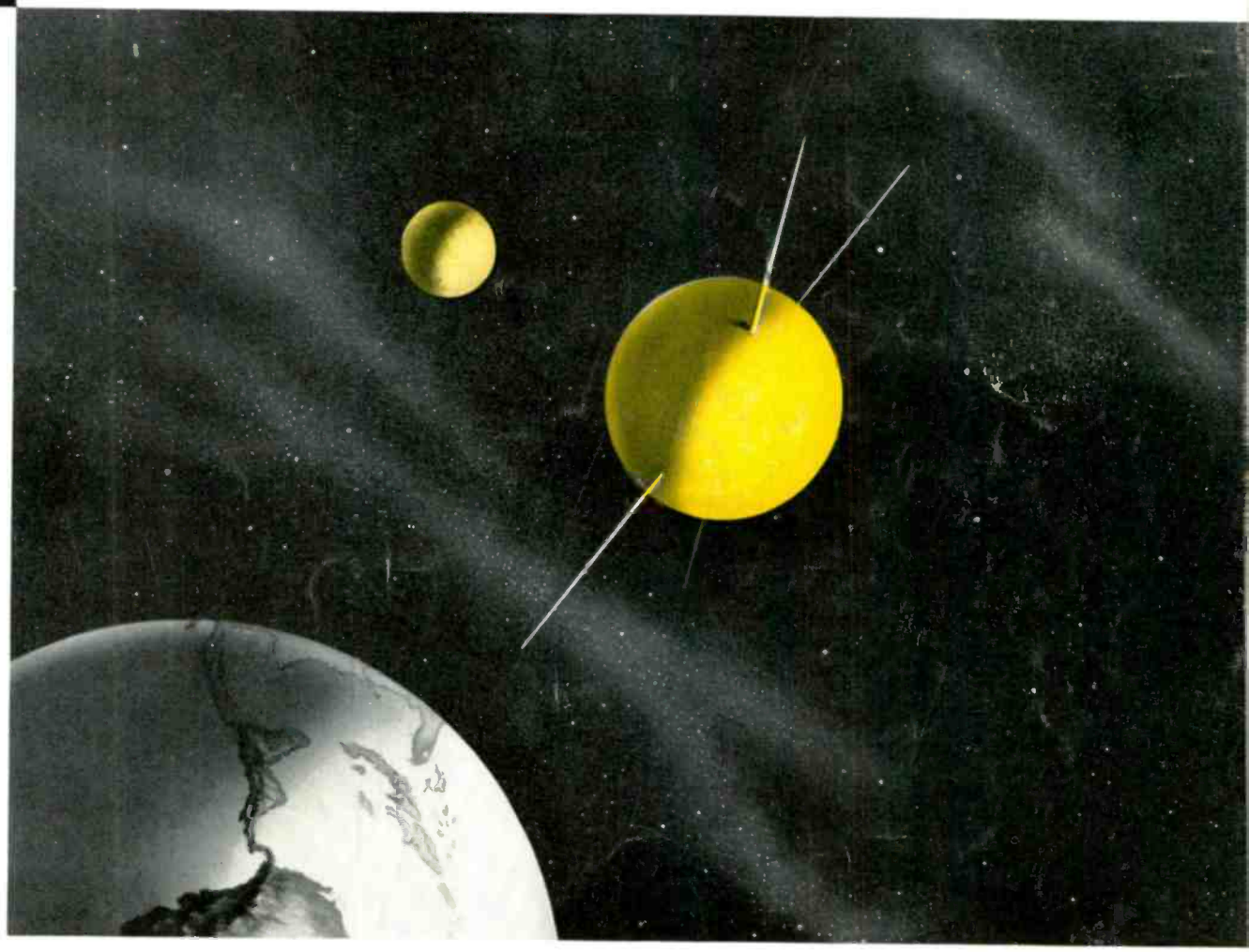
HI-FI

TAPE RECORDING



Help Track the Satellite—See Page 22.

May, 1957

35c

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5" reel	900 ft.
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TIME-AND-A-HALF for OVERTIME*

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- *One for maximum economy*

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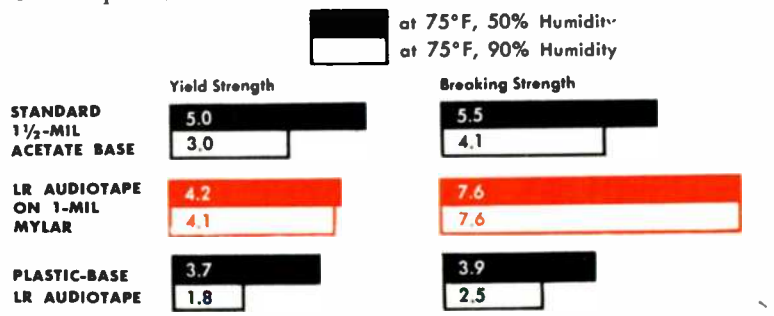

Whatever the requirements of your "overtime" recording jobs, ask for LR Audiotape. For information on the complete Audiotape line — five different types for every recording need — write for Bulletin No. 250.

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HI-FI

TAPE RECORDING

VOL. 4 No. 6 MAY, 1957

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IN THIS ISSUE

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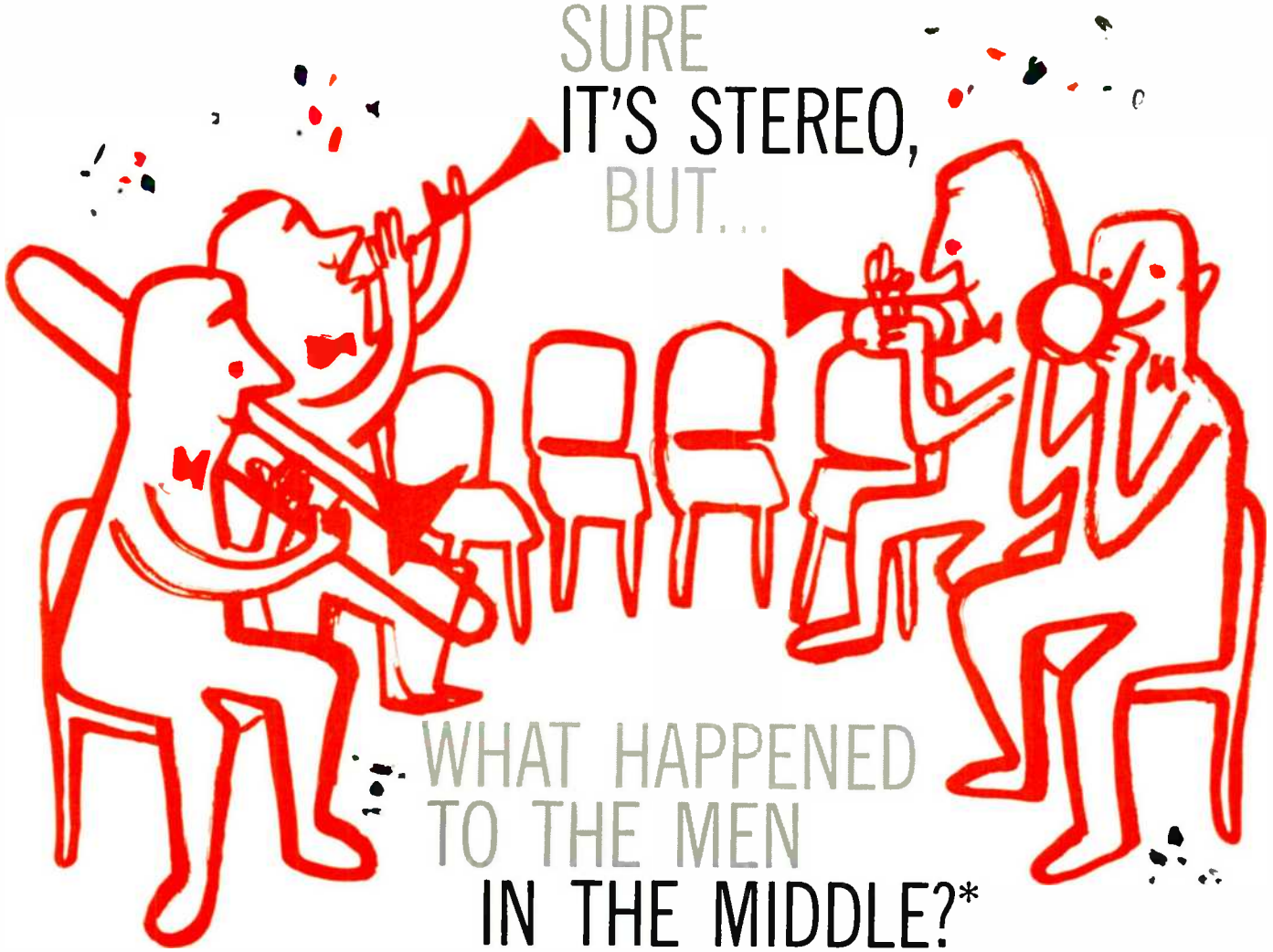
SURE IT'S STEREO, BUT...



WHAT HAPPENED TO THE MEN IN THE MIDDLE?*

Everybody knows that stereophonic tape recordings offer the very best in high fidelity music reproduction. Yet all too often, stereo is left and right only, and the music which should be heard from the *middle* is only vaguely defined or missing altogether.

To hear *true* stereo reproduction, you must hear middle as well as left and right. Only two loudspeakers are required to accomplish this, and the recordings are still two-channeled, but the original recordings must be made to the exacting technical and engineering standards necessary to produce full stereophonic sound.

STEREOPHONY INCORPORATED is proud to introduce a new and exciting series of true stereophonic tape recordings—recordings of such realism and dynamics that it's like discovering stereo all over again when you hear them for the first time. Every detail of sound from left, middle, and right is completely and faithfully reproduced, exactly as it was heard in the live session.

You'll want to hear the results for yourself. Your favorite local high fidelity or music dealer now has *STEREOPHONY INCORPORATED* recordings and he will be happy to demonstrate them to you. Look for the distinctive package shown below and let it be your guide to the finest in stereophonic music on tape.

**What Happened to the Men in the Middle?* Why, they went to make recordings with *STEREOPHONY INCORPORATED!* And to prove to you how successful they were, we've prepared a special Sampler tape made up of selections from each of our releases. The sound is fabulous—and so's the price—30 full minutes of stereo for only $4.95! Ask your dealer for *STEREOPHONY INCORPORATED SAMPLER VOLUME I* or write directly for your copy.

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NEW TAPES

By Georgie Sigsbee

As I sit here in this old desk chair (no ivory tower this) and compile a few written words to you, I am reminded of Robert Frost's poem, "An April Day," for although this is being written for the "you're one month on in the middle of May" issue, actually ". . . you're two months back in the middle of March" applies to us. For, as is necessary in the publishing business, this is being written 'way back in regard to May consumer receipt, or 'way ahead in regards to May publication. So when you see the bygone months mentioned, it really isn't "old hat!"

As you know the potentiality and progress of tape is both challenging and thrilling. In regard to the article in the March 1957 issue of this magazine about the additional time now available on the new tape cartridge developed by Cousino, Inc., (see April 1955 issue), I had just recently seen the Tefifon, made in Germany, which employs a plastic belt (vinyl record) in cartridge and upon engaging with stylus plays merrily for eight hours. As the fidelity did not compare to tape, it was of special interest to see that the tape engineers have made further advances and are still hard at work on increasing the playing time of this cartridge as well as developing other types of devices in the field.

There is so much room to grow yet, problems to be settled (one of the latest, to standardize or not to standardize, that is the question . . . stacked or both stacked and staggered), new equipment invading the market and more being worked on in the labs . . . it gets one dizzy at times, but lends vitality and increased interest to this field.

In January the wonderful results of video taping were brought to public attention during the inauguration of President Eisenhower when NBC performed their first video taping of a special event. A few minutes after he had taken the oath they showed the video tape of that moment which made a fine on the spot comparison. The clarity and fidelity were superb. Toward the end of February the CBS network employed the Ampex video tape on the Godfrey show with the same "live" results. A giant step forward from kinescopes. Tape . . . its potential, its progress, both video and audio, is showing prolific results.

Now that the initial excitement of the "ping" and "pong" of stereo sound is by the boards, the question is being hashed out as to just what stereo sound *should* sound like. The consensus of opinion is that it should reproduce the live performance as realistically as possible. Stereo should be a full, wide-range, well-balanced, sound. It should not be judged by "pinpoint audio." As the music lover settles into his easy chair he expects to hear, as nearly as humanly and/or mechanically possible, the music as originally produced. As long as recording companies execute the process of reproduction with the highest quality engineering and equipment, the results should be the finest.

A news item for the month of Ides was the good word from Phonotapes that they were now releasing a new series titled "Cameo" consisting of complete musical selections, 7½ inch speed, dual track, for only $2.98. Mozart's "Eine Kleine Nachtmusik," Prokofiev's "Classical Symphony," and "String Band Music of New Orleans" are some of the releases available.

And so onward and upward. . . .

CLASSICAL

SYMPHONY-BALLET
STRAVINSKY
Symphony in Three Movements
The Firebird Suite
Cento Soli Orchestra, Rudolph Albert, Conductor
OMEGATAPE 3008
7½, Dual . . . $9.95

This symphony is filled with the powerful force and originality of Stravinsky's instrumental colorations. It is a rather pleasant example of the electricism and polytonality found in his more recent works. The recording is one of clarity and brilliance.

The "Firebird," which helped shape and chart his future, is a delightful ballet based on various Russian fairy tales. This is Stravinsky before he broke with tradition and developed more completely his different style. Mr. Albert and orchestra de-

liver with energy and understanding the splashing color, the pulsating, protean rhythms and beauty contained in this composition. This high fidelity recording brings it all into sharp focus. You may find a small amount of hiss audible at the beginning of Track B, but for this there are no complaints and the overall recording is one you shouldn't miss.

ORGAN

CUSTOM-RECORDEX, TAPE # HC 2
7½, Single

Viennese Lantern
Your Song From Paradise
Durand Waltz
Two Guitars
Petite Suite
Dancing Tambourine
In a Persian Market
Waltzing Cat

Custom-Recordex of Newton, Ohio, has sent us three organ releases and we take this opportunity to welcome this company. If you belong to the group who like, and collect, light music played on the organ you will want to write the company for further details as to releases, prices, etc. The post office box is #206. As we receive additional data we will transmit it to you.

This particular tape employs the use of the Baldwin organ console, with percussion ensemble. The familiar pieces are well played by an unnamed performer. My particular favorite is the "Petite Suite" which contains a wide range of tonal colouring ably demonstrated by the organist on this instrument.

Fidelity is good.

CUSTOM-RECORDEX, TAPE 3 RR1
7½, Single

A Kiss in the Dark
The Boy Next Door
Serenata
Medley: Love, Nest, Penthouse Serenade, Tea for Two
Holiday for Strings
The Trumpeters Lullaby
Smoke Gets in Your Eyes
Crazy Rhythm
Home
Organist—Robert Read

On this tape we hear Robert Read playing the Baldwin Orga-Sonic spinet organ with an easy style producing about thirty minutes of soft, easy-to-listen-to music. This is the kind of tape which you might find a proper setting for the dinner hour. It certainly would not disrupt the digestion and might even tend to cut chatter and quiet the children!

Mr. Read's arrangements of these popular selections are sans flourish or show and are executed with a good feel for phrasing and rhythm.

Nothing profound insofar as repertoire but you will derive pleasure and some restful musical moments from this tape.

CUSTOM-RECORDEX, TAPE # JC1
7½, Single

Twilight Time
Mister Sandman
Blue Moon
Dipsey Doodle
Song of the Islands
Medley: Doodle-e-Doo, Whispering
Smoke Gets in Your Eyes
Swanee River
Begin the Beguine
Caravan
Dark Town Strutters Ball
Mobile
You Can't Be True Dear
Goodnight Sweetheart
Organist—Jim Current

Recorded on the Baldwin Orga-Sonic spinet organ with Baldwin percussion ensemble, Mr. Current presents these standard tunes with enthusiasm. The arrangements are stylized and lively and he makes good use of the tonal effects afforded on this instrument. During "Swanee River" he actually seems to be strumming the banjo via the organ! In "Dark Town Strutters Ball" he cuts loose and sets the joint jumping. The younger crowd should find his delivery readily acceptable; it's not rock 'n roll but its spiced up and far from pedantic.

Pleasant, foot-tapping background music. Good reproduction.

ORGAN RECITAL at Columbia University, Vol. I

19th Psalm (Marcello)
Ave Maria (Bach-Gounod)
Concerto in C Major, In One Movement (Duke Ernst)
Donkey Dance (Elmore)
Prelude and Fugue on B-A-C-H (Liszt)
The Squirrel (Weaver)
Toccata (Prince-Joseph)
Organist—Bruce Prince-Joseph

HIFITAPE R-709
7½, Stereo, Staggered or Stacked

Mr. Bruce Prince-Joseph is not quite in his 30's and has mastered both the pipe organ and harpsichord. Having been well schooled, he is presently professor of organ and college organist at Hunter College, New York.

The Aolean-Skinner pipe organ in St. Paul's Chapel on the campus at Columbia University has fine tonal and dynamic range. The chapel is quite "live" giving exceptional clarity of sound and if your equipment is capable of reproducing 32' (16 cycles per second) to 1' (16,000 cycles per second) sound, this recording contains them.

On this particular tape Mr. Joseph seems at his best performing the "Concerto in C Major" and "Prelude and Fugue on BACH." The latter highlights his expert handling of this instrument, good manual dexterity, and artistic interpretation. This young man also seems to be something of a composer as you will hear in the final selection.

Evidently Mr. Joseph felt the need to break the more classic compositions with a few short humorous bits, "The Donkey Dance" and "The Squirrel." They lend a change of pace which may be agreeable to some.

A beautiful recording, full-range fidelity.

