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audio record

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C. Torres, recording engineer, readies the Scully disc lathe for dubbing another Talking Book "page" from tape to master disc — at the American Foundation for the Blind, Inc. Story on Page 2.

In this issue

- How "Talking Books" Are Made
- Audio-Vis-Tac
- From Microphone to Loudspeaker
- New Products
- "Mylar" is Here

HOW "TALKING BOOKS" ARE MADE

by Dr. Philip S. Gross

New York City is full of surprises. One of these might well be termed "The Miracle on 16th Street."

To the casual passerby, the neat but unassuming facade of the brick building at 15 West 16th Street is merely that and nothing more. If he notices the bronze tablet beside the entrance, he may read the inscription "American Foundation for the Blind, Inc." And if he be in a contemplative mood he may suppose that this building houses a somber and sad-visaged clerical staff devoted to doling out sympathy and advice to the visually handicapped.

Nothing, in reality, could be farther from the truth. For it is here, on these very premises, that the Talking Books are made—here that a very real and very priceless product is manufactured—one that continually brightens the darkness for about 40,000 sightless persons from coast to coast. Here, within these walls, is a complete and remarkably efficient record manufacturing plant, including everything from recording studio to processing plant.

Of course there are many other valued services rendered by this organization—but the Talking Book is one of the most unique and most interesting. Hence our discussion will be limited to this one operation.

First of all, what is a Talking Book? As the name implies, it is a book that talks—a book that you *listen* to. It is not a *printed* volume, but a *spoken* volume—in the form of specially-produced long-playing, 33 $\frac{1}{3}$ rpm microgroove phonograph records. These Talking Books are loaned to the blind absolutely free of charge—the operation being financed by Congressional appropriation through the Library of Congress.

A Talking Book is an exact copy of its printed counterpart—being read, verbatim, from the original text. It is not a *condensed version* giving merely the essential elements of the book or story. It not only retains everything which the author put into it, but, is actually more "alive" than any printed page could possibly be.

But now let's look at a Talking Book in the making. As we leave the self-service elevator at the third floor, we step into the quiet hall of what is obviously a very professional sound recording studio. In a small but remarkably well equipped control room an engineer is monitoring thru headphones while an Ampex console type machine is



Recording and control room for Studio A, one of the special, acoustically treated reading rooms used for recording Talking Books. Mr. O'Donnell, of the recording staff, monitors the reading and keeps an eye on the Ampex console type unit as the story is taped.

recording a 2500 foot reel of tape at 15" per second. Through the window in the control room we see a man seated at a desk reading a book. He will read into the microphone like this for three or four hours a day until the book is finished. The average book requires a reading time of about 12 hours. Some, of course, run considerably longer. "Inside U.S.A.," for example, took 65 hours—"War and Peace," 79 hours—and "The Bible," 112 hours!

When the reading is completed, we have for an average book, sixty thousand feet of recorded tape—consisting of two dozen 2500 foot reels with 30 minutes recording time on each.

Next step in the making of a Talking Book is to dub from tape to master disc. This operation is performed in an adjoining re-recording room equipped with two rack-mounted Ampex tape machines and a pair of high-precision Scully disc lathes of the latest, automatic, push-button-controlled type. Here, the tape recording is transferred onto 13 $\frac{1}{4}$ " lacquer masters, with the same care and precision that go into the making of the finest, high-fidelity phonograph records. Each master contains

about 20 minutes of reading time, microgroove recorded at 33 $\frac{1}{3}$ rpm. Hence, a 12-hour book will require 36 master recordings—which will be released in the form of 18 double-sided 12" records.

So we will now descend to the basement, where the transformation from lacquer master to Vinylite pressing takes place. From the quiet dignity of the recording room, we step into the busy activity of a compact and highly efficient plating and processing plant—a plant that turns out an average of about 1000 pressings a day!

