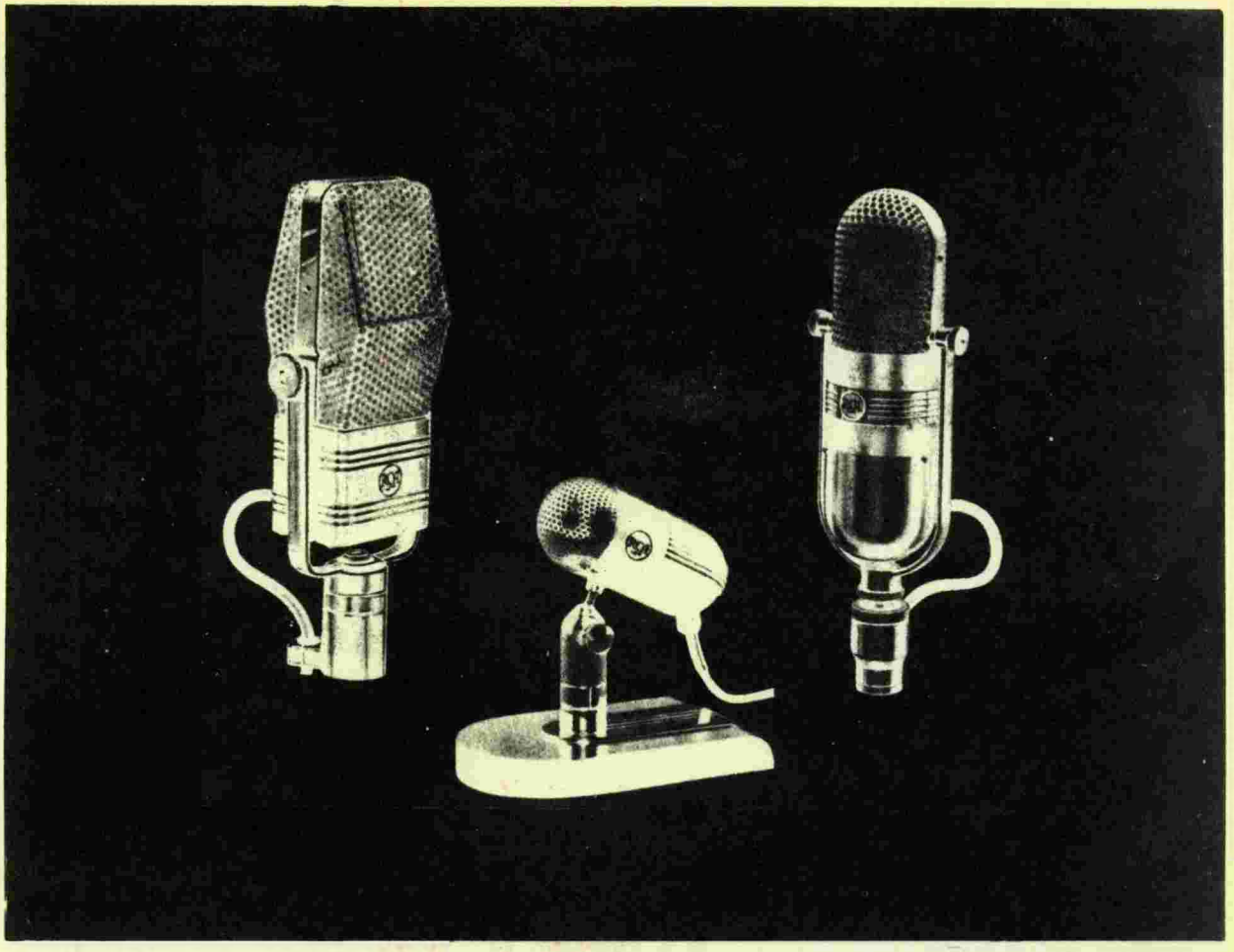

LESSON
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BROADCAST CONTROL ROOM EQUIPMENT AND STUDIO ACOUSTICS

RADIO-TELEVISION TRAINING SCHOOL, INC. • LOS ANGELES • ESTABLISHED 1922

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BROADCAST CONTROL ROOM EQUIPMENT and STUDIO ACOUSTICS

