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# audio record

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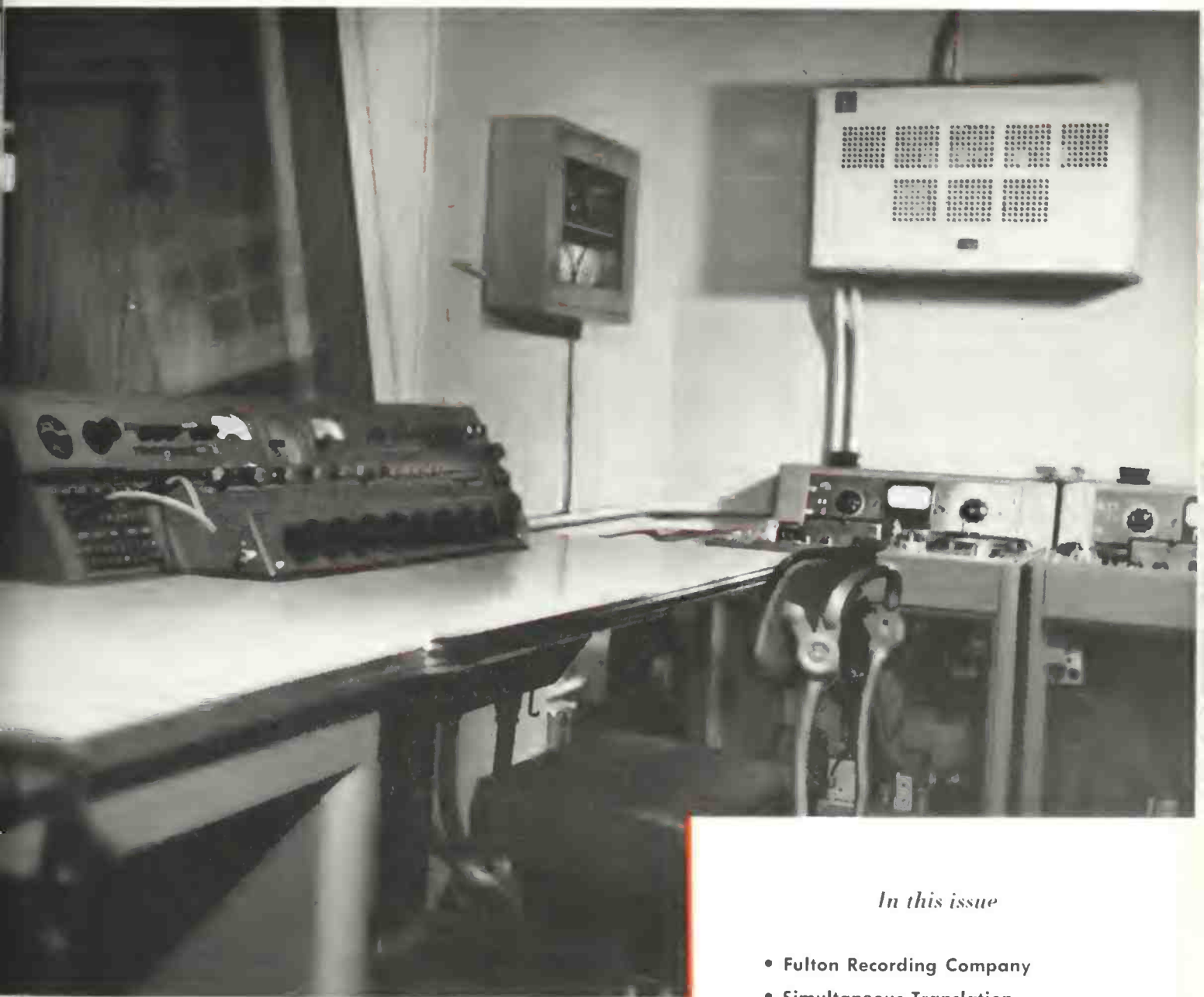

Control room for main sound studio at the new Fulton Recording Company, 80 West 40th Street, New York, N. Y., showing Western Electric, six-mike mixing console and two of the seven Ampex console-type magnetic tape recorders. Story on pages 2 and 3.