In a refrigerated cubicle where temperatures must be maintained at about 55°F all year around, the lacquer master is "silvered"—coated with a thin layer of metallic silver that conforms to every minute contour of the recorded disc. It then goes into the copper pre-plating bath, where a layer of extremely fine-grained copper is deposited on the silvered disc from an acid copper plating solution. From the pre-plating bath, the disc goes to a copper backing tank where a heavier layer of less finely grained copper is quickly applied to the back to give it the necessary strength and rigidity. The original lacquer

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Published eight times a year by Audio Devices, Inc., 444 Madison Avenue, New York City, in the interests of better sound recording. Mailed without cost to radio stations, recording studios, motion picture studios, colleges, vocational schools and recording enthusiasts throughout the United States and Canada.



Roger Roberge, of the American Foundation's plating shop, demonstrates the silvering operation — first of several steps in which the original lacquer master is reproduced in metal for making pressings.



Plating technician Al Powers loads a silvered disc into the copper pre-plate bath where the first stage of the copper backing is applied in this automatically controlled, five unit tank. Discs are rotated while plating to assure uniform deposit.

master is then separated from the finished metal matrix, which is subsequently stripped of its original silver deposit and given a hard chrome facing which is sufficiently durable to permit making many hundreds of pressings without appreciable wear. After precisely locating the center hole and machining the back to a perfectly smooth and flat surface, the metal matrix is ready to go to the adjacent pressing room. Here, five hydraulic presses are busily engaged turning out unbreakable 12" Vinylite records of the highest quality. Two metal matrices or "stamper" are mounted in each press—one for each side of the record. Labels are inserted, a pre-heated "biscuit" of purest Vinylite plastic is placed between the stamper, and the press is closed, applying controlled heat and a pressure of about 2000 pounds per square inch—113 tons for a 12" disc! When the press is opened, the finished record is removed, perfect in every detail and complete with printed label on one side and raised braille labeling on the other. The excess plastic is trimmed off, it is given a careful inspection for scratches or defects, and is then inserted in its individual protective envelope—a completed "page" of our Talking Book!

The year 1934 marks the 20th Anniversary of the Talking Book. During these 20 years, a total of over 2,650,000 records have been produced and distributed by the American Foundation for the Blind and the American Printing House, Louisville, Ky., for the Library of Congress. But things were not always as easy as might be assumed from the excellent recording and processing facilities described above. It took many, many years of tireless and

devoted research and development to perfect the Talking Book and put it into practical production.

When this job was first started, back in 1932, the American Foundation had no equipment, no tools, no instruments and only a very small, hot, stuffy corner of Grand Central Palace to work in. But they had an idea, and the determination to see it through despite all odds. Phonographs and phonograph records were both commercially available at that time. But neither were suitable for use by the unsighted. Machines were too complicated—records were fragile and only played a few minutes at a time. The unbreakable long play-

ing microgroove record was as yet unheard of. Finally, after two years of persistent effort the "crazy research boys" as they were called, had a workable long playing record, and a phonograph to play it on. At least it was good enough to interest the Library of Congress and warrant their financial backing. Even after the development problem had been licked, it was pretty tough going. Working conditions were almost desperately cramped. And since all recording was done directly on discs, fluffs and errors by the readers were a continual cause of concern. Any mistake anywhere on the record meant that the disc had to be
(Continued on Page 7, Col. 3)



Here's where the metal stamper produced by the Plating Department are utilized to turn out hundreds of Vinylite pressings or phonograph records for Talking Books. At center, Michael Gregory, foreman of the Pressing Department, checks a sample from one of the five hydraulic record presses.

AUDIO-VIS-TAC: A New Tool for Teaching

by Dr. Philip S. Gross

The furore that once was known as visual education has long since been supplanted by such terms as audio-visual approach, or the perceptual approach. There is general agreement that one learns through the senses.

To put it as a pure form of logic, if the audio-visual approach has rightfully supplanted the merely visual or auditory approach, it is easy to conceive of the use of the sense of touch, THE TACTILE, along with the audio-visual, giving us the audio-vis-tac, or if you prefer, the audio-visual-tactile *simultaneously*. It is this combining of the *three* senses of sight, hearing, and touch which explains the remarkable results obtained with the Tuch-Rite Keyboard in teaching the entire touch system of typewriting in only 90 minutes.