THE GEORGE WRIGHT SOUND

Chloe
Mood Indigo
Beyond the Sea

Honky Tonk Train
I Love Paris
Baubles, Bangles and Beads
The Whistler and His Dog
When You Wish Upon a Star
Dizzy Fingers
Organist—George Wright

HIFITAPE R-710
7½, Stereo, Staggered or Stacked
GEORGE WRIGHT PLAYS THE CONN ELECTRONIC ORGAN
Madeira
How Come You Do Me Like You Do
Aunt Blanche's Boogie
La Borrachita
Cool Tango
Beer Barrel Polka
Under Paris Skies
That Honky Tonky Melody
Pavane
Ragging the Scale
Wrap Your Troubles in Dreams
The Cactus Polka

HIFITAPE R-712
7½, Stereo, Staggered or Stacked

Once again Mr. Wright records at the mighty five-manual Wurlitzer and the variety of sounds which emanate from this instrument never cease to amaze and delight. Have you ever heard an organ emitting sounds like a train? Try "Honky Tonk Train." And don't be surprised when you hear the organ whistle and then bark like a big dog in "The Whistler and His Dog." Both cleverly done. There is no argument as to Mr. Wright's talent and proficiency and under his capable hands you will hear a Wurlitzer organ played by a master. Hi-Fi all the way.

On R-712 Mr. Wright leaves his favorite Wurlitzer to show what can be done with the electronic organ to make it sound like a pipe organ. As this has become such a popular musical instrument in the home (you can now buy a kit and make one for yourself) this tape should prove of interest to many.

I found this a thoroughly enjoyable recording with Mr. Wright playing with his usual virtuosity and lively interpretations.

Excellent fidelity.

JAZZ

STAN SELTZER PIANO
Cheek to Cheek
Easy to Love
Autumn in New York
A Foggy Day
Crissy's Blues
Speak Low
Blue Moon
The Way You Look Tonight
Let's Fall in Love
Have You Met Miss Jones

HIFITAPE R-202
7½, Dual

Stan plays these pop tunes with rhythmic, intricate patterns. His styling is original and he breathes new life into these oft-heard pieces. He has complete and sure command of the piano and possesses a clean, crisp touch. Expertly backed up by Red Mitchell at the bass and Frank Hudec on drums, their solid technique and good improvisations are spotlighted in such selections as "Foggy Day" and "The Way You Look Tonight." (Good bass work on this one.)

Reproduction of piano (as well as bass and drums) is excellent. With the power Seltzer and group packs this would have been even more wonderful via stereo.

POPULAR

SYMPHONY FOR GLENN MILLER
Moonlight Serenade
Moonlight Cocktail
Tuxedo Junction
At Last
That Old Black Magic
In the Mood
Serenade in Blue
Heinrich Alster, Hamburg Philharmonia Orchestra

BEL CANTO ST 8
7½, Stereo, Staggered or Stacked

Hot off the production line comes another top stereo tape from Bel Canto. I must admit to being prejudiced as to content since I have always held a special spot in my musical heart for anything by, or reminiscent of, Glenn Miller. For those who feel likewise or just like popular music in a smooth, easy style, this is a must. Good dance music, relaxing to just listen to, and if you have a voice you won't be able to resist the temptation to use it.

Heinrich Alster and the 74 men of the Hamburg Philharmonia Orchestra deliver this musical tribute with expert touch and a fluid, flowing style.

The string work is polished, the brass and reeds perform beautifully. Special microphones built by Dr. Eric Boyerman were used in this recording which was made at the famed Musikhalle in Hamburg, Germany. The separation of instruments is true, no extreme pinpoint audio for showiness, just a realistic audio sensation (and close your eyes and imagine the video) of the orchestra right there in the room, playing just for you to savor and enjoy. Need I say more . . . buy it and see!

BEL CANTO ST 8
SWINGIN' HARPSICHORD
Tico Tico
The Song from Moulin Rouge
Fascinating Rhythm
On the Street Where You Live
Moritat
Twelfth Street Rag
I've Grown Accustomed to Your Face
Nola
Fiddle Faddle
Cumana
Bruce Prince-Joseph at Harpischord with the Manhattan Trio

HIFITAPE R-603
7½, Stereo, Staggered or Stacked

Every once in a while we receive something that is really different and fascinating. This is one of those occasions. Here we have a classical performer turned to pop music; now this, in itself, is not too unusual, what it is is the instrument he has brought into the popular field . . . the harpsichord! Having once served as the supporting basis of almost every instrumental combination during the period of the development of chamber music and the orchestra, Mr. Joseph probably quite logically felt the harpsichord could serve in such a capacity for the modern instru-

mental combos. So he took the bull by the horns and if you have never heard a "hep" harpsichord, then here is your chance.

From an audio angle the highs on this unique instrument are a good test for your equipment. The lower end (goes down to 16' pitch) is 32 cycles per second. The tonal thuds and twangs reproduce well. The instrumentation of this group consists of electric guitar, celeste, drums, bass and sax doubling on clarinet and trumpet.

The particular instrument Mr. Joseph uses is also unusual in that it has not only two manual keyboards and four sets of strings, but, in addition, a pedal claviar which has a full 32 notes playable by the feet.

The group gets off to a rousing, accelerated start with "Tico Tico" and before they manage to race away they settle down to a delightful rendition of "Song from Moulin Rouge." In this latter selection and the two songs from "My Fair Lady" you hear the essence and full effect of the harpsichord at its modern best. Mr. Joseph plays with skill and versatility beyond question.

Fidelity and stereo reproduction is very good.

HAVE YOU MET MISS CARROLL

Everything I've Got Belongs to You
It's All Right With Me
Happiness Is a Thing Called Joe
Almost Like Being in Love
Love Is a Simple Thing
Barbara's Carol
Two Ladies in de Shade of de Banana Tree
My Heart Belongs to Daddy
You're Mine You
Have You Met Miss Jones?
I'm Glad There Is You
Get Happy

Barbara Carroll Trio

RCA BP 35
7½, Dual, 5"....$8.95

Another tape by this talented pianist which will be welcomed by her many fans. (Livingston 1081, reviewed October 1954 and Atlantic, April 1956). This latest recording is more sharply-honed and balanced, both in recording and playing. Miss Carroll was very good two years ago but she is even better now!

Giving a sparkling delivery to the selections, her presentations are well-proportioned, her ability to glide from playing pianissimo to fortemente is accomplished with graceful ease and her arrangements are definitely fresh and creative. From the dreamy rendition of "Happiness Is a Thing Called Joe" to the fast, stimulated performances of "Almost Like Being in Love" and "Get Happy," this is a topflight Carroll release.

Excellent balance, clarity and presence.

NOVELTY

WALT DISNEY SONG CAROUSEL

When You Wish Upon a Star
Whistle While You Work
Love Is a Song
Who's Afraid of the Big Bad Wolf
Little April Shower
You Can Fly!
Zip-a-Dee Doo-Dah
Alice in Wonderland
Bella Notte
Never Smile at a Crocodile
Bibbi-Di-Bobbi-Di-Boo
A Dream Is a Wish Your Heart Makes

Joe Reisman, his Orchestra and Chorus

RCA BP 36
7½, Dual, 5"....$8.95

The yougsters will love this one and undoubtedly request many re-runs, if our two-year-old is any indication. Her verbal entreaty, "Please play the Big Bad Wolf tape 'cause I like that kind," has been repeated countless times in only two days!

Joe Reisman, musical director for RCA Victor Records Division and top arranger-conductor, aided by a cheerful, animated chorus present this merry, rollicking interlude of songs from nine of Walt Disney's productions. The orchestra performs in sprightly fashion three instrumental arrangements: "Zip-a-Dee Doo-Dah," "Whistle While You Work," and "Bibbi-Di-Bobbi-Boo." Included on the tape is "Bella Notte" from "Lady and the Tramp" which you will not find listed on the liner notes.

Found myself humming and singing(?) some of these tunes and thinking that maybe a lot of us grownups could do well do with a pinch of the Disney-brand of pixie dust!

At the end of Track 1 the highs are briefly strident but otherwise this is a flawless tape. Don't be without it if you have small fry or are a Disney fan.

BLACK WATCH PIPE AND DRUM TUNES

Black Watch Royal Highland Regiment

PHONOTAPES "Cameo" Series
7½, Dual....$2.98

Recorded during an actual show in a large armory or auditorium, you receive a good audio perspective on this monaural tape. You'll hear the regiment marching to front and rear, the leader calling, audience applause, etc. Acoustically the auditorium is quite "live" and reverbations so terrific that at times our desk shook.

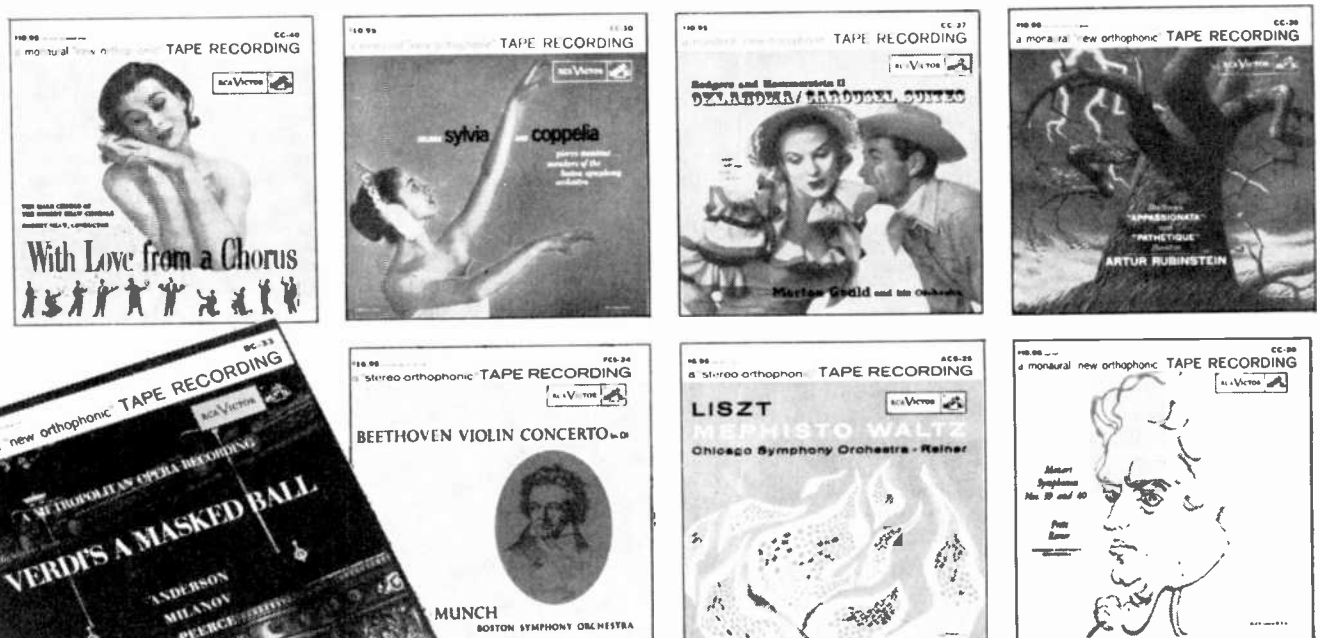
Unless properly reproduced from the original performance, the bagpipes can exhaust one's audio capacity in short time but not so with this tape. I put on a disc of bagpipe music and, needless to say, the tape fidelity was superior and less wearing.

Here you have about fourteen minutes of Scottish band music which is bound to delight all who possess even a wee drop of Scotch blood. If you play this late at night, with the windows open, you might awaken the neighbors or find a MacGregor or McNabb knocking at your door.

Top fidelity.

Sensational tape

- **Full-color record-album-style packaging with liner notes**
- **Standard 7-inch reels for all lengths of tape**
- **Clearly labeled reels for instant identification**



RCA Victor leads the way again with the first standardized pre-recorded tape albums. Tapes of all lengths are now on uniform 7-inch reels contained in 7-inch albums. Exciting covers with 4-color art and prominent titles make these albums a delight to use and store. There's no more fumbling with leader tapes for identification—RCA Victor reels are clearly labeled with titles and artists. Everything about these new tapes is planned for ease of use and perfection in sound.

news from RCA Victor!

The greatest tape release ever... first-time-on-tape performances... in the truest High Fidelity Sound!

Here are some of the world's most masterful performances, tape-recorded for the first time. And with the *Podium Presence* of RCA Victor's pre-recorded tapes, the music is so vivid, *you can almost see it.*

STEREOPHONIC

Salome: Dance of the Seven Veils* (R. Strauss) – Reiner, Chicago Symphony CCS-23, $10.95. *And Final Scene, with Inge Borkh.

Violin Concerto (Beethoven) – Heifetz, Charles Munch and the Boston Symphony Orchestra. FCS-24, $16.95.

1812 Overture (Tchaikovsky) – Reiner, Chicago Symphony. ACS-26, $6.95.

Mefisto Waltz (Liszt) – Reiner, Chicago Symphony Orchestra, ACS-25, $6.95.

MONAURAL

Pines of Rome; Fountains of Rome (Respighi) – Toscanini, NBC Symphony. BC-51, $8.95.

Symphony No. 9 (Beethoven) – Toscanini, the NBC Symphony and the Robert Shaw Chorale with soloists Farrell, Merriman, Peerce and Scott. EC-52, $14.95.

Il Trovatore Highlights (Verdi) – Milanov, Bjoerling, Warren, Shaw Chorale, RCA Victor Orch., cond. by Cellini. DC-34, $12.95.

Oklahoma!-Carousel Suites (Rodgers) – Morton Gould and His Orch. CC-37, $10.95.

Samson & Delilah Highlights (Saint-Saëns) – Stevens, Peerce, Merrill, NBC Symphony cond. by Stokowski. DC-35, $12.95.

Symphonies No. 39 and No. 40 (Mozart) – Reiner, Chicago Symphony Orch. CC-28, $10.95.

Finlandia, Op. 26 No. 7 (Sibelius); Dance of the Hours (Ponchielli); Zampa Overture (Hérold); Roman Carnival Overture (Berlioz) – Toscanini, NBC Symphony. BC-38, $8.95.

Sonata No. 23 in F Minor, Op. 57 "Appassionata" and Sonata No. 8 in C Minor "Pathétique" (Beethoven) – Artur Rubinstein. CC-39, $10.95.

With Love From a Chorus – Robert Shaw Male Chorale, R. Shaw cond. CC-40, $10.95.

Sylvia; Coppélia (Delibes) – Monteux, Boston Symphony Orch. CC-30, $10.95.

Melachrino on Broadway – George Melachrino Orchestra. CP-52, $10.95.

Under Analysis – Sauter-Finegan Orchestra plays great band hits. BP-49, $8.95.

Play Melancholy Baby – Matt Dennis plays and sings. BP-54, $8.95.

One Night in Venice – Armando and his Orchestra. BP-45, $8.95.

Cole Porter and Me—Eddie Cano and his Sextet. BP-50, $8.95.

Beauty and The Beat – Bob Scobey's Frisco Jazz Band with Clancy Hayes. AP-51, $6.95.

Dust On The Moon – Pablo Beltran and his Orchestra. BP-53, $8.95.

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TAKE 1 by the Editors

Do you know Mr. Reader and Mrs. Reader, that you are one of the best tape recorder salesmen that the industry has?

It's really true and we're not at all surprised. Within the last few months we sent out a questionnaire to 500 subscribers whose addresses we picked at random from the file. Perhaps you were one of those who received one. Better than 60% of the questionnaires were returned filled out and we want to thank every one who took his time to jot down the data and mail it back.

From the answers we found that 43% of our subscribers bought a tape recorder after having seen one demonstrated by a friend. They in turn have demonstrated to friends and the wave of recorder buying continues to go ever outward like ripples on a millpond when a stone is thrown in.

And did you know that 41% of the people who bought recorders bought the brand that you recommended? That shows you folks wield a very powerful influence and your friends take your word as to what is good and what is not.

We were interested too in what you did with your recorders. By far the greatest use was to provide music in the home or to use in music recording. Much of this was done from radio and TV. 20% of the replies said that the recorder was used for entertainment without going into detail. Other uses included teaching, voicesponding, church work, family recording, combining sound with slides and movies, etc.

We're right proud of the caliber of our readership too. 53% of those who replied are in management positions and there are lots of doctors, dentists, ministers, teachers, lawyers and engineers who read HI-FI TAPE RECORDING. Almost all kinds of occupations were represented including a janitor, housewife, taxidermist, parking lot attendant, photographers, chemists, students, a locomotive fireman and lots more. Tape recording has a universal appeal.

More than 40% of you buy recorded tapes for enjoyment and more than one out of every four plans to convert to stereo and a good many are planning to buy another recorder, either a newer model, a more expensive machine or a second recorder for copying or tape dubbing.

You pay a great deal of attention to articles on recorders and ads which appear in the magazine.

A new microphone, or a better one than that supplied with the recorder was high on everyone's "to be purchased" list along with external speakers, amplifiers and a great deal of interest was also displayed in kits for home construction.

The kinds of articles you said you wanted we are working on and will appear in future issues. Coming up next month is a story on how to build a kit to broadcast the output of your recorder to any radio in the house—or how to broadcast what your mike picks up to your recorder in another room. The concluding part of "Big Brain in a Box" will appear too to continue the fascinating story of tape in industry.

TEEN TAPERS

BY JERRY HEISLER, National President

A RECORDING activity that occupies much of my time is that of "phonocording", or recording from a phonograph. (Phonocording is an original word). This is a relatively simple process yet one that has many teen applications. Since teens purchase more records than any other group I think that a discussion of this use of a recorder might be interesting to you.

Before any recordings can be made from the phonograph the proper connection must be made between the two units. This can be done in several ways. The poorest way although perhaps the most obvious is to place the microphone in front of the phonograph speaker. This will reproduce the records, but will also reproduce any other sounds in the room as we've learned from sad experience. Except in emergencies this is to be avoided.

Virtually every home recorder is supplied with a patch cord containing alligator clips on one end and a standard plug on the other. The clips are attached to the speaker and the plug is inserted in the "phono" input of the recorder. This system is far superior to the microphone system in that you are recording directly from the phono and no outside noise will be picked up.

There are some difficulties with this system also. First of all if you "tap" the phonograph at the speaker you are receiving the sound after it has been amplified. When you feed it into your recorder you amplify it again, and unless you watch your indicator very carefully you are apt to overload the tape and distort the recording. Another disadvantage is the fact that the clips are only temporary and may fall off of the speaker leads causing you to record only a hum.