The operation of a broadcast station must be in accordance with a fixed schedule, and for that reason, reliable equipment and personnel are required for the proper control and maintenance of the equipment. The loss of but a few seconds from a 15-minute program may cause complete loss of the contract for entire program transmitted. The class and type of the equipment used in a broadcast station is therefore of the most reliable obtainable and of course its cost is propoftionately higher than that used by the operators of most public address systems.

BROADCAST CONTROL ROOM EQUIPMENT

The equipment used in the broadcast of a radio program may be divided into the respective locations where it is employed. For example: There will be found in the various studios of broadcast stations, microphones of various types - those which function more satisfactorily for a distant pickup and those which are better suited for the purpose of making announcements. Microphones are held in their respective operating positions on special stands that are commonly referred to as floor and desk types. The floor type of microphone stand is usually adjustable so that the height at which the microphone is held may be in accordance with the type of pickup made.

The programs that originate within the studios of broadcast stations are usually fed directly to a console which is equipped with a separate volume control or mixer for each microphone or channel. Then one volume indicator will indicate to the operator the level of the signal. This signal level is usually about 1 milliwatt. The circuit impedance is usually between 500 and 600 ohms, thereby making it possible to transmit the entire range of audio ffequencies from 20 cycles to 15,000 cycles with very little frequency discrimination. That is, this low impedance valve is not affected by the high distributed capacity between the wires of the cable and ground.

A typical console for the mixing of programs originating in a local studio for network transmission is shown in Fig. 1. The upper view shows the console from the operating position, while the lower left-hand view indicates the equipment which can be seen from one side of the console. In this console there are two line amplifiers

and a terminal box for telephone line connections. The lower right-hand view shows the controls of the equipment when viewed from the operating position, but with the control panel and the doors below the top of the desk open. The panel at the right of the operator consists of phone jacks into which patch cords, fitted with plugs at both ends, may be inserted for the purpose of the transmission of the desired program from the various studios or pickups outside of the local studio to the broadcast station control room at the transmitter.

