

1935 1936



# TAPE RECORDING

1937 1938

1939 1940

1941 1942

1943 1944

1945 1946

1947 1948

1949 1950

1951 1952

1953 1954

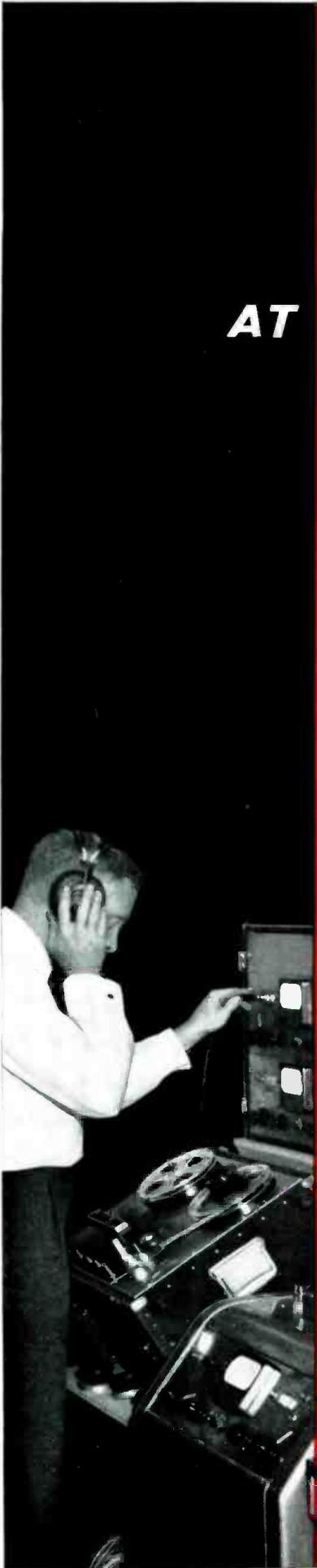
1955 1956

1957 1958

Mr. Sydney G. Brooks  
Brooks Jewelry  
Cádiz, Ohio

February, 1958

35c



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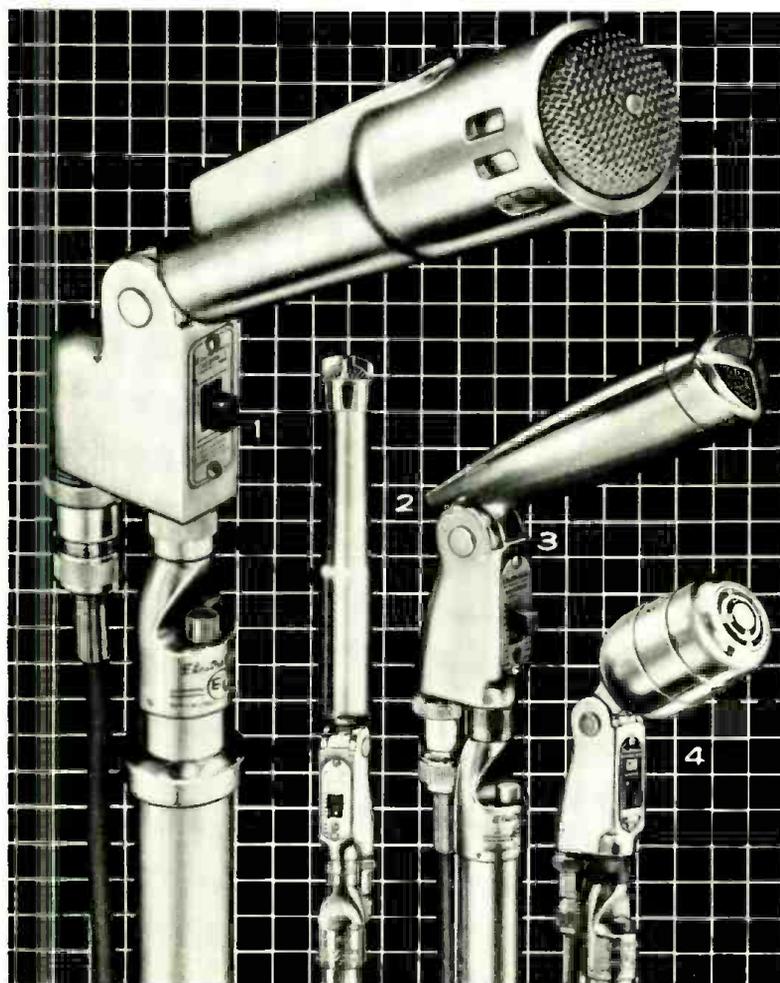
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**HI-FI**

**TAPE RECORDING**

VOL. 5 NO. 3

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**IN THIS ISSUE**

THE HISTORY OF MAGNETIC RECORDING ..... Mark Mooney, Jr. 21

FIRST USE OF MAGNETIC SOUND ON FILM ..... Louis E. Lembach 38

NEW TAPES ..... Georgia Sigsbee 6

TEEN TAPERS ..... Jerry L. Heisler 14

BOOK REVIEWS ..... 15

QUESTIONS AND ANSWERS ..... 16

TAPES TO THE EDITOR ..... 17

TAPE IN EDUCATION ..... John J. Grady 18

TAPE CLUB NEWS ..... 19

NEW PRODUCTS ..... 41



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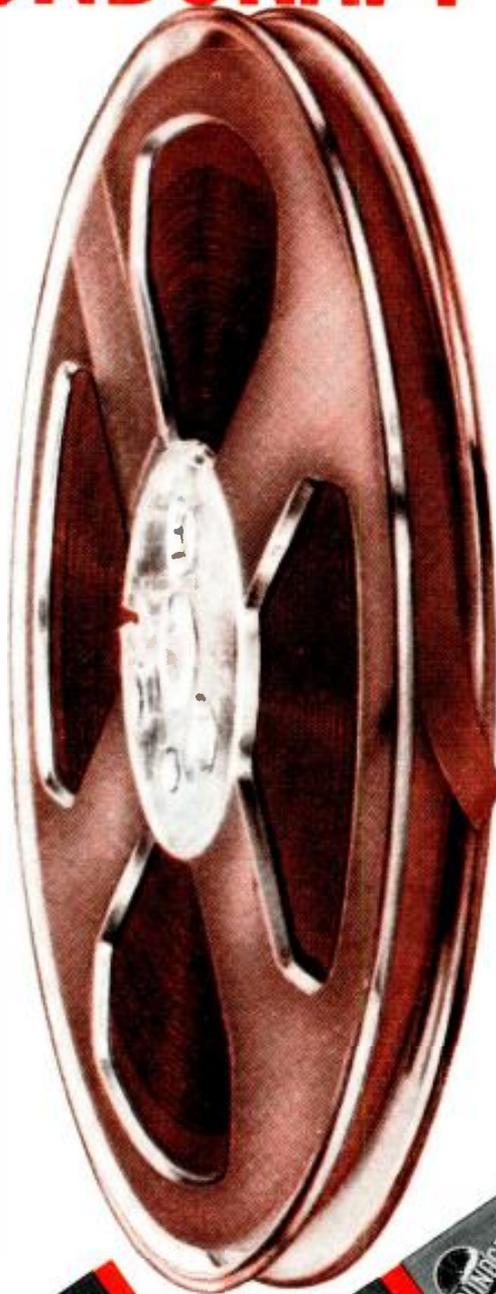
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# NEW TAPES

By Georgie Sigsbee

It has been a long time since I have communicated directly with you who read this column. As tape releases were increasing so terrifically this past year I felt it exceedingly important to devote all space available to reviews. Along with the constantly growing tape field, we are expanding our staff in order that you might benefit from increased number of reviews and diversified opinions. Dr. John Leahy who has considerable background in music, as

well as writing, and Mr. D. Sterling Wheelwright, Professor of Music and Humanities at San Francisco State College will be contributing to this column. We are sure you will enjoy their contributions.

## CLASSICAL SYMPHONY

FRANCK  
Symphony in D Minor  
Boston Symphony Orchestra

Charles Munch, Conductor  
RCA ESC-58  
Stereo . . . \$14.95 . . . 36 mins.

Sonically this is quite a piece of music, interpretatively it is very well done but somehow does not probe to the depth I would have it achieve. I feel at times as though I would like to tap Munch on the shoulder and say "slow down here and get more out of it." Franck wrote but one symphony and said all he had to say in it . . . and very beautifully so. The old RCA 78 with Stokowski takes Franck's musical words and expresses them with absolute inner glow, making a rapturous vision of the entire score. For those not otherwise indoctrinated, or prejudiced, this is a fine recording, expertly engineered.

## ORCHESTRAL

BERLIOZ  
Roman Carnival Overture  
WAGNER

Overture to "Die Meistersinger"  
The Symphony of the Air  
CONCERTAPES 510  
Stereo . . . \$7.95 . . . 18 mins.

From the first glowing tones of the English horn to the brisk closing, you will find the Symphony of the Air delivers Berlioz's *Le Carnaval Romain* with spirit and discernment. This is a very fine reading . . . the orchestra does itself proud as it performs without a conductor on the podium.

The warm and beautiful music abundant in Wagner's wonderful human music-drama "Die Meistersinger" is brought to light briefly within the structure of the Overture. The orchestra performs this selection in a precise, adept manner. The overall effect is not as compelling nor stirring as I would wish, but it is nonetheless a most acceptable rendition.

This was one of the first stereo recordings made by this group, composed of former members of the NBC Symphony. It was recorded in Carnegie Hall and the reproduction is very fine.

## BORODIN

Polovetsian Dances  
The Hamburg Philharmonia Orchestra  
Heinrich Alster  
BEL CANTO 23  
Stereo . . . \$7.95 . . . 14 mins.

These dances from Borodin's *Prince Igor* are performed in competent, animated fashion by Alster and the Hamburg Philharmonia. The recording is attractively engineered.

## STRAVINSKY

The Rite of Spring  
Paris Conservatoire Orchestra  
Pierre Monteux, Conductor  
RCA ECS-67  
Stereo . . . \$14.95 . . . 33 mins.

This composition created quite a sensation when Pierre Monteux conducted its premiere in Paris in 1913. This stereo

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production will become a "collector's item" not only as the product of a great conductor and one of the world's most famous living composers, but also because it is one of the best readings of this work. The fantastic moods of primitive nature are brought into sharp focus in this fine stereo recording and the entire interpretation is unquestionably authentic.—D.S.W.

**ROMBERG - DeFALLA**

Student Prince/Ritual Fire Dance  
Hamburg Philharmonia Orchestra  
Heinrich Alster, Conductor  
BEL CANTO 26  
Stereo . . . \$7.95 . . . 18 mins.

The tunes from Romberg's "Student Prince" are presented in a rather slowly-paced, background music style. The arrangements accent the instrumental work. Alster's delivery does not project the full flavor of romance and gaiety this music does possess, but it is nonetheless pleasant for relaxing musical moments.

The undulating rhythms of the *Ritual Dance of Fire* from De Falla's ballet "El amor brujo" are spread before you in stereo sound. An agreeable reading, backed by excellent sound reproduction.

**CHORAL**

**SCHUBERT**

Mass in A Flat  
Anne Bolinger, soprano  
Ursula Zollenkopf, alto  
Helmut Kretschmar, tenor  
James Pease, bass  
The North German Philharmonic Chorus and Orchestra  
Carl Bamberger, Conductor  
CONCERT HALL SOCIETY LX-58  
Stereo . . . \$17.90 . . . 44 mins.

The Mass in A Flat, one of six masses created by the talent of Franz Schubert, could be loosely termed a gorgeous hunk of music. This lovely music is given a stimulating, distinguished performance by the entire group of artists.

It is beautifully recorded and executed and is, therefore, highly recommended to all. Concert Hall and Bamberger are doing a wonderful job in producing choral works such as this and the recent *Brahm's Requiem*. I'm looking forward to more . . . as I am sure many of you are.

**OPERA**

STRAUSS, Richard  
Salome, Dance of the Seven Veils and Final Scene  
Inge Borkh, soprano  
Chicago Symphony Orchestra  
Fritz Reiner, Conductor  
RCA CCS-23  
Stereo . . . \$10.95 . . . 26 mins.

The oriental strains of this one-act opera are not the most characteristic sound of this composer. This is not "pretty" music, but brutally dramatic. The vocal finale is capably sung by Miss Borkh and, if you like the music, you will enjoy this performance as rendered by Reiner and the Chicago Symphony.—D.S.W.

**LIGHT CONCERT**

THE VIENNA STRINGS PLAY JOHANN STRAUSS

Wiener Blut  
Annenpolka  
Perpetuum Mobile  
Tales from the Vienna Woods  
The Vienna String Symphony  
Kurt Rapf, Conductor  
LIVINGSTON 717 BN  
Stereo . . . \$11.95 . . . 28 mins.

Many of you may be familiar with the Vienna String group. They have toured the U. S. several times under the leadership of Kurt Rapf. Rapf is also well-known in this country as a skillful organist.

The piano (I wonder if Rapf is playing it) and strings create a charming musical interlude which transports me to the atmosphere of dining salon or drawing room.

The fidelity is very good.

**POPULAR**

**FEYER PLAYS KERN**

The Way You Look Tonight  
Bill—Lovely to Look At  
Can't Help Lovin' Dat Man  
I Won't Dance  
They Didn't Believe Me  
The Last Time I Saw Paris  
She Didn't Say Yes  
Smoke Gets in Your Eyes  
The Song is You  
The Waltz in Swing Time  
I've Told Every Little Star  
Who

George Feyer and his Orchestra  
PHONOTAPES S-901  
Stereo . . . \$11.95 . . . 35 mins.

A delightful, melodious recording of Jerome Kern's songs which should provoke many a nostalgic thought. Hungarian-born pianist, Feyer, and his orchestra perform with verve and gaiety. He brings a continental sophistication into his interpretations of our pop tunes which is extremely refreshing. His background as a classical pianist is apparent and it is to the benefit of the pop field that such an artist made the transition with such good grace and skill.

Background music of high calibre . . . recorded and played with finesse.

**WHILE MY LADY SLEEPS**

Moonlight in Vermont  
Love's Got Me in a Lazy Mood  
Black is the Color of My True Love's Hair  
While My Lady Sleeps

Phineas Newborn, Jr., pianist  
Dennis Farnon and His Orchestra  
RCA BPS-80  
Stereo . . . \$8.95 . . . 20 mins.

Farnon, with the soft, singing strings and Newborn with slow-paced piano jazz improvisations, pool their talents in this recording. When they perform together the effect is blended but somehow I would rather hear Newborn alone or with a small quiet combo (that is the mood of this particular tape) . . . or Farnon giving with the soothing orchestrations . . . alone. It's something like Irish coffee . . . Farnon representing the whipped cream . . . Newborn the Irish liquid. It's different and interesting and one could develop a taste for it . . . but I could take the coffee plain . . . or the more stimulating stimulant . . . plain. I dunno . . . it's hard to put my



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- CARMEN DRAGON, HOLLYWOOD BOWL SYMPHONY ORCHESTRA:**  
*Russkaya!* (ZV-24)
- ERICH LEINSDORF, LOS ANGELES PHILHARMONIC:**  
*Debussy: La Mer*  
*Ravel: Daphnis et Chloe, Suite 2* (ZV-25)
- WM. STEINBERG, PITTSBURGH SYMPHONY with NATHAN MILSTEIN:**  
*Dvorak: Concerto for Violin and Orchestra* (ZV-26)
- LEOPOLD STOKOWSKI:**  
*Gliere: "Ilya Mourometz"*  
*(Symph. No. 3 in B Minor)* (ZV-27)



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finger on it . . . it's a good tape and the reproduction is excellent.

## 88 X 2

- Begin the Beguine  
All the Things You Are  
Vienna, City of My Dreams  
Malaguena  
Over the Rainbow  
Dizzy Fingers

Jay Norman, piano  
CONCERTAPES 511  
Stereo . . . \$7.95 . . . 16 mins.

88 X 2 = Jay Norman at the keyboard via sound-on-sound recording. Shedding his quaint, Norman artistically split records his easy piano style in this self-duo recording. The results are both interesting and agreeable. His work is nicely integrated and the reproduction of the piano is very good.

## SENTIMENTAL FAVORITES

- Miss You  
Skip-A-Lou  
Avalon  
Londonderry Air  
Whispering  
Margie  
Who  
Believe Me If All Those Endearing Young Charms  
Humoresque  
Beautiful Dreamer  
I'll See You in My Dreams  
La Cinquataine  
Lenny Herman and his band  
LIVINGSTON 1098 BN  
Stereo . . . \$11.95 . . . 28½ mins.

Once more taking his accordion in hand and gathering his band about him, Lenny Herman records the above selections in the inimitable light, rhythmic style which has made his past releases (of which I count at least eight) so very popular.

You will find the stereo reproduction is excellent.

## STEREO AMOR

- Reverie  
Amor  
Greensleeves  
My Wonderful One  
Almost Paradise  
OMEGATAPE ST-61  
Stereo . . . \$8.95 . . . 15 mins.

A very pleasant dish of soft mood music served to you by Andre Montero and his orchestra and pianist Heinz Sandauer and his group. It is difficult to say which selections, other than the final number, are Montero's. The sax solo in "Reverie" reminds me of some of Montero's arrangements. Sandauer does a fine job in "My Wonderful One" and the music is so relaxing you'll be sorry the tape is a short one.

Fine fidelity.

## PATTI PAGE IN THE LAND OF HI-FI

- Nevertheless  
Out of Nowhere  
The Lady is a Tramp  
The Thrill is Gone  
A Foggy Day  
Mountain Greenery  
I've Got My Eyes on You  
My Kind of Love

I Didn't Know About You  
My Sin  
Taking a Chance on Love  
Love for Sale  
Pete Rugolo and Orchestra  
MERCURY MBS3-2  
Stereo . . . \$10.95 . . . 26 mins.

Pete Rugolo has come up with top arrangements all beamed to spotlight pert Patti Page's vocal talents and Patti proves worthy of such attention. Her warm, personality is projected into her fine vocalizing. Pete has her swinging out on such tunes as "Nevertheless" and "The Lady is a Tramp" and easing up on selections like "I Didn't Know About You."

I was fascinated by the engineering of this recording. Two mikes were used for basic stereo pickup and another for getting the full band effect and then six accent mikes were employed to grab off further dynamic pickups. Patti's voice is spread with an echo effect . . . at times she seems definitely left . . . left of center . . . or out of nowhere . . . but she IS there and she IS good.

## INTIMATE DANCE STYLES

- Blue Lou  
Midnite Sun  
No Other Love  
Yesterdays  
So Rare  
Love for Sale  
BEL CANTO 28  
Stereo . . . \$7.95 . . . 14 mins.

Excellent reproduction is supplied to this small band which furnishes selections in diversified tempos suitable for dancing. There is some good vibe work in "Midnite Sun" as well as sharp solo breaks in this recording for guitar, clarinet, sax, etc. Arrangement of "Love for Sale" is particularly good.

## ORGAN AND PIANO

- Masquerade  
Beyond the Sea  
Miami Beach Rhumba  
Yellow Bird  
Jealous  
Stella By Starlight  
Love Letters  
My Beautiful Lady  
Tom Ashworth, Organist  
Vic Neeley, Pianist  
CUSTOM-RECORDEX SAN-1  
Stereo . . . \$10.95 . . . 29 mins.