*In this issue*

# "CLEAN SOUND" KEYNOTES NEW YORK'S NEWEST RECORDING STUDIOS

## Fulton Recording Company Opens Ultra-Modern Sound Studios In Mid-Manhattan

Unlike many present-day recording studios, which started from small beginnings and "just grew" like Topsy, the Fulton Recording Company started life as an already full grown organization, with completely modern facilities and equipment conceived and engineered as a unit, to provide the finest in sound recording service. Occupying the third and tenth floors at 80 West 40th Street, New York City, this new organization offers an interesting example of carefully planned studio layout, modern acoustical treatment, and the last word in precision sound recording methods and equipment.

The Fulton Recording Company is completely equipped for disc, tape and film recording — with two separate recording studios and control rooms, instantaneous and master disc cutting rooms, large tape and disc storage facilities, and private tape editing rooms on a separate floor.

The entire suite of offices, studios, control rooms and work rooms is air conditioned to precise specifications of temperature, humidity, and freedom from airborne dust particles. The constant temperature and humidity keep all studio musical instruments in perfect tune regardless of ambient temperature changes and assure exact duplication of acoustical effects for a given recording setup, regardless of the time interval between recording sessions. Freedom from dust particles is, of course, a tremendous asset in cutting microgroove discs and preparing masters for processing.

The main recording studio is of particular interest, as its unusually great height permits a very large floor area yet maintains an overall length-width-height ratio which is remarkably close to the theoretically ideal acoustical proportions of 5—3—2. This studio is 50 feet long, 35 feet wide and 24 feet high—enclosed on all sides by double walls with air space between. In acoustical treatment, this large studio has been designed to offer a practically limitless combination of sound reflection and absorption effects. The walls themselves are absolutely plain, with no fixed acoustical paneling. And both walls and ceiling are so constructed that the studio is completely free from parallel surfaces. A series of full length curtains 24 feet high are suspended from ceiling tracks all around the room, in such a manner that any or all portions of the wall area can be covered or uncovered as desired simply by opening or closing the proper curtains. In addition, the studio is provided with a number of movable acoustical panels, one side designed for reflection and the other for absorption of sound. This gives still further flexibility in obtaining special acoustical effects for small orchestral groups and solo numbers.

A portion of the main sound studio at Fulton Recording Company, showing the 24-foot high curtains on ceiling tracks which permit variation of acoustical treatment. Studio measures 50 by 35 by 24 feet, closely approaching the theoretically ideal acoustical proportions of 5—3—2.

The main studio's musical equipment includes a Steinway grand piano, Hammond organ, Celeste, Vibraphone, Chimes—plus an extensive collection of live sound effect gadgets. The latter, of course, are supplemented by a sound effects library of several hundred discs, covering just about every

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Western Electric, 6-mike mixing console in control room for main sound studio at Fulton Recording Company. Auxiliary panel at right-hand end of console contains special push-button controls for operation of the Ampex tape recorders.

conceivable natural and man-made sound—from the chirping of a cricket to the roar of a bomber in flight. In order to take full advantage of the perfect sound control which this studio provides, only the finest and most costly microphone equipment is used, including the recently developed Telefunken condenser microphone. (This device is described in the October 1951 issue of Audio Engineering.)

The control room for this studio is located high in the east wall, with a large inclined glass window giving an unobstructed view of the entire studio floor. It contains a Western Electric six-microphone input mixing console, three Ampex console-type magnetic tape recorders (there are a total of *seven* of these machines throughout the various recording rooms), a large RCA monitor speaker and complete timing and intercommunication facilities. The operation of the tape recorders is completely controlled by push buttons located at the right side of the control console. The engineer in charge therefore has the entire recording operation right at his own fingertips, without the need for flashing a signal to another operator handling the tape machines.

The second recording studio is smaller in size, designed primarily for voice recording of small groups. Here, too, a wide variety of acoustical treatment is permitted by the use of plain walls and movable acoustical panels of the type previously described for the large studio. This small studio has its own separate control room, equipped with a four-microphone RCA mixing console and Ampex tape recorders push-button controlled from the console. For outside tape recording work, portable Magnecord machines are used.