There is a format for accomplishing these results that includes pre-planning of the entire keyboard course by an expert, simplification which led to the invention of the Tuch-Rite Keyboard Device, and IMPLEMENTED by the use of the AUDIO-VISUAL-TACTILE technique. Is this semi-hypnotism? Probably not, but the effect is the same—the pupil follows simple instructions and performs on the Tuch-Rite board within 90 minutes in a manner that normally would take 3 to 6 weeks. There are so many pitfalls he avoids, so many plateaus of learning which he never hears about or even experiences, that he learns easily a skill which is known to be tedious and long in the learning under ordinary conditions. Unless someone has pointed out the drudgery connected with the old system, he would never be aware of his good fortune in learning by this newer way. This was demonstrated in a typing class at the Adult Division at Brooklyn College, where all the pupils were beginners, taught by the writer. In less than the specified 90 minutes, more likely 55 minutes, a class of 40 mixed adults learned to manipulate the entire typewriter keyboard without having to look at the keys.

HOW DOES IT WORK? It is made to work as an audio-visual-tactile training device by preplanning through the use of associations, mnemonics, analysis, and the construction of simple devices so that there is a ready meeting of the minds of teacher and pupil response.



Dr. Philip S. Gross, founder of the Tuch-Rite Plan is free to devote all of his attention to observation and supervision of the class, while the Revere portable plays back carefully planned, tape recorded instructions for teaching touch-system typing by the combined audio-visual-tactile method.

First there is the Tuch-Rite Board. This is an instrument for *learning the keyboard*, on a simulation of the actual typewriter. By the use of this learning instrument the student is able to concentrate on mastering the typewriter keyboard without the distracting interferences of the complex mechanism of the typewriter. The student is not bothered by paper insertions, carriage returns, keys jamming, etc. The Tuch-Rite device is not mechanical nor is it electrical. It may be used in any classroom, it is not attached to the table or desk; it measures $12\frac{1}{2} \times 12\frac{1}{2} \times \frac{1}{4}$ inches and weighs but a few ounces. The Tuch-Rite Board is used over and over again.

Tape recordings, carefully planned, accurately timed and expertly dictated are the INSTRUCTIONS for the use of the BOARD. This releases the instructor for performing the more important functions of observation and guidance. The tapes are used in teaching the alphabet and figure keys. *The student does not approach the typewriter until after mastering the keyboard*: this is accomplished in a mere fraction of the time required by old-fashioned methods of teaching typewriting. There are

five reels in a complete set of tapes with a total running time of about one hour, available in either $7\frac{1}{2}$ or $3\frac{1}{4}$ inches per second speeds. The Tuch-Rite Typing Textbook is an easel type 6" x 9" text. Monotonous drills and exercises have been avoided.

The author wishes to emphasize the fact that the audio-vis-tac approach can be utilized just as effectively in other skill-learning fields. He already demonstrated this at Fort Monmouth in teaching the International Morse Code. The same too can be said for the effectiveness of teaching and learning foreign languages by the audio-vis-tac method.

The audio-visual-tactile system should not be confused with the old system of multiple sense appeal. Not only are the three senses used in the audio-vis-tac approach, but they are used SIMULTANEOUSLY, just as three separate wires are connected in a single cable for a single purpose through a MULTIPLE approach.

Further details on the Tuch-Rite Plan or the Audio-Visual-Tactile method can be obtained by contacting Dr. Philip S. Gross, 609 East 53rd Street, Brooklyn 3, New York.

From Microphone to Loudspeaker

A simplified discussion of some important fundamentals—prepared for the non-technical user of educational audio equipment

By **Wolcott B. Louis**
 Assistant Supervisor
 in charge of Technical Operations
 Station WBOE,
 Cleveland Board of Education

The increasing importance of audio work in schools, involving the use of tape recorders, various types of sound systems, and allied electronic equipment, has made a basic working knowledge of microphones and associated equipment almost imperative.

The lack of textbooks or any published material on this subject is evident to any person who has attempted to locate such material. The information which is available is, in most instances, far too technical for the layman in this field.

This article will attempt to develop certain fundamental ideas which may be used as guides in working with audio equipment.