Ashworth and Neeley collaborate to bring you standard pop selections. Their efforts are nicely integrated in "Yellow Bird," "Jealous," and "Love Letters." In the slow arrangement of "Beyond the Sea" the reproduction of the piano is not too keen and in the final tune I cannot get a stereo effect . . . seems to me that both instruments are on one side of the room. The stereo engineering is not too well done and the reproduction of the instruments is not bad in the case of the organ—which is more closely recorded than the piano—but the piano reproduction could be better.

## JAZZ

- GOLD COAST JAZZ—Volume I  
Saturday Comes 'Round  
Don't Blame Me

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If I Should Lose You  
Dark Horse  
Scott Free

The Octet  
CRITERIATAPE CRT-1  
Stereo . . . \$11.95 . . . 31 mins.

The Octet is composed of trombonist,  
Lon Norman (now with Herbie Fields'  
Sextet); trumpet man, Jerry Marshall  
(formerly with Charlie Barnet's . . . now  
with Arnie Barnet's orchestra); one of  
Miami's best reed men, Berry Poger who  
plays alto-tenor flute; Eddie Gralka, bari-  
tone and tenor man who plays in a local  
Miami group called "The Paragon's;" Mar-  
vin Marvin, tenor; Bill Ladley, drummer  
with Herbie Brock's Trio; Paul Sarmento,  
bass; Frank Defabio, piano (formerly with  
Billy May's) and Joe Black, piano (form-  
erly with Herbie Fields' Sextet).

Lon Norman does the arrangements and  
they are enthusiastically tackled by the  
men as you will hear when they slap out  
on the four Lon Norman numbers. You  
who like jazz should like this.

The recording is fine.

**JAZZ AT STEREOVILLE, Vol. II**

I Got a Right to Sing the Blues  
Walkin' My Baby Back Home  
When Your Lover Has Gone  
I Knew You When

Cootie Williams, trumpet  
Rex Stewart, cornet  
Coleman Hawkins and Bud Freeman, tenor  
saxes  
Lawrence Brown and J. C. Higgenbotham,  
trombones  
Hank Jones, piano  
Billy Bauer, guitar  
Milt Hilton, bass  
Gus Johnson, drums

**CONCERT HALL EX-50**  
Stereo . . . \$8.95 . . . 19 mins.

I don't think a jazz fan will resist the  
temptation of latching on to this, the sec-  
ond, album "Jazz at Stereoville." It is a  
real must . . . top men in the field, re-  
corded in bright, well-balanced stereo  
sound.

Man, this is *the* reel . . . go get it.

**MISCELLANEOUS**

**AN ADVENTURE IN MUSIC THERAPY**

Baby's Lullaby  
Musical Kiss  
The Wind in the Desert  
My Destiny

Twin Pianists, Gene and Florian Mack  
Vocalist, Marie Vernon  
Drums, Hugh Allison  
Bass Virtuoso, Leon Ziporlin  
**MUSIC THERAPY RECORDS S1**  
Stereo . . . \$5.95 . . . 11 mins.

Two things which set this tape apart  
as something different are the tunes, which  
are the original musical and lyrical efforts  
of Armand and Olive LaFrance, and the  
interesting experience of hearing a fine  
classical string bass artist, Leon Ziporlin,  
at work on a diet somewhat lighter than  
his usual fare. Marie Vernon sings three of  
these tunes in an agreeable soprano voice.  
Insofar as the selections go, #1 and #3  
are, in my opinion, the best of the lot. I  
don't care for the lyrics of #2, and in #4  
the main theme sounds too much like  
"Getting Sentimental Over You" for me to  
consider it very original.

The low frequency range is used to spot-  
light the bass work of Ziporlin. The repro-  
duction is good and the tones of his instru-  
ment deep and rich. I would like to hear  
a tape wherein he performs works in the  
classical field.

The stereo engineering is good and  
though I did not receive any noticeable  
"sedation, stimulation or vibrations" from  
this recording . . . the content is different  
and it is performed with good intent.

Mr. and Mrs. LaFrance are going to re-  
lease music with the therapeutic angle in  
mind. They feel, and rightly so, that music  
can have a very salubrious effect. As mem-  
bers of the National Association of Music  
Therapy they hope to promote more peace  
of mind . . . for those who will listen.

**IN A MONASTERY**

Aratrika Service  
Kandana Baba Bandana  
Breaker of this World's Chain  
O Mother Make Me Mad With Thy Love  
Rakkhal  
In the Cave

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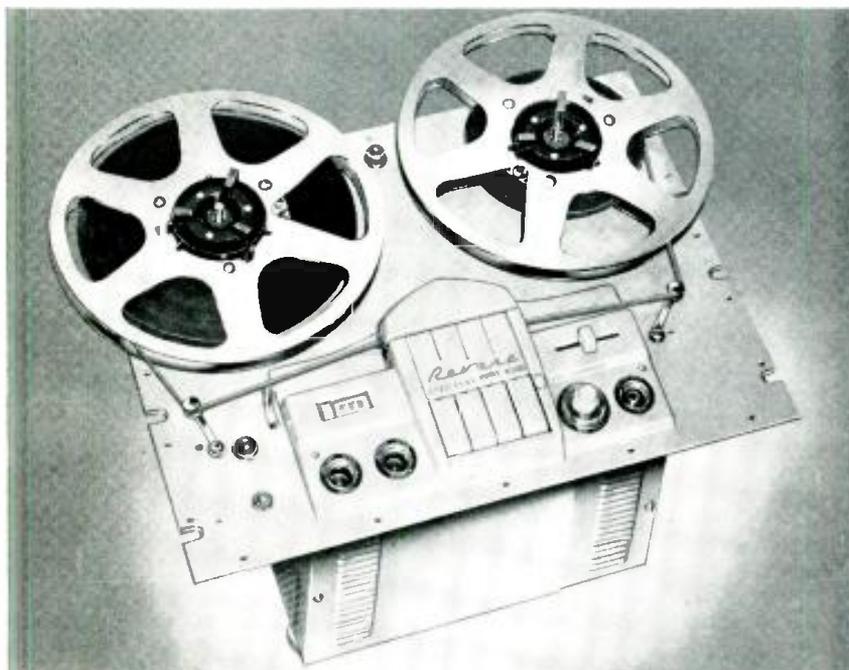
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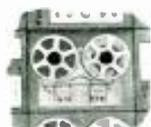


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**TR-800-D**—Same with built-in radio **\$275.00**

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**TR-1200**—Same with built-in radio **\$219.50**



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Kali Kali Ma  
Choir: Ramakrishna Monastery  
James Barnes, Musical Director  
Philip Griggs, Organist  
OMEGATAPE ST-55  
Stereo... \$8.95... 14 mins.

This is an unusual and fascinating tape. Recorded at the Ramakrishna Monastery in Trabuco Canyon, California, the 7-man choir blend their voices in exotic chants, choral works and a spoken hymn which will virtually transport you out of this world into one ala Shangri La. The monastery is operated by the Vedanta Society of Southern California, a group having its roots in Hinduism.

The choir is aided by percussive instruments which lend even more to the musical atmosphere. The reproduction of voices, percussion and organ is very good.

### MARCHES

#### CONCERT MARCHES

My Hero  
La Boheme  
Inglesina  
Marcho Poco  
Litely and Politely  
The Gypsy Baron  
The Allentown Band  
Albertus Meyers, Conductor  
WFB Production 1205 SI  
Stereo... \$9.98... 18 mins.

The Allentown Band is one of the oldest concert bands in America. Under the baton of Mr. Meyers this well-known group gives

an upbeat band concert which will cause foot-tapping to become accelerated. The band is good... the pace is brisk. Aesthetically, I did not care for the pop-swing version of "Musetta's Waltz" from "La Boheme."

The reproduction is good; the stereo effect is not of "pinpoint" variety. I cut the right speaker and found things still quite intact on the left. Cutting the left speaker I found, after pulling up the volume, that things were pretty much all there too. With both speakers operating the audio was spread but I couldn't grasp any definitive here... and there... so that's about the size of it.

### NOVELTY

500 MILES TO GLORY  
Indianapolis Motor Speedway  
MERCURY MS2-6  
Stereo... \$8.95... 20 mins.

Start your engines... we're off again! Here is another four-wheel race, this time recorded at the famous Indianapolis Motor Speedway Annual Classic of 1957. This 20-minute tape was culled from some 125,000 feet of recording made during time trials and the entire race.

You will hear the screaming of tires, the fast swish of cars, a crash, etc. along with a couple of interviews... one with the winner, Sam Hanks.

The fidelity is clear... and for my money the track could be too! You sports fans who like exciting events of this nature, will like this tape.

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**DANCE MUSIC**

**HARRY MARSHARD**

Resort Favorites for Dancing  
 Harry Marshard and His Society Dance  
 Orchestra  
**BEL CANTO 29**  
 Stereo . . . \$11.95 . . . 31 mins.

One of the first steps toward "respectability" taken by jazz in the '20's was its invasion of the "society orchestra" field. Musicians whose activities had been limited to bars, roadhouses and after-hours clubs suddenly found themselves lionized by the "white-flannel" set from Bar Harbor to Newport. Here is a tape which recalls the tunes and tempo of that period.

The notes say that the mood created by Marshard is "gentle" but from the be-whiskered "Row, Row, Row" to the more recent "I Could Dance All Night" this group enthusiastically beats out a constant jazz (oft ragtime style) tempo. Solo instrumentals bring to mind some of the old-time greats; i.e., Beiderbecke-like trumpet work on "The Man I Love."

According to the notes "Harry Marshard" is more than just one orchestra . . . it is an organization of more than 200 musicians who play here and there about the nation. All the bands play with the same tempo and style, whether the selections are old favorites, new show tunes, or calypso. Incidentally, the beat is readily adaptable to the Latin-American rhythms of "Hold 'Em Joe" and "Pum-Pa-Lum."

The engineering is excellent.

**DEMONSTRATION**

DEMO TAPE B 81-S, Vol. II

STEREOPHONY, INC.  
 \$3.95

I have had the pleasure of reviewing some eleven tapes released by this company (through the EMC Corp.) and feel qualified in stating that anyone possessing a stereo system will want to become well acquainted with Stereophony's products. To date I find the recordings are excellent, the repertoire refreshing and different, and the prices very appealing.

On this particular 18-minute sampler you will find introductions are made with sufficient brevity by Leigh Kamman. I take exception to one word in the opening statement where it is said that " . . . Stereophony ALONE can create the illusion of presence and realism. . . ." In all due respect to this company I feel that there are many others who are doing an equally fine job of engineering.

In this demonstration tape you will hear seven complete selections taken from Stereophony releases. The tape contains two pop and one mood number followed by a fine choral group singing a spiritual and a soft, more serious selection by the Voicestra. You are then brought back sharply to the pop field and the tape is rounded off with some spirited march music.

As we have mentioned before in these columns the demonstration tapes put out by the various companies are inexpensive stereo if you don't mind a few "commercials."

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Vienna State Opera Orchestra  
 Conducted by  
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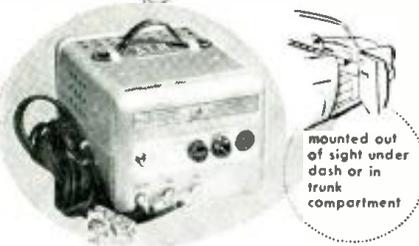


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## TEEN TAPERS

BY JERRY HEISLER, National President



BEING employed part-time in a camera store where I have a chance to sell recorders, has given me the chance to find out many people's views on recording. It is surprising to know that many people who own recorders know little more about them than they can learn from the instruction book that comes with the machine.

Subjects that I had thought common knowledge, such as dual track recording, and how a tape is erased, seem vast mysteries to many users of recorders. This being the case, and since teens are basically interested in learning, (I think) I thought that a brief discussion on learning about recording would be in order.

It seems to me that anyone spending in the neighborhood of \$200 for a recorder and its allied items, (and that's what most of you pay) should want to know everything possible about that recorder and about its proper use. It's surprising to learn of the great number of recorders that are stored in closets and used once or twice a year. This seems ample reason to believe that many people simply don't know how many ways they can use their machine.

The basic way to learn about anything is through reading, and fortunately there are many books on the subject of recording available. That you are reading this magazine shows that you want to find out what's new in recording and now let me encourage you to go further with your reading. Harold Weiler's, "Tape Recorders and Tape Recording," is a good all around text on the subject written in language that everyone can understand. It tells you how to place your microphone, clean your recorder heads, and all other common place operations that a recorder can be put to.

With this under your belt you are on the way to being a first class operator of a recorder. I find that most teens are interested in mechanical things too and this is borne out by the fact that many of you have written in with ideas for gadgets and applications for recorders. A man who is a real friend of Teen-Tapers, Charles G. Westcott, of Minnesota Mining, has written a book called "Tape Recorders—How They Work." This book takes you under the cover of your recorder and tells you just how it operates. Illustrations are used extensively and this book gives you real insight on what goes on inside.

These two books are basic reading in my opinion. There are also other books available which contain general uses of recorders. Some of the better ones in my opinion, include: "How To Make Good Tape Recordings," which is edited by the Audiotape people; "Your Tape Recorder," by Robert and Mary Marshall; and "Ribbons of Sound," by Carl Barlehen.

Those of you who really want to get technical will enjoy "Rider's Specialized Tape Recorder Manual," which gives detailed service instructions on most of the better known popular priced recorders.

And then there are those of you, who like myself, like to sit in an armchair and learn in luxury. You'll want to hear "All about Tape on Tape" which lets you listen to the story. This tape as well as the first two books mentioned are available from the magazine or you can get them from most dealers selling the magazine.

By taking an interest in learning about recording you will be able to derive much more pleasure from your recorder. A learning project is a good one for a school club or to do on your own. Once you have a basic understanding about recording, you will have the tools at your command to enable you to discover new uses for a recorder. You'll be able to talk intelligently on it, and you'll perhaps be able to save yourself some repair bills by being able to make minor adjustments yourself. Anyone who pays several hundred dollars for a recorder should not be satisfied with the instruction booklet alone. In most cases these books are painfully inadequate and tell little more than how to operate the machine in its simplest fashion.

While on the subject of increasing our recording education, don't forget the valuable help your local dealer can provide. Most dealers are themselves very interested in recording and invariably they own recorders of their own. They know from personal experience how to derive the greatest pleasure from a recorder, so don't hesitate to ask for their advice.

Lastly, don't hesitate to call on me or anyone else at the magazine. Our sole function is to help people derive pleasure out of recording, and my speciality is teens. If you need any advice please let me know. I try to keep up with all of the developments in recording, but of course I still have much to learn. I will promise you one thing for certain though, and that is that if I can't answer your question I can sure put you in touch with someone who can. People in the recording industry seem extremely anxious to discuss recording and especially with young people like us. A letter to any manufacturer on any recording problem is sure to bring you a very satisfactory reply. So don't let your recorder go to waste. Learn all you can about it and its operation and you'll get the most value from it.

We'll have more on stereo next month and we'd just like to mention that we now have an Ampex portable stereo outfit to look over which sure stimulates our desire to go stereo.

# BOOK REVIEWS

*Elements of Magnetic Tape Recording* by N. M. Haynes, Engineering Vice President, Amplifier Corporation of America. 6 1/2" x 9 1/4" cloth bound, 392 pages including index. \$7.95. Published by Prentice-Hall, New York.

Mr. Haynes is no stranger to magnetic recording having been associated with it since 1936, long before the tape recorder became what it is today. He has put his wealth of experience and knowledge into the pages of this work which, in our opinion is one of the most concise, and at the same time most complete textbooks on tape recording produced to date.

The book is a technical one, yet interestingly written and may be followed by anyone with a basic knowledge of electronics. It covers well the theoretical background, the elements and principles of the magnetic recording system, the basic apparatus and how it works and circuits, their use and maintenance.

The book contains twenty-five chapters that cover the subject from theory to basic maintenance and repair. There is a lot in this book—all of it worth having.

*Elements of Tape Recorder Circuits* by Herman Burstein and Henry C. Pollak, 5 1/2" x 8 1/2", 223 pages, paper bound, \$2.90, cloth bound, \$5.00. Indexed. Published by Gernsback Library, Inc., New York.

As might be inferred from its title, this book is limited in its scope covering in its 10 chapters the fundamentals of tape recorder electronics. The chapters include: Elements of a Tape Recorder, Characteristics of a High-Quality Tape Amplifier, Head Characteristics, Tape Characteristics, Bias Current, Equalization Requirements, Equalization Circuits, Oscillators, Record-level Indicators, Minimizing Noise and Hum. A substantial part of the book is written from the standpoint of design and a basic knowledge of electronics is needed to read it for maximum benefit. Mathematical formulae are held to a minimum. The principal coverage is audio tape recorders in the professional and moderate price range. The book does a thorough job within the scope set by the authors.

*Stereophonic Sound* by Norman H. Crowhurst, 118 pages including index, paper bound, 5 1/2" x 8 1/2", \$2.25. Published by John Rider Publishers, New York, N. Y.

This book has been written to give the reader a better understanding of stereophonic sound. It presents, however, excellent material for understanding monaural sound as well.

The first chapter reviews and presents the basic principles of binaural listening in a clear and not too technical manner. Later chapters cover the principles and differences of stereophonic systems consisting of two-channel, three-channel and coded single channel stereo. In addition to the above items this book contains a discussion on the choice of loudspeakers for stereophonic listening.

We would highly recommend this volume to everyone who is interested in a better understanding of stereophonic sound.