Equipment for the cutting of instantaneous and master discs includes two Fairchild variable-pitch, hot-stylus disc recorders and three Presto machines. Master discs are cut in a separate room, provided with independent amplifiers and equalizers. Engineers familiar with the intricacies and precision requirements of cutting microgroove discs will appreciate the importance of being able to do this exacting work in private and without interruption or distraction.

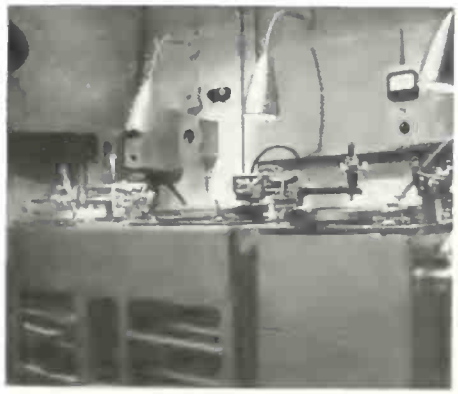
The provision of separate tape editing rooms is another feature planned for the convenience of Fulton clients. For example, after making a dozen or so "takes," the client and an engineer can immediately retire to one of the editing rooms and play back all of the recordings in undisturbed privacy—giving their undivided attention to the job at hand.

Sound recording for motion picture and TV films is done on standard 1/4-inch magnetic tape, with a separate synchronizing signal added directly on the tape while recording. This is accomplished by means of a Rangertone synchronous signal machine which forms a part of the specially designed film recording equipment. Here's how this system works. Assume, for example, that a client comes in with a 16mm print of a film to which he wishes to add a sound track. While the film is being projected, the sound is simultaneously recorded on 1/4-inch tape together with the synchronizing signal. After recording, film and sound can be played back immediately—the synchronizing signal keeping the picture and sound in exactly the same relationship to each other as during the recording. This playback gives a fool-proof check on the correctness of both the sound and the synchronization, after which the film and reel of tape are sent to the photographic processing plant where the sound is transferred to the film track.

Mr. R. J. Oulmann, General Manager of the Fulton Recording Company, states that although this new organization is geared to do large volume recording work, the major emphasis is on quality rather than quantity. With this objective in mind, all recording equipment is completely checked *every day* . . . to make sure that there is not the slightest deviation in recording characteristics and fidelity of sound reproduction. Every tape and every disc produced is checked from beginning to end, and must measure up to quality standards even higher than those actually required by Fulton clients. Hence the slogan "Clean Sound" which is used in this Company's promotion to characterize the quality of their service.

One particularly exacting assignment which is currently in production for the Haydn Society is the recording of 81 sides of an 83 side collection of the complete quartets of Haydn performed by the Alexander Schneider String Quartet. The other two sides were recorded in Europe. This is typical of the character of work which the Company is equipped to handle.

Mr. Oulmann brings to the Fulton Recording Company an extensive background of experience in the sound recording and motion picture field both here and abroad. He was director of motion picture production at MGM International and has been in the recording end of this business for the past 24 years. Mr. Newton Avrutis, Supervising Engineer, was formerly with MGM International in charge of recording foreign sound tracks on feature films and shorts. Mr. Richard E. Mack, Chief Sound Engineer, was previously with Audio and Video Recording Corporation and the Carnegie Hall Recording Company.



Three of the five disc lathes in Fulton Recording Company's disc recording room. Equipment includes two Fairchild variable-pitch recorders with hot-stylus cutting heads.

# LANGUAGE BARRIERS BROKEN

## by IBM Simultaneous Interpretation System

EDITOR'S NOTE: The new United Nations Building in New York is probably as close to being a modern "Tower of Babel" as it is possible to get. For here delegates from all over the world speak freely—each in his native tongue. Yet each can be heard—and *understood*—by all others present. Because of the importance and technical ingenuity of the multi-lingual communication equipment used here and at other international gatherings, we are sure that the following description will be of timely interest to our readers. This same IBM system is also used in the teaching of foreign languages and other applications involving the simultaneous transmission of recorded material to a diversified audience on a selective basis.