Generally, microphones may be divided into two broad classifications: those having *high impedance* output and those having *low impedance* output. Microphones are also available which may be adjusted to operate at either a high or low impedance output. Low impedance microphones are generally found in commercial use. Portable public address systems, small tape recorders, and record players usually require high impedance microphones. There is one essential difference, other than impedance output, between these two types. The length of the cable used in conjunction with a high impedance microphone has a definite effect on the frequency response of the microphone. The greater the length of the microphone cable used with a high impedance microphone the greater will be the high frequency attenuation. When high frequency attenuation appears in an electronic system the bass sounds appear to dominate. Crystal microphones are always of the high impedance type. Prices of high impedance type microphones vary from about \$6.00 to \$40.00. Low impedance microphones usually have good frequency response and are generally in a higher price bracket.

The sensitivity of either type of microphone varies, depending upon the specifications to which the microphones were con-

structed. Both types, however, are in most cases quite comparable in their ability to detect sounds.

These microphones must be used with an amplifier which has an input impedance that will match the output of the microphone. A high impedance microphone for example, should be connected to an amplifier having a high impedance input. If a high impedance microphone is connected to a low impedance input, amplifier distortion will result. This distortion may be extremely severe or barely noticeable, depending upon the degree of mismatch.

The two main types of microphones may be subdivided into "pick-up pattern" classifications. Both high and low impedance microphones are available in unidirectional, bidirectional, or nondirectional types. (See Fig. 1, 2, and 3). In many instances microphones are equipped with a "variable pattern" adjustment. It is possible with a microphone of this type to obtain any desired "pick-up pattern" by the simple method of tuning an adjustment screw to the desired position.

How can one determine what "pick-up pattern" to use? It is difficult to set hard and fast rules concerning this matter. There are several variables that may change any rule which might be formulated. The following factors will influence the choice of patterns:

1. Room acoustics
2. Size of room
3. Types of voices
4. Type of program
 - a. Straight speaking
 - b. Vocal music
 - c. Instrumental music
 - d. Combination of (b) and (c)
 - e. Size of group

By checking the above listed factors you can readily understand why the choice of the "pick-up pattern" may be involved. In making a choice, we may be governed largely by the size of the group rather than any technical details.

Because there are fewer complications under most conditions, a unidirectional pattern is generally preferred. This should cover approximately 90% of all situations.

The "pick-up pattern" of a unidirectional microphone is approximately heart-shaped. It will vary from this pattern to a limited extent, in different makes of microphones. The unidirectional pattern, how-

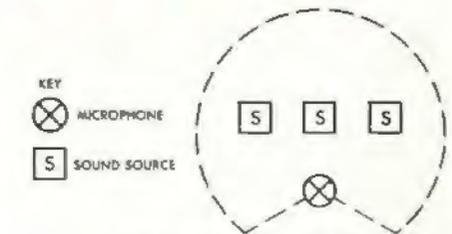


Fig. 1. Unidirectional Pattern

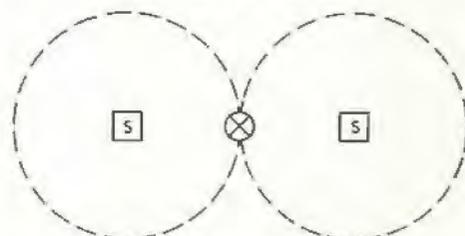


Fig. 2. Bidirectional Pattern

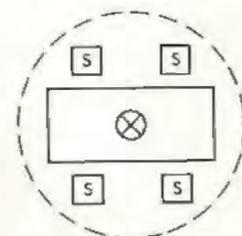


Fig. 3. Nondirectional Pattern



Fig. 4. Soloist — Instrumental or Vocal

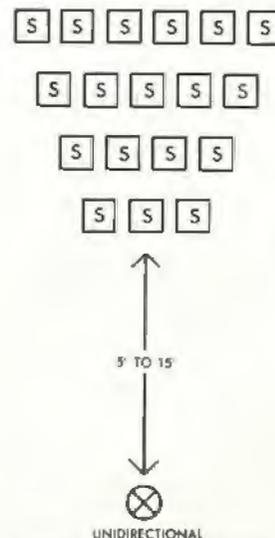


Fig. 5. Suggested Vocal or Instrumental Pick-up

(Continued on Page 6, Col. 1)

Microphone to Loudspeaker

(Continued from Page 5, Col. 3)

ever, is usually of sufficient width at a normal microphone distance to allow three or possibly four people to use it simultaneously, as shown in Fig. 1.