In my opinion and through wide experience there is only one correct method of recording from a phonograph. This is to install a permanent jack in your phonograph. When this jack is properly mounted on your phonograph all that is needed to make a recording is to insert a patch cord. As was mentioned before over-amplification is a problem. In this system we can eliminate it by tapping the phonograph before the amplifying stage. To do this, follow the wires from the arm to the point where they enter the amplifier and tap at this point. If you have a magnetic cartridge on your phonograph then you will need the preamplification stage of the phonograph if your recorder does not preamplify. If your recorder does not have a separate input for a magnetic phono then chances are it doesn't preamplify. To test this out, make a temporary tap before the amplifier stage on the phono and plug it into your recorder. If you receive good results at low to medium volume go ahead and make the permanent tap. If you have to turn your recording level all the way up you need preamplification. If you are not familiar with phonograph circuits ask your repairman to show you where this stage is. If you don't like to tinker, he can do the entire job for a few dollars.

Now that we have a permanent tap into our phonograph what are some of the things we can utilize it for? I find it is very enjoyable to make up tapes of various kinds of music. For example, I have a full tape of mambo music that I made from various records I had. When the gang wants to dance the mambo I just put on this tape and I have a full reel of mambo music featuring selections from various bands without shuffling records. You can make similar tapes of any kind of music you like. A full 12" L.P. record (both sides) will barely fill a 7" reel of tape of both sides. You can record 12 or more 78 rpm recordings on a side of a 7" reel. Utilizing the extra play tape you can put about 3 sides of LP recordings on a full reel of 7" tape, and about 18 standard 78 or 45 records on each side of the same reel.

I find that with my being at college and the hi-fi set and records being at home, I can enjoy my favorite records by having them on tape while the family enjoys the discs at home.

Around your high school you certainly must know of people who collect various types of records. By arranging to exchange with them you can swap recordings without having to buy so many records. This is an excellent basis on which to start a club and some of the members might wish to donate reels of music to the school itself.

One particularly useful aspect of "phonocording" is to preserve valuable discs. Many orchestral recordings cost $5 and $6 and are valuable in a collection. When I get such a recording I copy it on the first playing, the point of its "highest quality", and thus if anything should happen to it I have a "spare".

One closing suggestion that I might offer is to always be sure your records are clean before copying them. An anti-static cloth or spray costing less than $1 is an excellent thing to have and a "once over" of your records with these devices will insure your recording your records at their best. Records wear slightly with each playing. Your tapes will never wear out under normal use.

Just another of the many, many uses that teens can make of a recorder. Try it!

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:

I am a young dansker, twenty-six years old. I have a two-speed, 3¾ and 7½ ips recorder. What I am interested in is tape correspondence with one or two tape enthusiasts. May I ask you if you have any names and addresses you can give me or can you give my name and address to tape-respondents . . . so to speak. *Bent Andersen, Bjornsonsvje 80. Valby Kobenhagen, Danmark.*

We would suggest that you join one of the tape clubs listed on page 17 of this issue. Meanwhile, if anyone would like to contact Mr. Andersen—there's his address.

To the Editor:

I would like to see a speaker dividing network diagramed.

I am sure many other readers would like to build their own net-work in order to utilize various speakers that may be laying around.

Was most pleased to have your magazine go on a monthly basis. There is only one thing I find wrong with it. The moment it arrives I can't rest or do anything until I read it from cover to cover.

In a non-joking way, I do have a question or complaint, not about the magazine but about recorded tape. Why don't the companies use a tape long enough to get a complete symphony or other continuous selection on one side or track? I do, by using 1800 or 2400 foot tapes. My main objection to discs is the necessity of turning over the record and breaking the continuity and mood. Recorded tapes, unfortunately, have the same fault.—*R. Smith, Miami, Fla.*

We'll see what we can do on an article on speakers and dividing networks. Your suggestion about recorded tapes will be read by the officers of the companies. It is a good idea but it would raise the prices somewhat because of the higher cost of the tape.

To the Editor:

There is one solution to the problem of playing a backwards tape made on a German machine which has not been mentioned. A simple way to play a tape backwards is with the aid of a stereo machine. Side two of a monaural dual track recording will be played backward if standard stereo-play technique is used. Just turn off the volume of track one and turn up the volume on track two.—*Edwin H. Hess, Richmond Hill, New York.*

To the Editor:

The best thing I have found for holding tapes on the reel is a length of ¼" elastic (similar to what the gals use in the tops of their you-know-whats). Cut it to length and tie a knot or sew the ends and leave a short piece extending to pull it off the reel. *John H. Clayton, Dayton, Ohio.*

To the Editor:

About the trouble with squealing and sticking of tapes, I had it also even with standard brand tapes. You haven't mentioned an easy way out which is to switch to paper tapes. I believe they are still available and one grade is stronger than plastic. They are plenty good enough for ordinary uses. Another solution I used on one machine was the addition of a roller type tape guide where possible or the replacement of a solid tape guide post by a roller type. My work is amateur voice only and is not critical and paper tapes made five or six years ago in this humid, hot climate have held up better than plastic.—*R. W. Simpson, Miami, Fla*

To the Editor:

I would like to suggest that a portable tape recorder be placed on the market having all the features of the latest model T-700-D Revere but with the following important additional features: 1—capable of recording simultaneously on two tapes as well as only on one tape. 2—When playing, be able to make a recording of what is being played.

Such a machine would have these valuable advantages: 1—when recording a letter, instructions or a speech to be received later or acted upon at a distance, it is very important that an exact copy be retained. It can then be referred to in the same manner as a carbon copy is made of a letter. This machine should be able to accomplish this without requiring an additional machine, time or effort.

2—While playing, be capable of recording a duplicate tape at the same time. This would avoid the expense of having two machines to do this dubbing and the labor of connecting them up.

Why could not a recorder be designed so that the shafts holding the reels are long enough to hold two reels each, one above the other? The two tapes, as at present, could be fed through the same but a deeper slot. If that is impractical perhaps two slots could be provided. The proposed machine need not be much larger than present portable models, yet would accomplish much more than two of these could do now.

I am only an amateur, but correspond by using tapes and would like to make taped copies of my correspondence at the same time. I also make copies of tapes loaned me. I would like to own a machine such as I have outlined.—*Arthur P. von Deesten, Los Angeles, Cal.*

Until such a recorder comes along you might try recording two tapes at once by using the 1 mil Mylar (double-play tapes). Put two of them together on the same reel and feed both together past the head. You'll find the second tape will have a recognizable recording on it.

QUESTIONS & ANSWERS

Questions for this department may be sent on tape or by means of a postcard or letter. Please address your queries to, "Questions and Answers," 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—Reading of your mag in *Mechanix Illustrated* I hasten to encourage you in a strictly for rustlers mag. Bootleggers of song unite! We have nothing to lose but our anonimity. Questions—is it a violation of the copyright law to tape records for our own use? I seem to be getting as accurate a response at 3¾ ips as at 7½. Does this mean I'm tone deaf? Can I install a tweeter and a woofer in my recorder without engaging in a lot of complicated rebuilding? How about some complete information on demagnetizing.—*W. K. S., Vista, Cal.*

A—*You may copy records for your own use but don't try to sell them or you will have legal lights camping on your doorstep with summons. Many recordists tape their records, making the tapes when the records are brand new and then playing the tapes to save the perishable discs. People also exchange music this way by making copies of each other's record collections. 2—If the tapes you play on your recorder, or the material you record does not exceed the capabilities of the slower speed then there would be no noticeable difference between the two. If the recorder head is dirty, the high frequencies would fall off at either speed and the two would sound more nearly alike. 3—Whether or not you could install a tweeter and woofer in your recorder would depend upon how much room there is in the case. You might install the tweeter and woofer in a separate case which you could baffle to obtain the best response. 4—Demagnetizing is a very simple procedure. The demagnetizer is held against the tape head for a few seconds and then slowly withdrawn. After it has been removed to a distance of three feet the current is cut off . . . and that's all there is to it.*

Q—Have always suspected that my tape recorder ran a bit slow and in order to check this I thought of recording a record then play back the record and the tape at the same time. First I tried it at the 3¾ ips speed and it was perfect. But at 7½" noted that the tape was slowing down a bit so played seven minutes and timed the two and found the tape ran five seconds slow.

Is there any way I can correct this without taking the recorder back to a repairman? The repairman in this neighborhood is not very reliable and I don't care to lug thirty-five pounds on a bus.—*S. M. J., Chicago, Ill.*

A—*We would suggest that you give your recorder a thorough cleaning and, if necessary, oil it according to the instructions—and very sparingly. Remove the mechanism from its case and check the drive wheels and belts to make sure they are not slipping. If the wheels appear slick and shiny, hold a rubber eraser against them to remove the shine and provide a better grip. This, under normal circumstances will cure most troubles. You might also check the drag clutch on the payoff reel to see that it is not too stiff.*

Q—I would like to install a counter on my recorder. Is this possible? *B. G. B., Escanaba, Michigan.*

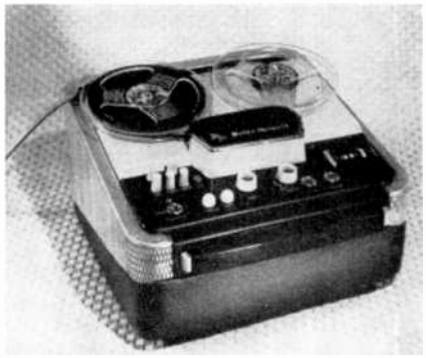
A—*Installing a counter on a tape recorder which has no provision for one can only be tried on an experimental basis. If it works, fine, if not, you can always remove it. The difficulty lies in the possible introduction of wow or flutter in the drive mechanism because of the added element.*

Q—Where may pressure pads be purchased? I've made several inquiries but haven't been able to locate a source. The best I could do was to use foot pads but they're too soft.—*H. B., Paterson, N. J.*

A—*The manufacturer of your recorder should be able to supply them. If unobtainable from that source, you may get some felt scraps from a hat maker, or cut up an old felt hat. This felt is fairly close to that used in the pads.*

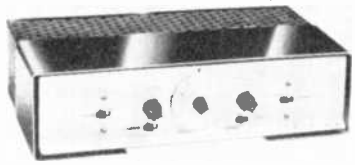
NEW PRODUCTS

BELL & HOWELL 775



Bell & Howell Co., 7100 McCormick Road, Chicago, Ill., has introduced its new Model 775 tape recorder. This machine is dual track, has speeds of 3¾ and 7½ ips, 50-13,000 cps frequency response, and wow and flutter of less than 0.5%. It can be adapted to dictation by means of a "pause" button. Other features include acoustically balanced twin 5¼" speakers, a public-address switch control, a resettable 3-digit program indicator which permits rapid location of any desired portion of tape, and dual recording-indicator lamps. The new unit, which is priced at $189.50, is housed in a streamlined case with a perforated steel frame, Tyrolean gray molded top and bottom, and a panel of tweed-textured vinyl across the top. For additional information, contact the manufacturer.

MADISON FIELDING AMPLIFIER



Madison Fielding Corp., 863 Madison St., Brooklyn 21, N.Y., is marketing its Model A-15 amplifier, which incorporates a completely transistorized preamplier section. The front panel of this unit has only three functionally spaced controls; subsidiary functions have been relegated to simple side switches. A full 16 watts of audio power is available at the speaker terminals; tone controls are of the variable crossover feedback type affording a maximum boost and attenuation of 20 db at 20 and 20,000 cycles; the power amplifier section has a full 20 db of feedback; and distortion is less than 1% at full output, less than .1% at 1 watt. The preamplifier section is completely shielded and separately housed, and the entire unit is housed in a sturdy metal cabinet, finished in baked charcoal color. It is priced at $89.95. For additional details, contact the manufacturer.

TURNER MIKE

The Turner Company, of Cedar Rapids, Iowa, has introduced a new, low impedance microphone for use with the Turner Third Hand. It is called Model 132 and it features a small dynamic head with the transformer built into the breastplate of the Third Hand. This model was designed to be used with the Third Hand, as shown in the picture, and, according to the company, it has all the features of a dynamic microphone—wide range, flat response, better voice reproduction and greater resistance to heat, cold and moisture. Response is 100-10,000 cps; level is —58 db. Model 132 mike mounted on the Turner Third Hand is priced at $42.50. For complete information, contact the manufacturer.

NEW KLIPSCHTAPE

A new Klipschtape Division of Klipsch and Associates, Hope, Arkansas, has been organized. Among the company's first releases are six stereo tapes with popular, classifical, and documentary recordings. These stereo releases are 15 ips recordings on 7" reels, priced at $9.95. Write to Klipsch & Associates, Klipschtape Division, for a tape listing and additional information.

TAPE CLUB NEWS

Tape-Respondents, International has entered into a reciprocal agreement with the British Amateur Tape Recording Society, whereby members in each organization may hold honorary memberships in the other club at a special discount in fees. The arrangement will be of special interest to the American members of T-R-I who desire additional tape contacts in Great Britain, as well as British members of the B-A-T-R-S who desire additional U.S. contacts. Members of either organization may obtain details by contacting either of the two secretaries—Jim Greene of Tape Respondents, International, or Ted Yates of British Amateur Tape Recording Society, 210, Stamford Rd., Blacon, Nr. Chester, Cheshire, England.

Voicepondence Club member Harold Buzzard suggests that more tape triangles be formed for those individuals who wish to do more tapesponding. Three members are included in each triangle, which simply involves the use of dual track recording. Each person records on the track last used by the person to whom he will send the tape. You will thus have two recordings (one on each track) from two persons each time you receive a triangle tape. To start such a triangle, choose two voicespondents with a maximum of mutual interests. You will find that a tape triangle circuit is completed in a relatively short time, as compared to a round robin tape.

A Twin City tape club is proposed in St. Paul and Minneapolis. Chairman Protem, Richard Enebak, has announced that all are invited to join, and they may obtain more information by writing to him c/o Twin City Tape Recording Club, 1593 Jessimine Lane, Apt. F., St. Paul 6, Minn.

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

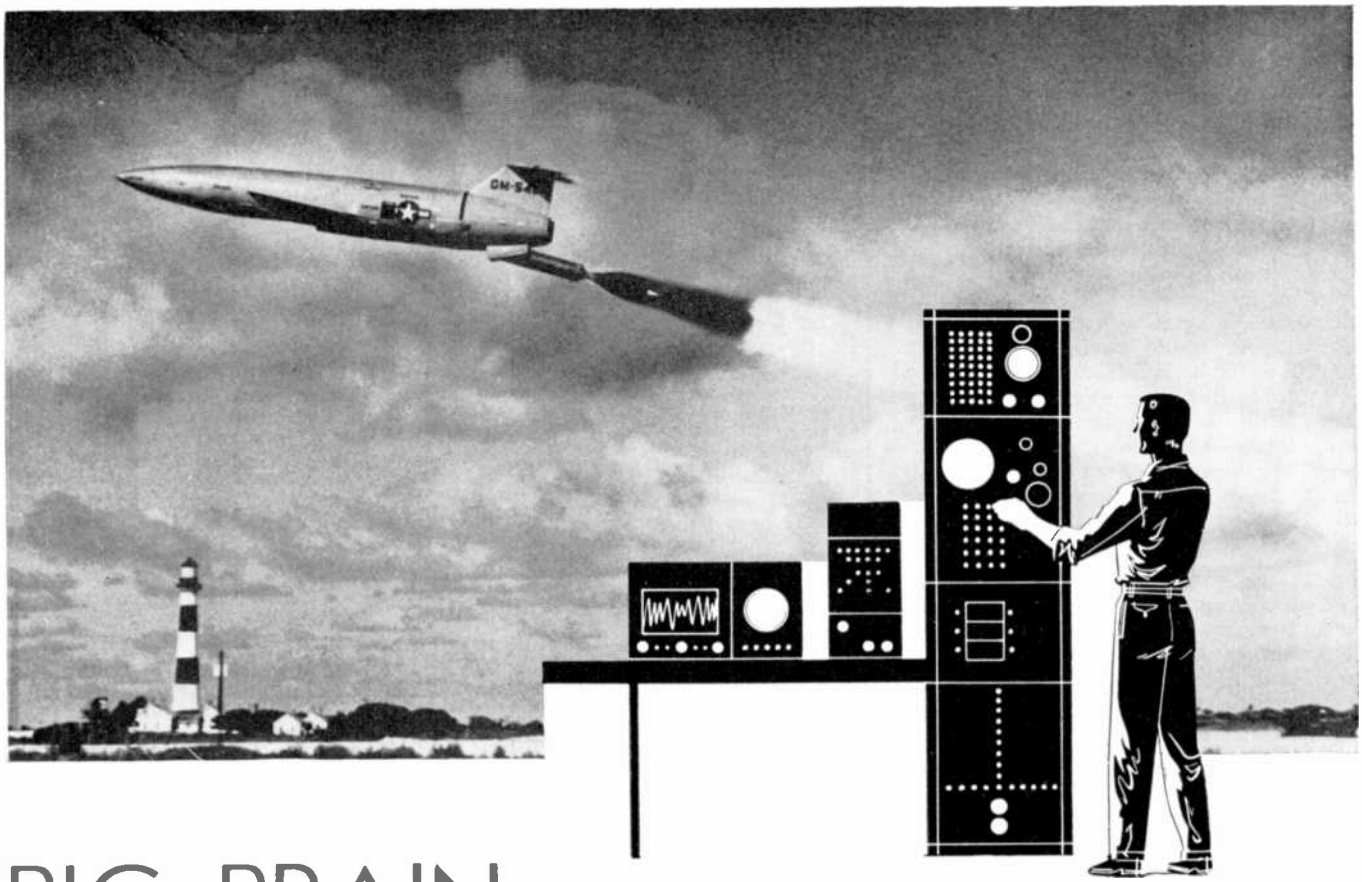
WORLD TAPE PALS, Inc.
Marjorie Matthew, Secretary
P. O. Box 9211, Dallas 15, Texas

INTERNATIONAL TAPE WORMS
Art Rubin, National Chairman
P. O. Box 215, Cedarhurst, L. I., N. Y.

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 148, Paoli, Pa.



BIG BRAIN in a BOX

by Marion Mitchell

PART I

Like the power of a woman, the magnetic recorder and its marvelous memory on tape are not to be underestimated. Reading this article may not quite give you an inferiority complex in your tape recorder's presence, but it should make you realize that there's quite a brain in that box.

NEXT time you slip a reel of hi-fi, wow-free, "out-to-15,000" music on your trusty little tape machine, I hope you'll see it in a new light . . . maybe even give it a little pat on its amplifier.

Chances are, like a lot of tape fans, you've come to take the little gem for granted.

Sure, it plays Bach or bop like you never heard before. It helped Junior snag his first "A" in English. It even made your big speech before the club practically perfect. And think of all the parties it's been the life of!

