Extra Play* tape

No more stopping for reel change when you're tape recording longer musical works, dramatic productions, sports and news events! New "Scotch" Brand Extra-play Magnetic Tape 190A cuts time-consuming changeover breaks by giving you 50% more recording time on each reel—with as much tape as you'd find on 1½ reels of conventional tape.

Secret of new "Scotch" Brand's extra playing time is a more potent oxide coating which offers improved hi fi response, yet is 50% thinner than standard tape coatings. A thinner tape backing produces more uniform hi fi output—cleaner, crisper tones—while retaining critical strength factors to meet the demands of all home recorders.



EXTRA-THIN. 50% thinner, more potent oxide coating, 30% thinner backing permit more 190A tape to be wound on standard reel. One roll of new tape does job of 1½ reels of ordinary tape.



INCREASED FREQUENCY range of new Extra-play tape enables home machines to produce recordings with greater hi fi response than formerly possible with most conventional magnetic tapes.



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