The nondirectional "pick-up pattern" may be required if a panel discussion group is using the microphone, as in Fig. 3. Greater care must be exercised when using this nondirectional pattern than when using either uni or bidirectional patterns.

How many microphones should be used in a given situation? The answer to this question has a direct relationship to the size of the group which will use the microphones. One fundamental principle may be used as a guide. *Always use as few microphones as it is possible to use.* There are very few situations that will require the use of more than one microphone. Large groups of speaking voices, instrumental or vocal music groups can be successfully handled with one microphone providing care is exercised in the placement of that microphone. This is also true when a combination of piano and a vocal or instrumental soloist requires the use of a microphone either for recording or amplification to a loudspeaker. Probably a very high percentage of all possible usage can be taken care of with one microphone.

Modern technical literature and commercial technical experience emphasizes and re-emphasizes one important point in the use of any type microphone. *Stay away from the microphone.* There appears to be no distance less than 18 inches where a microphone will reproduce a true picture of any sound. Therefore, keep away from the microphone. Twenty inches, two feet, or even farther. As long as the ear cannot detect an "off-mike" sound the actor is not working too far from the microphone. When the speaker is too close to the microphone the sound which will be given off by the loudspeaker or the recorded program will be distorted or "mushy." When a microphone is used for music pickup, either vocal or instrumental the above rule becomes increasingly important. Distances of such sound sources may be as great, 5 to 15 feet. Figures 4 and 5, illustrate some possible suggestions for microphone placement.

In conclusion I believe that careful attention to fundamental principles in the technical operation of microphones and associated equipment, plus a willingness to experiment and accept the results with an open mind, will lead to very noticeable improvement in the quality of programs produced by electronic equipment.

NEW PRODUCTS

MAGNETIC DISC RECORDER



Magnetic Recording Industries
11 East 16th St., New York 3, N. Y.

Developed to serve the educational field, in applications where simplicity of operation is a primary consideration, the "Magneticon" is a magnetic disc recorder which can also be used to play standard phonograph records. Basically, it is a 3-speed portable phonograph which instantly converts to a complete magnetic recorder-playback unit whenever the student or teacher wishes to record on a special magnetic disc. A magnetic needle plugs into the place of the phono needle. The records can be replayed an indefinite number of times, or can be erased and re-used over and over again. By means of a "Magneticon Attachment", existing phonographs can be adapted to making and playing magnetic records. "Magneticon" prices start at \$69.50.

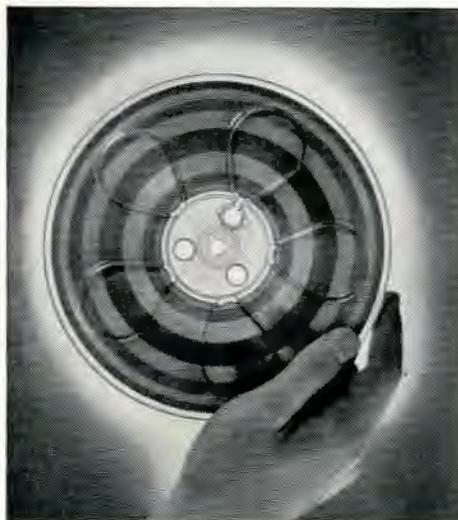
LONG-PLAY BATTERY PORTABLE



Amplifier Corporation of America
Magnemite Division
398 Broadway, New York 13, N. Y.

The Magnemite® 610A, a new battery powered portable tape recorder with spring wound motor, operates at a tape speed of 15/16" per sec. while maintaining a frequency response of 300 or 2500 cycles. Measuring 5" wide by 8" high by 11" long, the 610A weighs 12 lb complete with flashlight-type batteries with 100 operating hour life. Dual track recording provides total playing time of 4 hours on a 600-foot reel of standard 1/4" tape. Can be monitored with headphones while recording. Playback also available through headphones, or output may be fed into an amplifier. Spring motor provides 30-minute winding cycles and may be rewound while recording. Indicator light signals 30 seconds before rewind time.