"So what?" you say. "Is that *all* it can do?"

Before you start looking down your nose at your little old tape rig, pal, take a look at what some of its rich relations are doing—some of the big tape jobs that do everything but think. These tape recording robots have been put to work on some of the biggest research programs in the country, ranging from national defense to national advertising.

When it comes to cost, these "data recorders"—as they are usually called—are a far cry from the "under $300" tape machine that graces the average tape fan's living room. They start at a thousand or two and range on up, depending on the amount of auxiliary equipment involved.

Yet they operate on the same basic principles that enable your home recorder to come through loud and clear with the sound that sounds so good.

What are data recorders used for? Here's a quick run down:

* In aircraft testing and guided missile work they record hundreds of thousands of pieces of information from every flight.

* In geophysical prospecting (loosely translated, that means "looking for oil") they help find out what's under the ground.

* In electronic computers they serve as a whopping big filing system that automatically whips out the information you want at a moment's notice.

* In factories they act as robot machine operators that will do exactly as told and though they might occasionally burn out a tube, will never get tired.

* In testing laboratories they recreate a given set of conditions—play them back, in other words—for the de-

Left: A typical home recorder is compared to a large console-type recorder. Although data recorders may cost many times as much as home tape recorders, both operate on the same general principles. Center: Specially manufactured instrumentation tape for data recording must meet some of the most rigid specifications known. Right: Valdemar Poulsen, who died in 1942, was described as the "Danish Thomas Edison." He patented a magnetic recorder employing a spool of wire.

sired effect on whatever is being tested.

So far we've only started, but now let's take a look at a data recorder. In outward appearance it's not much more than an oversize version of your own machine although it's usually mounted in a console, or in a standard communications type rack.

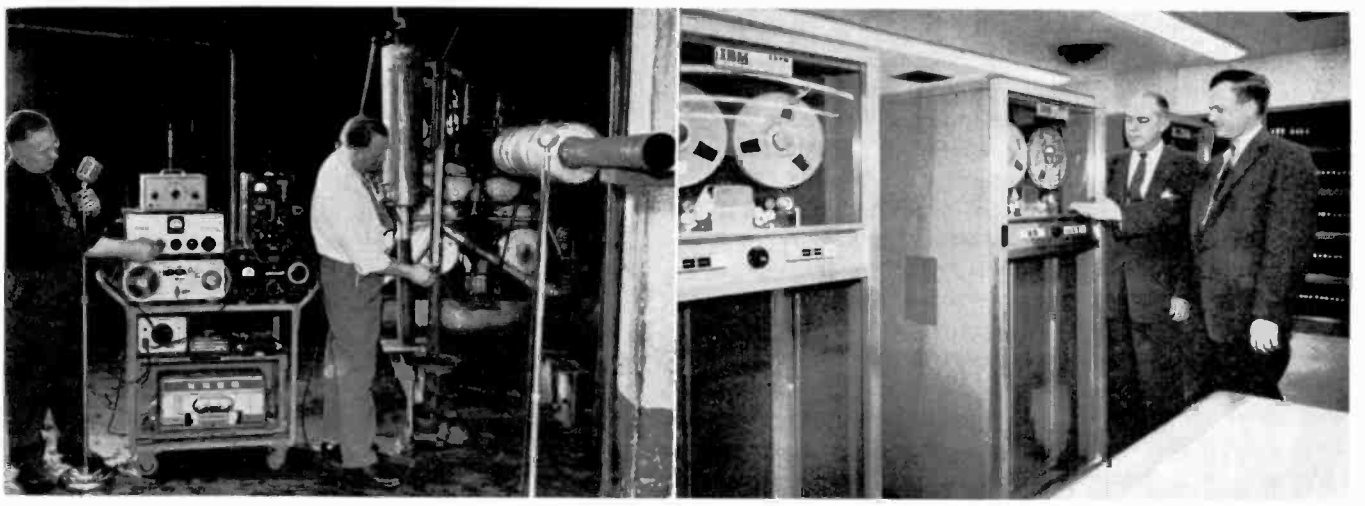
One noticeable difference is that most data recorders use wider magnetic tapes. While the standard tape for sound recorders is ¼" wide and employs either one or two tracks, the data recorder tape may be wider—usually ½" or 1" in width.

Reason for wider tape is that it makes it possible to record a great many tracks side by side on the tape—as many as 14 such tracks on a 1" tape. Like the stereophonic tape recorder, all the tracks on such data recorders are recorded simultaneously in the same direction.

This in itself is a rather amazing accomplishment, since it makes it possible to record many simultaneous events without confusing or mixing them—something few human memories can do. Everything is kept clear and distinct in its own track, or channel, on the tape.

A second obvious distinction between the home recorder and the data recorder is the large tape reels—10½" or 14" in diameter—used on the data machines. Large reels are employed for longer recording time at higher tape speeds—15", 30", 60" or 100" per second rather than 3¾" or 7½" per second.

Hand in hand with higher tape speeds comes a wider frequency response range. All other things being equal, the faster speed at which the tape moves past the recording head, the higher the frequency response possible. Therefore instead of providing a relatively flat response at 7½" per second out to 12,000 or 15,000 cycles per second—the upper limit of average human hearing—data recorders are frequently required to record and reproduce frequencies up to 100,000 cycles per second and even higher. Video tape recorders, for example, may have a top frequency response from 2½ to 4 million cycles per second.



Left: Tape recorders are widely used in testing laboratories to achieve product improvement, especially in the automobile industry. Here noise level tests are run and recorded on tape for scientific comparisons between various muffler designs for industrial engines. Right: Tape handling units for an IBM electronic computer serve as versatile "filing cabinets" which store millions of bits of data, yet produce it upon command in a matter of seconds.

From Oil Wells . . . .

Seismic data such as that involved in earthquake study or in geophysical prospecting for oil is recorded and analyzed on this 7-track Ampex tape unit mounted in a communications type rack.

Now let's go into how the data recorder puts its tape to work to do all that it does.

Basically, magnetic tape and the tape recorder make up what you might call a memory device.

Let's compare it with the old noggin:

The recorder itself and all its electronic innards is really a system something like your own nervous system. Your senses—taste, sight, smell, hearing and touch—detect something happening around you and shoot a quick signal to your brain via your nervous system. Unless you're dead, that message is recorded as an experience—something you will remember for an indeterminate length of time.

A good example is the way you hear. Sounds are really air vibrations that cause your ear drum to bounce around inside your head, ultimately generating minute electrical currents which your nervous system relays upstairs. There your brain records, or more simply, remembers it.

Now in the case of the tape recorder in your living room those sound waves cause the microphone diaphragm to vibrate, again generating electrical current values which the recorder puts on the tape.

What makes tape so useful in so many ways today is that we're making progress so fast we're liable to forget what we've found out before we're able to do anything about it.

Actually, as a memory device, the old noggin is fast becoming outmoded. It's been getting that way for several thousand years now, but the age of electronics has really boosted it along. It just can't remember enough.

It took our hairy ancestors some time to get wise to the fact that they forgot a lot more than they remembered. But it took them a lot longer to come up with a solution—writing things down. And that isn't so simple, either.

Ever tried chiseling *your* grocery list on a granite slab?

Much, much later came the printing press—a means of recording information that was pretty good for a few hundred years and still will be for most of us. Then somebody invented the typewriter to speed up writing, and for recording pictorial information, Eastman met Kodak and they came up with the camera.

Means for recording audible information—sound—was next, starting with Edison's wax cylinders and phonograph and ranging right on through Valdemar Poulsen's 1892 wire recorder, recording discs, improved wire recorders and finally magnetic tape.

All these methods gave man a more exact, a more permanent record of some type of information or event which he might otherwise forget. Even if he didn't forget it completely, chances are he wouldn't remember it in its exact detail because of the shortcomings of the human brain.

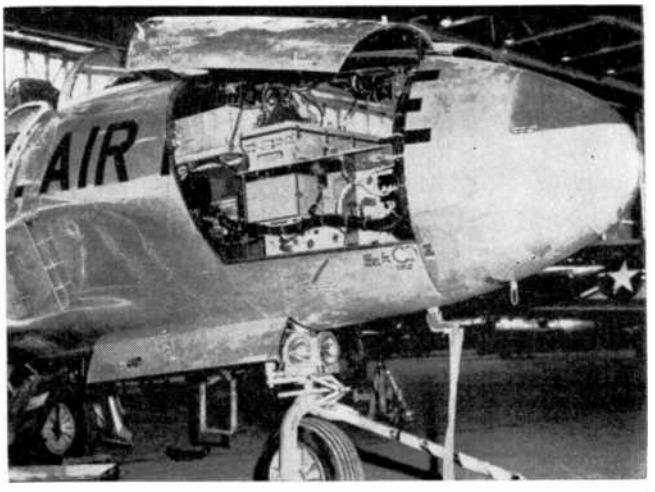
Who, for example, could remember a song as accurately and as permanently as you can record it on tape? The very fact that we resort to records of any sort—audible or visual—is pretty good testimony that the human memory is a little weak, to say the least.

But by using artificial memory devices, we can remember, recall, even "relive" events with a degree of realism that great grandpappy would never have believed possible.

Most types of memory devices other than the tape recorder are relatively easy to understand. You write words with a pencil or a typewriter which have a meaning you were taught as a child. A camera provides visual records by focusing an image on a light-sensitive emulsion on a piece of film. And while it is comparatively simple to understand how a tape recorder can record sounds and music, it is a little more difficult to grasp just how it can do all the other things it can.

How, for example, can the tape recorder remember the feel of the airflow over a jet plane's wing? How can it

. . . To Aviation . . . .



An Ampex battery-operated data recorder and amplifier are mounted in the nose of this Air Force F-80 to tape record data during flight tests. An alternative method of recording flight test data is to transmit instrument readings to a ground station via FM radio and tape record it there.

From Alka Seltzer . .

Automation, made possible by magnetic tape, takes many forms ranging from control of giant milling machines to animated displays such as this unit which contains a miniature tape recorder. In addition to giving a taped product pitch, it moves its head and turns spotlights off and on.

recreate the sub-zero temperatures a rocket encounters as it arcs through the sub-stratosphere? And how can it reproduce the number of "g's" encountered in a pull out from a steep dive toward the earth?

It does it with symbols—simple symbols at that. They're electrical voltages.

Words, after all, are merely a means of representing something. They're arbitrary symbols which somebody agreed upon as meaning something specific to make it easier for us to communicate with one another.

But there's one communication media that is almost universal in technology today—electrical voltages. They can be used to transmit information of virtually every kind. And since the tape recorder already utilizes electrical voltages to put a signal on tape, it's perhaps the easiest and best way to record almost anything. Even pictures and other visual information are possible on tape now that the video recorder is here.

The voltage signals come from a variety of sources. In recording sound it's a matter of varying air pressure on the diaphragm of the microphone which causes the crystal, or other pickup, inside to generate such voltages. Similarly the movement of a phonograph needle or stylus operates in the same fashion on the pickup. The thermostat on your furnace is still another example.

Such devices are called transducers—gadgets which respond to pressure, temperature and other forces and translate them into electrical voltages.

In an aircraft flight test, for example, no human pilot could begin to remember or write down the multitude of events occurring all over the plane during the flight. Yet that information is essential to the engineers in determining flaws in its design or construction.

And in the case of a guided missile, even the pilot gets left on the ground, and he can't observe very much from there. Although missiles are tracked with cameras, they fly too far, too fast, and only visual information can be tracked on film anyway.

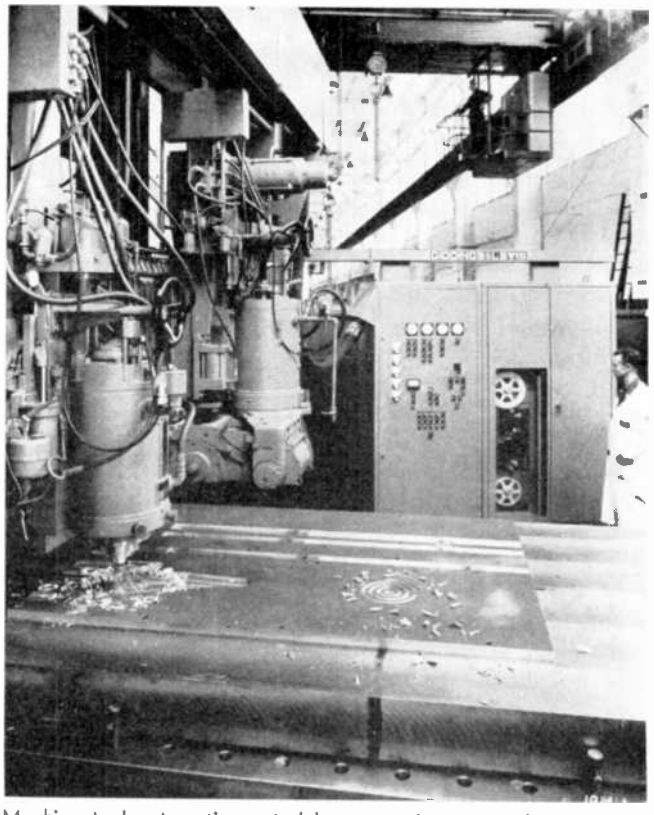
Today, however, hundreds of tiny transducers—pickups—of one type or another are located aboard the plane or missile. Each picks up certain information—air speed, vibration, stress, temperature, and so forth—and converts it into terms of electrical voltages. These are either recorded in rapid succession on a tape recorder in the plane, or are radioed back to a ground station and taped there.

Transducers, then, serve as the detectors of information and provide an almost unlimited number of "nerve centers" aboard an aircraft or missile. So many such centers, in fact, reporting so much information that no human, no mechanical memory system can keep up.

The result is that—not only in aviation, but also in many other fields—man has turned to a new type of memory system, a new method for recording and storing data that is faster and more efficient than any other yet devised, a memory system based on magnetic tape.

(to be concluded next month)

. . To Automation . .

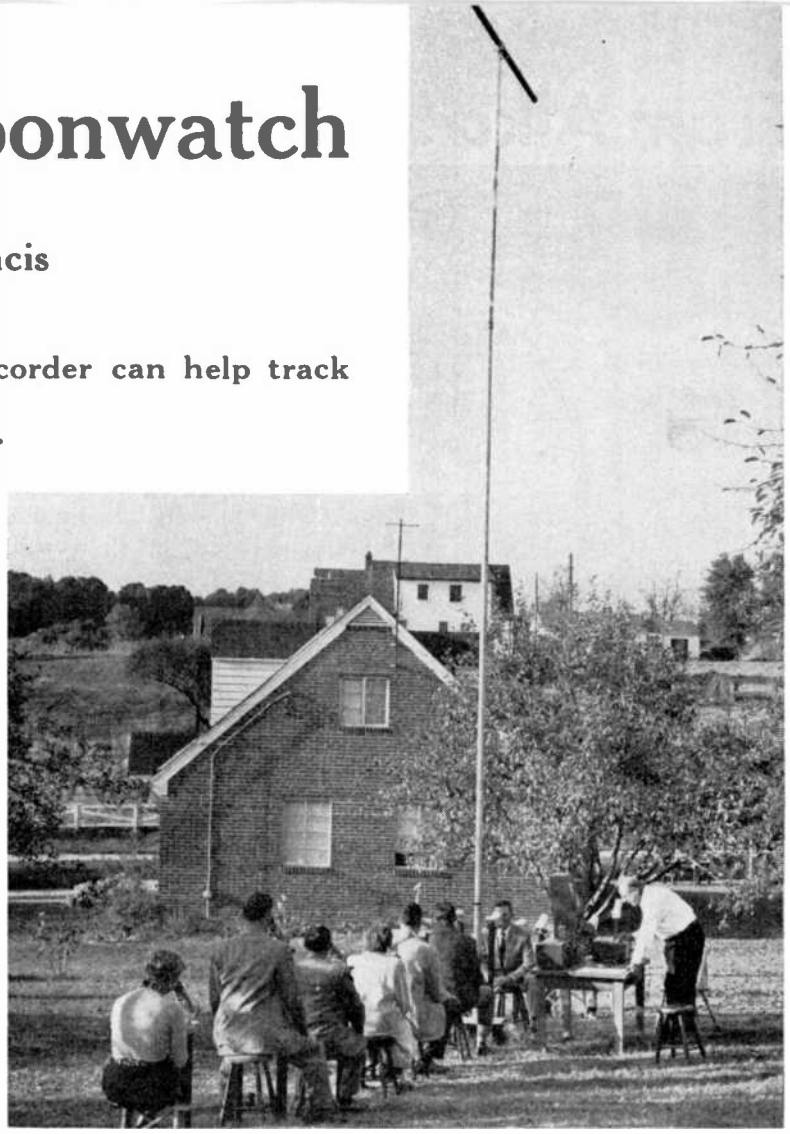


Machine tool automatic control by magnetic tape is demonstrated by this aircraft spar and skin milling machine system designed by the Giddings and Lewis company. Tape unit in background caused milling head to perform precision cuts called "plunge," "pocket" and "channel" on aluminum sheet in foreground.

Operation Moonwatch

by Mike Francis

. . . . Here's how you and your recorder can help track the world's first man-made moon.



G. R. Wright, standing, chairman of the U. S. National Advisory Committee, checks a control box and the sighting pole, during a practice session of the first group of persons to test such equipment, in preparation for tracking the earth satellite during this International Geophysical Year.

Sunpapers Photo

THIS year one of Man's dreams will become real.

Sometime in the autumn of 1957 scientists at Patrick Air Base in Florida will send the first man-made satellite circling the earth in its orbit beyond the atmosphere. Heading southeastward over the Atlantic Ocean, the first missile to achieve a semi-permanent orbit in outer space will speed at 18,000 miles per hour, completing each revolution around the earth in 90 minutes. Depending upon conditions, this projectile will circle the globe many times during several weeks or months before it finally dives into the atmosphere and burns up like a meteor. Many other artificial satellites will follow the first flight.

The importance of artificial satellites, and of timing and tracking their motions, cannot be overestimated. Later paragraphs will show how you can put your magnetic recorder to use in assisting official satellite observers to make accurate time determinations of their observations.

The vehicle for the tremendous lift required to place the satellite in its orbit is a three-stage rocket. As each stage becomes exhausted after doing its work it disengages itself from the rest of the missile and drops down into the sea. The final stage, under radio control by ground operators, will level off the trajectory, fire, and eject the payload.