With the advent of large international meetings in connection with world trade and international commerce following the first World War, the frustration of the language barrier brought into being the use of simultaneous interpretation.

About 20 years ago, Mr. E. A. Filene conceived the idea of expanding the whispering interpreter technique, then being used by some delegations, to a system whereby a complete service could be rendered to the conference as a whole. In the whispering technique a delegate who does not understand the language being spoken could have an interpreter sitting at his elbow give him a running whispered translation of the proceedings. While this was an improvement over the consecutive interpretation system whereby each speech was repeated into each of the different languages causing much delay and confusion in the meetings, it was still rather crude and annoying to the surrounding delegates.

The basic idea of the simultaneous interpretation was to provide booths semi-soundproofed from the main convention hall in which interpreters could listen to the speaker's words conveyed to them from the speaker's microphone through a wired system to sets of headphones. While listening to the speaker's words on the headphones, they would give a simultaneous running translation into their own microphones. The microphone of each different language interpreter would have its associated amplifiers and wired distribution cables to every seat in the room. Each seat would be equipped with a pair of headphones and a selector switch allowing every delegate to listen to the language of his choice.

From the crude beginning of this telephone type of system, another international figure, Mr. Thomas J. Watson of the International Business Machines Corporation and associated with Mr. Filene in the International Chamber of Commerce, picked up the idea and with the facilities of the international organization of the IBM, proceeded to improve the system and build a workable set of equipment which could be used at the meetings of the International Chamber of Commerce, the International Labor Organization, Rotary International, and the League of Nations.

Simultaneous interpretation equipment has been used for the last 20 years at these large international meetings and finally came into its own with the needs brought up at the War Crimes Trials at Nuernberg. Here a vital need for continuous and immediate understanding of everything going on at the trials caused the United States Government to promote the idea of installation of the IBM equipment in all of the court rooms at Nuernberg and likewise at Tokyo. IBM agreed to lend the necessary equipment to the Allied High Command and proceeded to overcome the difficulties of procurement in order to build the additional equipment required and to bring in all existing equipment for use in Germany.

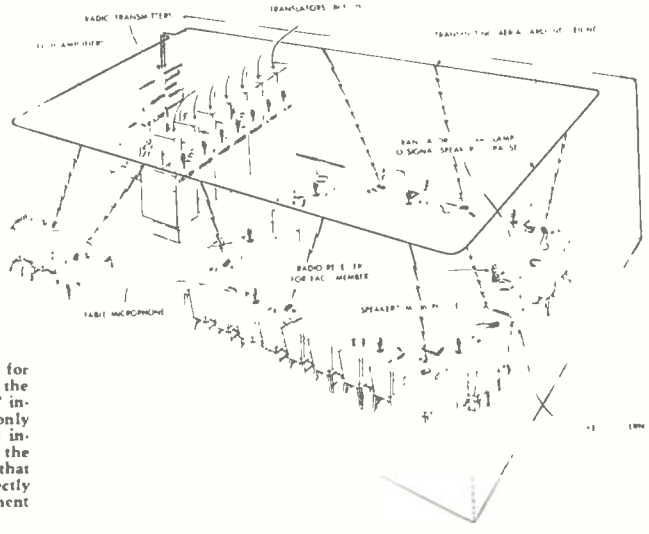
Headset and miniature radio receiver for the IBM Wireless Translating System embodying Filene Finlay Patents. The shoulder strap contains an embedded antenna and the receiver is battery operated, permitting the listener to move about freely without any fixed connection to power or other outlets.

The success of this system at Nuernberg, which was capably organized and operated under the direction of Col. L. E. Dostert, made the use of simultaneous interpretation a "must" at the United Nations. At the conclusion of the trials in Nuernberg, Col. Dostert became associated with the UN at Lake Success and again became the guiding hand in the formative days directing the work connected with the installation of IBM Simultaneous Interpretation Equipment in the conference rooms and council halls.

One of the most difficult tasks in connection with the use of simultaneous interpretation such as that experienced by the UN, was the building up of a corps of interpreters capable of simultaneous interpretation and of top caliber necessary for the deliberations of the world's top tribunal.