COLORED TAPE



Audio Devices, Inc.
444 Madison Ave., New York 22, N. Y.

Audiotape, now available on green, blue or standard brown plastic base, offers interesting possibilities for color cueing, color coding and other applications as well. The reel illustrated contains selections recorded on the different colored tapes

— each clearly separated and instantly identifiable. Typical uses for colored tapes are as follows.

As a studio trademark for tape transcriptions. For quick, positive spotting of different selections on same reel. For identifying temporary material added to a library tape. For language work, to separate permanent material recorded by the instructor from "blank" sections for recording by students. For enabling temporary sections, as above, to be safely erased without removing any of the permanent material. The price of blue or green Audiotape is only slightly higher than the standard tape.

Audiotape 5" and 7" plastic reels are also available in red, yellow, green, blue or clear plastic. Colored reels can be used as follows. For identifying studio, field, safety and customer's tapes. For separating daylight-saving-delay tapes from those used for studio recording. For distinguishing between edited and preliminary recordings. For storing important "don't erase" material. For color coding the tape library by subject matter or type of music. For identifying tapes of different speeds. For distinguishing between single and dual track recordings.

The price of blue or green Audiotape is only slightly higher than that of the standard plastic-base tape. And empty Audiotape colored reels are available, individually boxed, at the same price as the clear plastic reels.

audio pointers for the Recordist

by C. J. LeBel, Vice President,
Audio Devices, Inc.

"MYLAR" IS HERE

It will be recalled that a year ago we discussed a new base material for tape, the Du Pont polyester film Mylar*. Now, over two years since we first began limited production runs with the material, "Mylar" has become available in substantial production quantities. For the first time it is worthwhile to consider some of the possibilities of this plastic.



C. J. LeBel

Properties of Interest

Not every property of a plastic is significant to the recordist. For example, the widely acclaimed improvement in flex life, a fortyfold increase at 0° F., is really unimportant, however the advertising gentry may welcome it. Recording tape does not fail due to excessive flexing, rather it fails in tension or in tear. We are therefore most interested in the following:

- Tensile strength
- Impact strength
- Tear strength
- Softening temperature
- Moisture effects
- Elongation

Strength

Based on the manufacturer's data, we may tabulate the tensile, tear and impact strength of cellulose acetate and polyester film as follows:

	STRENGTH		
	Tensile	Impact	Tear
2 mil "Mylar"	12 lbs.	200 kg-cm	75 grams
1.5 mil "Mylar"	9 lbs.	170 kg-cm	35 grams
1.0 mil "Mylar"	6 lbs.	90 kg-cm	22 grams
1.4 mil acetate	4 lbs.	10 kg-cm	5 grams

While the increase in tensile strength is over 100%, the improvement in impact strength is manifold. Since tape failures often come during a stop from fast forward or rewind, the latter improvement is the more significant.

The improvement in tear strength suggests at least fair immunity to rough handling—a boon to schools.

* Du Pont trademark

Climatic Effects

The softening temperature is a good index to the effect of high temperatures.

"Mylar"	240 — 245° C.
Acetate	65 — 110° C.

Acetate softening temperature may readily be reached during a tropical expedition, or under military conditions, while it is obvious that "Mylar" suffers no such limitation.

Moisture absorption is a measure of the effect of a humid atmosphere, often encountered under tropical and military conditions.

"Mylar"	0.3%
Acetate	9.0%

A consideration of both effects indicates that under adverse conditions the "Mylar" will retain most of its initial strength, while the acetate will become very weak. Effects of humidity on timing are important too. If, at normal room temperature, the humidity is increased from 20% RH to 92% RH, a half-hour program on polyester tape will gain only 1¼ seconds. An acetate-base tape, under the same conditions, would gain 19 seconds!

Furthermore, "Mylar" lacks the Achilles heel of acetate—the tendency to become brittle rapidly when stored under warm, dry conditions. Storage conditions for "Mylar" do not appear to be critical.

This discussion should not be taken as a proof of infinite life for "Mylar." We really do not know, for the oldest samples (which even approximate the present material) are only seven years old. That they are presently unchanged is no final proof of hundred year life. On the other hand, it does appear that polyester tape has a better chance to have hundred year life than has acetate, under typical recording conditions. So if a recording does have to be stored for years on tape, it probably should be on "Mylar."