The payload, a gold-covered hollow sphere just 20 inches across, will periodically vary its distance from the earth's surface from 200 miles at nearest distance (perigee) to 800 miles at farthest (apogee).

While invisible to the naked eye at any time in its orbit, the satellite can be seen with simple optical aid during morning or evening twilight at certain places on the earth. These points will be known in advance and will change from day to day.

Popularly called a "basketball" the satellite will carry a wealth of electronic equipment compactly placed in its hollow interior. It will gather information directly from outer space, data and measurements unimpaired by absorption effects through many miles of the earth's air blanket. Temperatures, ultra-violet ray counts, magnetic field densities and variations, cosmic ray distribution, and many other important data will be picked up by the satellite's instruments. A telemetering transmitter will at once radio this information to receivers placed at strategic points on the surface of the earth.

The entire project of artificial satellites is part of the 1957-1958 International Geophysical Year (IGY). This is a broadscale scientific program encompassing 55 nations, 5000 scientists, and every known branch of science relating to the earth, the atmosphere, and interplanetary space.

The scientists themselves consider the IGY, which runs for 18 months beginning this July, to be the most powerful onslaught yet directed at the mysteries of the earth and its blanket of air. It has been said that we will learn more about the earth in these 18 months than we have learned during the past 50 years.

Launching artificial satellites is in itself a task challeng-

ing the utmost of advanced engineering and technical skill. However, once the missile is implemented and placed in its orbit, then the real problems of research begin. The data transmitted to surface receiving stations will of course be of immense value to scientists who will analyze this information.

Yet astronomers, meteorologists, geophysicists and others will want far more than this. They want to know as precisely as possible the exact motions of these circling satellites, how they change position from moment to moment, how they behave as they dip spirally into ever greater densities before they burn up in our atmosphere. Data thus determined can lead to highly accurate determinations of the shape of the earth, the size and mass of bulges and bumps on the surface, the exact distances between points on the land area of the earth. The density gradient of the air—the rate at which it becomes thinner as we go from the earth's surface to "pure empty space"—this and many other important atmosphere characteristics can be accurately determined by a close study of the peculiarities in a satellite's motion.

This is where you and your tape recorder can play an important part in this exciting project.

The job of tracking the satellite has been assigned by the U. S. Government to The Smithsonian Astrophysical Observatory, whose director is Dr. Fred L. Whipple. Dr. J. Allen Hynek, associate director, is in charge of satellite tracking, while Dr. Armand N. Spitz is coordinator of Visual Observations. These men, together with other expert astronomers, have organized amateur astronomers into a nation-wide system of satellite observers. They call the project Operation Moonwatch.

Operation Moonwatch is perhaps the most important single phase of the satellite project. The system consists of many Moonwatch teams spread across the country, each consisting of a dozen or more members and a station leader appointed by the Smithsonian office.

The job of an observing team is very specific: equipped with standard optical instruments and a reliable timing method, a Moonwatch team is responsible for an *accurate* report of the passage of a satellite across a north-south line running through their station. This report *must* include the time within one second of the satellite passage, and the position in the sky within one degree. These are stringent requirements, to be sure, but they can be fulfilled.

Positional accuracy is obtained by the skillful use of approved low-power, wide-angle telescopes. A tape recorder, together with a short wave radio receiver already a part of the Moonwatch station, can provide the required accuracy in timing the observation. An experienced operator who knows recording techniques can make such a timing system fool-proof.

As shown in the photograph the timing system consists of a short-wave radio, a tape recorder, and a microphone mixer. The system can be used anywhere within the range of the National Bureau of Standards time-signal station WWV near Washington, D. C., its associate WWVH in Hawaii, or CHU at Ottawa, Canada. The Moonwatch station will have 115-volt, 60-cycle power available for the short-wave receiver, and the tape recorder and mike mixer can be plugged into this, or if away from power lines a battery driven converter may be used.

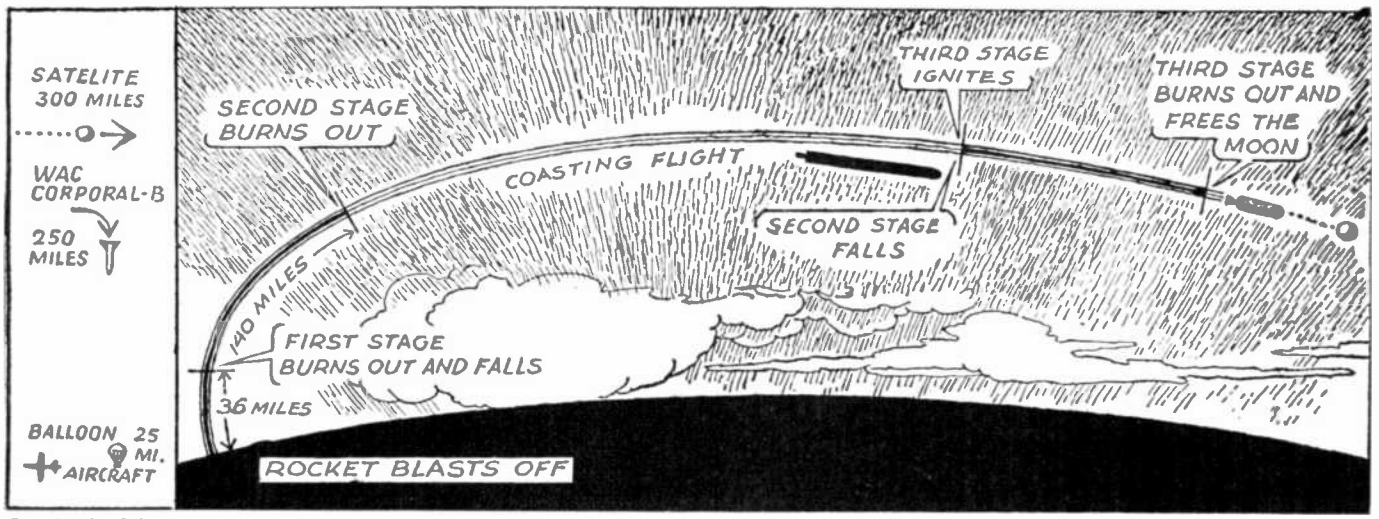
Picked up by the radio, a continuing background series of WWV time signals is fed by the mike mixer to the tape recorder. Also fed in, by separate mixer channels, are the observer's verbal announcements. These may include a spoken signal when the satellite is seen in one of the observing instruments, audible reading of the coordinate scales, and other remarks. With these verbal reports superimposed on WWV time signals, the tape furnishes a permanent record of what each observer said and the exact time at which he said it. The tape may be played back as often as desired.

Being a veritable "electronic memory," the tape recorder forms the brain of the system. The model shown in the photographs is a Webcor Royal. Recording and playback speeds of the recorder are of no direct consequence in this application. The Webcor Royal will record and play back in both directions, eliminating the need to turn over the reel by hand and consequent loss of valuable recording time when the end of the tape is reached.

A monitor switch is a good idea, for it enables the user to listen to the recording while it is being made. Monitoring is necessary, for instance, if insertion of the plug connecting the short wave radio to the microphone mixer will cut off the radio loudspeaker. This is true of the

Drawing by Orban *Courtesy Saturday Review Research Section, Science and Humanity*

Although the orbit of the manmade satellite remains constant, the revolutions of earth make it appear to move. Left Globe: Rocket takeoff and return of earth moon to equatorial starting point. In the time the satellite takes to go around the earth (100 minutes), this position shifts 1500 miles. Center Globe: Indicates how orbit reaches from a minimum altitude to a maximum. Right Globe: Crisscross paths of orbit around earth every 50 days.



Drawing by Orban *Courtesy Saturday Review Research Section, Science and Humanity*

Only 10 seconds after blast off of the Vanguard rocket from Cape Canaveral, Florida, the earth satellite will appear 300 miles above Puerto Rico, 1500 miles away. The above illustration shows what happens in the meantime. Toward the left is a yardstick of the progress of man in space to date.

Hallicrafters receiver shown in the photographs. The time signals, in this case, are being fed through the mixer to the tape recorder in electrical form and are being directly impressed upon the tape. However, they are inaudible during recording until the monitor switch is activated.

A short-wave radio receiver is indispensable at a Moonwatch station, as it brings the exact time from WWV to the observing team. Types and models will vary widely from one observing team to another. My receiver is a Hallicrafters model TW-2000.

For a Pentron mixer equipped with phone jacks at the input circuits, the cable connecting it to the TW-2000 output, also a phone jack, will have to be fitted at the radio end with a phone plug. For the Hallicrafters S-38D, however, the radio end of the cable will need a set of phone tips. If the radio is a National SW-54, the cable will need a pin plug. The jacks on the short-wave receiver are designed for use with a pair of earphones, and thus there may be a mismatch of impedances in feeding the time signals to the mixer. This does not affect the results in any way, as long as signal amplitude is correctly adjusted by the volume controls on both the short-wave receiver and the mixer.

The purpose of the mixer, with its separate volume controls governing separate input channels, is to balance the amplitude of the radio time signals, which are subject to fading, with the amplitude of the observer's voice. The tape recorder has its own volume control and recording level indicator. In the Webcor Royal the volume level indicator is of the green "tuning-eye" type.

In using both the powered and non-powered types of mixers, I have found that the powered type is most satisfactory. The Pentron Audio Mix is shown in the photographs, and contains built-in amplifier circuits requiring power voltage for operaton. Where a Moonwatch station must use long microphone extension cables, the amplification of the powered mixer is needed to overcome the db losses in the line. The Pentron unit has four high-impedance microphone jacks, each with its own volume control. The two low-impedance jacks are not used in this application.

The cable connecting the mike mixer to the tape recorder is part of the mixer and ordinarily plugs directly into the tape recorder. Impedances ordinarily match between the output of a mixer and the input of a tape recorder.

Some Moonwatch stations will be laid out with the observers arranged along a line about 40 feet long, as shown in photograph 1. If so, multiple microphones will probably be necessary, since every observer in the line must be within range of a mike. Until it actually happens, no one knows which observer will see the satellite pass through his telescope field. The Pentron mixer has three available high-impedance input jacks, in addition to the jack accepting the cable from the radio receiver. Three separate mikes can be used, through mike extensions if necessary, to pick up each of the observers' voices. Webcor makes a model 2929 mike extension, 15 feet long, ideally suited to this need. It has a standard phone plug at one end and a phone jack at the other. Two of these may be used in series with any kind of high-impedance microphone. Here the amplifying feature of the Pentron mixer is needed to overcome the losses in 30 extra feet of shielded mike cable.

If feedback occurs this can be minimized by keeping all microphones as far as possible from the recorder, and adjusting the volume controls on the mixer separately for each microphone, aiming at loudest signals without feedback.

At an observing station where all telescopes are equipped with reticules (eliminating the need for the observers to line up under a north-south mast), observers can be arranged in a small circle while making observations. In this case, one or two microphones placed within the circle will pick up their voices readily without too much gain. Monitoring can then be done through the tape recorder loudspeaker.

While the Moonwatch station leader will be quite familiar with radio time signals, the tape recorder operator must have a working knowledge of them as well. WWV provides an identifying Eastern standard time oral announcement every five minutes. This identifies the next five minutes, during which the seconds beats are heard. The start of the first three minutes of each five is indicated

by a long dash accompanied by a double click, and by a double click only for the final two minutes, during which the audio tone disappears. A Morse Code statement (Universal time) precedes the announcer's voice introducing the next five-minute period.

While recording an observation, to fix securely the moment of a spoken signal, the recording must include at least one five-minute identification on the same continuous run of tape. Then, during the playback, the time of the observation is found by counting the seconds beats between the start of that five-minute period and the observer's spoken signal. A second playback should be made as a check on the interpretation of the time signal count.

Should the five-minute time announcement preceding the observation be missed for any reason, it is still possible to time the observation by permitting the recorder to run to the *following* five-minute identification. Then count the time signals from the moment of observation to the recorded time identification.

Short-wave radio transmission is affected by ionospheric changes, and the signals are subject to occasional fade-outs. Their duration may be a few seconds or several hours. Furthermore for certain periods of each hour and day, the signals are regularly interrupted. But these lapses should not appreciably affect the accuracy of the results obtained by the tape recorder method, particularly in timing the artificial satellites.

To provide against loss of its signals due to fading, WWV broadcasts simultaneously on frequencies of 2.5, 5, 10, 15, 20, and 25 megacycles per second. WWVH broadcasts on 5, 10, and 15 megacycles. CHU, Canada, operates at 3.33 7.335, and 14.670 megacycles. Receiving sets may tune to the band of optimum signal reception for the period of the observation, or the band may be changed if the selected frequency is subject to serious fade-out.

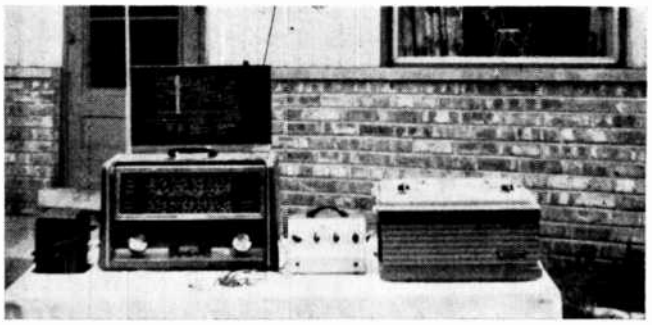
As for periodic interruptions, WWV is not heard for four minutes each hour, beginning at about 45 minutes after the hour. The signals begin again at about 11 minutes to the following hour. WWVH is interrupted for twice each hour, starting on the hour and half-hour, and for a period of 34 minutes starting at 19:00 Universal time (9:00 a.m. Hawaiian standard time.) Since the observing times for the satellites will be during morning and evening twilight, this 34-minute interruption is of no consequence to observers in Hawaii or in the continental United States. CHU at Ottawa occupies the first minute of every hour with station identification.

Therefore, for any observation made during periodic interruption of WWV, WWVH, or CHU, or during temporary radio fadeouts, keep the recorder running continuously to the next identification that can be properly recorded. When the recorder is played back *at the same speed* the beats can be counted against the time elapsed.

This can be done on the spot by reactivating the radio loudspeaker and setting the recorder to play-back. The time signals, now audible in the radio, can be counted as the recording plays back from the recorded observation to the recorded time announcement following it. Once this interval is determined the true time of the observation is established by subtraction.

Another method of timing the interval of recording during a period of radio silence is to use a synchronous electric clock with a sweep second hand to count the seconds.

Inquiries concerning technical radio broadcast services



Needed at each station is a tape recorder, short wave radio capable of picking up the time signals and a mixer. The sound of the observers voices picked up by the mike plus the time signals from the radio are fed through the mixer to the tape. This provides an extremely accurate record of the satellite's passage.

of WWV and WWVH may be addressed to Radio Standards Division, National Bureau of Standards, Boulder, Colo.

The 12-degree field of the observers' telescopes and the one-degree per second angular speed of the satellite's motion combine to shorten the actual observing time to around 12 seconds at most. This is the time the satellite requires to traverse the full diameter of the field. In most cases the satellite will appear to cut the field in a short chord, and will run its path through the field in a correspondingly shorter time.

During each passage of the satellite over a Moonwatch station, therefore, the entire observation will consume 12 seconds or less. It is during these 12 seconds that the passage must be accurately timed. With the radio receiver feeding the time signals through the mixer to the tape recorder for at least five minutes previous to the expected passage of the satellite, with all observers at their instruments, and with each observer within range of a microphone, the team is ready to make the observation. When the satellite appears, one observer (possibly two covering overlapping fields) will see it.

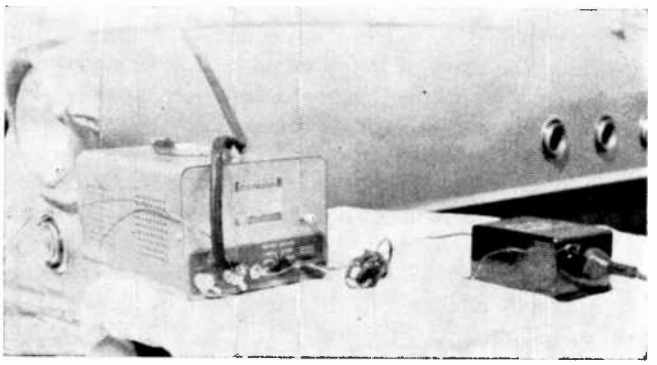
When it enters the field, the observer says "See!"

When the satellite crosses the mid-point of the field. the observer says "Center!"

When it leaves the field, the observer says "Saw!"

These words, superimposed on the time signals, are then played back on the recorder and analyzed. First, the five-minute period in which this observation took place is identified. Then the seconds are counted from the time reference to each of the three words. This count yields the times, to the second, at which the satellite entered, bisected, and left the observer's field.

(*Continued on page* 33)



If your observing station is away from power lines you may feed the recorder, mixer and radio from an inverter working from a 6 or 12 volt battery. As the drain on the battery is heavy, use a rental battery instead of the car battery.