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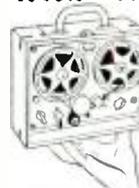
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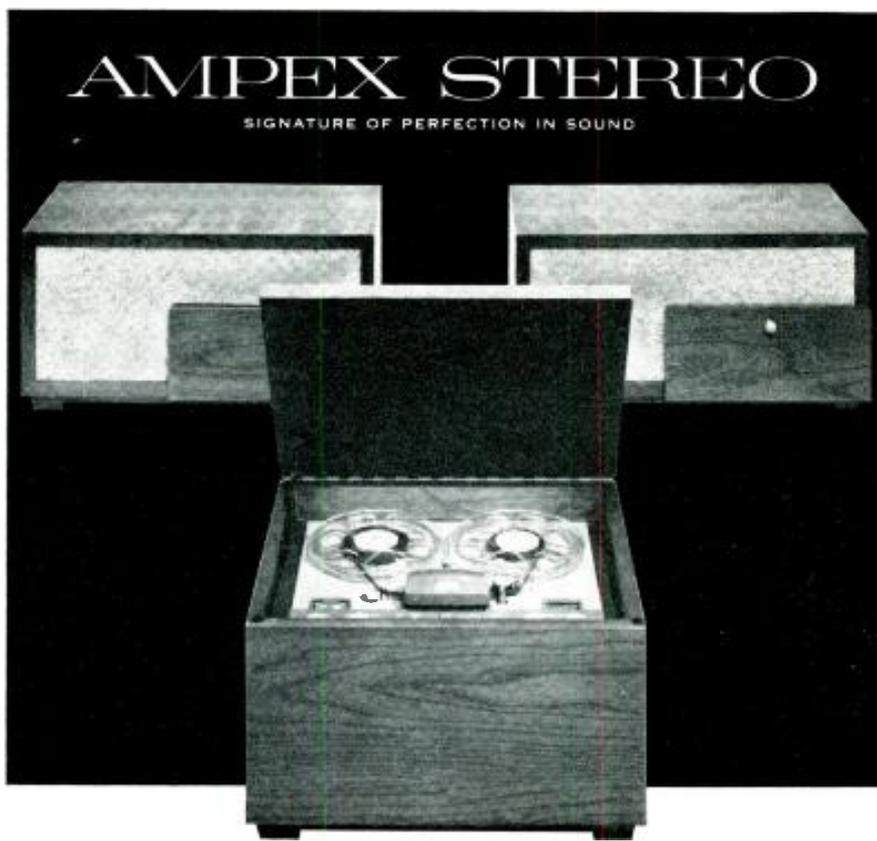


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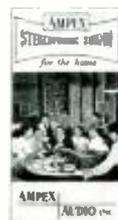
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Questions for this department may be sent on tape or by means of a postcard or letter. Please address your queries to, "Questions and Answers," Hi-Fi TAPE RECORDING, Severna Park, Maryland. The most interesting and widely applicable questions will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

**Q**—Please advise me on the following: What is the best way to record from radio or TV? 1—Use the microphone? 2—Use the direct connection (and where should it be connected—at the loudspeaker or volume control for best results)? 3—Use a pick-up coil, such as is used in rapping from telephones and where should it be placed? To get good results where do I control the volume—on the radio or on the recorder to prevent overloading as indicated by a flash, i.e. is it better to have the radio playing louder and decrease the volume on the recorder until the overload flash does not indicate or the other way around? This question applies to TV recording as well.—G. N. D., New York City, N. Y.

**A**—All of the methods you mentioned may be used for recording from radio or TV; however for the very best results your connection should be made to the volume control on the radio or TV set.

If you use a microphone then your recording will be limited to the reproduction that is afforded by the set speaker, in most small radios and TV sets this is none too good. In addition you will pick up all the room noise.

The second best method would be to connect your auxiliary cord to the voice coil terminals on the loudspeaker itself. This connection is a low impedance, relatively high power output and should be plugged into the radio-phono jack on the recorder. For the most part satisfactory results will be obtained at this point. The only drawbacks being the question of the quality of the power amplifier in the radio or TV set and sometimes, the loudspeaker will act as a microphone and add a bit of random noise but this is very unusual. The telephone pickup device works on inductance and should be placed near the speaker but again we feel the response would be limited.

In all cases, precaution should be taken to avoid hum pickup by using shielded cable (except in cases of connection to the loudspeaker) and grounding the shield on both the radio and recorder chassis. With some AC-DC sets, it may be necessary to use an isolation transformer because of the difference in potential on the chassis of the set and the recorder.

In general, it is best to feed a moderate amount of signal into the recorder so that your recording is done with the control somewhere in the mid-range. The overload light should flash occasionally on the loudspeaker peaks of sound.

**Q**—In a popular magazine, Satevepost December 7 issue, I think it was, appeared an illustration of a plainclothes investigator using a tiny tape recorder under his arm. This tape recorder is much smaller than

any I have seen previously. Can you tell me what firm manufactures tiny pocket-sized tape recorders using standard tape which can be played back on any playback mechanism? E. F. W. San Bernardino, Cal.

**A**—We believe the recorder in question was a wire recorder and not a tape recorder. The Minison, put out by Geiss-America, 6424 N. Western Ave., Chicago 45, Ill., is a tiny wire recorder which is probably the machine shown.

The only similar tape recorder is the Tapette, made by Broadcast Equipment Specialties, Box 149, Beacon, N. Y. It about covers the palm of the hand and uses standard Mylar base tape. This unit records at 1 7/8 ips or 3 3/4 ips and may also be had in a 15/16 ips model. So far as we know, this is the only tape recorder of small dimensions that uses a standard speed.

The recently reviewed Dictet, made by the Dictaphone Corporation is a magazine type and the Mohawk Midgetape also uses a magazine. These two recorders will fit into an overcoat pocket or a case about the size of a camera case. The Dictaphone Corporation is at 420 Lexington Avenue, New York and Mohawk may be addressed at Mohawk Business Machines, 944 Halsey Street, Brooklyn 33, N. Y. We would suggest you contact the manufacturers directly for literature on the various units. Most of them respond very well to the voice range but not so well to music.

**Q**—There is one question to which I'd like an answer. That is what is the best way to play my recorded tape through an external amplifier. I have tried it with two different recorders using an output transformer but with only slight success. There must be a better way to take the recorded sound from the recorder and play it through a larger amplifier. How about the recorder's volume control or is there a special place a person could pick up a signal and feed this signal into the phono or mike input of, say, a 20 watt amplifier?—F. A. C., Alhambra, Cal.

**A**—Some recorders have both a high and low output. The high output is the external speaker output jack and the low is usually marked "amplifier." If the output is taken from the external speaker jack it may be fed into the phono jack on the amplifier. If the output is taken from the low gain "amplifier" it then may be fed into the microphone input on the amplifier. No transformers are necessary unless there is a considerable mismatch in impedances between the outputs and inputs used. If the current supplied from the recorder is too heavy a resistor may be inserted in the hot side to cut down the strength of the input.

# 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, Hi-Fi TAPE RECORDING, Severna Park, Md.

To the Editor:

Recent publicity on current phonograph stereo disc experiments predicts that sales of stereo tapes and tape recorders will lag when this development materializes. Nothing is further from the truth.

No record manufacturer has yet committed himself to a specific date for the public sale of so-called stereo discs. Several stereo disc recording and reproduction systems are currently being demonstrated but manufacturers have yet to agree on specific standards.

Both Westrex (subsidiary of Western Electric) and London Records have conducted demonstrations before businessmen and technicians with inconclusive results. Other systems are still to be examined before a decision can be made on comparative engineering advantages, production requirements and compatibility with existing monaural systems.

Manufacturers of cutting heads, playback heads and associated equipment cannot tool up until there is a clear direction and the assurance of a profitable enterprise. It seems that stereo discs and playback equipment will be available within two years—but this experimental first public offering will be made only by firms which want to pioneer this untested market.

Meanwhile what does this mean to the magnetic recording industry? Every major producer of home entertainment equipment is either manufacturing or planning to manufacture a tape recorder.

Every major record label has entered or plans to enter the recorded tape business by the end of 1958. The reason can be summed up in two words—"stereo sound."

Sales of tape recorders have been substantially increased by the addition of stereo. Eighty per cent of industry production in 1958 will be in monaural-record stereo playback equipment. More than 90 per cent of recorded tape produced in 1958 will be stereo. Even now half of the companies are promoting and selling stereo tapes exclusively.

In 1958, the Magnetic Recording Industry Association plans to sponsor stereo concerts, public displays and demonstrations of stereo equipment—all to promote sales. A special brochure on stereo is also being designed and written for public distribution. We will use every means at our disposal to educate the public to the superior qualities of stereo tape and stereo recorders.

By 1960 about four million Americans will be enjoying tape recorded music in the home. In other words within three short years about twice as many families will have tape recorders. This projection, based on a consensus of informed industry sources, takes into account the coming competition of stereo discs. However we should bear in mind: Stereo discs will actually

help to sell more recorders and more recorded stereo tape because more people will become interested in obtaining the finest home stereo sound reproduction.

When the tape recorder was first introduced to consumers, it had to compete with

the firmly-entrenched disc and phonograph industry. Despite this competition recorder sales have advanced year by year.

We can effectively compete with stereo discs and stereo disc-playing equipment just as successfully as our first recorders competed with phonographs. Today recorded tape has proved its basic advantages and the tape recorder continues to increase its unique and effective service to industry and consumers.

We believe that the stereo disc will benefit all phases of the entertainment industry. Past experience shows that each important innovation in the electronic arts has contributed to the general progress of our industry.—Irving Rossman, President, Magnetic Recording Industry Association.

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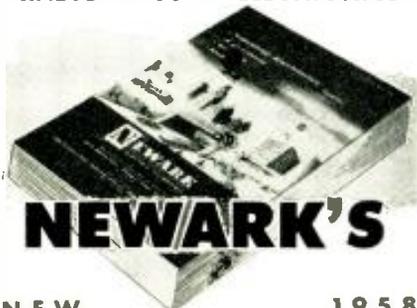
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# TAPE IN EDUCATION

BY JOHN J. GRADY, JR.



FOR over two years TAPE IN EDUCATION has been pitching posies at ambitious experimenting educators—generally classroom instructors. These are the teachers who have been devising a variety of ways to utilize the advantages of magnetic tape. And have then adapted tape recording to their teaching routine, thereby increasing the efficiency of their instruction and benefiting the students in their classes.

Here is an illustration of faculty experimentation that qualifies for top recognition. At the beginning of the present 1957-1958 school year, a major state university, with an enrollment of over 17,000 students, made a most modern language laboratory available to classes in Germanic languages. Naturally, there's a history of research and experimentation prior to the installation of the laboratory. And again, faculty members, seeking better teaching methods, are entitled to praise for venturing beyond the orthodox teaching routines of yesterday. In the following paragraphs there are extracts from an explanatory report by William F. Roertgen of the University of California at Los Angeles. It is a convincing report, extolling the use of tape recording at the university level. TAPE IN EDUCATION is grateful to Mr. Roertgen for the information regarding the new language laboratory at UCLA, with which he is so intimately associated, from origination to functioning completion.

The introductory lines of the report deserve quotation: "In order to make full use of all modern facilities in foreign language instruction and thereby to deepen the learning experience of the students and improve their mastery of the foreign language, the Department of Germanic Languages at UCLA has requested the University administration to provide a language laboratory designed primarily for instruction in the lower division classes of the Department.

The great advances made since 1945 in the perfection of technical equipment for recording and producing sounds offer promising vistas to the field of language instruction. Foremost among these innovations is the tape recorder, which combines fidelity of sound reproduction and ease of operation with comparatively inexpensive operating materials (tapes) that can be used repeatedly without impairing the quality of reproduction. While other equipment, such as magnetic disks, has excellent qualities, the planning of the UCLA laboratory was centered around the use of the magnetic tape recorder because of its greater versatility."

Educators are reminded that the language laboratory installation at UCLA is a carefully planned one. Faculty members and professional electronic technicians designed the development to meet definite objectives. Results desired included an increase in the

speed, accuracy, fluency and, most of all, the enjoyment with which students learn foreign languages. There is satisfaction that these aims have been attained. The laboratory is readily accessible. It is located in Royce Hall, in the heart of the extensive campus. Thirty semi-soundproof booths are provided with a tape recorder equipped with headphones for listening and with a microphone for recording. A selector switch permits the student in his booth to pick up pre-recorded material from a master tape recorder, to record it on his own machine, if he so desires, and to hear it through his headphones. A monitoring system makes it possible for the instructor to listen in on the student's voice without disturbing his work. For students with particular problems, the laboratory has a soundproof correction booth in which the instructor can handle individual difficulties with pronunciation. Individual circuits connect each booth with four master tape recorders and two phonograph turntables located at the main control console. Thus, functionally, each booth can receive a choice of six programs, a plan which makes the laboratory flexible for simultaneous study by six different groups of students.

The language laboratory at UCLA is not limited to audio instruction. Efficient foresighted planning is evident in this carefully designed facility. Therefore, visual instruction has been provided for, too. In the rear of the room, a projection platform will accommodate a 16mm soundfilm projector, a slide projector, or an opaque projector. The lab booths have unique hinged walls, which may be folded down in a few seconds. This arrangement permits each student to have an unobstructed view of the screen installed in the front of the room. And especially designed blinds keep daylight out during projection periods.

This, necessarily brief, outline of an excellent report of a tape recording installation at a major university may excite the curiosity of some teachers and administrators. Within the report there is reference to most of the problems which will confront educators contemplating tape recording installations. There is mention of the ambitious teachers restricted by a limited equipment pool, who could become discouraged because the desired tape recorder is either "spoken for" or is otherwise unavailable. There is mention, too, of the student "fortunate enough to own a tape recorder." These, and other considerations may make the complete report of Mr. Roertgen a desirable item. TAPE IN EDUCATION rates the report one of the finest endorsements of tape recording ever issued. Perhaps it might be available at Office of Public Information, University of California, Los Angeles 24, California.

# TAPE CLUB NEWS

Tape-Respondents, International member Jim Claffey of the American Embassy at Saigon in Vietnam, has organized a local club there. Most of its members are comprised of native youths who wish to better their knowledge of the French and English languages through tape correspondence. There are about ten members in this group at present, and the average age is 19. They all speak Vietnamese, most of them speak French, and a couple speak various Chinese dialects. All are high school or college students. Jim would like to contact several local tape clubs, school-room classes, church groups, etc., interested in conversing in English about any subject.

The Potomac District of The Voicesspondence Club recently held a meeting at Silver Spring, Maryland. District Deputy, Bob Crouse, has been planning such meetings on a semi-annual basis. He has met enthusiastic response from the members in his district, which consists of Maryland, Delaware, West Virginia, District of Columbia, and Virginia. Some of the meetings have formal programs and some are informal get-togethers, but they are always well attended.

The Voicesspondence Club is always glad to see its members take an active part in club activities, as are all clubs. Some members participate even more. Such is the case with the Lee G. Riggs family of Omaha, Nebraska. These Voicesspondence members are busily recording the Bible on tape and have offered to make copies of the various books available to the club's blind members. They say their purpose is two-fold—to make the club more interesting and to make the Bible available to more persons.

## JOIN A CLUB

- TAPE RESPONDENTS INTERNATIONAL**  
Jim Greene, Secretary  
P. O. Box 125, Dept. T., Little Rock, Ark.
- THE VOICESPONDENCE CLUB**  
Charles Owen, Secretary  
Noel, Virginia
- WORLD TAPE PALS, Inc.**  
Marjorie Matthews, Secretary  
P. O. Box 9211, Dallas 15, Texas
- AUSTRALIAN TAPE RECORDISTS ASSOC.**  
Jack A. Ferry, Federal President  
Springbank Rd., Clapham, S. Australia
- UNITED RECORDING CLUB**  
Richard L. Marshall, President  
2516 S. Austin Boulevard  
Chicago 50, Ill.
- THE NATIONAL TAPESPINNERS**  
Carl Lotz, Secretary  
Box 140, Paoli, Pa.
- THE BRITISH AMATEUR TAPE RECORDING SOCIETY**  
Ted Yates, Secretary  
210 Stamford Road  
Blacon, Chester, U. K.
- AMERICAN TAPE EXCHANGE**  
Stuart Crouner, Secretary  
181 E. Main St.  
Gouverneur, N. Y.

We are happy to see the quickened pace at which the American Tape Exchange Club is expanding. Membership has steadily been increasing. We wish the club continued success.

American Tape Exchange member Bill Underwood has been working on his ham radio license. Bill would like very much to tapespond with any other ham operators, and any members interested in radio are invited to contact him.

The British Amateur Tape Recording Society has a tape dubbing service for its members. While the service is not free, it is operated at rates that will just cover costs, including postage. Details are available on application to the General Secretary.

The B.A.T.R.S. which to date has provided its many members with a new Adventure Into Sound, now provides an Adventure Into Space, with recordings of the earth satellite. This recording is now held in the club tape library, and copies can be obtained only via the B.A.T.R.S. Tape to Tape Dubbing Service. Write to Ted Yates, 210 Stamford Road, Blacon, Chester, U. K. for details.

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More important—the box holds Sonoramic's new wide latitude recording tape.

This tape is a giant step forward in recording tape engineering. It guarantees the user distortion-free recording and maximum performance regardless of make of recorder, line voltage fluctuations and tube age and head condition. Lubricated-for-a-lifetime too, to eliminate squeal, layer-to-layer adhesion and deposits on heads.

Feature of the new Sonoramic line is the Tensitized Double-Play Mylar\*—2400 feet on a 7" reel—which is twice as strong as ordinary magnetic tapes with the same playing time. Whatever your tape needs—for the home or for professional use—you'll find a Sonoramic tape to fit your needs.

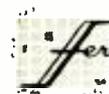
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# Some of the Men Who Pioneered



Frank Healy and John T. Mullin with Magnetophon



S. J. Begun

All of the men shown on these pages were instrumental in making big advances in magnetic recording. Together with others who are not shown, they helped make magnetic recording what it is today.

Left: Frank Healy, General Manager of 3M's Minicom Division, and John T. Mullin, Director of Engineering, shown with one of the German Magnetophones were connected with the Bing Crosby shows, first show to use tape in radio broadcasting in the U. S.

Lower left: S. J. Begun, Director of Research of Brush Development (now the Clevite Corporation) was responsible for getting the first U. S. commercial recorder on the market, the Brush "Soundmirror" first shown in 1946.

Below: J. Herbert Orr, President of Orradio Industries, was one of the Signal Corps team that got into Germany during the war. His firm began to manufacture Irish tape in 1950.

Right: Dr. W. W. Wetzel, General Manager, Magnetic Products, M. C. Hegdal, Production Manager, and R. L. Westbee, Vice President of Minnesota Mining and Manufacturing who produced the first commercially available tape in 1947. It was a paper based black oxide.

Far right: Marvin Camras of the Armour Research Foundation is often called the father of modern tape recording. He is the industry's most prolific inventor and a recipient of the John Scott Award for scientific achievement. He holds more than 95 patents in this country including three design patents.

Lower right: C. E. Smiley, President of Livingston Audio who was the first to produce stereo tapes commercially when there were few playbacks.

Far right, lower: Joseph F. Hards who produced the first monaural tape library and who founded the Magnetic Recording Industry Association in 1953.



J. Herbert Orr

**W**ITH the close of the year 1957 tape recording marked the end of a decade of extremely rapid advancement. In the home, stereo tape was bringing the finest music ever obtained, in the factory giant machines were being controlled from the magic brown ribbon and television, the public's eye on the world, was recording both the pictures and sound on tape. The era of magnetic photography had been born. Tape recorded the heartbeat of industry and guided missiles in space, tape wrote paychecks and kept records in banks and the end was not yet in sight.

While these remarkable ten years pointed to still greater achievements the road had not always been a smooth one. There was sweat and tears and heartbreak along the way from the first days when magnetic recording was presented to the world.

Valdemar Poulsen, a Danish telephone engineer is the acknowledged father of magnetic recording. This man, the "Danish Edison" patented the first magnetic recording de-

vice in 1898 after improving an earlier model he had constructed in 1893. The machine took the Grand Prix at the Paris Exposition in 1900 but by modern standards it was crude indeed. Using wire as the recording medium (tape hadn't been invented yet) it was weak on recording and weaker on playback (there were no amplifiers) yet it did give a creditable performance. The wire ran at astounding speed and as much time was consumed in rewind as in the original recording. Despite these drawbacks improved models of the early machines found wide use in Europe as dictation machines. The American Telegraphon Company, founded in 1903, sold some half-million dollars worth of shares to the public but its high hopes were never realized and the company went into receivership. According to S. J. Begun in his excellent book "Magnetic Recording" the history of the company, especially the testimony presented at a Senate hearing concerning its activities, "read like a cloak-and-dagger dime novel."