Elongation

The elongation of "Mylar" at break is several times that of acetate. The material is more-elastic, but this is an important factor only if the material is heavily stressed.

Future

From all these data it would appear that magnetic tape on polyester film has a real future for tropical and military applications, probably in 1.5 mil thickness. Material of historical value should also be so stored.

In some cases it may be desirable to put 1800 feet of tape on a seven inch reel, 3600 feet on a 10½ inch reel, or 7500 feet on a fourteen inch reel. In each case 1 mil "Mylar" appears to be the answer.

The read-in, storage, and read-out mech-

Talking Books

(Continued from Page 3, Col. 3)

discarded and the whole thing done all over again. And every ruined disc meant an additional strain on a limited budget. The reader was well aware of this, and his very fear of making a "fluff" invariably brought one on. Once, while recording an early series of discs for the Bible, in the hot, stuffy little 4 by 4 foot studio, the reader—a good man of the cloth—had fluffed seven times in succession. He was about halfway through the eighth try when it happened again. Whereupon the distraught Reverend slammed the book shut and exclaimed in unsanctimonious disgust, "Oh rats in the garret!"

This is an extreme case, of course, but it well illustrates the serious problems that were completely eliminated with the advent of tape recording. Now, with all original recordings being recorded on tape, a fluff is no problem at all. Scissors and splicing tape will fix it in a jiffy. Knowing this, the reader is much more at ease, and the fluffs are practically non-existent.

Today, under the guidance and supervision of John W. Breuel, Assistant Director in Charge of Technical Research, The American Foundation's Talking Book department is a model of efficiency, economy and productivity. During the past year, playing time on each side of the discs was increased by one third, with no rise in cost. And the Talking Book studios were completely remodeled and acoustically treated to provide just the right degree of "liveness" for recording. And this research is continually going on to make Talking Book records and other special recording projects as nearly perfect as modern technology will permit.

Talking Books, and special talking book reproducers, are currently available on loan, without charge or obligation, to visually handicapped people anywhere in the United States. They are available through 28 regional distributing libraries throughout the country, and are mailed, free of charge, to qualified individuals anywhere in their respective district.

Further details on this priceless service to the blind can be obtained by writing to Gregor Ziemer, Director of Public Education, American Foundation for the Blind, Inc., 15 West 16th St., New York 11, N. Y.

anisms for a digital computer handle tape at high speed, often with frequent starts and stops. Here, 1.5 or 2 mil "Mylar" appears of interest.

Reference

1. C. J. LeBel, Some Comments on a New Base Material. Audio Record, vol. 9 no. 2, p. 7, Feb.-March 1953.

WHAT'S **NEW** IN TAPE RECORDING

- *immune to temperature*
- *impervious to moisture*
- *practically unbreakable*

audiotape

on **Mylar*** polyester film



The new EP Audiotape provides the *extra precision* that is so important to *dependable* magnetic data recording and reproduction. It is especially produced to meet the most exacting requirements for uniformity and freedom from microscopic imperfections. Available in 1/4" to 2" widths, 1,225 to 5,000 feet. Write for Bulletin No. 207.

Here's a professional magnetic sound recording tape that offers a new high in *permanence* and durability. It can be used and stored under the most extreme conditions of temperature and humidity without any ill effects. For all practical purposes, it is virtually *unbreakable*. Now available on 1, 1 1/2 and 2 mil Mylar*, in standard sizes from 600 to 2,500 ft. Write for Bulletin No. 201.

type **EP***
audiotape



* **EXTRA PRECISION** magnetic recording tape for telemetering, electronic computers and other specialized applications



manufactured by
AUDIO DEVICES, Inc.
444 Madison Ave., New York 17, N. Y.



Audiotape, now available on green, blue or brown plastic base — and Audiotape reels in red, yellow, green, blue and clear plastic — provide *instant identification* that can simplify your cueing, filing, recording and playback problems. Write for Bulletin No. 209.

AUDIO DEVICES, Inc.

444 Madison Ave., New York, 22, N. Y.

Export Dept., 13 East 40th St., New York 16, N. Y., Cables "ARLAB"