Placing E-V Speakers for Stereo

by Howard Souther

Marketing Director High Fidelity Products, Electro-Voice, Inc.
Adapted from Electro-Voice Bulletin-Sound Selling

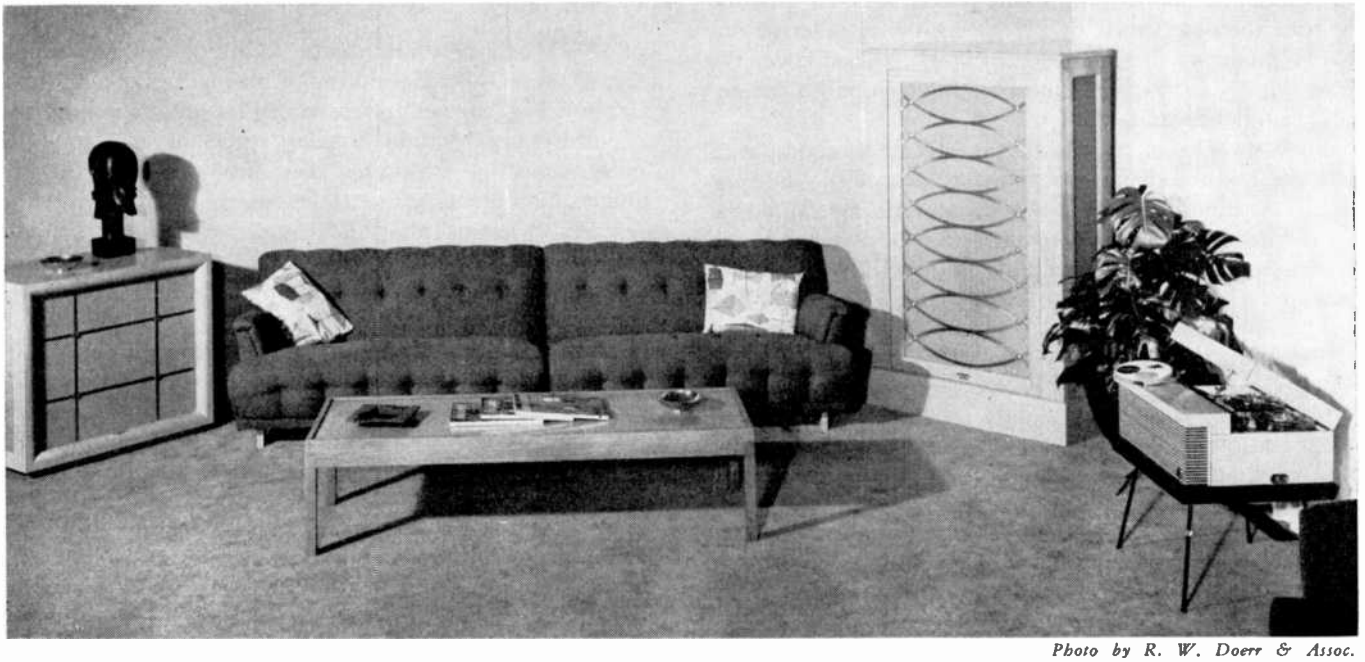


Photo by R. W. Doerr & Assoc.

Left, the Regency III and right the Patrician IV speakers used for stereo reproduction. In order to achieve the best results the high frequency horns must be swung as explained in the text.

BECAUSE of the increasing popularity of stereo reproduction in the home, more and more questions are being raised about speakers and speaker placements.

It has been found that the major stereo effect is accomplished by those frequencies lying above 500 cycles per second; this is approximately the top half of the audible spectrum.

It is possible to achieve some audio perspective, approaching the effect of stereo sound, with a single channel system. Single channel stereo effects are accomplished principally by the following phenomena:

1—*High Signal-to-System Noise.* This is perhaps one of the most important factors contributing to the illusion of reality. 60 db is obtainable and is frequently obtained, providing a satisfactory ratio. Usual ratios average 40 db.

2—*Aural Perspective.* This is achieved by microphone placement in reference to the pickup of direct sound in comparison to reflected sound.

3—*Playback Level.* Ideally, the playback level should be that at which the program was originally recorded by the live subject. Compensation for lowered level is available through amplifier controls. In order of their importance these are: the loudness control, presence control, bass and treble controls.

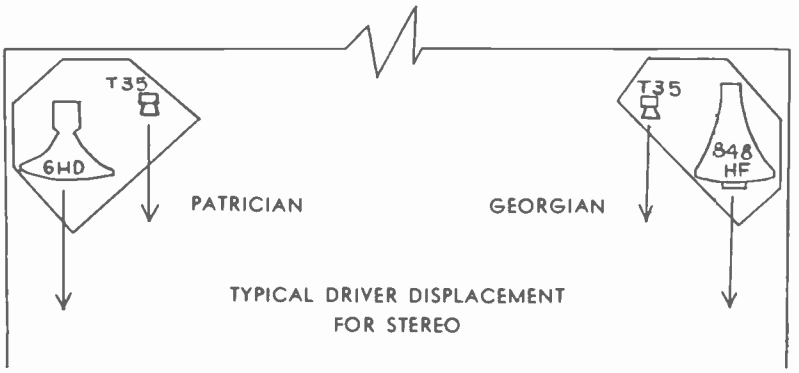
4—*Reverberation.* Reverberation is present in all sound as observed in the normal listening environment. A prominent exception is music played and recorded in the open air. Reverberation, judiciously employed in the recording, allows a subjective intensification of the sound by as much as 12 db without raising the amplifier power. This is 1½ times subjective loudness.

These factors are those which give an impression of reality to single channel sound and should be taken into account when you make your own recordings.

If the theory alone were to govern, then binaural, or stereo sound would presume a rigorous separation of right and left sounds. This can be accomplished practically only by earphones. In such cases the recording technique would be to space the microphones one head apart and situate them at normal hearing distance from the sound source.

But—who wants to wear headphones for stereo listening. We enjoy it most when we share it with others; the use of headphones precludes this.

Fortunately there are a number of ways to maintain the



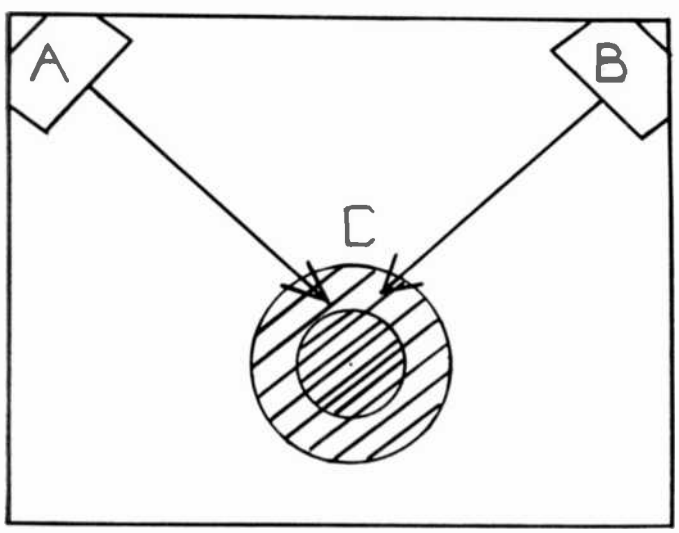
The drawing shows how the drivers should be displaced for the best effect. At left is the Electro-Voice Patrician and at the right, the Georgian. The photos, upper left and right show how the small driver horns are turned to be parallel to the sidewalls of the room.

maximum stereo effect and at the same time eliminate the use of headphones.

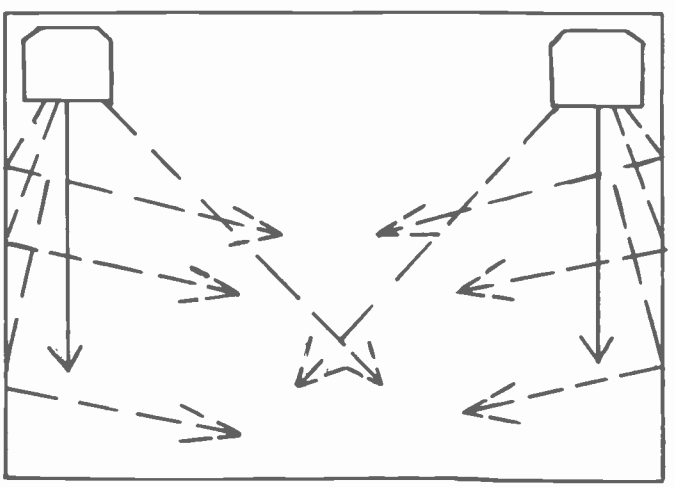
One of these is to increase the microphone spacing during recording. As a starting point, the microphones may be placed in front of the source about one-third of the source width apart. Variations of this placement are then employed for musical balance and other effects. It can be seen that this delivers the necessary separation of right and left sounds to the recording.

Another factor is the spacing of the speakers for playback. This spacing invokes careful consideration of the playback locale. For instance, one of the unsolved problems is the recording condition. Should the recording be made in a dead room so that the proper reverberation is obtained from the playback area? . . . or should the recording be made in a live room and the playback be in a dead room so that all the necessary reverberation is recorded on the tape?

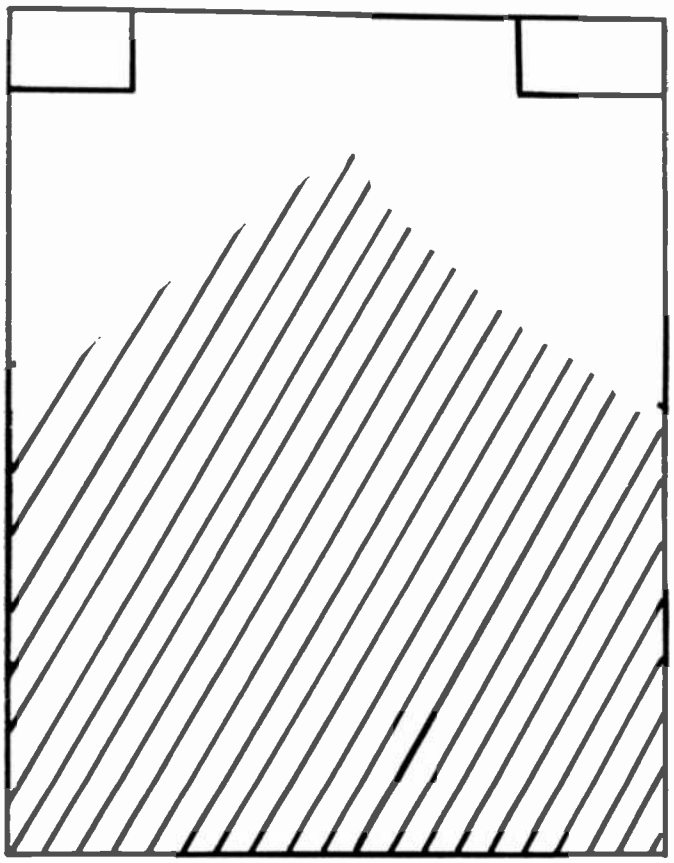
Bringing the questions down to the practical, reasonable recording technique should allow for average living room liveness as an addition to the recorded liveness. This average room might be approximately 14 x 21 x 8 feet, carpeted and have two or three overstuffed pieces, plaster walls and average window drapes. Such a room would approximate a reverberation time of one second. The ideal for music is about 1½ seconds, or slightly more. The record-

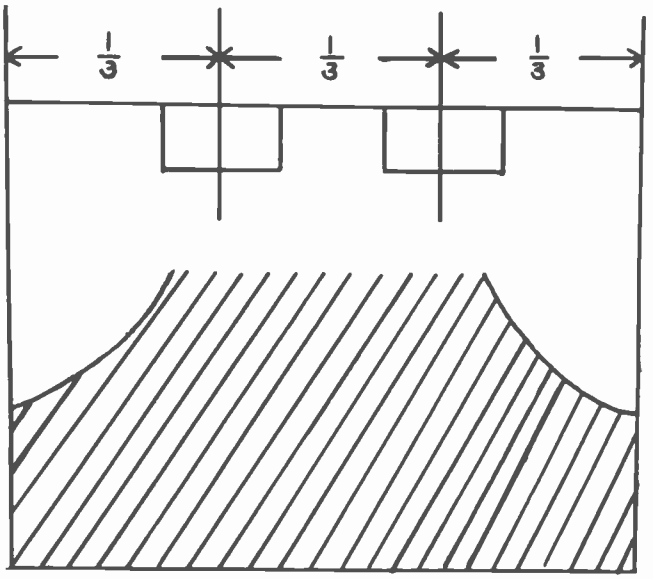


If corner speakers are used for stereo the major solid effect, shown by the circle, is small because the speakers in the corners focus the sound at one point in the room. This is undesirable.



If the corner speakers are turned parallel to the side wall the treble and high frequencies traverse the walls at a grazing incidence and are reflected into the room. The effect is very real.





The placement of the speakers depends upon the size and shape of the rooms. For a "broad" room, the speakers perform well if placed flat against the wall and are spaced at 1/3rd intervals as shown in the diagram. If the room is elongated, the corner position has been found effective and gives the greatest area of "solid effect" indicated by the shading.

ing itself could supply the additional reverberation time for optimum liveness.

While refinements are inevitable, the major recording companies, as well as several of the independents, are subscribing generally to these requirements.

Empirical determinations for the best stereo speaker placement have been made by Electro-Voice engineers. The diagrams above show the best placement for symmetrically sided rooms and the best placement for elongated rooms.

What are the requirements for speakers? The stereo effect is a novel effect, and the initial experience with it subconsciously masks speaker deficiencies. Thus, first listening prompts most individuals to consider lower priced or inferior speakers as adequate. This does not hold after discrimination is allowed to be exercised; the better the speakers, the better the stereo effect and the more listening pleasure achieved.

Identical speakers are not required; however, both speakers should be good ones. An exception may be taken relative to bass response. If a reversing switch is used on the speakers the bass can be switched to the larger, best bass reproducing speaker. It goes without saying that the treble ranges of both speakers should be of equal quality, though not necessarily identical.

No speaker manufactured currently has perfect dispersion in the treble and high range so important to stereo. More power is always available down the axis. Thus, corner speakers focus sound in one point of the room.

An imbalance or concentration of 3db seems sufficient to localize the effect. In motion pictures, "Vistavision" depends upon this minor increase in power to displace the sound source completely from one side of the screen to the other.

An effective means of distributing the sound throughout the listening area is to turn the corner speakers parallel to the side wall so the treble and very high frequencies traverse the walls at grazing incidence, as shown in the diagram.

This results in a multiplicity of focal points over the widest listening area. Note that considerable distribution in this case is achieved by reflection. Perhaps the superior effects achieved this way are due to the even balance of the sound from the two speakers resulting from this diffusion. In any case, the listener finds *himself* displaced as he moves from one side of the room to the other—a desirable effect, duplicating reality.

In the larger Electro-Voice speaker systems, the Centurion, Georgian and Patrician, it is not feasible to twist the entire housing to face down the room, nor is this necessary. The treble horn and VHF driver only need be rotated 45 or 50 degrees toward the wall adjacent to the listening axis.

This is accomplished with fair ease upon gaining access to the cabinet interior. The exception is the Patrician, in which case the 6HD horn and T25A driver must be extracted and placed at the proper angle (presumably in a decorative housing) on top of the cabinet. The diagram, page 27, shows the typical driver displacement for stereo for the interior assemblies of the Patrician and Georgian.

The settings on the treble and very-high frequency attenuators on Electro-Voice speaker systems should be advanced to the full "on" position for stereo reproduction. This is necessary for the preservation of the brass-high balance due to the absorption of the highs by the reflecting walls. This also presumes that loudspeaker systems alternative to Electro-Voice, with deficient or beaming highs, will probably deliver less effective stereo response.

Because of the Electro-Voice diffraction principle in horn drivers, unusual efficiency and dispersion of treble and very-high frequencies is attained, making them ideally suited for binaural or stereo reproduction.

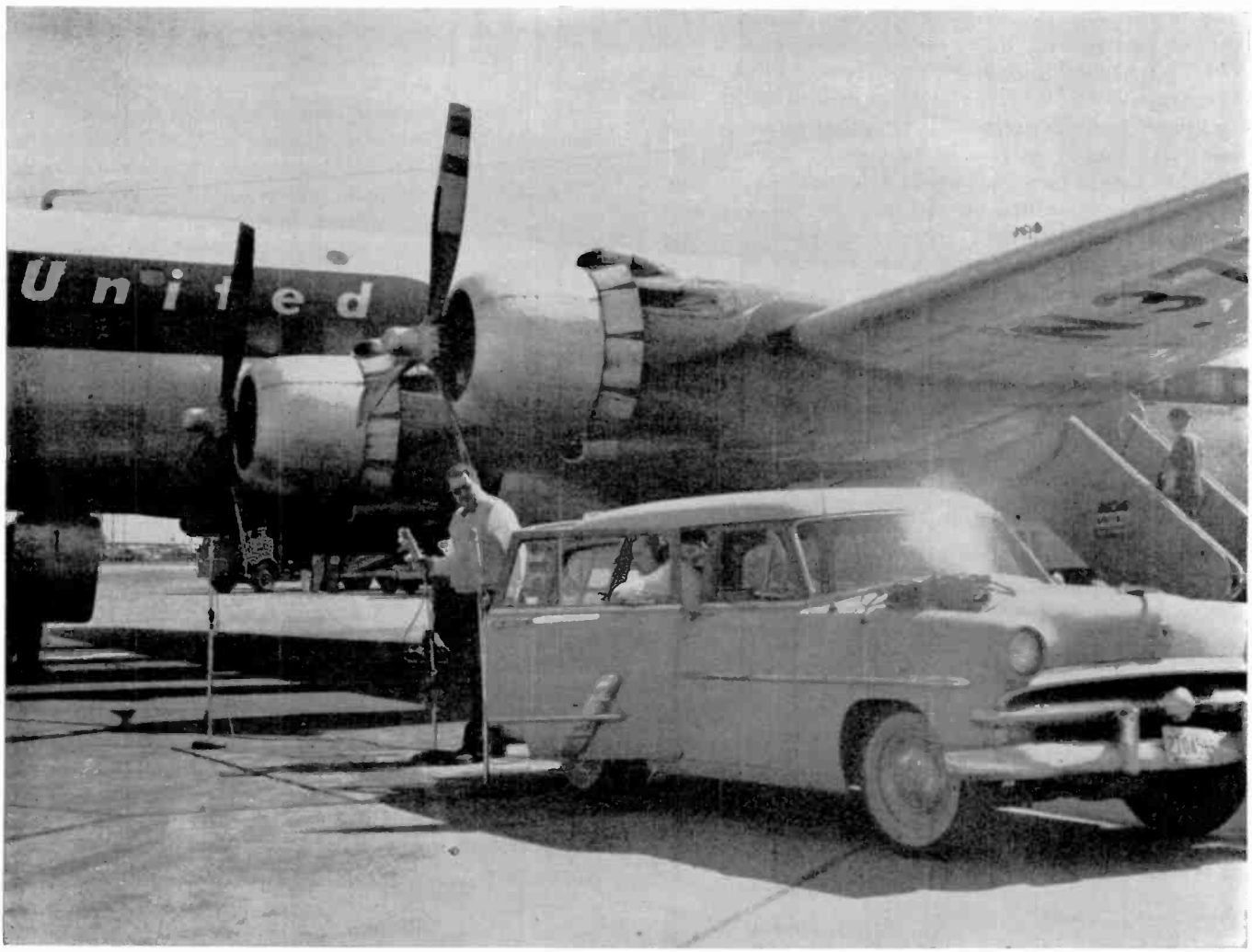
Sound in the Round

PART II

by Robert Oakes Jordan
and James Cunningham

AS we started out to record the sounds for our second volume of "Sound In The Round" for the Concertapes label it was as though we were deaf to any new sounds of our city. I guess all of us have a fascination for train sounds. Even though we had put on tape the awesome stroking, puffing sounds of the last great steam locomotive in the middle west, we wanted more. Our first choice was the enormous diesels that ground their way to the east in clouds of oil smoke and carbon monoxide. We failed monotonously on our first try. We are now convinced that all diesels sound like somewhat larger elevated trains.