# in Magnetic Recording



L. to R.: Dr. W. W. Wetzel, M. C. Hegdal, R. L. Westbee



Marvin Camras



C. E. (Ched) Smiley



Joseph F. Hards

Because no magnetic material will record properly without the addition of a bias current to the recording head the earliest recordings were not all they could be. In 1907 Poulsen and Pendersen patented a method of DC biasing which effected a great improvement in the quality of recordings. Many honors came to Poulsen before his death in 1942.

A number of wire dictating machines were made in Germany and sold in some quantity during the 20's, including the first machine to use a magazine loading principle. In America, after the collapse of the Telephon Company magnetic recording all but died. The Navy, however, kept on working and in 1927 W. L. Carlson and G. W. Carpenter made the next great discovery—the AC bias. This was patented by them in 1927.

The other ingredient necessary for the rebirth of magnetic recording had come about when Lee De Forest invented the vacuum tube in 1912. Amplifiers then could be

built and since AC biasing provides satisfactory recordings all the ingredients were present for further growth.

The prophet arose in Germany, a chap named Kurt Stille who talked financiers into forming a patent holding company to sell rights to those who wished to make magnetic recording machines. His efforts met with success and gave rise to a number of recorders including the Blattnerphone which was probably the very first tape machine—even though the tape was of steel rather than the familiar plastic. In 1920 a voice had been heard suggesting the possibility of using powdered magnetic materials on tape but nothing had been done about it. Blattner went to England with his machine and it was actually used to provide sound with some of the early movies.

In 1927 a German named Pflumer was experimenting with powdered coatings on tapes to be used in place of wire. So far as we know he did not use the magnetic oxide but coated his tapes with powdered metallic materials.

Needless to say, the tapes were rough and sometimes the coating would fly from the machine in a fine spray as the tape flew across the head. In 1931 two large German firms continued his work, A. E. G. the machine, I. G. Farben, the tapes.

S. J. Begun of Brush Development Company (now the Clevite Research Center) designed the Lorenz recorder in Germany. This steel tape machine found wide use in German broadcasting stations. Mr. Begun came to this country in 1935 and was instrumental in the rebirth of magnetic recording on this side of the Atlantic.

Meanwhile the cry of "Heil Hitler" was rising and in 1933 and subsequently the Nazis took all the recording equipment they could get. In 1935 the German Magneton was exhibited in Berlin and made a hit because it used plastic tape instead of steel. As conditions in Europe grew progressively worse the curtain was drawn on our knowledge of magnetic recording advances but the Germans were working on improving their machines at top speed. Also in the 1930's the Japanese were doing some work on magnetic recording.

Meanwhile in this country some research was going forward. Bell Telephone built a steel tape machine in 1935 and first demonstrated stereo sound at the World's Fair in 1939. The stereo machine used two Vicalloy steel tapes wound on the same reel which separated and passed over two heads. It is interesting to note that Vicalloy was a very hard steel, harder than the average knife blade and it cost, then, \$1.50 a foot. Bell Labs also built a "Mirrophone" so that people could hear how their voices sounded on the phone. The machine was also used for weather reports by telephone. The only organizations in this country that took a serious view of magnetic recording before the war were the Brush Development Company, and Armour Research Foundation.

As seems to happen so many times in human endeavor, the stress of war brought great advances in magnetic recording. With money no object and the necessity of adequate recording devices for the military, developments moved at a brisker pace. About this time, 1940, Marvin Camras, magnetic recording's most prolific inventor became associated with the Armour Foundation and developed a wire recorder which both Armour and General Electric produced. Brush Development also produced recorders of its own design and, in addition, Brush received a Naval Research and Development contract for a machine which would use tape instead of wire.

It is interesting to note that from the time of the collapse of the American Telegraphon Company until 1937 when the Brush Soundmirror was placed on the market no magnetic recording equipment had been made in the United States. The early Soundmirror had a recording time of only one minute on an endless tape.

By 1939 the Germans had achieved good plastic tape although far below the quality we enjoy today. They had also developed a number of machines, including one with a rotating head and within the next two years Magneton tape recorders were installed at Radio Luxembourg. These had a 30 inch per second tape speed.

Brush, meanwhile, had brought out a paper tape which the Bell Telephone Labs were experimenting with, but it was not placed on the market. Brush also made a coated wire for recording and by 1943 Webcor was building wire recorders for the Navy.

In September of 1944 Brush contacted Minnesota Mining and Manufacturing Company to see if they would be interested in developing a thin tape with a coating of ferromagnetic powder on it. It was pointed out that if successful, this might have some post-war applications as well!

3M's took the job and Dr. Ralph Oace began experiments to find the right binder. Early efforts failed as the tape was tacky and to make matters worse, the firm had no test equipment or recorders to work with. Every sample had to be sent to Brush for evaluation. By July 1946, however, the binder problem was licked and a group headed by Robert L. Westbee began to see how the lab work could be transposed into production.

A bit later that same year, Brush brought out its redesigned Soundmirror and its own paper-backed tape which had a black iron oxide coating.

The Armour Foundation continued with wire and from 1947 to 1948 Webcor (then Webster-Chicago), Sears-Roebuck, RCA and others did turn out many machines for public use but the wire boom failed to materialize.

It was in 1946 that Magnecord, the oldest maker of professional tape recorders now in business was formed. Their first product was a wire recorder of professional caliber. The firm was formed by four men, John S. Boyers, now Chief Engineer for Bell Sound Systems, Russ Tinkham, now with Ampex, C. G. (Spec) Barker of Filtors, Inc., and J. L. Landon. Many of the beginnings of now respected companies were about as John Boyers describes the start of Magnecord:

"The Magnecord organization started with Russ Tinkham and Spec Barker more or less backing each other out one afternoon trying to make some money. They were both, at the time, working for Armour Research Foundation and had seen the great interest developed by Armour's wire recording program, particularly that generated by the so-called 'Master' recorder on which I had done the electronics.

"One of them said to the other that he thought it would be a good idea to get into some money and put up a balloon making these things but he did not know where to get the people. The other—I think it was Tink—said that getting the people was easy, so Barker said 'Getting money was easy'—and they had each other! Tink immediately came to me and suggested we go out for a cup of coffee. I knew something was up, first because he didn't drink coffee—particularly in the afternoon—and on the way over he asked me if I was interested in making some money. I said, 'Certainly—as long as it was honest.' This was in November of 1945. The company was incorporated in May of 1946 and set out to produce the only professional wire recorder ever made. We called it the SD-1, standing for 'Super-Duper'—a name which was thought up one Saturday afternoon. It was during this time that we agreed among ourselves to work not more than 70 hours a week because we found that working 85 or 90 hours a week for any extended period of time was far beyond the point of diminishing returns.

"Our entry into the tape field was through a little device having the trade name 'Audiad.' This was a point-of-sale machine and was sometimes called the 'audible advertiser.' We made 500 or 1000 of the things which incorporated a very simple tape drive at about 6" per second and an AC-DC type amplifier. They could be started by closing an external circuit and would eventually stop when a hole in the tape passed a contact shoe. The storage device was



*Now you can record entire radio programs  
on "Magnetic Ribbon"!*

**Here's the "NEWS in home recordings . . .  
SOUNDMIRROR**

- From radio or "home talent"
- Recordings can be cut with scissors, edited, and spliced with cellulose tape!
- It's inexpensive (1/2 hour recording for only \$2.50!)
- Recordings are "reused" as new recordings are made!

"Magnetic Ribbon" Recording is easy to sell because it offers more! It's Magnetic Recording on Paper!

- Continuous 1/2 hour recordings!
- No needles, no discs, no technical skill needed!
- It's substitution recording! Cash in on this profit picture and all the new magnetic recording is making—

Sell the **SOUNDMIRROR** "Magnetic Ribbon" Recorder

Write **THE BRUSH DEVELOPMENT CO.**, 3405 Perkins Ave., Cleveland 14, Ohio



**SOUNDMIRROR**<sup>®</sup>  
*Magnetic Ribbon recorder*

Trade Mark Reg. Patent Pending

*Brush...* **FIRST IN MAGNETIC RECORDING**

Above: one of the first consumer advertisements was this Brush ad for the Soundmirror. Note that the word "tape" was not used, instead it was called "magnetic ribbon." Upper right: shortly after the introduction of the postwar Brush Soundmirror was this Magnetape Twi-Trax recorder made by the Amplifier Corp. of America marketed in 1947. It featured automatic reversing at the end of the tape. Right center: first tape recorder on the American market was this 1947 Brush Soundmirror shown here. Right lower: granddaddy of all "Scotch" brand magnetic tapes was this tape No. 100 with a paper backing and a black oxide introduced in 1947. Only recorder initially was the Brush Soundmirror operating at 7 1/2 inches per second.



merely an elongated box in which the tape was expelled in much the same fashion as is now used on some computers. We had all kinds of difficulties because the things ran so blasted hot they would on occasion melt down the binder then used in the paper base tapes. They had phenomenal success when intelligently used—one fellow in a ten cent store in Madison, Wisconsin, increased his business 35% the first month he had the thing in use.

Going into the tape recorder business on a professional basis was rather difficult since we had already designed a portable wire recorder having magnesium castings, etc. which promised to be a very good machine. However, our New York representative, Harry Miller, convinced Tink and me in room 1126 of the Commodore Hotel at two o'clock one morning that we should make a tape recorder. This was in March of 1948, I am not positive about the year but it seems right. By the time Tink and I got back to

Chicago a day and a half later, we had outlined the genesis of the Magnecord PT-6 line of equipment. In May of that year we showed our first unit—I believe it was at the National Association of Broadcasters in Los Angeles. Within three days we had written \$45,000 worth of business whereas the previous year our entire gross business was, if I remember correctly, \$24,000. PT-6 machines are scattered all over the world, I suspect the total number is in excess of 35,000 by now. (Editor's note: Magnecord, which is now a division of Midwestern Instruments has just announced that production of the PT-6 line will be resumed with stainless steel fronts and new equalization.)

"There was some question as to whether we had a tiger by the tail or the tiger had us by the tail; in any case it was late August when we shipped our first production machine. It was during this period that the 90 hour weeks became very common. I recall during this period some very

# CHRONOLOGY OF MAGNETIC RECORDING

- 1893**—Valdemar Poulsen the "Danish Edison" makes the first magnetic recorder.
- 1898**—Poulsen patents the "Telegraphon" wire recorder.
- 1900**—Telegraphon wins Grand Prix at Paris Exhibition.
- 1903**—American Telegraphon Company formed using Poulsen's design.
- 1912**—Lee De Forest invents vacuum tube making amplification of weak signals possible.
- 1920**—A. Nasavischwily of Germany first suggests use of powdered magnetic material. Modified Telegraphon marketed in Germany by Kurt Stille. Karl Bauer, Germany, develops first tape magazine. Dailygraph, Germany, wire recorder by Echophone Co.
- 1927**—Experiments with powdered magnetic material on paper and plastic by Pfeumer of Germany. Patents on powdered recording media issued to J. A. O'Neill, U.S.A., Pfeumer of Germany and Ofanhauser. W. L. Carlson and associates granted patent on AC Bias.
- 1930**—Blattnerphone using steel tape used by BBC and for sound for movies in England.
- 1931**—Development of coated tape by I. G. Farben of Germany.
- 1932**—Textophone recorder, wire, embodied several improvements over Dailygraph. Made by C. Lorenz Co., Germany and associated with International Telephone and Telegraph.
- 1934**—Stahltonmaschine, Germany by C. Lorenz, used steel tape and probably was first machine used for radio work.
- 1935**—Magnetophone made by A. E. G., Germany used plastic tape at 30 inch per second speed. Bell Telephone Labs, U.S.A., develops steel tape machine.
- 1937**—C. N. Hickam of Bell Telephone Labs demonstrates "Mirrorphone" using steel "Vicalloy" tape. Brush Development Company brings out "Soundmirror" developed by Acoustic Consultants and using steel tape. Western Electric produces Mirrorphone using metal tape. Used for weather reports on phone, etc. First stereo demonstration at World's Fair by Bell Telephone labs using steel tape machine.
- 1938**—Magnetophon model K-4 developed in Germany.
- 1939**—Tonschreiber, using rotating heads, developed in Germany. Brush Development Company markets paper tapes, black oxide, also develops coated wire for recording. Germans had achieved good plastic tape.
- 1941**—Brush, General Electric and Armour Research Foundation make wire recorders for armed services. Magnetophons of good quality installed in Radio Luxembourg. Marvin Camras develops A.C. bias method and Armour Research applies for patent on it.
- 1942**—Marvin Camras designs model 50 airborne wire recorder.
- 1943**—Webcor makes wire recorder for Navy.
- 1944**—Minnesota Mining starts experiments on tape and coatings under guidance of Dr. Ralph Oace.
- 1945**—Allies "liberate" German Magnetophon as Germany collapses from Allied push. Investigating teams describe German methods and developments during war years.
- 1946**—Magnecord formed, starts making wire recorders. Brush Soundmirror prototype using tape first shown. Shure develops methods of mass producing heads. Allies ship German machines back to U.S. Herbert Orr assembles machine in Alabama. Magnetophon demonstrated by John Mullin to I.R.E. group in May. Ampex Electric Company interested. Marvin Camras and associates stripe magnetic film. Tapes being made by Brush Development Company, Indiana Steel Company, and Minnesota Mining and Manufacturing Company. No firm had market production. Indiana Steel tape was friable metal, not oxide.
- 1947**—Wire Recorders on market include: Polyphonic by Electronic Sound Engineering Company; Pierce by Pierce Wire Recorder Corp.; Brush by Brush Development Company; Pentron by Pentron, Inc. Tape Recorders included: Magnephone by Amplifier Corporation of America; Magne-sonic by Sound Recorder and Reproducer Co.; Sound-mirror by Brush Development Co.; Ekotape by Webster Electric Co. Brush Development had a magnetic disc recorder called a "Mail-A-Voice." Minnesota produced its first tape for the market. #100, paper base, black oxide tailored to Magnetophon machines and #110, black oxide on plastic base. Tape recording demonstrated to ABC by Colonel Ranger. Magnasynch developed a magnetic film recorder, first to use 16 mm. magnetic film. Dr. W. W. Wetzel, H. K. Smith and R. Herr of Minnesota Mining developed a red oxide which had superior recording characteristics. However, when they applied for a patent, they discovered that Marvin Camras had a prior claim for the same material. It was the development of this oxide that made modern recording possible. This became tape #111 and was the first commercially produced for the market using the new oxide. Electrosonic Specialties established. Built Memotape in situational recording and transcription devices for psychiatric treatment.
- 1948**—Both wire and tape show gains. Wire recorders new on market include Air King and Crescent by Crescent Industries; Dynaport by Lear, Inc.; Wire Master by Precision Audio Products; Silvertone by Sears Roebuck; Magnetone by Brush Development Co.; Nemeth and Master by Nemeth Co.; Isophone, a telephone recorder by Oberliken Tool and Die Works; WiRecorder by WiRecorder Corp., Webster Electric, Powell and National Polytronics. The first Ampex 200 was delivered and ABC bought 12 at \$5,200 each. The ABC Network pioneered tape in the broadcasting field. Berlant Concertone 1401 was marketed. Magnecord made a dramatic switch from wire to tape. Crestwood Recorder Corp. brought out Crestwood Recorder using a Canadian made mechanism. International Electronics of Philadelphia also made a machine. Stencil Hoffman made a multi-channel recorder, a transcription recorder and "Minitape," a completely portable machine. Minnesota Mining marketed the new red oxide tape for the first time. Berlant marketed the "Stenovox" a 1/2 track dictating machine and Crestwood had a fixed half-track head. Berlant also developed the idea of multiple heads. Pentron made a telephone answering device. Tape had completely changed the broadcasting industry.
- 1949**—New recorders on the market include: Fairchild, made by Fairchild Recording Co.; Presto by Presto Recording Co.; and the Rangertone by Rangertone, Inc. Magnecord demonstrated the first stereo recorder at the Audio Fair. The first tape splicer, the Carson, by Magneccessories was marketed as was a solution to make magnetic tracks visible. Audio Devices marketed their first tape, oxide coated, red or black on either plastic or paper base. Tape featured uniform coating and lubrication incorporated. National Standard Company brought out their black oxide "Permo-magnetic" tape.
- 1950**—Recorders on market included: Knight by Allied Radio; Ampro by Ampro Corp.; Ultratone Tapeograph by Audio Industries; Recordofone by Bell Sound Systems; Concertone by Berlant Associates; Magictape by Crestwood; Dormitzer by Dormitzer Corp.; Eicor by Eicor, Inc.; Califone by Califone Inc.; Masco by Mark Simpson Mfg. Co.; DuKane by Operadio Mfg. Co.; Astra Sonic by Pentron; Tapewriter-Scribe by Permoflux Corp.; Revere by Revere Camera Co.; Stencil-Hoffman by Stencil Hoffman Co.; Webcor by Webster-Chicago; Ekotape by Webster Electric; Wilcox-Gay by Wilcox-Gay Corp.; Musictape by York Radio and TV Corp.; Travel Corder, a portable, by Michigan Electronics Co. and recorders by Sonar Radio Corp., Magnetic Recording Industries, Ltd., and Pentron. Brush Development Co. sold their first multichannel heads and recorder. The first recorded tape catalog issued by Recording Associates. It contained 8 tapes. Wire-response Club and Tape Respondents International organized. Orradio Industries marketed first tape, oxide coated on plastic base. Minnesota Mining offered a red oxide on paper base. Tapemaster deck on market.