A serious drawback to the use of the simultaneous interpretation up until this time was the time and labor involved in wiring the language channels to each seat. This not only required many hours of labor and a rather high expense in the installation, but it definitely "fixed" the seating arrangement of the room because of the attachment of the cables to the chairs.

Mr. Watson had, for a long time, proposed the building of a complete wireless system but due to restrictions caused by the war and the press of other more im-



Schematic diagram of typical setup for IBM wireless translating system, of the type used for so-called "temporary" installations which are to be used for only a few weeks or months. Permanent installations such as that used at the United Nations are similar except that the listeners headsets are wired directly to the speech amplifier equipment without the radio link.

portant development projects the wireless system had not been completed at the time of the Nuernberg trials. The development project was given top priority in 1946 and the system completed for the first use on a large scale at the International Radio Conference in Atlantic City in 1947.

The IBM Wireless Translating System consists of miniature battery-operated receivers for each delegate. This receiver has a neck strap for support which also acts as an antenna. The three small hearing-aid type of tubes furnish the necessary pick up and amplification to operate a pair of headphones attached to the receiver. Each receiver is provided with seven separate channels which can be selected by the delegate simply by turning a selector dial on the top of the receiver. The simultaneous interpretations are "broadcast" to the conference area by small radio transmitters connected to the interpreters' microphones. Each interpreter's booth or language has its own broadcast frequency.

In a conference where several delegations are meeting in a round table discussion, microphones are provided for each delegation and are controlled from a central point by the control operator handling the equipment for the entire conference room.

With the availability of the IBM Wireless Translating System at moderate cost to international conventions, the use has increased tremendously in the last two or three years. International conferences both large and small can now reap the benefits of universal understanding and break down the language barrier which has existed in the past by the use of this system. Equipment can be installed at a conference site in a very short time because there is no longer the requirement of cabling or wiring all of the seats.

IBM built 5000 of these miniature wireless receivers and keeps the supply about evenly distributed between Europe and the United States. Complete equipment is available for 16 international conferences running simultaneously in various parts of the world. Conferences in Europe and the Near East are serviced with equipment from the IBM organization in Zurich, Switzerland, while conferences in North and South America are serviced from the IBM main factory at Endicott, New York.

In order that the record may be straight and the necessary documents available at international meetings, the practice of recording the proceedings is becoming more and more prevalent. The entire conference proceedings from the speakers or floor microphone are normally recorded on tape or on discs. In many cases recorders are also connected to the individual channels of the simultaneous interpretation system in order to afford verbatim reports of the actual proceedings as translated and as heard by the delegates. This system of recording the translated channels provides a quick check if a question is raised as to the accuracy of any particular simultaneous interpretation of a knotty question. Recording of the various language channels provides a means of producing the necessary conference documents immediately so that mimeographed resumes of the proceedings into working languages may be furnished to the delegates at once.

The United Nations General Assembly in session at Lake Success, New York, showing the IBM simultaneous interpretation system in use. This same permanently wired system is in use in the new U.N. building in Manhattan, permitting each delegate to listen to a running interpretation of every speech while it is being given.

# Patent Awarded for "Safe-Handling" Audiotape Package

This Audiotape package is now covered by U. S. Patent No. 2571133.

With the many thousands of different package designs in use today, you've got to have something that's really *original* and *distinctive* in order to obtain a clear patent on it. That's why it was very gratifying to receive word that the "Safe-Handling" Audiotape package had been found patentable and is now fully protected by U. S. Patent No. 2571133.

For the past year, this distinctive package has been used for all 2500 foot and 5000 foot reels of Audiotape, on Standard N.A.B. hub or complete aluminum reel.

The separate folding inner container, with wooden hub core and turntable loading slot, offers three important advantages:

1. It permits tape on hub to be transferred from package to turntable without danger of becoming unwound or slipping from the hub. The inner container, held as in insert above, is placed on the turntable so that the tape hub engages the hub core of the machine. The container is then simply pulled out from under the tape. In returning tape to container, this operation is just reversed.