Did you ever hear the lonesome call of a foghorn? Did you ever wonder where they were out in the fog? Have you any idea how much water lies between that foghorn and the shore line? I wish now, we could forget. Since recording began people have been trying to get good "takes" of gulls, foghorns and buoy bells, and we had our ears set for the best. The night before our lake voyage we rented what seemed to us a small ocean liner about 25 feet long, well equipped with an old inboard engine from a 1925 Reo, and a pair of oars. We arrived shoreside with all the recording equipment, and portable power unit and all at a dark 4:30 in the morning. The lake was smooth as glass as far as the spring fog permitted vision. The wide concrete breakwater, our port of call, was out yonder somewhere east and near to the sound we wanted to record. Jim and I began to load the boat which now looked only large enough for a small lagoon. As I carried the Ampex



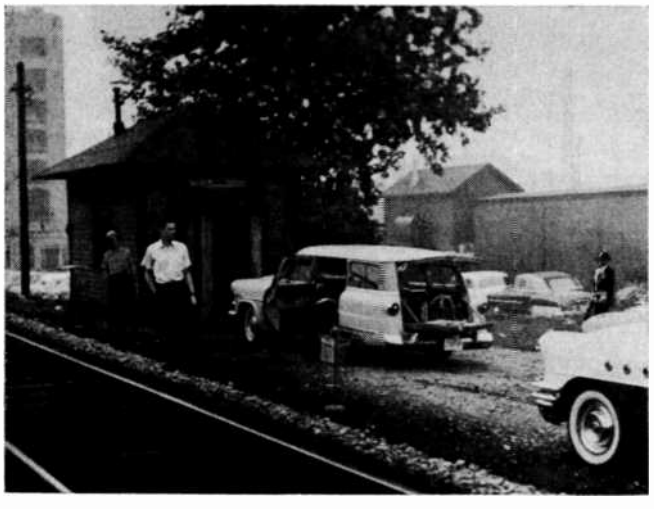
For volume two of Sound in the Round the author sought out the services of an obliging airline (United) and a willing pilot who gunned the motors to give the sound of aircraft in flight. This was combined with some bombing noises and the whole integrated into a noisy bombing raid.

To get jet sounds the authors obtained the permission of the army and recorded right on one of the runways. They were successful despite the blast of the burners and the clouds of dust whipped up on the takeoffs and landings.

350 recorder to the boat I found that a mixture of wet sand, water and silt supported our combined load at ankle depth. We shoved off and headed into the fog, the only sounds were a mixture of four cylinders, seagulls and a distant foghorn; and after 20 minutes we arrived.

My first mistake of the day was to shut the engine off after we bumped into the concrete breakwater. It had loomed out of the fog, with what seemed like all the speed of an ocean liner. "Hardover right," I said to myself, just like I've seen on television, as Jim grabbed at his deflated life belt. I "turned" the boat in the opposite direction just perfectly since the concrete breakwater wasn't moving after all. With the engine shut off and no place to tie-up with the mooring rope we didn't have, I alternated paddling with one oar, and handing the load of equipment, piece by piece to Jim safe on solid concrete. The foghorn was so loud we couldn't talk to each other except by sign language which neither could translate. With our batteries set up, microphones turned on, and the recorder making some semblance of operation, I stepped backwards into the lake while tieing up our boat with an extra micro-

Waiting for the train to come in. James Cunningham and the B & O yardmaster wait with the stereo recording equipment to catch the sounds of a diesel. The steam trains are gone but not forgotten.



phone cable. The resultant sound will be in volume 3 of "Sound in the Round." With the foghorn, the gulls, and buoy bells on tape we began to think about that long voyage to the beach. About this time an automobile appeared on the wide concrete top of the breakwater, and a man asked to see our fishing licenses. It dawned on us that the local boatman had been plainly greedy in his rental plan. We bummed a ride for our equipment and ourselves from the friendly sheriff, and the next week I wrote the boat man a letter telling him how he could take a walk for his boat.

There had been some plans made with James R. Lawson, the world famous carillonneur, to record the 72 cast bell carillon in the bell tower of the Rockefeller Memorial Chapel. This magnificent instrument, on the campus of the University of Chicago, is the world's second largest cast bell instrument. I was surprised to find that the smallest bells weighed about ten pounds and the largest bell weighed over eighteen tons. I was also surprised to find that there were 275 steps up from the base of the bell tower to where we were planning *that I should place the microphones*. For the record, I must now admit my main function as the director of these laboratories is to carry equipment up, down and across every recording mission we do. With an Ampex 350, cables and microphones I bear a remarkable resemblance to a mountain climbing army pack mule. Involving only 750 feet of microphone cable, four microphones, power supplies, and a mixer, the process of recording was underway. It was an exceedingly difficult microphone placement since the sound energy variations from bell to bell were so great. Mr. Lawson played several dynamic and deafening selections as I climbed around the bells to rearrange the "mikes." With Jim below me by many stories in a room where the recorder was placed, I could talk to him over our intercommunication system, and the final placement was accomplished. As the concert began I was wending my way down across the narrow, precarious catwalk to the spiral tower stair case. In all we were able to record 90 minutes of this remarkable instrument. We hope to put out a complete cast bell carillon tape showing the great artistry of Mr. James R. Lawson playing the Rockefeller Memorial Carillon.

We had decided earlier that we would employ the techuique of multiple recording on some of the sounds. Our evolved idea was to produce the sounds of an aerial bombing raid without starting another war. Volume Two of "Sound In The Round" has the finished product with the roaring, diving planes, the bomb bursts ack-ack guns and the inevitable machine gun. In doing any multiple recording it is necessary to have as many tape machines as you have sounds to combine. It is possible by extensive rerecording to pile sound upon sound with only three machines; but by the time you have put in your six or seven sounds the noise level has risen and the quality has dropped to a point where mass duplication is impossible. It was our plan to use one machine as the master recorder and the other machines simply as two channel stereophonic playback units. We then picked, timed and spliced together the various sounds for each playback device: the planes on one machine, the bomb bursts on another, the machine gun on another and so on. Each machine had a full length tape at 15 ips all timed with the others. By remote control the machines were all started simultaneously. In this

fashion the sounds were combined at one time and without loss of quality. Since our early recording of planes were not exactly right, for this tape we went back to United Airlines and asked the use of one of their four engine planes that sounded like a bomber. An unusual request but they were remarkably helpful in allowing us to park right under the wing of a DC-6. A friendly pilot provided the engine reving, the flight sounds. We had thought that jets would make interesting sounds so we asked the army to help and they did. With permission we were allowed to go with correct escort out on the very landing strip and between hot after blasts of the jets and clouds of dust we got some remarkable jet sounds we didn't use in our older fashioned war.

After all the sounds are collected and we have a tentative format for the tape; it is then that all the hours of sounds must be listened to and sorted for context. This has become one of my easier jobs since it involves simply sitting, listening and scoring. We may start with thirty ten-inch reels of tape and the final boiling-down reduces this to about four reels, out of which the final sounds are chosen. Out of fifteen hours of tapes we arrive at fifteen minutes of sound. I have listened to so much noise I am never quite sure where I am. If you listen to stereophonic sound for long extended periods your mind's ear can no longer tell your reasoning centers where you are. This is what happens to critics who have the undesirable job of reviewing this type of demonstration tape. Several have objected to its loud "hi-fi" realism and I don't blame them. If I had had close neighbors here at the laboratory I am sure they would have long since moved to quieter Gary, Indiana, with its steel mills. We understand from Leonard Sorkin, recording director of Concertapes, that there *is* going to be a third volume of "Sound in the Round." I am so glad for the sound and noise loving stereophonic fans. We have had the pressure put on our organization to put these volumes of Sound in the Round out on an LP record. The source of this pressure is our company auditor and his boss, our treasurer.

After everything is recorded, the hardest part of the job begins. Here Mr. Jordan is subjecting himself to the ear splitting task of listening and timing various pieces of tape to determine which shall appear in the finished product.

TAPE IN EDUCATION

BY JOHN J. GRADY, JR.

BELIEVE it or not, many of our teenage students are becoming "smoothies." This, of course, refers to their speech habits. And in a complimentary way. Reports indicate increased enrollment in Speech classes, and there is a general awareness, among students, of the life-long value of proficiency in oral communication.

In recent years, speech departments equipped with tape recorders, have helped greatly in making students conscious of oral deficiencies.

The Audio-Visual Education Center, of the city schools of Warren, Ohio, has supplied TAPE IN EDUCATION with information, which proves that the students of Warren are receiving efficient modern instruction. A recent weekly news-letter, in a clean-cut manner, which could not be misunderstood by students or their parents, deserves quotation:

"What means of communication do we use most often?

That's easy, Oral Expression.

Nearly all of our attempts to make our thoughts, wishes, desires, orders, etc., known to others depends on oral expression.

What do we do to improve this important factor in our children?

Have you tried the *tape recorder?*

It is almost magical. Simply have the child listen to his voice recorded.

Most people are completely unaware of their own voice.

With critical listening, diction, expression, inflection, and continuity stand out.

The tape recorder is not difficult to use.

Give your children the opportunity to improve oral expression."

The implied urge in the above message could influence many parents, ambitious for the advancement of their children, to follow the course adopted by parents who investigated the permanent value of a tape recorder as an educational tool, and installed one in their home.

The citizens of Warren, Ohio, have reason to be proud of the installation of modern tape recording equipment in their schools. Present policy calls for at least one tape recorder in each building, but special need had brought the inventory to a total of 42 instruments. All elementary teachers are qualified operators, as the result of workshop projects. And these teachers have access to recorders for home use nights and weekends. It is this privilege which is responsible for numerous teachers devising new uses. Using the words of the audio-visual supervisor, the relaxed atmosphere of their homes, rapidly brings proficiency. And, as has been discovered in many other towns and cities, faculty experimenters seeking the accomplishment of a definite objective, have been successful in developing a great variety of usages for a most versatile educational implement.

In the junior and senior high schools of Warren, there are students acting as operators. This practice is general, and as a result an instructor can give supervision and individual attention to students needing it.

In the high school commercial department at Warren, shielded wire in conduit terminates at each desk. Three tape players serve the department, each one is set up with dictation at different speeds, which permits students to work at their present level of achievement. Each student is provided with ear phones.

Speech students at Warren are fortunate. They do have incentives to become proficient. The speech therapists keep continual records of each student. Each one is allotted a separate reel of tape, and is permitted use of the tape recorder for checking individual progress.

TAPE IN EDUCATION is grateful to Kenneth D. Weber, Audio-Visual Supervisor for the Warren City Schools, for information on his tape recording installation. And in extending friendly congratulations, there's a whisper that thousands of schools would welcome such an A-V department as exists at Warren.

NEW PRODUCT REPORT

STAFF OKSTED

Product: Sony Condenser Microphone Model C37A

Price: $300, with case and power supply.

Distributed by: Intersearch, 7 Arcadia, Cincinnati, Ohio.

SONY CONDENSER MICROPHONE

. . . . hand made diaphragm, excellent (omnidirectional or unidirectional) response.

THERE must be something special about a condenser, or capacitor microphone, when one observes the number of "microphone credits" on records and tapes which name this or that condenser mike as the sound pick-up unit. Does the capacitor mike have something special? We decided to find out.

Let's see first, how a capaciror or condenser microphone works. If you will refer to the diagram on the facing page you will see that the capacitor mike consists essentially of two elements, a moving element and a fixed plate. Its output consists, essentially, of a changing capacity, which changes as its diaphragm moves backward and forward in relation to the fixed plate. This may be used to cause a voltage change in a conventional preamplifier or it may be used to detune an oscillator. In either case, the moving element causes an audio signal to be available.

Why should the condenser microphone be better than, say, a crystal mike? Both have diaphragms which move in somewhat the same fashion.

The condenser mike diaphragm does not have the extra load of moving an element thus has greatly superior compliance. The crystal element is not essentially a "flat response" element due to the load caused by the crystal—the condenser mike is.

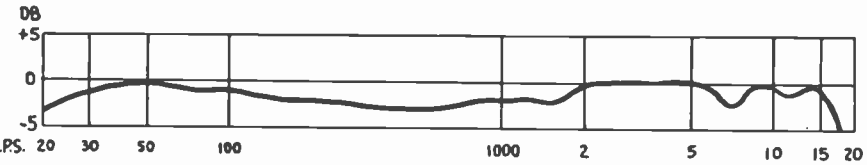
The condenser being very lightly loaded, and thus capable of good response, is further improved by some manufacturers by filling the space between the elements with a light gas. Helium is well suited to this use and it raises the high frequency response even further. Or the element may be made a resonant unit and tuned, to make it react most strongly, to the signals above the normal high end of human hearing. This makes the microphone tend to have a very good high frequency response. By its very nature, the condenser microphone has a wonderful low frequency response. Good response at 10 cycles is not too much to expect.

So far, all has been to the good. What's wrong with a capacitor microphone? One thing against it is the need for special cables and auxiliary power supplies. While the tremendous amplification needed with the non-oscillator type microphones would seem a problem, one of the first things you are impressed with upon hearing the output of a condenser mike is the extreme freedom from noise, the common "hiss" and "fry" associated with most other mikes.

The mike we selected for test was the Sony, a Japanese unit made in the tradition of the recent Japanese cameras, that is, well built, with a certain flair of originality.

The microphone made a trip to an anechoic sound chamber, to which we have access. Here, it was run against a calibrated microphone, with the results shown in the frequency response chart.

While we are usually unimpressed by manufacturer's claims, we were much impressed by the curve produced by this microphone. It showed the microphone to be flat within $\pm$ 2 db from 20 cycles to 18,000 cycles. This curve was run in an independent lab-



The response curve obtained with the Sony microphone when tested in an anechoic chamber against a calibrated mike. The response was within plus or minus 2 db from 20 to 18,000 cycles per second. Note absence of peaks.

oratory and showed the microphone exceeded the manufacturer's claims for it.

Unlike other capacitor microphones, which have been measured in the same chamber, the Sony did not have any peak which would put it outside of a plus or minus 2 db claim on response.

This is something that other capacitor microphones tested in the same chamber have not exhibited. A prominent peak at 10 Kc is a common fault in some capacitor mikes, at least in the samples tested in this particular anechoic chamber. Coupled with a profoundly quiet and noise-free amplifier, we found this response to be unexcelled by any microphone we have ever tested.

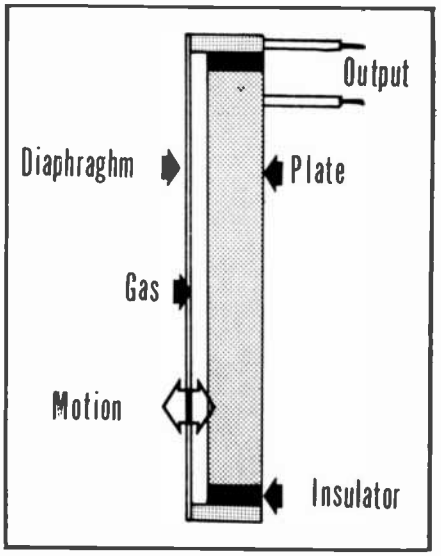
Naturally, we also took it out in the field and did recording with it, the results of which confirmed our anechoic chamber measurements in their entirety.

The microphone is sturdily constructed with the upper head housed in a metallic net; the lower part, which contains the 6AU6 amplifier in a statically shielded circuit, is solid.

The response of the microphone may be changed from unidirectional to omnidirectional, or vice versa, by a control at the rear of the head. The switch for the selection of three low frequency responses is located on the power supply. The distance between the power supply and the microphone may be up to 240 feet.

The diaphragm is specially designed and hand made of titanium. Each microphone is made individually, tested and retested until perfect before being installed in the case.

The coupling is the standard 5/8-27 thread and the microphone weighs about one pound. The power supply weighs six pounds. The output impedance is 200 ohms. Output level is



The condenser, or capacitor microphone operates from the changing capacity between the fixed element and the diaphragm.

—70 db.

In relation to other kinds of microphones, condensers come high but if money is no object then we bow in wonder at their capabilities, at least as represented by the Sony.

Our conclusion is, if you can afford it, go capacitor. They are all the claims would indicate, at least if we use the Sony as an example. It is an excellent microphone.

(*Continued from page* 25)

If two observers covering overlapping fields both see the satellite, their respective times of entry and exit will be different, but they will both say "Center!" at the same time. One can imagine how confusing this can be without using a tape recorder. With a tape recorder each word by each observer can be separately identified, even if the tape must be played back several times for analysis.

After the observation, when the time and position of the satellite's passage have been determined, the leader of the Moonwatch station communicates his data by telephone to headquarters in Cambridge. Here reports from other stations are being received and the data thus gathered is fed into an electronic computer. This unit then works out a tentative orbit for the satellite. As subsequent data is received, it is added to the computer, which then produces an "improved" orbit. With enough information, the computer can work out a very accurate orbit in a short time.

But it doesn't stop here. The computer's orbit computations are sent to a group of highly specialized photographic Baker-Nunn camera stations arranged in a chain running across the North American and South American continents. Here these precision instruments photograph and time the satellite's flight with remarkable accuracy. They have been designed and built especially for this purpose. These elaborate instruments, however, cannot go into action without first receiving initial data from Moonwatch stations throughout the world. This shows how important it is for Moonwatch observers to be accurate in their observations and quick in reporting them to headquarters.

While the first satellite is planned for this fall, observing teams are busy rehearsing their roles in the project. In North Canton, Ohio, a Moonwatch team under the leadership of Richard Emmons has been practicing satellite-tracking in a planetarium built by Mr. Emmons. The team uses a specially built satellite projector which places a simulated satellite image on the dome of the planetarium. Its motion can be controlled to follow the apparent path of a real satellite through the sky. A tape recorder is used in conjunction with the short-wave receiver to time the satellite's "passage."