- 1951**—Crosby Enterprises demonstrated first video tape recording machine in November. The Mini-Music continuous tape cartridge was announced by Television Associates of Indiana and Cousino, Inc. brought out the continuous tape magazine. Webcor announced its two direction recorder.
- 1952**—Victor Animatograph Corp. brought out its Magnesound for converting optical movie projectors to magnetic sound projection using striped film. Broadcast Equipment Specialties announced its spring-driven, self-powered portable Tapak. The first language course was offered to the public, a course in French by the Tapespondence School. Crestwood brought out 7½ ips hi-fi machine with separate record and monitor heads. World Tape Pals founded.
- 1953**—New recorders include: FME by Federal Manufacturing and Engineering Corp.; Telectro, lowest priced recorder by Telectrosonic; RCA by Radio Corp. of America; Warren Portable by J. C. Warren Corp. First issue of Tape Recording magazine issued under name of Magnetic Film and Tape Recording. Pentron announces tape dictation machine and 6 channel "electronic orchestra" using ¼ inch tape. Minnesota Mining announces Hi-Output tape. RCA demonstrates their video tape recorder. A-V Tape Libraries expands tape catalog and absorbs Recording Associates library of eight tapes. The Magnetic Recording Industry Association was formed. Joseph F. Hards, first president. The Voicesspondence Club was begun using as a base the older Wirespondence Club which it took over. Program for blind begun. Development work started on Fidelipac tape cartridge. RCA announces video tape records in color.
- 1954**—New recorders include: V-M Tape-O-Matic by Voice of Music; the Motek Tape Deck and Aspden tape deck kit offered by Fentone Corp.; TDC by Three Dimension Co. First stereo tape catalog, one page, issued by Livingston Electronics. EMC offers educational monaural recordings for school and church. Omegatape enters field with recorded tape. Minnesota Mining and Mfg. Co. announces Extra Play Scotch #190 tape on 1 mil acetate base, a laminated striping for motion picture film, and two tapes on polyester base. Audio Devices issues colored tape and reels. Orradio Industries announces Irish Ferrosheen. Hack Swain issues electronic organ tapes. Revere Camera Company announces Synchro-tape, a striped tape for synchronizing tape recorded sound to home movies. Pentron issues three speaker recorder. Gibson Girl splicer announced and Ekotape offers a projector that operates a slide projector automatically. Dynamu introduces replacement heads for recorders. Reeves Soundcraft receives movie Oscar for magnetic sound in new Cinemascope picture "The Robe." Bell offers tape playback unit to fit record turntable. Carousel recorder by Tapex Corp. announced. Revere announces TR 1000 and Mohawk its Midgetape, smallest recorder made to date. Pentron introduces patented monomatic single control principle. Technical Tape Corporation enters raw tape field. Audiotape now available on Mylar base. First "face to face" tape club formed in Philadelphia. Ampex 600 recorder announced. Audiosphere (Livingston) offers binaural player. Broadcast Equipment Specialties produces tiny pocket tape recorder. Remsel Industries announces Film Harmonic sound device for 16 mm. projectors. Mitchell recorder by Mitchell Mfg. announced. Mylar base tape 1 mil thick announced by Reeves Soundcraft. Berlant Broadcast recorder announced. U. S. Time Corp. brings out magnetic disc recorder and International Radio and Electronics announces the Crown Broadcaster. Ferroprint enters field of raw tape.
- 1955**—First stereo conversion kit issued by V-M. Double-Play tape on ½ mil Mylar base announced by Orradio Industries. Berndt-Bach announced the first 16 mm. sound on film magnetic camera. First commercial catalog of recorded tapes issued. First network transmission of color video tape recording. First mail-order tape center announced, the "Tape Shelf." Ameritape announces music from Soviet Russia. Ekotape shows tape deck for custom installation. Telefunken recorder imported from Germany by American Elite. New: Recorded-Tape-of-the-Month Club
- Ampex announces automatic broadcasting station. Stenorette Dictating machine imported from Germany by DeJur. Ampex announces stereo playback machine and speakers. EMC offers monaural playback machine. Bell and Howell enters recorder field. Columbia Records brings out recorder. Grundig recorder imported from Germany. Viking announces decks. Reeves Soundcraft announces Plus 100 tape on ½ mil Mylar base. Flahan invents tape threader. Minnesota Mining offers extra play tape in both acetate and Mylar bases.
- 1956**—V-M offers Tape-O-Matic with built in stereo playback. Magnecord announces new Citation line. British Ferrograph imported by Ercona Corp. Emerson offers recorder. Midwestern Broadcasting School offers correspondence course on tape. The St. Cecilia Co. enters raw tape field. EMI portable (British) imported by Ercona. Bel Canto first ads appear for recorded tape. First ad devoted entirely to stereo tape appears (Livingston). Reeves introduces slide rule tape timing chart. Ampex demonstrates first video tape recorder. RCA announces "see-hear" tape player to play video tapes through TV set. First coast to coast video tape transmission, Jonathan Winters show on NBC. Pentron announces magazine loaded recorder. Fidelipac tape cartridge and player shown. Bell announces three-speed recorder. Tandberg recorder imported from Norway. Charles Sigsbee, first reviewer of recorded music on tape killed in auto crash. Omegatape advertises stereo tapes. Stereophonic Music Society (mail order stereo tapes) organized. Pentron announces stereo playback feature on its recorders. Bel Canto goes stereo. Tape Recording magazine publishes first stereo directory of tapes and equipment. Approximately 150 stereo tapes available. Firms represented include: Livingston, Concert Hall, RCA, His Master's Voice, Webcor, Concertape, Omegatape, Bel Canto, A-V Tape Libraries, HiFiTape, Celestial, EMC, Stereotape, Sony and Sonotape. Tape Recording magazine goes monthly to service growing industry. Ampex announces 122 series of monaural record-stereo playback machines, Presto makes airborne reproducer for music aloft in commercial airliners. Bell Sound offers stereo playback, Dictaphone brings out Dictet pocket recorder, RCA introduced a stereo playback, and EMC, Concertone, Viking and Amplifier Corporation of America were active on the stereo front. Minnesota Mining purchased Bing Crosby Enterprises. Westinghouse introduced "talking elevators."
- 1957**—Minnesota Mining introduces new leader and timing tape. Pentron issues stereo kit for conversion of older recorders. First Tapebook, "All About Tape on Tape" by Jack Bayha published by Tape Recording magazine. Book is listened-to instead of being read. FM multiplexing of background music gains headway. Audio Devices introduces low print through master tape and C-slot reel. Cousino tape cartridge and player demonstrated. Steradapter for converting recorders to in-line stereo announced. Audio Devices announces Extra Precision instrumentation tape. Minnesota Mining sells first commercial reel of video tape at \$306 per reel. Stereophony, Inc. started in stereo tape business. German Butoba recorder imported by Audio Master. ISI recorder featuring magnetic differential clutch announced. Dynamu markets bisonic head. Ekotape announces stereo model, as does Ampro. Bolex markets Synchromat for 8 mm. movie synch with tape recorder. Soundscriber Corporation markets 24 hour recorder with tape speed of 2½ ips. Modernophone announced a Dormiphone Memory Trainer using a tape cartridge. Italian Geloso recorder imported by American Geloso Electronics. Revere issues stereo conversion kit. Norelco recorder (Netherlands) imported by North American Philips. Capitol Records issues stereo tape. First stereo tape rental library announced. V-M offers recorder playing either stacked or staggered tapes. Columbia Records enters tape field with stereo tape. 39 companies issuing stereo tapes. Catalog shows over 650 titles in stereo. Magnecord reissues old PT-6 series recorders. 3M's announces tensilized polyester Double Play tape, Scotch #200. Ferrodynamic enters raw tape manufacturing field. Autosperser system for store-casting marketed by Audiomation Laboratories.



Left: this is an Ampex 200 tape recorder patterned after the German "Magnetophon" which used a special Minnesota Mining and Manufacturing Co. tape—No. 112—which was introduced in April of 1948. Subsequent Ampex recorders were modified to utilize 3M's red oxide tape No. 111. Tape speed of the Ampex 200, like the German "Magnetophon," was 30 inches per second. Right: tape recorder which was instrumental in switching the hundreds of radio stations over the country over to magnetic tape was the "Magnecorder" shown here, brought out in 1948. Magnecord started making professional wire recorders in 1946 but switched to tape.



considerable discussion as to what the speed of the tape should be. There seemed to be a good reason to settle on 18" per second since this was the sound-film speed. However, Colonel Ranger had brought back from Europe the Magnetophone operating at 77 centimeters per second which, as you know, is very close to 30 inches per second. For some reason or another the NAB decided to halve the 30" per second speed, thus coming up with 15 inches. At the time I agreed to this speed, I had only one head which would perform satisfactorily with reasonable equalization. We decided on the basis of this one head to pin down the equalization and thus live with our troubles. Initially, with production heads we would consider it a normal day when the yield was 1%. Subsequently, through proper tooling and techniques we were able to reverse this to where 98 per cent of the output was acceptable."

Now we must retrogress a bit to 1945. The Germans were crumbling and as the troops were pushed back the newest tape machines fell into Allied hands. Colonel Richard H. Ranger writes:

"The center of the Magnetophone production was the



In use by 1949 were these Fairchild professional tape recorders. At that time tape recorders were made by Fairchild, Magnecord, Presto, RangerTone, RCA, Amplifier Corp. of America and Ampex Electric.

A.E.G. in the part of Berlin which finally came under the French. I found that there were parts for eighteen machines available which had not been assembled. The French agreed to let them be assembled and the eighteen were to be apportioned six to the French, six to the British and six to the U. S. When I came back some weeks later, I found the first had gone to the French, the second to the British and the third was to go to the French. Well, we finally got that straightened out and five of ours did excellent service in our Army Broadcasting and the sixth one I brought back to Fort Monmouth, along with some twenty cases of all kinds of technical equipment which would be of interest to the Signal Corps. A good bit of this material was color photography. And, of course, quite a bit was about the three types of tape they were then making. I gave some lectures on what I had found and shipped some of the units to those who asked for them in this country. I figured it was the finest type of reparations we could get and I was glad to be able to pass the information around.

"J. Herbert Orr, (now president of ORRadio Industries) had gotten them back to coating Luvitherm magnetic tape at the Wald Michelbach plant before he had a bad auto accident over there which laid him up for some months.

"Actually, several Magnetophones of various vintages were liberated to this country and all of this really started the tape industry in this country."

John T. Mullin, a member of one of the signal corps teams came upon Magnetophones in Frankfurt, disassembled and shipped two of them back to the United States. After the war he demonstrated them on the west coast. The machines which had been used at Frankfurt radio went out to 10,000 cycles and were 'clean.' They produced the finest sound he had ever heard. He photographed the instruction manuals and found that the frequency range of the machines could be extended to 15,000 cycles. Among the disposable surplus he sent back to his home in San Francisco were 50 reels of Luvitherm tape. When he returned home he assembled the machines he had sent piece by piece from Europe and in May of 1946 he made several demonstrations, one of them before an I.R.E. group of about 250 technical people.

The next day he was visited by Alex Poniatoff, Myron Stolaroff, Harold Lindsay and Charles McSharry—the men



Left: this 1949-50 professional tape recorder is a Stencil Hoffman unit in use today at radio station KULA in Honolulu. Right: professional tape recorders developed by RCA about 1950 are shown here. They were used, among other things, to record the Groucho Marx radio show.

who made up Ampex Electric Company. Poniatoff who had formed the company and turned out electric motors during the war was looking for a new product. All of his people, and there were only eight, were interested in something in the high fidelity field and had considered making a hi-fi speaker but when they heard the Magnetophone they knew it was for them. Mullin and his associate, Bill Palmer were retained by Ampex as consultants to assist in building an American machine patterned after the Magnetophone and Ampex started designing a production recorder of its own.

In 1946 wire recording was far in the lead but Minnesota Mining decided to investigate the magnetic materials themselves. The management decision to go ahead resulted in the establishment of a tape recording laboratory group. The binder problem had been solved in earlier experiments and after comparing the German tape, the Brush tape and the earlier experimental tapes it was felt the solution lay in a superior oxide.

It was this decision that brought Dr. W. W. Wetzel into the picture. He was then head of the physics section of the 3M Central Research division. Together with R. Herr and H. K. Smith he set out to find a new oxide. German tapes had low output, poor response at short wave lengths, required high speeds and the uniformity varied widely. They began working on testing equipment for tape—none was available. they had to build it from scratch. Another department started to devise ways in which tape could be produced commercially and the newly organized tape lab under M. C. Hegdal investigated methods of making dispersions and coatings. Another group began work on tape duplication and one man was called in to survey the market applications and encourage machine development. All this and not a single tape had been marketed.

1947 was the year of the breakthrough. The first tape was a black oxide product on a paper backing and went on sale that year. Next came plastic tape and although the market was almost non-existent at the time the future never looked brighter.

It was in 1947 too, that tape swept the broadcast world. To Bing Crosby and the American Broadcasting Company must go the credit for crashing this field.

Crosby Enterprises had sent a man to John T. Mullin's shop where he saw the Magnetophone. He told Mullin it was just what Crosby had been looking for to relieve him

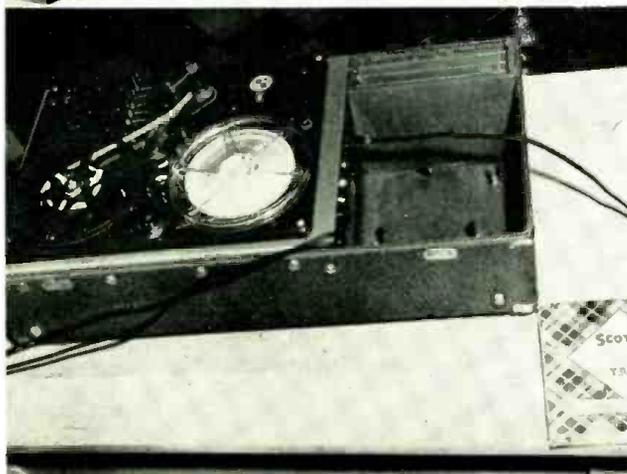
of the tedious editing from disc to disc and the poor quality that resulted in the finished product.

Mullin was then introduced to Frank Healy of Bing Crosby Enterprises and to Murdo McKenzie, the technical director of the Bing Crosby show. Mullin demonstrated the Magnetophones and the men realized that they never could do on discs what Mullin was so easily doing on tape. Mullin recalls that Frank Healy was ready to make a deal for the machines on the spot but McKenzie had heard about a demonstration made by Colonel Ranger of his new Rangertone recorder in New York. He felt that it should be tested also.

Colonel Ranger has very kindly supplied the story of that demonstration held at New York:

"Bing Crosby started transcription broadcasting using discs in 1946. But building a finished program on disc by retranscribing from disc to disc took time and degraded the quality with successive generations, so it was decided to test out all the available media against each other; disc, film and tape. In the summer of 1947 Bing came to New York for a program and it was recorded at WJZ in New York, on disc and film. At the same time, Larry Ruddell of WJZ had piped it on a telephone line over to Muzak, where he arranged for us to record it on tape. The disc recording was done by NBC, the film by RCA. We all got a good recording of the takes. Then some three weeks later, the disc takes had been put together to build a finished program and we were given a sample to match. They then asked us how long it would take us to come up with a tape version. We quite surprised them by saying 'Would tomorrow evening be all right?'

"We got it together just by splicing the tape and then some days later came the blind test of the three versions in the board room of the old Blue Network in the RCA building at 30 Rockefeller Plaza with Mr. Mark Woods, president of the Blue Network in charge. All versions were started together and it was possible to switch from one to the other, A, B or C—with no identification. After this had gone on a little while, Mr. Woods rose and said he did not like it at all; he could not tell what he was listening to, and instead asked for a short section of A, then the same section of B and finally C. Mr. H. Pierson Mapes, vice president of the Hutchins Advertising Agency, representing Bing's sponsor, Philco, was sitting next to me. When



Above: by 1950 the "Record-O-Fone" by Bell Sound Systems was on the market. Like many other units of its day, it used a zigzag tape threading system. Upper left: introduced around 1949, this earliest Eicor tape recorder found use in many schools. Upper center: quite common in early days was a combination tape recorder-disc player of the same type as this Wilcox-Gay "Recordio." Some units would record discs also. Lower center: one of the early tape recorders about 1949 was this Dormitzer machine. Lower: the Warren self contained portable which utilized wet cells and was on the market in 1953.

B was played he asked me, 'Which one is that?' When I hesitated to reply he said, 'Well, you don't know any better than I do, do you?'

"I was quite sure I did, because it was certainly a case where a father knows his own child. Then on came C and when applause came in the program, the advertising man reacted with 'Rain on the roof!'

"A 1, 2, 3 vote was taken and it came out five for disc, six for tape and one for film. Then Mr. Woods picked up the votes and read off those for disc—an engineer, an engineer, another one, another, yet another.

"Now who voted for number 2? I did, the treasurer did and all the laymen. You engineers are so used to hearing disc that you think it is the only real sound. Your votes are just no good!

"As a parting word, may I add that H. D. Bradbury of RCA asked to be excused from the voting as he too felt sure he knew which was which, the same as I did.

"In a couple of months all the Crosby shows were from tape spliced together by Jack Mullin in Hollywood using a modified Magnetophone and the era of taped programs was started."

In the fall of 1947 came a new magnetic material. The lab work of 3M's had paid off and at last it was possible to realize the dream of a readily erasable tape with good frequency response and a more uniform signal output. The answer lay in a new red oxide which today is the familiar coating on plastic tape. With it, 15,000 cycles per second frequency was possible at a tape speed of only 7½ inches per second as against the old standard of 30 inches. It opened up a whole new realm of possibilities in the home recording field by making lower cost, longer playing and high fidelity tape recorders possible. When 3M's moved to patent the new oxide they found that inventor Marvin Camras of Armour had already made application for a similar material.



Above: proposed for use with 33-1/3 rpm turntables was this Presto tape deck that was powered by the phonograph spindle about 1950. Upper right: the Crestwood "Magictape" of about 1949 was a popular tape recorder both for home and school use. Upper center: one of the earliest home recorders was the 1950 Ampro unit shown here in school use. Lower center: early Pentron machine was this "Astra-Sonic" about 1950. Lower: one of the first tape decks to be sold on the home market was this "TapeMaster" unit brought out about 1950.



1948 was a big year for tape also. At the end of '47 wire still dominated the picture with some 17 firms producing wire recorders but only four, Rangertone, Brush, Amplifier Corporation of America and Sound Recorder and Reproducer Company making tape machines.

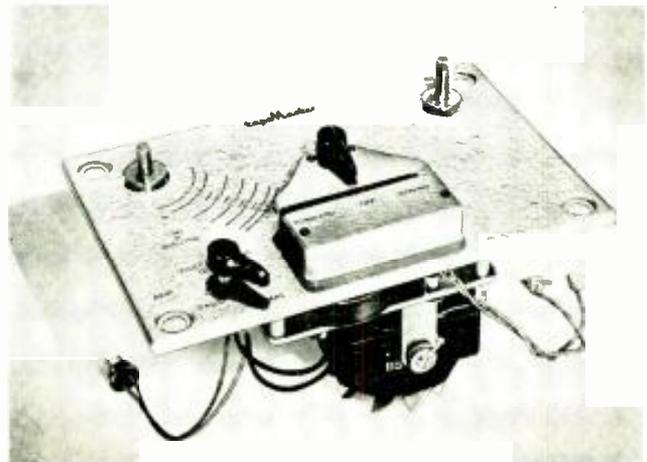
Early in 1948 3M's marketed the new red oxide tape. In April Ampex delivered its first model 200 machine to Bing Crosby Enterprises, who became a distributor for the new machines. The first demonstration of the Ampex was conducted in April of 1948 in Hollywood to record Crosby's ABC show. The strength of that demonstration prompted Middlebrook, ABC vice president in charge of engineering to buy 12 of the Ampex machines at \$5,200 each—and then 12 more.

ABC's move was a major step in the acceptance of magnetic recording. Capitol records bought two units and the dam had burst. A guaranteed supply of both tape and recorders had turned the trick.

At the end of the 1948 season, Mullin went to New York to tape and edit three shows for ABC there. He became acquainted at that time with Charles Rynd, then a vice president of ABC, who was very interested in tape's future. Later, Rynd quit ABC and became eastern distributor for the Ampex machine, then later became one of the pioneers of the recorded tape field by starting A-V tape libraries.

At the close of the year Allegheny Ludlum Steel Corporation, National Standard Company and Wilbur B. Driver Company were offering recording wire. Brush Development Co. offered plated wire and Indiana Steel Products was marketing Hytlux plastic tape with a metallic coating. Minnesota Mining was offering both paper and plastic base oxide coated tape. 1948 also saw the dramatic switch of Magnecord from wire to tape.