2. It simplifies the attachment of reel flanges to the standard N.A.B. hub. After one flange has been set in place and the half-screws dropped into the holes, the inner container is folded down onto the reel, permitting it to be turned over without dropping the screws.

3. It protects tape in storage and prevents flattening of the bottom of the roll. That's because the tape is suspended from the wooden hub core fixed to the inner container and does not rest on the outside edge of the roll.

audio pointers for the Recordist

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

# HINTS ON SELECTING A TAPE RECORDER

C. J. LeBel

The past several years have seen many new tape recorders offered to broadcaster, studio, school, and home. Prices vary from under a hundred to over four thousand dollars and it is only natural for the purchaser to want to pay as little as possible. If he is wise, he will also wish to spend enough to secure the facilities and results he needs for his work. A full discussion of machine design would take a book in itself, so that we will have to content ourselves, in this section, by pointing out the factors to be considered, and by touching lightly on certain necessary characteristics.

### Dimensions of Performance

In any application the recording performance is the first thing to be considered, the most important point being, the frequency range. If this is too small for your work, there will be complaints of poor intelligibility or of lack of naturalness, or refusal to broadcast your tapes. If the range is too great, you have paid too much for your equipment. The next factor is that of signal to noise ratio, for if this is too small background noise will be offensively loud, and the adjustment of recording level will be too critical. Again, if the ratio is *much* greater than necessary then the equipment cost has been higher than it might be. Finally, the distortion should be low, since high distortion leads to a loss of clarity and naturalness, and listener fatigue is rapid.

Next we must consider economy of tape use. Low tape speed means that we need less tape for a given program, but it also means either reduced frequency range or increased noise level, for a given perfection of design. We can cut our tape requirements in half, theoretically, by using dual track recording. Practically, this is often undesirable, for it makes editing impossible, and introduces slightly higher noise level.

Convenience of operation is particularly important to the non-professional, as are size and weight. No amateur wishes to carry his machine around on a hand truck. Many semi-professionals overvalue the extreme in portability, and so sacrifice some of the quality of performance that they need. In many cases a heavy machine can be rolled around on a tea cart.

Finally, we must not overlook stability of characteristics, and durability. The broadcaster and the studio must have it, the school needs it, and the home user is irked by the lack. Some machines have been made with every component driven too hard, suitable for operation over only a short period of time, while others have been built to stand up when used sixteen hours a day.

In each field of application a different set of requirements predominates, for what is best for one is not necessarily best for the other. So each application must be studied separately.

### Radio Broadcasting

The National Association of Radio and Television Broadcasters has adopted standards for frequency response, shown below. Studio recorders should conform to the primary standard curve, but portable machines used for field interviews — speech only — will find the secondary standard satisfactory.

The signal to noise ratio should be at least 50 db, using a reference point of 2% harmonic distortion. Since this reference is a peak level, distortion should be less than 1%, harmonic, at 10 db or more below the reference level. The volume indicator setting, that is, the nominal recording level, should be at least 6 and preferably 10 db below the 2% reference point, to allow for the fact that the peak level is about 10 db above the meter-indicated level.

Remembering that a station must often run many hours a day with no time out for equipment maintenance, the recorder should be able to run for at least 16 hours continuously without significant change in gain or distortion.

The average studio recorder is too heavy to be portable, but there are several makes of semi-portable design, using two 35 to 45 pound units. These offer nearly full studio quality, and many stations use them interchangeably in studio and field.