A nationwide Moonwatch "alert" is at present in the making, and it may already have occurred by the time you read this. This alert is a "dress-rehearsal" for the real satellite tracking program. It will be complete in everything but the satellite itself. All stations will be notified to go into action at a certain time. They will observe and time their "observations." "Fly-bys"—U.S. Air Force planes carrying lights that look like satellites from the earth—will be provided over some stations. All stations will report their observations and timings to headquarters. In this way Operation Moonwatch hopes to iron out the "bugs" in the system, and develop well-trained personnel, team members that will not explode from excitement when the satellite actually passes overhead.

The Smithsonian Astrophysical Observatory publishes frequent bulletins for visual observers of satellites. These bulletins are available at the request of people or organizations who are seriously interested in helping the Moonwatch program.

If you are interested in loaning your tape recorder to a nearby Moonwatch team, or in working with them to help time the satellite, write to Supervisor of Station Operations, Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge 38, Mass. State the purpose of your request for Bulletin No. 5 for Satellite Observers. This bulletin gives the locations, leaders, and addresses of Moonwatch stations registered at headquarters.

This bulletin also appears in the February issue of *Sky and Telescope,* published by Harvard College Observatory, Cambridge, Mass. Largest astronomical magazine in the world, *Sky and Telescope* carries articles of prime interest to amateur and professional astronomers throughout the world. Charles A. Federet, Jr. is the editor.

Besides timing the satellite, the method described can be used for many other astronomical phenomena. The satellite project, however, has a very special charm all its own. This is a golden opportunity for tape-recorder enthusiasts to enlist their equipment and their know-how in a genuine attempt to enrich the scientific knowledge of the whole world of man, and to have a lot of fun doing it.

SHOP OR SWAP

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

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

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

TAPE PALS UNLIMITED! Search no more. All categories. Write me today. Miss Zenobia Raghunandan, 41 Eldert Street, Brooklyn 7, New York.

OPERA & CLASSICAL MUSIC Lovers: Would like to tapespond. Have large music library; excellent recording equipment. Sidney R. Denker, 2215 Cranston Rd., Cleveland 18, Ohio.

25 SETS GUMMED LABELS (Top and Fnd) $1.00 Postpaid. Use New Set when Re-Recording Tape. Specify 7" or 5" Box. Fabro Equipment Corporation, 21 Goodale Circle, New Brunswick, New Jersey.

WANTED: Used Recording Tape, any quantities, large or small; also want empty reels, etc. Richard Lackner, 2029B Bradley, Chicago 18, Illinois.

HI-FI RECORDING TAPE: Plastic base 1800' extra play on 7" reels—$1.86 each. 1200' on 7" reels—$1.65 each. Minimum order 3 rolls. Top quality guaranteed. Include sufficient postage. Florman & Babb, Inc., 68 West 45th Street, New York 36, N. Y.

BERLANT SERIES 30, Model 32 half track tape recorder with hysteresis synchronous motor complete with Wyco metal case and superb Danish B&O ribbon mike with matching Berlant transformer, latest model used only a few hours in home, absolutely perfect and as new in mfgrs. original carton, an over $800 value for only $500. National Horizon 20 watt amplifier used only two months, net value $89.95 for $55. R. C. Sherbahn, 9941-B Young Dr., Beverly Hills, California.

SAVE 50% on Tape Duplication! Why pay more? 600' S/T 2.00, D/T 2.50 - 1200' S/T 3.00, D/T 4.00. Tape Included, All Speeds, Any Quantity, Postage Paid, Prompt Service. Jack's Recording Service, Box 6273, Asheville, N. C.

TO SETTLE ESTATE: Crown Imperial, 3 Speed, VU Meter, Large Reels, 20 Watt Amp, Case ($445.), $275; Crown Prince Deck dp, $260.; Pentron Dynacord Prof Model in Case ($645.), $400. Above 3 Orig. Warranties Intact. Berlant Network Recorder, Remote Controls, Hysteresis Motor, 5 Heads Used—Good Condition ($895.), $300. Also used De Luxe Klipschorn, Primavera Cabinet, slight marks, but Drivers like new ($796.), $350. We pay shipping. Air Mail replys to Cross County Audio Exchange, 583 Gramatan Avenue, Fleetwood, Mt. Vernon, N. Y.

FREE 70-page catalog of all recorded tapes plus informative tape articles. Stereophonic Sound League, Inc., 113 West 57th St., N. Y. C. 19.

SPECIAL (Three) 15 minute tapes: 1. Mystery and Suspense in: True Cases of Strange Phenomena. 2. Sacred Music as Broadcast From Knott'sberry Farm. 3. How to Make Money. $3.98 each. Young Recorders, Box 497, Long Beach 1, Calif.

WANTED: Heathkit OL-1, 3", oscilloscope or complete unassembled kit. Write condition and price to E.C. Wiley, 329a N. Fountain, Cape Girardeau, Mo.

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

DISC OR TAPE RECORDINGS from your tapes. Complete quality service. Write Sound Unlimited, 4361 Miller Ave., Erie, Pa.

LEARN HYPNOTISM, SELF-HYPNOSIS from tape! Other Helpful recordings! Free information. Drawer TR5-697, Ruidoso, New Mexico.

TAPE RECORDINGS OF CHRISTIAN songs and music for shut-ins in exchange for your 7" tape and reel, anywhere in the world. Bro. Geo. Phillips, 5310 N. Shirley, Tacoma 7, Washington.

RECORDING TAPE—Hi-Fi, high quality, brand new 1800', 7" reels, precision slit, abrasive free non-shedding, extra tough break resistant, 2-¼" reel hub. $1.89 each in lots of 3 or more. Sample $2.29. Money back if not fully satisfied. Used 1200' reels boxed and on 7" reels, 99c each. New and used recording equipment and supplies. Please include sufficient postage.
Recording Services, P.O. Box 231, Wallingford, Conn.

FOR SALE: Ekotape recorder, dual-speed, model 205, used very little, in brand new condition. Cost $225, yours for $145. Joseph Polite, Exton, Pa.

WANTED TO BUY: A Masco recorder, tape 52C or 52CR, or what have you to offer in the Masco line. Donald W. Rose, Franklin, Nebr.

WANTED: Electro-Voice 15" LF Driver. Fisher 80-C Preamp Control Center. Carl Fiene, Steeleville, Ill.

FOR SALE: Crestwood 404 hi-fi tape deck, complete and brand new. Must sacrifice. Originally $205. Best offer takes it. Will send prepaid in original carton. Bill Stamm, 2263 Morrison Ave., Union, N. J.

FOR SALE: Rek-O-Kut M12 12" overhead lathe complete in original carton. Cost $109.95. Sale $75.00. Roy S. Kolb, R.D. 1, Spring City, Pa.

MAY WANT at later date used Ampex 601 half-track and Telefunken condenser mike. Will appreciate reply from anyone possibly having either unit for sale. Walter L. Draughon, First National Bank, Fort Myers, Florida.

HIGHEST QUALITY TAPE POSTPAID. 1200', 7" reels in boxes, 3/$4.75, 6/$9.00, sample reel, $1.69. Long play tape—1800', 7" reels in boxes, 3/$5.50, 6/$10.50, sample reel, $2.20. Satisfaction guaranteed. Fidelatape, 1575 Thieriot Ave., New York 60, N. Y.

FAMOUS MAKE RECORDING TAPE, Boxed 7" reels, 1200', 1½ mil acetate, $1.40, or 3 for $3.90; 1800', one mil acetate, $2.00; 1800', one mil Mylar, $2.70. Add 20c postage per reel, 40c postage for 3 reels. Write for complete price list. Tape Company of America, Box 50, Jersey City 3, N. J.

FOR SALE: Transcription Library. Dance Bands, Light Concert, Latin-American, Novelty, Hawaiian Music, etc. Will trade or buy Thesaurus or E.R.P.I. Transcriptions by Xavier Cugat's Orchestra. Sam Kiamie, 930 Grant Avenue, Pelham Manor, New York.

$100.00 WEEKLY SPARE TIME With A Tape Recorder! Proven Facts Free! Dixieland Publishers, Asheboro 18, N. C.

REK-O-KUT "Challenger" disc recorder with accessories, like new. Excellent value, $350. Webcor 210 tape recorder, good condition, $120. Barry Bergman, 122 Douglass St., Reading, Pa.

WOULD LIKE TO tapespond with anyone interested in music of other countries. Send tapes as I'll do, dual track, 3-¾ or 7-½ ips. All tapes answered promptly. Harlon Triplett, 3344 West Adams, Chicago, Ill.

WANTED: Berlant five-head model, or other professional recorder, reasonable, for missionary work. Please, can you help? Voice of Hope, Box 185, Simcoe, Ontario, Canada.

EV CARDAX 950 MIKE used twice, $20 postpaid. Want low impedance and transformer, unidirectional preferred. Paul Bauereis, Box 270, Wheaton, Illinois.

MULTIPLE PRESSINGS NOW AVAILABLE from your tapes. Also Disc Cuttings. All speeds, lowest prices. Patmor Sound Systems, 92 Pinehurst Ave. 3K, New York 33, N. Y.

1957 VM-710 NEW tape recorder in sealed factory carton, received as a gift. Cost $189.95. Yours for $139.95. Jack Fives, 2916 Rockrose Avenue, Baltimore 15, Maryland.

CONCERTONE 1501 in case with amplifier and speaker hardly used, perfect condition. Cost $432. Will sacrifice for $275 because buying stereo. Peter Joyce, 460 Park Avenue, New York. Telephone PLaza 5-5400.

HAVE SEVERAL NEW and used tape recorders to sell or trade, have too many. Webcor, Ekotape, V-M, a model BK 403 Brush Sound-Mirror, all first class reconditioned. Want a late model recorder that will take 10 inch reels. I will pay cash difference in trade. Geo. F. Bischof, Fort Worth 4, Texas.

FANTASTIC COLLECTION of legendary European and American opera broadcasts, 1935-present. Prefer exchange tape copies for similar material, but other arrangements possible. Donald Atkins, 18 East 64th, New York 21.

FOR SALE: 1956 RCA portable phonograph, three speeds, three speakers; Sonotone 2T cartridge with 100 hours on LP diamond. Sell for $100. Details on request. R. W. Long, 7426 Harvard Avenue, Cleveland 5, Ohio.

VIKING of Minneapolis announces the "35 Series,"

A complete line of handlers for the new Fidelipac *continuous loop* tape cartridge

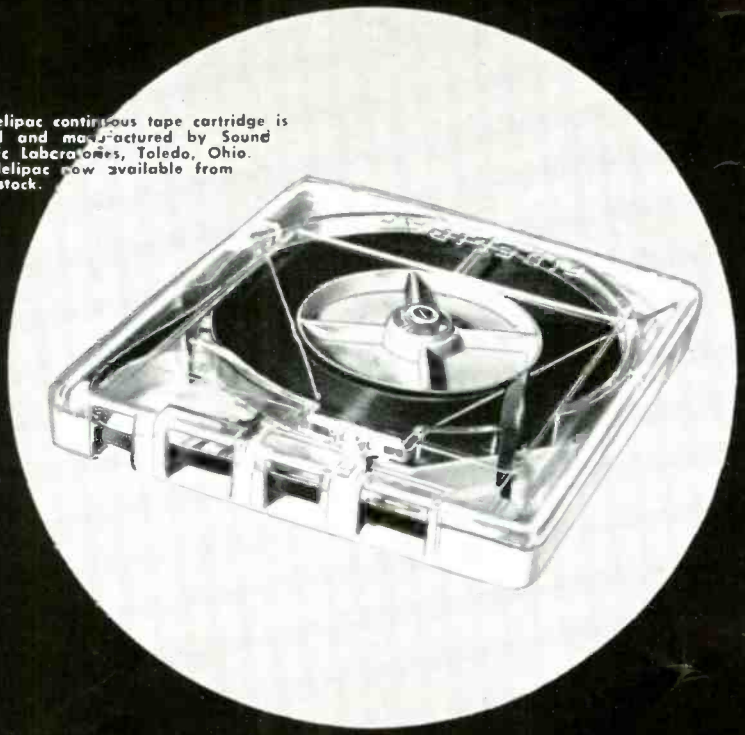
The "35 Series" handlers have been designed to fill the need for a cartridge handler combining high performance with complete dependability. They are available now in limited supply for background music applications, point of sale devices, experimental and research applications.

The "35 Series" cartridge handlers feature:

- Instantaneous cartridge change . . . single fingertip control initiates play or release.
- Frequency response and low flutter and wow characteristics comparable to VIKING's outstanding "FF75 Series."
- Head configurations for in-line stereo play, monaural play, monaural erase-record and erase-record-monitor operation.
- Tape speeds of 3¾ and 7½ i.p.s. instantly selected.
- Suited for use with standard VIKING recording and playback preamplifiers.

THE VIKING SERIES 35 HANDLER

The Fidelipac continuous tape cartridge is patented and manufactured by Sound Electronic Laboratories, Toledo, Ohio. 600' Fidelipac now available from factory stock.



In the Fidelipac cartridge, the tape is completely self contained – permanently protected, permanently identified.

Static neutralizing bearing surfaces distribute static charges and eliminate sticking and binding of tape.

Cartridge designs to accommodate 300', 600' and 1200' of tape, respectively. Minimum loop playing time: a few seconds. Maximum playing time (1200' Fidelipac, 3¾ i.p.s. and Moebius loop): approx. two hours, monaural.

Note to audiophiles – Major tape recordists, including Bell Canto, Concertape, EMC, Livingston and Omegatape currently offer selected stereo tapes in the Fidelipac continuous loop cartridge.

Further information may be obtained by writing to Viking of Minneapolis

Viking OF MINNEAPOLIS

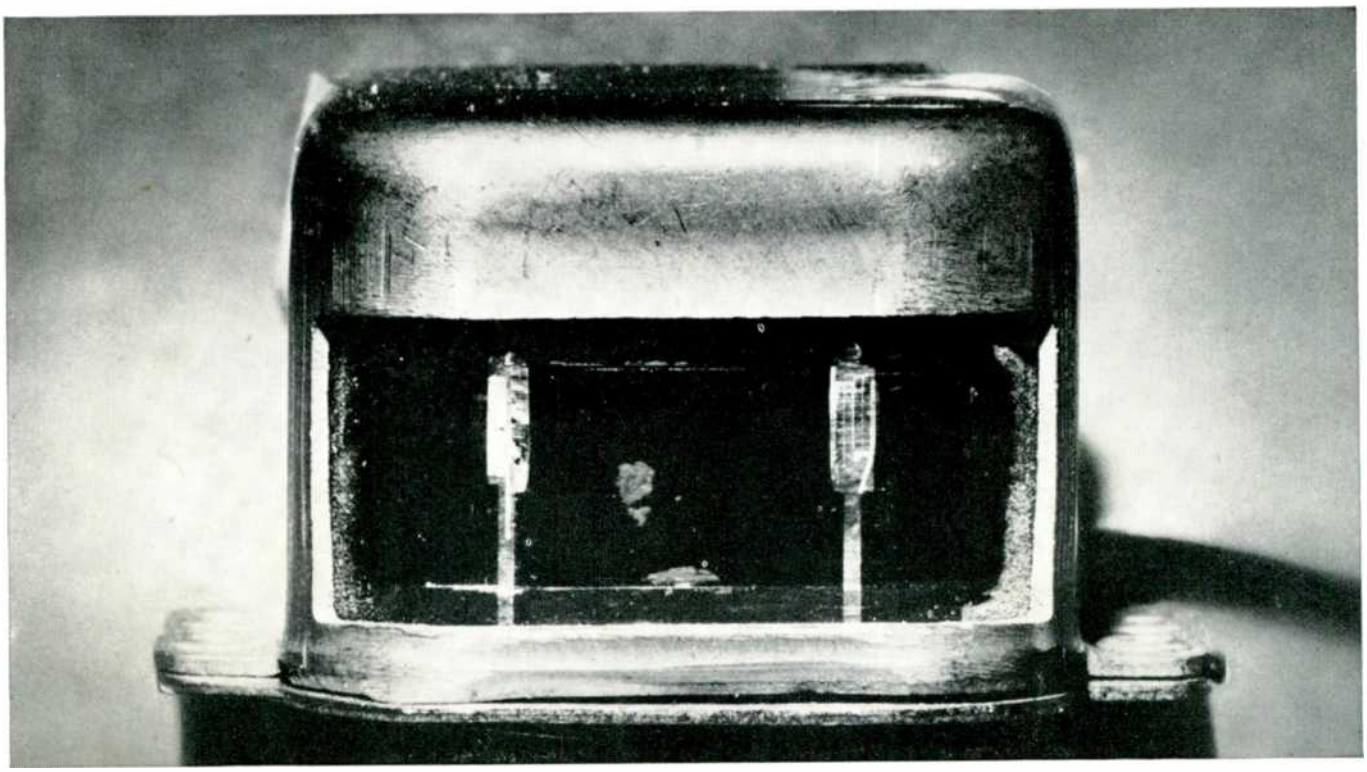
9600 Aldrich Avenue South, Minneapolis 20, Minnesota

EXPORT DIVISION: 23 Warren Street, New York City 7, New York

Cable: SIMONTRICE, NEW YORK (All Codes)

"Scotch" Brand's dry lubrication

stops magnetic head wear



Enlargement of badly worn and pitted recorder head. Heads in this condition cause loss of high frequency response.

Know what's the most *vulnerable* part of your recorder? It's the sensitive magnetic head—the tiny, precision-made part where dirt or lack of proper lubrication can cause annoying wow, flutter and harmful friction.

It's relatively easy to keep your recorder head free of grime. But how do you keep it well lubricated?

"SCOTCH" Brand Magnetic Tapes do the job for you! *All of these fine tapes are "self-lubricating"*. Thanks to "SCOTCH" Brand's exclusive silicone lubrication process, these tapes glide smoothly over the magnetic head. No sticking . . . less friction . . . wow and flutter are cut noticeably, even in hot, humid climates!

"SCOTCH" Brand's dry lubrication stays put . . . lasts the life of the tape. And what a difference it makes in the sound of your recordings! You'll *hear* what we mean the next time you play a reel of silicone-lubricated "SCOTCH" Magnetic Tape.

Extra playing time *Extra strength* *Higher fidelity* *True economy*

SCOTCH BRAND Magnetic Tapes

Your guarantee of quality

only "Scotch" Brand has silicone lubrication