In 1949 the first splicing block was born, the "Carson" splicer which is still sold by Magneaccessories. At the same



**RECORDING ASSOCIATES** tape means . . . undistorted quality . . . full and perfect tone range . . . unmarred quality after thousands of plays — lasts indefinitely

Your favorite music incomparably and indelibly recorded

**REEL No. 001—"Cocktail Time"**

**Track A:—**

Guilty  
Confessin'  
If I Had You  
I'll Never Be The Same  
Sleighride In July

**Track B:—**

It Must Be True  
Garden In The Rain  
Peg O' My Heart  
What's New  
Stars Fell On Alabama  
Exactly Like You

**REEL No. 002—"Cocktail Time"**

**Track A:—**

You Go To My Head  
I Understand  
I'll See You Again  
Cynthia  
Sentimental Rhapsody  
Wizard of Oz

**Track B:—**

By The River Of The Rosas  
Somewhere In The Night  
It Had To Be You  
Almost Like Being In Love

**REEL No. 003—"Cocktail Time"**

**Track A:**

I've Got You Under My Skin  
Cumana  
Tonight We Love  
Babalu  
Poinciana  
Alexander's Ragtime Band

**Track B:—**

We Could Make Such Beautiful Music  
How Are Things In Glocca Morra?  
You're Mine (V-J)  
Bim Bam Boom  
Great Day

**REEL No. 004—"Cocktail Time"**

**Track A:—**

Music Maestro Please  
The Best Things In Life Are Free  
You're So Understanding  
Just One Of Those Things  
A Fellow Needs A Girl  
Caprice For Strings

**Track B:—**

Deep Purple  
Tea For Two  
Girl Of My Dreams  
Illusion  
Holiday For Strings

**REEL No. 005—"Organ Reveries"**

**Track A:—**

My Heart Stood Still  
Blue Room  
Lover  
I Didn't Know What Time It Was  
Smoke Gets In Your Eyes  
Why Do I Love You?

**Track B:—**

The Touch Of Your Hand  
Bill  
All The Things You Are  
They Didn't Believe Me  
My Blue Heaven  
You Tell Me Your Dream

**REEL No. 006—"Organ Reveries"**

**Track A:—**

Kiss Me Again  
I'm Falling In Love With Someone  
Moonbeams  
A Kiss In The Dark  
Sweetheart  
Among My Souvenirs

**Track B:—**

Rose In The Bud  
Remember  
I'll See You Again  
Lady Of The Evening  
Summertime  
Peggy O'Neill

**REEL No. 007—"Organ Reveries"**

**Track A:—**

Love, Here Is My Heart  
I Hear You Calling Me  
Girl Of My Dreams  
Roses Of Picardy  
While Hearts Are Singing  
Your Eyes Have Told Me So

**Track B:—**

From The Land Of The Sky  
Blue Water  
Dear Old Girl  
A Perfect Day  
The Bells Of St. Mary  
Suppose I Had Never Met You  
Oh What A Pal Was Mary

**REEL No. 008—"Concert Hall"**

**Track A:—**

Roses From The South  
Minuet (Mozart)  
Allegretto (Mozart)  
Intermezzo (Bizet)

**Track B:—**

Allegro  
Minuet in G (Beethoven)  
Londonderry Air  
Overture (Shepherd King)  
(Mozart)

ALL RECORDINGS ON HIGH FIDELITY PLASTIC TAPE

**Tape Recordings Will Save You Money!**

More economical than discs for the same playing time

ALL RECORDINGS ON HIGH FIDELITY PLASTIC TAPE

**RECORDING ASSOCIATES**

113 W. 42nd St., New York 18, N. Y. LOngacre 4-8317

This is a reproduction of the first catalog of recorded tapes which was issued by Recording Associates in New York in 1950 and featured eight reels. This illustration shows the inside two pages. The back page contained an order blank for the tapes. Below: the V-M 711, first home type recorder to offer stereo playback. Prior to this the firm issued a conversion kit to enable users of the model 700 to convert to stereo.

time they put out a solution to make tracks on tape visible. A new tape manufacturer entered the field in 1949, it was Audio Devices who came into the field with both plastic and paper base tapes in black and red oxide formulations. The tape featured uniformity of coating and had a lubricant added.

What most probably is the first commercial stereo recorder was offered by Magnecord in 1949. Stencil Hoffman had made multi-channel recorders a year prior to this time and Marvin Camras has demonstrated stereo sound from tape at the Armour Foundation. As mentioned earlier, Bell Telephone Laboratories demonstrated stereo recordings at the World's Fair in 1939. To go farther back, Alexander Graham Bell in 1892 wrote a paper on binaural hearing over the telephone.

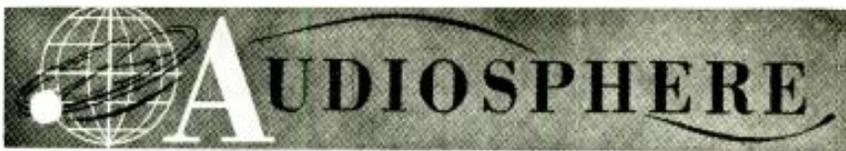
The Magnecord stereo stemmed from a request from Dave Apps of General Motors laboratories for a stereo machine because the monaural recorders they had been using to analyze auto noise did not give them the sound perspective desired. Magnecord built one for GM, then two more which were shown at the 1949 Audio Fair, the first time the public had been treated to stereo.

On the Magnecord was a three-head assembly with a spacing of 1-5/16 inches between the heads. This was later

converted to 1 1/4" and became the standard for staggered stereo tapes.

The response to the original models was good. They built 12 and sold them and then another 25. Hundreds were





## THE AUDIOSPHERE TAPE LIBRARY

To meet the rapidly growing demand for what may, in its truest sense, be classed as HIGH FIDELITY pre-recorded tape, AUDIOSPHERE, Inc., has extended its recording activities into that field and now offers the following initial releases.

The May Festival Series, for example, has been specially recorded for both the hi-fi enthusiast and the music lover and contains superlative programs recorded with professional equipment to the highest standards of the art. The series includes selections recorded in the famous *Teatro Comunale* in Florence, Italy, with the 92-piece May Festival Orchestra under the direction of one of Europe's most eminent conductors *Vittorio Gui*. Result—superb musicianship, majestic and dynamic range and free concert hall presence.

Reel Number (Monaural)	Reel Number (Binaural)	Selections
701	BN701	<i>Schubert</i> : Unfinished Symphony <i>Sibelius</i> : Finlandia
702	BN702	<i>Wagner</i> : Tannhauser Overture <i>Wagner</i> : Flying Dutchman Overture
703	BN703	<i>Musorgsky</i> : Night on Bald Mountain <i>Borodin</i> : Polovtsian Dances <i>Sibelius</i> : Valse Triste
704	BN704	<i>Debussy</i> : Afternoon of a Faun <i>Schumann</i> : Manfred Overture <i>Glinka</i> : Kamarskaja
705	BN705	<i>Rossini</i> : William Tell Overture <i>Brahms</i> : Academic Festival Overture <i>Mosyevet</i> : Under the Lime-trees

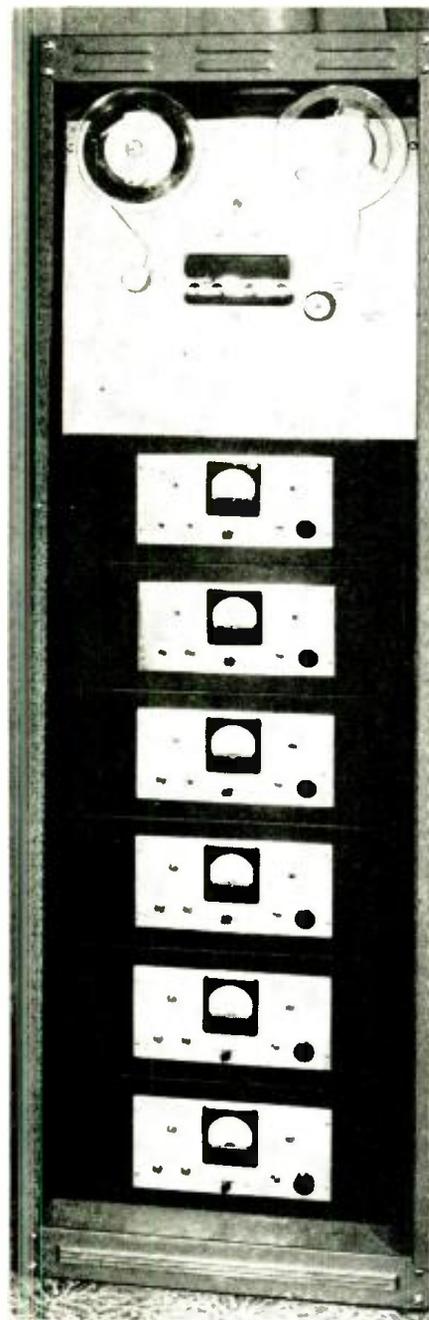
In addition to the above series, the following releases are now available:

706	BN706	VOICES FROM VIENNA, Vol. I (The Music of Strauss)
707	BN707	VOICES FROM VIENNA, Vol. II

The above two reels are separate programs of the type of material which is recommended for the excellent reception of the Audiosphere disc release. Programmed differently for tape, with much new material added, each of these reels should sell itself.

708	BN708	<i>Pfitzner</i> : Little Symphony, opus 11 (performed by the Vienna String Symphony, Collegium Musicum Wien, under Kurt Rapf)
		<i>Dukas</i> : Sorcerer's Apprentice (performed by the Florence May Festival Orchestra under Vittorio Gui)

All programs are on 7" reels, 7.5 IPS, and are available either as full track or BINAURAL recordings. They are priced at \$10.00 each for either monaural or binaural tapes.

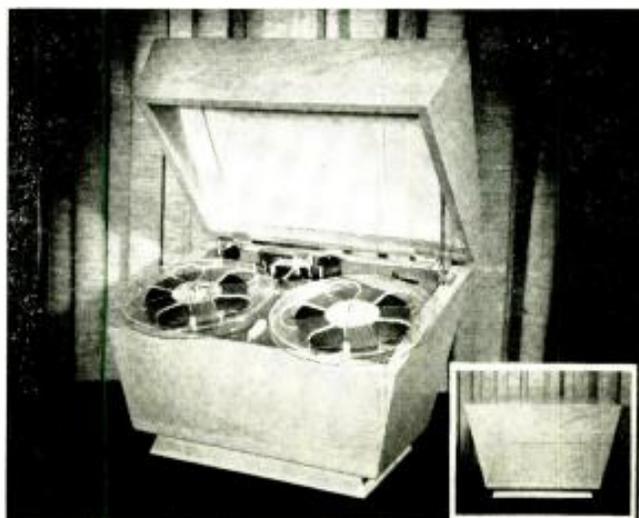


Left: the Pentron electronic orchestra. This unit had six separate channels on 1/4 inch tape, one for each of the six instruments in the band. It was shown in 1953. Right: a reproduction of the first stereo tape catalog. This single sheet was put out by Livingston in May 1954. Below: Livingston designed and sold this stereo player, the first on the market to provide something for the public to play its tapes on. It had staggered heads, as had the first Magnecords.

made after this.

The first music in stereo, used to demonstrate the machines was not for sale. Apparently the National Symphony Orchestra was the first large orchestra to be stereo recorded. The Navy Band was the first band to be stereo taped and such dance and jazz aggregations as Benny Goodman, Lionel Hampton, Woody Herman, Jerry McPartland and others appearing in Chicago were stereo taped by crews from the factory on an experimental basis. Many of these original tapes are still in existence.

1950 saw manufacturers entering the field of tape recorder manufacture almost by the dozen. At the end of the year there were twenty new names added to the list. Some are still making recorders, such as Ampro, Webcor, Allied Radio, Concertone, Masco, Revere, Ekorape, Stancil-





The founders of the Voicеспondence club. John Schirmer, of Chicago, seated at right in photo, founded the Wireспondence Club back in the days of wire recorders (1950). When tape began its ascendancy the club was called the Voicеспondence Club and was, and is, operated by Charles Owens, (seated at left of photo) and his wife Melva as a hobby. Right: the late Fred Goetz who organized Tape Respondents International in 1950 in California. He operated the club as a private venture until the time of his death when its operation was continued by Jim Green of Little Rock, Arkansas. Both clubs have a large membership.



Hoffman and Wilcox-Gay. Others have been discontinued over the years between then and now.

ORRadio Industries, fathered by J. Herbert Orr who was one of the members of the Signal Corps team that had liberated German equipment, began to make Irish tape in Alabama. It was plastic base with an oxide coating. The same year, Minnesota Mining brought out a new paper base tape #101.

1950 also saw the formation of two organizations to encourage the exchange of wire recordings and tapes between individuals. John G. Schirmer founded the Wireспondence Club while working for Webster-Chicago (Webcor), and on the west coast, Fred Goetz started the Tape Respondents International.

1950 also marked the birth of what was to become an industry within an industry—the sale of tape recorded with music of speech.

The pioneer in this field was Joseph F. Hards who writes:

"Back in the early part of 1950 I had a small business known as Recording Associates. My primary interests were the sale of a disc library to industrial plants, wired music operators and radio stations. I became interested in the developments in magnetic tape and made up what was to my knowledge the first catalog of recorded tapes. We had a series of about eight subjects and while the project never did get off its feet, we did sell a few. The research given this project was responsible for the further introduction of the A-V Tape Library which, under the auspices of Audio and Video Products I developed and produced."

On the west coast, Col. Fogel of Tempo tapes entered the field and a bit later Magnecord brought out "Magnecordings by Vox" which were European tapes with duplication done by Larry S. Toogood, one of the pioneer duplicators. The early efforts were chiefly program material and background music.

1951 was marked by the introduction of a new firm to the tape field, Reeves Soundcraft who brought out a red

oxide, plastic base tape. Ernest Frank was their director of research. This year also saw the first demonstration of video recording on tape when Crosby Enterprises, now the Minicom Division of Minnesota Mining, showed the first black-and-white TV images played from tape. Two continuous type cartridges were brought out, the Cousino and the Mini-Music by Television Associates of Indiana. Webcor brought out their first two-directional recorder, a feature which they have maintained through the years.

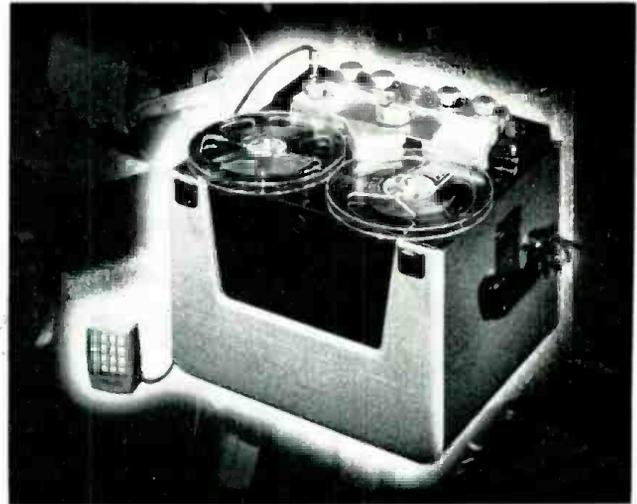
In 1952 a course in the French language was issued by the Tapespondence School, now Audio-Visual Publications, of Middlebury, Vt. Prof. Ferdinand Marty was responsible for this development. A self-contained spring wound portable, the Tapak, was made by Broadcast Equipment Specialties and the Victor Animatograph Corporation brought out the first device to convert optical projectors to magnetic sound on film—the Magnesound. Crestwood built a 7½ ips hi-fi machine with separate record and monitor heads. By 1952, the wire recorder was definitely on the way out. Harry Matthews, of Texas, founded World Tape Pals.

1953 brought a rash of new products and improvements and also marked the beginning of the Magnetic Recording Industry Association. Telectrosonic brought out the least expensive recorder, a machine selling for \$79.95 and Federal Manufacturing and Engineering entered the field with their FME recorder. The Voicеспondence Club, taking over the older Wireспondence Club as a base began operations and immediately instituted a program for the blind. Reeves introduced their "Lifetime" tape the first 1½ mil tape using DuPont Mylar base. Reeves Soundcraft also received a motion picture "Oscar" from the Academy of Motion Picture Arts and Sciences for the development of magnetic sound on film. The award was made for the Cinemascope picture "The Robe."

In April of 1953 Joseph F. Hards wrote to all the manufacturers of magnetic equipment and suggested the formation of the Magnetic Recording Industry Association. A formation meeting was held and was attended by: Herman



Left: the Revere Camera Company of Chicago developed its Sychrotape to permit more accurate synchronization of sound from tape with home movies. The tape was striped and the flicker of the projector shutter provided a stroboscopic light effect to time the recorder and projector. Adjustments in speed were made manually. Right: automatic control of slides for home and business was provided by this Model 207 Ekotape. The top track of the tape was used for voice or music and the lower track for signals which, through a relay, operated a slide projector and changed pictures without an operator touching the controls. Earlier devices included a photo cell mounted on a recorder which picked up the light reflected from white tabs attached to the back of the tape.



Kornbrodt, Audio Devices, James Pickert, Bell Sound Systems, Robert Leon of Brush Development Co., Irving Rossman of Pentron and Don Ward of Reeves Soundcraft. The first elected officers were: Joseph Hards, President, Russell Tinkham, Ampex, Vice President, Herman Kornbrodt, Audio Devices, Secretary, Victor Machin, Shure Bros., Treasurer, and the balance of the Board of Directors was made up of Bob Leon, Brush and Paul Jansen of Minnesota Mining. Work began almost immediately on standards for the industry and to C. J. LeBel, of Audio Devices went the hard job of general chairman of the Standards Committee.

In September Bing Crosby Enterprises showed the recording and playback of color TV. In December RCA demonstrated their color video tape recorder also. November of 1953 saw the first issue of *Hi-Fi Tape Recording Magazine*, then under the title of *Magnetic Film and Tape Recording*.

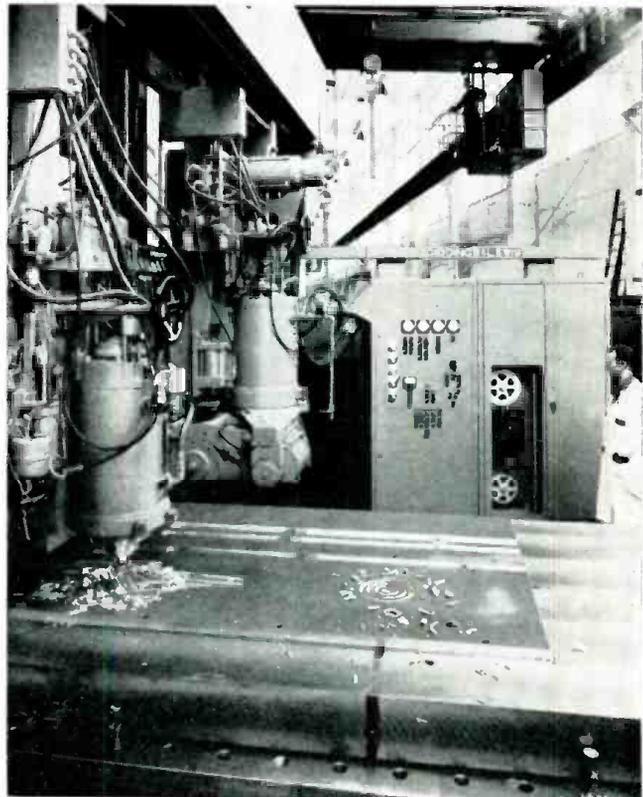
The tape manufacturers were busy with new products in 1954. Reeves Soundcraft brought out their 1 mil Plus 50 Mylar base tape. Minnesota Mining announced their Extended Play 1 mil acetate base, and a laminated striping process for movie film. ORRadio Industries brought out the Ferrosheen process of tape coating and Audio Devices colored reels and colored tape. V-M entered the recorder field and Omegatape entered the field of monaural recorder tape, as did EMC with educational and religious recordings.