### Disc Recording Studios

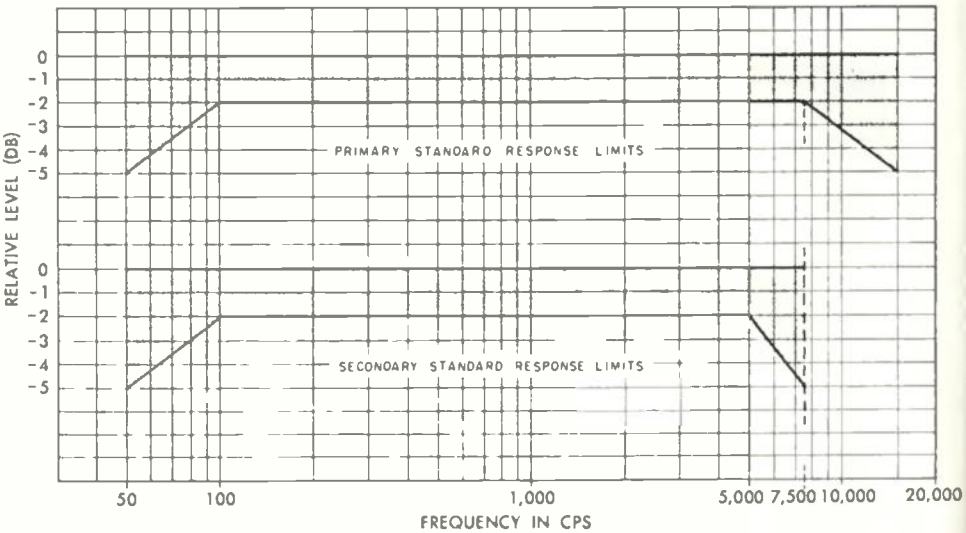
While these remarks are directed mainly to the phonograph record and transcription studio using tape for original recordings, they also are significant to the radio station which produces commercial records. The main objective is to make sure that the tape will produce minimum impairment of the quality of the disc recorded from it.

The frequency range should be at least as good as the NARTB primary standard (see chart), and might well be somewhat better — say not over 2 db change in response up to 15 kc. The signal to noise ratio must be at least 60 db to match a modern vinyl pressing, and preferably 62 or 63 db. The distortion should be as low as possible in the normal range of recording levels. Stability should certainly be adequate for 16 continuous hours of operation without significant change of gain or distortion.

There are no portable machines conforming to this specification; there are a few transportable models consisting of two sections of about 75 pounds each. For the lower grades of work a broadcast portable machine may be used, but there is a significant sacrifice in performance.

### Educational Recording

There is no single educational applica-




NARTB Recording and Reproducing Standard, showing frequency response limits for magnetic tape systems.

tion—instead there are at least three, each with its own special aspects.*

First comes material which is to be broadcast; this should certainly be prepared on equipment at least equal to broadcast standard. See the broadcast section. Next comes material where *accuracy* of reproduction is essential. In order of decreasing need for wide frequency range we have experimental phonetics, and speech correction. For the former a full 15 kc range is essential, while for the latter 7.5 to 10 kc may be satisfactory. The frequency range needed to clearly show a student a speech fault is surprisingly great.

Finally we have applications where reproduction must be pleasing and intelligible, but need not be particularly accurate. Here 6 kc is quite adequate. It should be pointed out that the school with only 6 kc equipment will be unable to do a workmanlike job of speech correction, whereas a wider range machine can be used for less stringent projects when the full range is not essential. Therefore, any school should have at least one wide range machine, even if the full range is only needed part of the time.

Listener fatigue is particularly to be avoided in educational applications, and we believe that a signal to noise ratio of at least 50 db is essential for material which is to be listened to with attention for more than five minutes at a time; for other cases 45 db may well suffice. For minimum fatigue the distortion should be under 1% in the normal level range, though it may rise to 2% on peaks.

The school has rather special stability requirements, for a machine should operate for five months (one term) a few hours a day, without need for maintenance, and major maintenance should be required no more often than once a year.

A school machine must have fast forward and fast rewind (at least 5 and preferably 10 times normal speed) so that a given section of tape may easily be picked out for use.

One educational group has voted to standardize on single track equipment to make editing possible, but this is not yet exclusive practice throughout the country.

The need for portability in educational equipment is badly overestimated. If the individual sections are not over 35 to 40 pounds in weight, the heavy combination can well be carried about on a tea cart or cafeteria cart.

Two input circuits are virtually essential, a radio tuner or line, and one (or more) microphones. As to the output, it should be possible to use a high quality external loudspeaker instead of the wretched unit so often built in. It should also be possible to feed a line—usually the school public address system.

Machines which live up to all these specifications may cost three to four times as much as the lowest cost equipment.

### Home Recording

Home use takes either of two forms: speech or music. In the former case, 6 kc frequency range is likely to be adequate; in the latter, at least 9 kc and preferably 15 kc should be available. Modern home phonograph records have good response up to at least 12 kc, and 15 kc in some cases, so that comparable response should be available.

For short time listening a signal to noise ratio of 40 db may be adequate, but for extensive use at least 50 db should be available. Remember that a modern vinyl phonograph record has at least 60 db when measured by the same method as a magnetic recorder.

The same dual standard applies to distortion. For a few minutes a sustained 5% is bearable, but for long continued listening with close attention, minimizing listener fatigue demands an upper harmonic limit of 1 or 2%.

The choice between single and dual track recording is again a question of editing versus economy.

Portability demands a weight of not over 30 to 35 pounds, though some enthusiasts have managed to handle a 65 pound professional machine. If left in a single place, weight is certainly not a serious matter. Home machines generally have all the input and output circuits required.

### Office Recording

If we are to judge by European example, the office dictation field will be a very successful application for magnetic recording, and indeed several manufacturers are already in the field. Economy possibilities are very attractive.

For clear reproduction of the sibilants and fricatives of speech, at least 4 to 5 kc range is necessary, and 6 kc may be desirable. For minimizing listener fatigue the signal to noise ratio should be at least 35 and preferably 40 db. The distortion should also be low, not over 2% during normal operation, and not over 5% on peaks.

Portability is not essential, but minimum use of desk and floor space is quite necessary.

### Machine Features

A number of features are available in the better grade of machine, and the purchaser should decide in advance which are necessary for his particular application.

First we have the question of two head versus three head machines. All machines have an erase head; a two head machine uses the second head alternately for recording and reproducing, whereas a three head design has separate record and reproduce heads. Since the requirements for optimum performance in recording and reproducing are not alike, a double duty head is at best a compromise, and slightly better performance can be achieved with separate heads. They also permit monitoring off the tape during recording—a wise safety precaution during important jobs.

Adjustable bias is desirable if the absolute utmost in quality is to be obtained. Lower cost machines have a fixed value of bias, which is somewhat non-uniform from one machine to the next off the production line. Fortunately, Audiotape has considerable bias latitude, and so long as the bias is more than a minimum safe value, good results will be obtained.

In professional machines recording at 15 inches per second, excessively fast rewind and forward shuttle speeds should be avoided. At very high speed momentary heavy stresses are induced in the tape, deforming it and leading to trouble during subsequent handling.

To minimize head wear it is desirable to have means for lifting the tape off the heads during rewind and fast forward operation.

Since demagnetizing the recording head is a regular operation, convenient provision for it should be made.

A year or two ago, the relation between frequency range and tape speed seemed to be one kc range per inch per second speed. Today, professional machines may offer 1.4 kc per inch per second, and some home machines (where signal to noise ratio is not so much of a problem) offer 2 kc per inch per second

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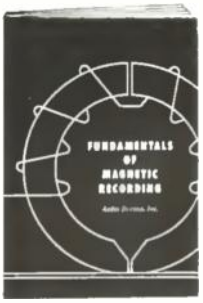


The foregoing is an excerpt from one of the chapters in Mr. Le Bel's new handbook on the Fundamentals of Magnetic Recording.

This 50-page pocket-size volume includes a wealth of valuable information on all phases of magnetic recording—including background, recording methods, magnetic relationships, tape characteristics, AC and DC bias, erasure, frequency response, noise level, distortion, machine features and helpful hints on operation and maintenance.

Copies may be obtained by writing to Audio Devices, Inc., Dept. R3, 444 Madison Avenue, New York 22, N. Y.

*See Standards for Educational Recording Machines, by C. J. LeBel, Quarterly Journal of Speech, Vol. 36, No. 4, pp. 520-523, Dec. 1950. Reprints available from Audio Devices, Inc.


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This completely new and up-to-the-minute technical manual contains 50 pages of valuable information on basic magnetic principles and tape performance. Professional recordists will find it extremely interesting and helpful — an important addition to their reference files. A request on your business letterhead will bring you a free copy by return mail.

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