The pointer toward the future came from Audiosphere, a division of Livingston Electronics who announced a catalog of eight stereo tapes, even though the stereo Magnecords then in existence were about the only machines that could use them. They also designed a player and amplifier on which the public could play the tapes. Ched Smiley, Livingston President and stereo pioneer writes:

"Livingston entered the stereo tape field, wistful, alone and afraid, the only participant in the infant industry. Initial releases were on the only medium then available, 7½ inch per second, staggered binaural tapes with a very small library.

"Acting as an industrial bell-wether, Livingston sponsored the manufacture of an inexpensive stereo playback unit, an inexpensive stereophonic amplifier and a line of

associated accessories. The first two years of Livingston's hectic beginning were dominated by solving the problems encountered in their role as lone missionary for home stereo. This included endless demonstrations all over the country at audio fairs, dealers, representatives, distributors and just anybody who would listen. Techniques in stereo recording, duplicating and processing had to be developed. Also, the library had to be expanded and once again Livingston found itself in the role of a missionary essentially



Machine tool automatic control by magnetic tape is demonstrated by this aircraft spar and skin milling machine system designed by the Giddings and Lewis company. Tape unit in background caused milling head to perform precision cuts called "plunge," "pocket" and "channel" on aluminum sheet in foreground.



Left: among cartridge developments is the Mini-Music made by the Television Associates of Indiana which appeared in 1951. The small plastic container held a continuous loop of tape. Right: the Cousino Audio Vendor uses graphite lubricated tape in a moebius loop. Both devices are used for talking displays and similar applications.

exhorting the flock to climb on the stereo bandwagon." While it took a few years to do it, these early efforts bore fruit as is evidenced by the swing to stereo that came in the next two years.

1955 was the year in which V-M offered a stereo conversion kit for its recorders, bringing stereo to the low priced field. Bern-Bach developed a magnetic head to fit a motion picture camera and thus sound on magnetically striped film was possible in 16 mm. Audio Devices brought out its extra-precision coating for tape and ORRadio Industries announced Double Play tape on 1/2 mil Mylar base. At the dedication of the new Minnesota Mining Research Laboratory, network transmission of color video from tape was shown using RCA equipment. The signal originated in New York and was brought over coaxial cable to St. Paul.

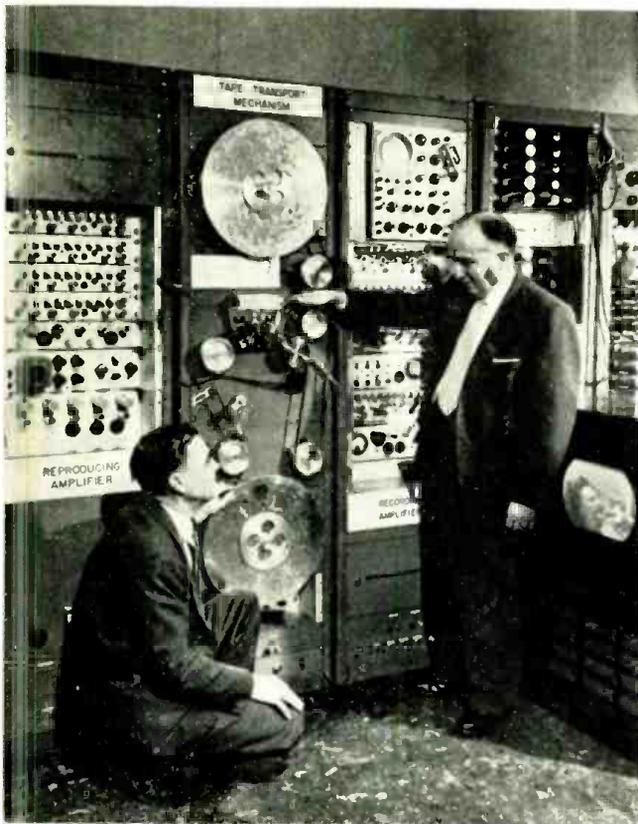
In 1956, V-M offered stereo machines with the playback feature built in. Nortronics made the first non-encapsulated stereo head and Pentron a magazine loaded recorder. Big

surprise of the year was the breaking of the Ampex Video Tape Recorder at the NARTB show. Operating at only 15 inches per second it swept the industry almost as the Magnetophone had done in radio days. RCA offered stereo playback equipment and tapes. RCA also announced preliminary work on a hear-see video tape player for playing video tapes through the home TV set. It used 1/4 inch tape at 10 feet per second. In October the first coast to coast network show, the Johnathan Winters show, was telecast from tape.

Audio Devices led off 1957 with their low print through tape and a new reel. Capitol records joined in producing stereo tapes and Minnesota Mining built the world's largest plant for the production of tape. The first video tape recorder to go to an independent station was delivered by Ampex and the first catalog devoted to listing stereo music became available from *Tape Recording* magazine. At the year's end it showed more than 650 different tapes from 39 different companies.



George Eash began his development of the Fidelipac cartridge and its accompanying player in 1953 but it was not publicly offered until 1957. The unit was among the first to have a long playing time. Right: the Cousino cartridge, a further development of the earlier Audio Vendor. Both units may be used for stereo and future tape developments may be along these lines



Looking back over the years from the vantage point of the end of 1957 one can see the remarkable progress that has been made. Some of it has been slow and halting and at other times the dash of new developments has been so swift that it was difficult to keep track of them.

Over the years since 1893 sound has been developed from the weak recordings and playbacks of the early Telegraphon to the full range of stereophonic reproduction both at home and on the screen. Film is being replaced in television by magnetic tape just as fast as the new video recorders are delivered. In the closing months of the year 1957 the first commercial was made on location using tape. The actors and equipment were in a mountain location and the TV signal was beamed back to the studio and video recorded.

Each of the large tape manufacturers has under construction new plants for the manufacture of tape for both industry and the home—and their plans for the future are giant sized.

The roster of men who have made this growth possible is a long one, from scientists, engineers and production men to those who controlled the purse strings and had the confidence in the future of an industry to venture into an untrodden field. We wish we could list them all and our apologies to those who have been omitted because of lack of space, are sincere.

The prognosis for the future can be written from the records of the present. The growth in sales of tape recorders is one indication. In 1950 sales of wire and tape recorders totaled 110,000, in 1951, 100,000, in 1952, with wire recorders pretty much out of the picture sales were 150,000 units. In 1953, 200,000, in 1954, 225,000, in 1955, 360,000 of which 60,000 were in the more than \$600 class. 1956 figures show about 400,000 and '57, not yet compiled will go still higher. Production of stereo machines has exceeded monaural and with the development, by Ampex, of



Above: the first video recorder was developed by Crosby Enterprises and shown publicly for the first time in November of 1951. The Crosby name has long been associated with tape recording, singer Bing Crosby having been instrumental in getting tape recording into U. S. radio back in 1946. Left: the RCA video recorder which was demonstrated in September 1953 with color TV recording. The first net transmission of color TV took place in September 1955 between New York and the new Research Laboratories of Minnesota Mining and Manufacturing Company in St. Paul, Minnesota on the dedication day.

high speed duplicating machines, music on tape and stereo broadcasting has grown by leaps and bounds.

The Magnetic Recording Industry Association is likewise increasing in membership and stature and now has more than 30 member firms.

In this short history we have not been able to follow the fantastic developments in the industrial side of tape recording: geophysical recording, telemetering, computing, etc., which have shown growth similar or greater than the audio side of magnetic recording. That would be another story.



The Ampex Video Tape Recorder was developed in great secrecy and first demonstrated in the NARTB show in May of 1956. The machine created a sensation and the networks immediately placed orders. This is the first unit to be delivered to an independent station, the King Broadcasting Company which operates KING-TV and KGW-TV in Oregon.

# First Use of Magnetic Sound on Film

by Louis A. Lembach

.... The first lip-synch magnetic sound film was produced in three days.

**M**AGNETIC recording has now come of age and is taking its place as an industrial tool in America. Much credit for this magnetic recording era is due to Armour Research Foundation of Illinois Institute of Technology, Chicago, Illinois, and its youthful inventor, Marvin Camras, who introduced a wire recorder shortly before the start of World War II. As soon as specialized machines could be designed and built, they were adopted by all branches of the armed services. Several years later tape recording made its debut and is now found working in many types of commercial dictating, calculating, and scientific machines, in home recorders, and in radio stations the world over where the bulk of transcribed programs are recorded on tape.

In the last few years a new phase of magnetic recording has been presented to the public—*magnetic sound on film*. Hollywood's Cinema-Scope carries a four-channel magnetic soundtrack which encircles the audience with stereophonic sound. Also 16mm projection equipment is now available to the amateur and professional, making it possible for him to produce quality sound-on-film pictures.

Marvin Camras, now a senior physicist in Armour Research, was asked to read a paper before the 1946 annual meeting of the Acoustical Society of America on his, then, new development—“*Magnetic Recording on 16mm Film.*” This paper in its final form provided a very dramatic presentation before a select group of scientists several years before industrial engineers were able to design and build equipment for mass production and sale. This new development sparked the imagination of the several young men who were responsible for it into a challenge of its use, that illustrates a pioneering spirit so valuable in industrial research. Ordinarily a research program is carried out in a systematic, dignified, and painstaking manner. But an occasional exception adds zest to an otherwise routine life. And I'm giving fair warning that the following true story was definitely an exception.

One morning Camras came into the lab and asked three of his co-workers if they would care to hear his talk for the

meeting. They stopped their work and gathered round to hear it through. In the discussion that followed, Arthur Appel gestured to the equipment he had been working on, saying, “This pile of stuff is giving you all the data you are using. Too bad it can't go along to share in the applause”. Then Walter Carr remarked, “Why don't you put the paper on film, Camras? Then they will know that your ideas really work”. “Impossible”, he said. “That meeting is only three days off !!” There was a dead silence in the lab for almost a minute and then Camras exclaimed, “What are we waiting for ?? !!” That was the beginning of one of the fastest motion pictures, with lip synchronized sound, that had ever been made.

It took only a few minutes of planning and each had his immediate job outlined. Camras' first task was to quickly re-write his speech into a “scenario” to be used as a soundtrack on the film. The commentary and the picture must complement and support each other. Next he read it aloud with a stop watch in his hand so that each section of this commentary be given the proper length of exposed film to carry it. These two tasks took well into the evening. The writer gathered up the rough pencil sketches of the circuit diagrams, frequency response curves and recording head plans, re-drew them preparatory to taking them home to be photographed that night with his Bolex camera. This camera was brought to the lab the following morning to photograph all remaining portions of the film.

The 16 mm projector which was used to record as well as reproduce the sound, needed much work to be done on it to bring it up to the peak of performance, and to adapt it again for recording from a microphone. Arthur Appel, who had been in charge of designing and building the electronic equipment for the projector, took over this task. Art had come into Armour Research several years before as a young scientist-engineer and had been in the department since the early days of wire recording. The projector had been used almost entirely to record tones from an oscillator, which would give information on its ability to record over



A view of the Magnetic Recording Laboratory in the Electricity and Magnetism Building at Armour Research Foundation in Chicago, 1946.

the entire audible range. A continuous tone helps the engineer to track down and eliminate "wow", to measure signal-to-noise ratio, harmonic distortion, etc. About the only time a microphone was used was when making adjustments in the mechanism. A small loop of film threaded into the projector, carrying a continuously changing record, would then play back the change the adjustment had made within a few seconds. In the past, about the only words the machine had spoken were something like this: "Testing, 1, 2, 3, 4, Hello test. hello, Hello, HELLO !!!"

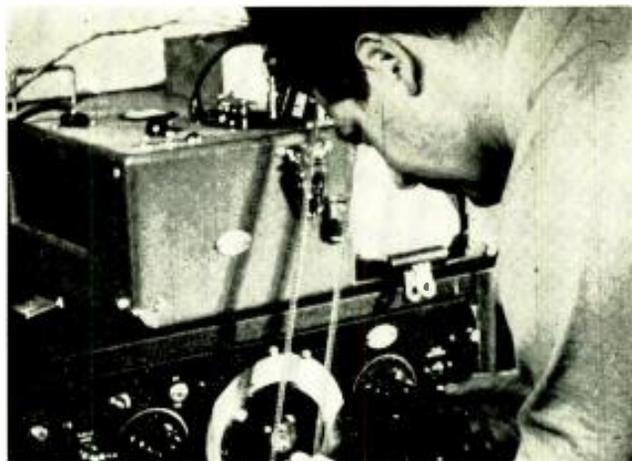
That first night the writer photographed several hundred feet of film showing all the drawings, circuit diagrams, and a number of photographs, and in the morning on the way to work, dropped them off at a processing plant for finishing. They were done by noon. Our lab by this time had completely changed from physics research to a movie studio. It was decided that the introductory paragraphs of the talk could best be shown by photographing Marvin Camras seated at his desk reading from the manuscript. Floodlights were commandeered from the Optics Dept. Unnecessary equipment was moved into the hall and the lab was prettied up a bit with a simplified background. A wire recorder was hidden under the desk to record the rate of talking, to assist in matching it to the lip movements on the film. (We wished later that efforts had been made to obtain a high quality wire recording. This would have saved us hours of work in the final recording.)

The four of us worked as a good team. There was a big staff employed in this building, but we soon found out that every researcher has a dozen ideas and we didn't have time to select the best one. *1/3 of our time was already gone!!*

The exposed film that came back from processing at noon now needed a sound-track, so Carr had many hours of very tedious work outlined for him. This sound-track is a narrow, very thin coating of a specially developed iron oxide in an adhesive binder, coated to one side of the moving picture film, between the sprocket holes and the edge. Walter Carr, the ace machinist who worked with Camras, had built this wierd piece of mechanism by learning from Camras what should be done, studying rough sketches, then using his own ideas. Walter is a very unusual machinist, completely unorthodox in his methods—and irreplaceable. When by conventional machinists' procedure, it would take weeks to build up a working model, Walter could have one running in a couple days. However, there would be much evidence of what some people would call junk, in his area of the machine shop.

The film coating apparatus which extended along fifteen feet of the wall of an adjoining room contained parts of an Electrolux sweeper to run it; a machinery fountain oiler to deposit the coating; an electric mixer to keep the coating solution agitated; a hair dryer to make it set quicker; and a queer assortment of pulleys to carry it back and forth from supply to take-up reels. It was quite a gadget—but it worked!! This film coater had been used primarily to coat short lengths of film and then selected sections could be used for testing. Here was a specific batch of film—It *all* had to be done *quickly* and it *must* be *good*. Optical recording, to which this was being compared, had reached a high state of perfection and this sound must have at least equal quality. This was to be shown to a very critical audience—The Acoustical Society of America—those men know bad sound when they hear it!!

Let's get back to the studio. It was 3:00 P.M. and we were ready to shoot. Where was our star? Under the desk, re-



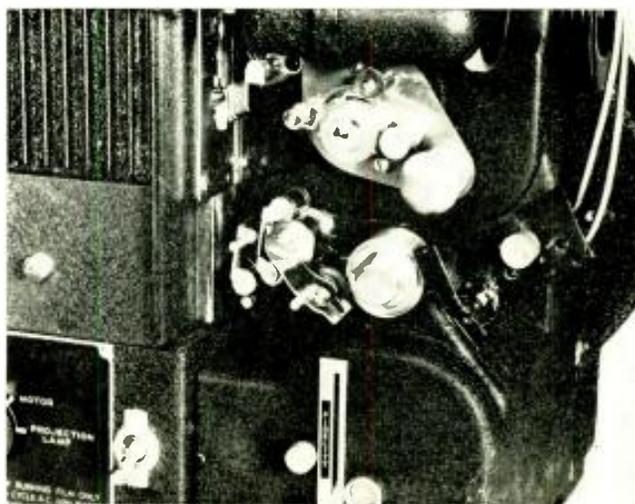
Arthur Appel making a frequency response curve on the magnetic stripe that had been experimentally applied to film.

threading the wire recorder. When he came out his disheveled appearance would make him just perfect for the part—if he were to portray a bum from Skid Row. But Marvin was way ahead of us. He'd brought along a clean shirt, tie, razor, and boundless energy.

Each paragraph of the paper was photographed twice; First, to be sure the exposure was correct under this unfamiliar lighting; next to provide against accidental damage to the film later. This was fortunate, for the coating machine went out of adjustment at one time and put a line down the middle of the picture. After photographs of Camras were taken we turned the camera on the projector and moving pictures of its recording mechanism were shot—so were we. It was much past bedtime.

The following morning our final film went out for processing immediately. We found the other reels all coated, ready for sound. Walter left work as we came in, but he was back again before the other film was returned from the processing lab and ready for him to apply the sound stripe.

Our photographic studio of yesterday now had to be reconverted into a recording laboratory. Our projector at that time has turned out to be in many ways a prototype to the ones being manufactured for both amateur and professional makers of 16 mm sound films. (Armour Research is a development laboratory and is not engaged in any manufacturing.) With this projector, as a film is shown, sound may



The magnetic sound head that both records and plays back was mounted on a standard optical projector and fed from external electronics.



Left: the sound stripe was placed between the sprocket holes and the edge of the film. Right: a frame from the picture showing Marvin Camras reading the paper before the Acoustical Society.

be recorded on the sound-track. It can then be played back immediately for it needs no additional processing. To record a new sound-track an erase head is automatically energized to eliminate the old one. This amazing little recording head was about the size of the eraser on the end of a lead pencil. This, under Camras' direction, was the writer's field of endeavor and he recalls that in one dimension it had to be correct within one half-thousandth of an inch. The head was small but it took much electronic equipment to feed it.

The carpenter shop was now ready to deliver a 4 x 4 x 6 ft. box with a large window in one side. This was our sound-proof room to keep the projector and nearby train noises away from the microphone. The projector was all threaded up. We were ready to begin recording. It was noon the second day. *2/3 of our time was gone.*

That afternoon and evening most of the text of the talk was put on film. The sections explaining the circuit diagrams and response curves were done first to gain experience. Marvin Camras was inside the little booth, and Arthur Appel manned the projector and recording equipment. After several trial starts this part of the film was recorded in its entirety. It was then replayed for the very critical "Camras' ear"—then redone. The third recording was acceptable.

The final voice recording was the lip-synchronized introductory paragraphs showing Mr. Camras at his desk. This was a real problem. The film was cut into paragraph lengths, then each length was made into a 30 to 50 foot loop by cementing the beginning to the trailing end. A loop of film was threaded into the projector, across the room to a pulley, and back to the top of the projector. Marvin, wearing headphones to hear the wire recording, looking at his manuscript, watching the projected film on the screen in front of him, was seated in the very warm little soundproof box trying to talk coherently into the microphone. Each flaw was ironed out as the voice was recorded, then heard back. These paragraph loops of film each averaged about fifteen recordings before words matched lip-movements throughout the entire length. There were many starts that were not heard back. The men would just let the machine run until it reached the beginning of the paragraph again. It was maddening to see the clock on the wall tick off the hours so fast.

The following morning we began to assemble the completed reels of recorded film. It wasn't until we were well along that another rude awakening came—one to show what amateurs, in a hurry, can do. The man assembling and edit-

ing the film had overlooked the fact that the sound-track precedes the picture by some eight inches. Therefore we had to dig in the wastebaskets for the opening words of several paragraphs. Short cuttings of film by the dozen were slowly dragged by hand over the recording-playback head mounted on the projector, to find these missing words.

We'd decided to finish up our demonstration film with around thirty seconds of music to illustrate its possibilities in that way. (These scientific papers are not allowed to run over an allotted time and we had used it all up.) While photographing drawings the first night the writer had finished up one of the rolls of film by shooting some wooden cut-out letters on his titling board, which read, THE END, and had animated the effect by having them fall from view in a spinning motion, one at a time. Arthur had selected some orchestral music on a phonograph record and was recording it on the end of the film. The final chords of the orchestra were almost synchronized to the dropping of the final letters. It was such a surprise that he had to record it again to get it just right. "Just right" took several re-recordings and it about drove the rest of us wild for, *OUR TIME HAD RUN OUT.* However Art's "ham" ending gave the film a fine professional flourish that later brought a rousing applause from the audience. Our completed film had to be all spliced together, the equipment packed, and a dash made for the Chicago loop where the morning sessions of the meeting were about over.

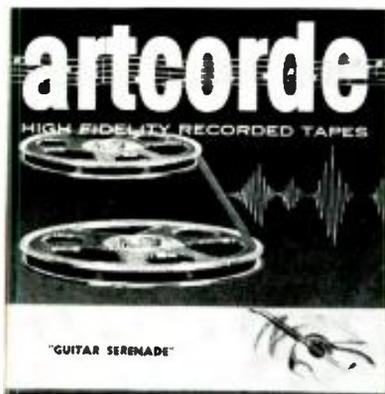
Camras had taken a big risk. Our equipment was completely "haywire" and could have failed us. The head men of Armour Research had been in New York all week and had returned only that morning and were going directly to the meeting. Such an unconventional presentation of a scientific paper before a national assembly should have been carefully checked with them. Someone suggested that moving pictures in the loop can be projected only by union labor. There wasn't a union man on earth that knew anything about this projector. Marvin may have to talk fast to keep Arthur at the controls. Oh well!!

Shortly after lunch, in the plush meeting room in the penthouse of the Stevens Hotel, Marvin Camras in acknowledging his introduction completed his remarks thus: "I think I'll take it easy this time and sit down in the audience with you and let a movie projector read my paper. It's nice to be lazy."

Do you suppose he really believed that?????

# NEW PRODUCTS

## NEW TAPE COMPANY



Arccorde Recorded Tapes, a newcomer to the recorded tape field, has announced its first tape releases. They are monaural, 7½ ips, dual track, 5 inch reels in attractive individual boxes, and are priced at \$6.95. Stereo releases are expected to be issued shortly, according to the firm. For further information and catalog, write to Arccorde Recorded Tapes, Box 561, Huntington, N.Y.

## ALONGE SPLICER



Alonge Products, Inc., 165 West 23rd Street, New York 11, N. Y., has announced its completely non-magnetic splicer for ¼ inch tape. The tape is laid into a track on the unit and held in place by two spring bronze pressure pads. To cut the tape, the arm is lowered and the top knob firmly pressed. An engraved center line marks the point of the cut and an index marker on the unit indicates a point 1½ inches from the center as a reference in editing and marking. In the splicing procedure, the splicing tape is laid over the recording tape and the splice is achieved in a single downward stroke of the cutting arms. Two side knives cut the splicing tape to the exact width of the tape. It is priced at \$29.95. For additional information, contact Alonge.

## LOW-PRINT SCOTCH TAPE



Minnesota Mining and Manufacturing Co. has announced a new magnetic tape that both reduces print level by 8 db and increases high frequency response. Called "Scotch" brand tape No. 131 "Low-Print," this tape, according to the manufacturer, provides an improvement in short wave length response of 2 db as compared with conventional tapes, with no loss in low frequency performance. While this tape has been designed primarily for professional use, it is available to anyone. It comes in a grey box marked "for professional use" and can be identified by a gold "Low-Print" seal on the cover. For price and additional information, contact Dept. A7-236, of M.M. & M., St. Paul, Minn.

## EICO SPEAKER SYSTEM



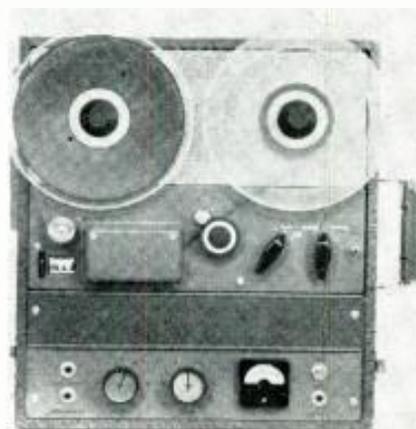
Eico, 84 Withers St., Brooklyn 11, N.Y., has produced a new bookshelf-size, 2-way speaker system complete with factory-built cabinet. This HFS-1 speaker system features a Jensen heavy-duty 8" woofer and matching Jensen compression driver exponential horn tweeter (with level control) in a tuned bass-reflex cabinet. Frequency response is: Woofer—plus or minus 4 db maximum variation 80-2000 cps; Tweeter—plus or minus 2 db maximum variation 2000-10,000 cps; Overall Response—plus or minus 6 db 70-12,000 cps. All visible surfaces of the acoustically-engineered cabinet are smooth-sanded, clear-grained birch; the neutral acoustical grille cloth supplied is framed by a smooth-sanded solid birch picture molding. This system is priced at \$39.95. Complete information available from the manufacturer.

## TURNER MIKE



Turner Company, 929 17th Street, N.E., Cedar Rapids, Iowa, has introduced a new crystal microphone, the Model 52. The new model has a high output for a hand mike. Company engineers say it has been designed for tape recorder and general public address work. Output level is -45 db; response is 60-8,000 cps; it has 6 ft. single conductor shielded cable, and a brown metalustre finish. List price is \$12.00. For additional information, contact Turner.

## ROBERTS RECORDER



A new portable tape recorder, Model 90, has been introduced by Roberts Electronics, Inc., which contains a hysteresis synchronous drive motor. Attractively styled in a hardwood carrying case covered with sheer gray pyroxalin, this machine has been designed with greater power than it is ever required to put out. The drive motor and a precision balanced flywheel hold wow and flutter to 0.18% at 7½ ips. Frequency response is quoted at 40 to 15,000 cps and signal-to-noise ratio is 50 db. Controls are simply designed and easy to use. It sells for \$299.50. An illustrated brochure and additional information may be obtained by writing: Roberts Electronics, Inc., 1028 North La Brea, Los Angeles 38, Calif.

# 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, \$.39 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 ad to: Shop or Swap, Hi-Fi Tape Recording Magazine, Severna Park, Md.

**ANY 1200' TAPE DUPLICATED**—One or both tracks, monaural or stereo, \$5.00 per reel post-paid if check accompanies order. Send master and instructions to W. A. Yoder Company, 714 N. Cleveland Street, Richmond, Virginia.

**FOR SALE:** Motek K-5 tape deck and preamp in wood base, practically new. Cost, Net, \$110. \$75 or best trade. T. T. Cobb, Box 88, Daytona Beach, Florida.

**HI-FI TAPE BUY**—Watch your recording head. Use abrasion resistant permanently lubricated tape. Hi-Sonic specializes in guaranteed highest quality perfect tape at prices below inferior tapes. 40/15,000 C. P. S. Uniformly coated. 7" boxed reels acetate 1200' 1 1/2 mil 1/1.39 4/\$5.04. 1800' 1 mil 1/\$1.87. 4/\$6.76. Mylar 1800' 1 mil 1/2 \$2.60. 4/\$9.40. 2400' 1/2 mil 1/\$3.61. 4/\$13.28. Add 25¢ per shipment. Other tapes available. Hi-Sonic Dept. 2, P. O. Box 86, New York 63, N. Y.

**SYNCHRONIZER HOOKUP:** Make sound movies with your tape recorder \$10.00. Anderson, 2842 South "B" Street, Stockton, Calif.

**WANTED**—Professional portable tape recorder. Prefer Ampex, Concertone or Magnecorder. Give full specifications and condition. Must be reasonably priced. Syd. Owen, 702 Cumberland Road, Atlanta, Georgia.

**WANTED:** Volunteer readers for blind college and university students. Must live within driving distance of Berkeley and Oakland, California. Write or visit Victor Torrey, 1103-65th Ave (Apt. B), Oakland 21, California.

**COUNSELINGS ON TAPE RECORDINGS**—Vocational, personal, child guidance. 25 years experience. "Key to Self-Analysis" free. Write 10-29 Francis Place, Los Angeles 34, California.

**USED RECORDED TAPES** bought or sold. Paradise of Sound, 2113 Pennsylvania Avenue, N. W., Washington 7, D. C.

4 INCH 30 minute tape and strong light weight carton that cost only 4¢ to mail anywhere in the U. S. Carton and tape can be used many times, only \$1.00. George F. Bischof, 1503 E. Vickery Blvd., Fort Worth 4, Texas.

**ANY 1200' TAPE duplicated**—\$5.00; Any 1800' tape duplicated—\$6.00. One or both tracks, monaural or stereo. Money order must accompany order. Send master and instructions to: Samuel Candler Enterprises, P. O. Box 9667, Atlanta 19, Georgia.

**WANTED:** Minifon recorder or small tape recorder; automobile 110V inverter; used recording tape, any quantity; Dick Lackner, 2029 Bradley, Chicago 18.

**CUSTOM RECORD CUTTING SERVICE** Tape to disc. Write for information and prices. Electronic Associates, Box 91, Merion, Pa.

**\$100.00 WEEKLY** Spare time with a tape recorder! Fabulous new business. Entire country wide open! Record weddings, parties, sports events, stereophonic sound, sound-on-sound multiple recordings. Make radio commercials, sound effects. Have fun and make big money in the glamorous business of tape recording. Money-making facts free! Dixieland Publishers, Asheboro 18, N. C.

**LEARN HYPNOTISM, SELFHYPNOSIS** from tape! Other helpful recordings! Free Catalog! Drawer TR697, Ruidoso, New Mexico.

**HIGH FIDELITY RECORDING TAPE.** 1800' 7" reels boxed. Price each in lots of 1/\$2.49, 3/\$1.89, 6/\$1.81, 12/\$1.79, 24/\$1.74, 48/\$1.72, 100/\$1.69. Guaranteed, top quality. Please include postage. Catalogue, Broadcast Tape, P. O. Box 231T, Wallingford, Conn.

**WANT USED** 4 or 5 inch reels. Will sell or trade 7 inch reels. Magneraser \$10. Telephone pickup \$5. Beckstead, Box 2630, Phoenix, Arizona.

**EARPHONE BINAURAL** recorded tapes. Exciting demonstration tape, \$3.50. Check or COD. Stacked or staggered. John Paul Jones Productions, 655 Main, Lafayette, Indiana.

**BRAND NEW** 1956 Model Ampex 600 Tape Recorder. A bargain to anyone interested. Call Laureldale, Penna. Walker 92368 or write G. R. Folk, 1729 N. 11th St. Reading, Penna.

**MAGNECORDER . . . PT6-BA2HZ . . .** Binaural recorder and PT6-BN Binaural Amplifier, perfect condition, cost \$874.00. Sell \$500.00 cash. Call or write W. A. Yoder, Box 7127, Richmond, Va.

**TAPES** for children. Educational entertainment. Stereo—monaural. Write Jones, 655 Main, Lafayette, Ind.

**FOR SALE**—New tube tester. \$25 worth of tubes free. Details, write Richard Guy, Colchester, Illinois.

**MIKE-AUDIO MIXER:** Ideal, tape recorders, disc, etc. Inputs: 2—\$3.75; 3—\$4.75. Brochure—Ruby Recording, 520 Fifth Avenue, New York City.

**NOW!** You can buy stereo tapes at big savings. Most all labels, both in line and staggered. Monaural also. Send 25¢ for catalog to Stereo Tapes, Box 25, North Andover, Mass.

**"TAPE GUILD"**—Complete tape center—All labels—accessories—Ampex Recording facilities—Visit our stereo theatre—4574 Laclede—St. Louis, Mo.

**WANT TO BUY USED** Concertone Model 22 or 23 recorder, in N. Y.-N. J. area. Also want to sell several dozen 10" aluminum boxed reels—\$2.25 each prepaid. Send information on recorders and checks for reels to Edward Schultz, 91 Whittingham Terrace, Millburn, N. J.

**PROFESSIONAL DUPLICATING.** Tapes, records, transcriptions. Berlant and Viking equipped. Write—Midwest Recording Enterprises, Box 207, Lombard, Illinois.

**FREE TAPE RECORDINGS** of Christian shutin music, western gospel singing, great Baptist choirs, Christmas and Easter Cantatas, the "Messiah," complete church services, (southern Baptist but no doctrines) Biblical dramatizations, and many others. Also available amazing Carillon Chime recordings. For complete list write Charley Summers, Box 986, Mobile Alabama.

**SEVERAL NEW \$10 SHURE #TR5** tape recording heads, erase/ record/ playback, \$4.75 each, postpaid. E. Hofber, 938 School, Chicago 13.

**TRADE-IN HEADQUARTERS** FOR recorders, Hi-Fi; Top dollar toward Acrosound, Altec, Fentone, Fisher, Garrard, Marantz, Pickering, Stevens, Thorens, others. Many like-new components at a big saving. Money-back guarantee. Our customers trust us. Greenwich Specialty, Greenwich, N. J.

**LEARN WHILE ASLEEP** with your recorder. Amazing book gives full instructions. \$2.00. Guaranteed. Research Association, Box 610-TR, Omaha.

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All Brands over 600 Titles.  
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Write for complete catalog & prices  
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PROCESS TAPE**



**CONVENTIONAL  
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ALL RECORDING TAPE is coated with magnetic oxide. On ordinary tapes this coating rubs off in use and forms a harmful deposit of abrasive dust on the recording head. Unless the head is constantly cleaned, the collection of abrasive dust eventually wears it out. A further disadvantage of oxide-shedding, common to all ordinary tapes, is that after a few playings, the tape loses enough coating to alter its original frequency response characteristic.

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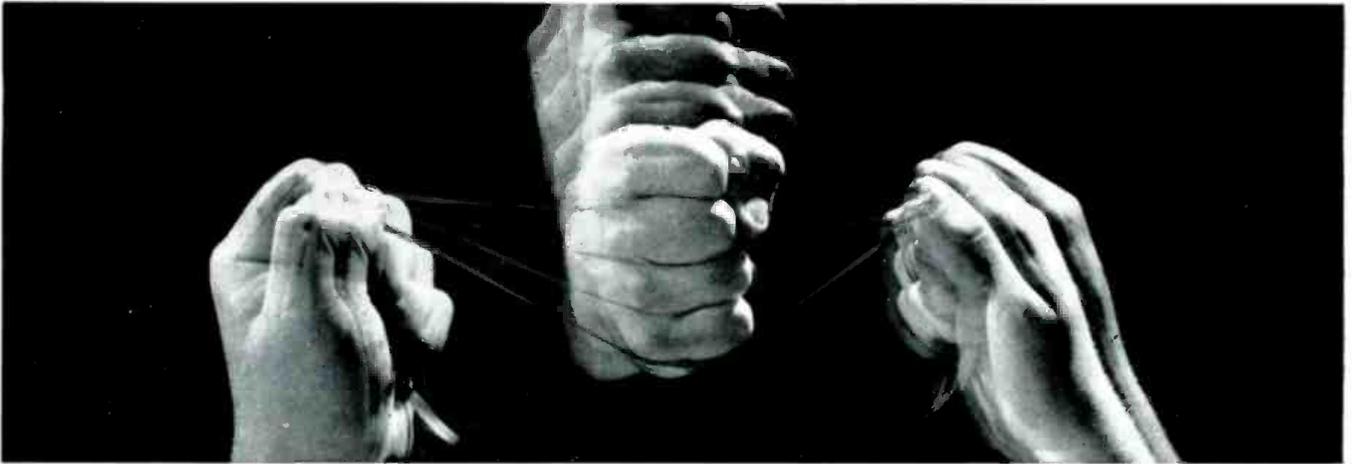
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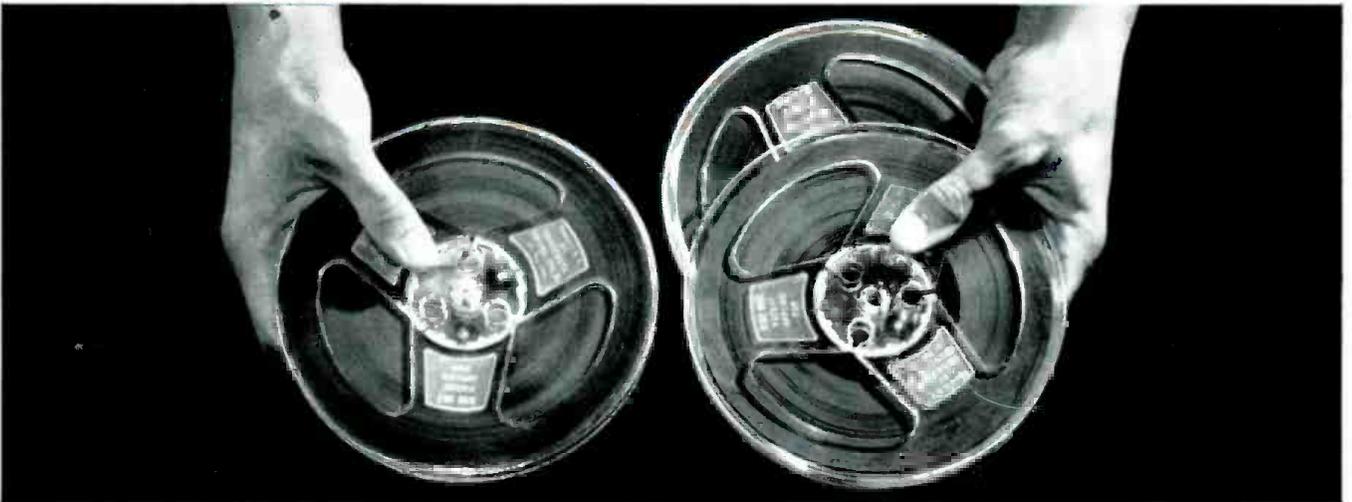
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