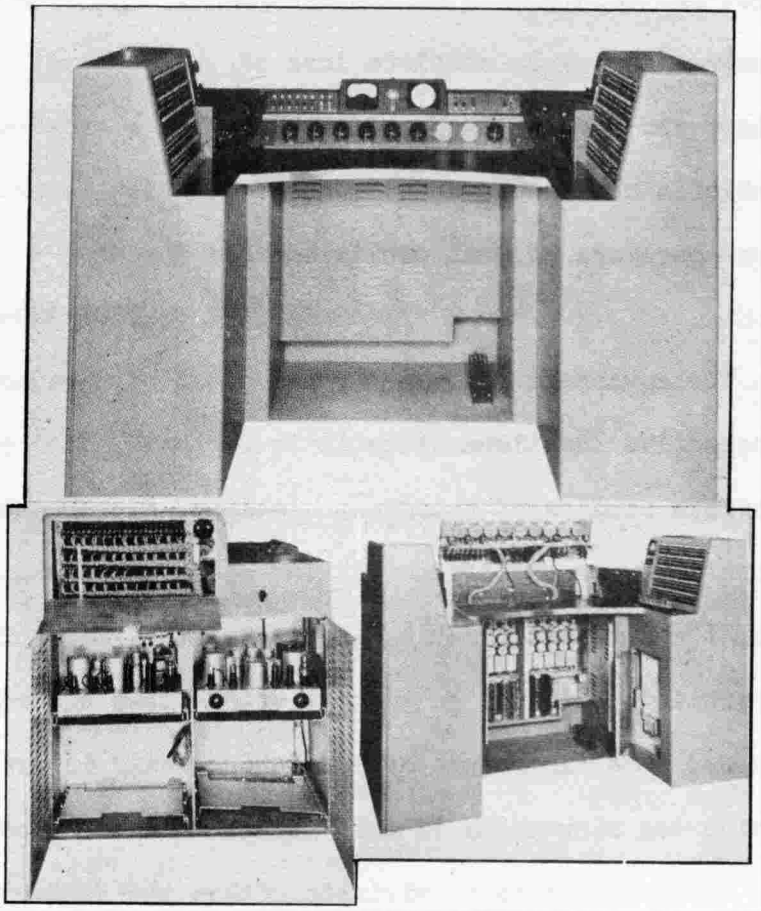


FIG. 1. Here is shown the RCA type 2-A Control Desk built especially for the Columbia Broadcasting System.

In Fig. 2 is shown the complete speech input system which has been designed in accordance with the individual requirements of a broadcast station by RCA engineers. They have found that no two broadcast studio layouts are alike, and never, except in the smaller stations, are the equipment requirements exactly the same. Furthermore, the larger the installation, the more specialized the equipment problem becomes.

The master control desk or console is used for the purpose of monitoring several programs at the same time in the event the local station is to feed a program to the network while the local station is carrying either a program from a studio or a remote location within the city. This is the reason why the master control desk shown in Fig. 2 has five sets of volume indicators and control panels above the desk top. A series of jacks may be seen in the second panel from the left. The control room monitor loud speaker may be seen setting on the floor to the left of the large metal

racks carrying the associated amplifier equipment which is used in connection with the various microphones and loud speakers.

Many of the independent broadcast stations are equipped with small compact consoles for the purpose of controlling the volume level and mixing of the various sources of sound. A typical compact console is shown in Fig. 3. Program sources may be from any one of the following points or units:

1. Phonograph recordings.
2. Transcriptions.
3. Local microphone.
4. Announce microphone.
5. Studio A.
6. Studio B.
7. Remote pickup 1.
8. Remote pickup 2.

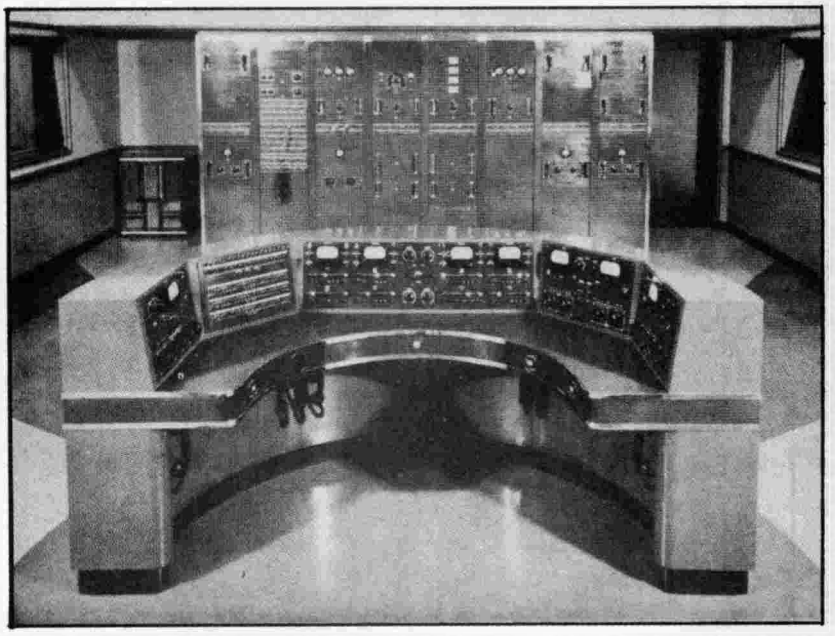


FIG. 2. This speech input master control desk, racks, and monitoring loud speaker are installed within the studios of Station WFBR in Baltimore, Maryland. This equipment was custom built by RCA engineers to the individual requirements of the station.

The RCA Speech Input Consolette, type 76-B2, provides a complete, flexible and high quality speech input system for f-m, as well as standard broadcasting. This unit provides all the amplifying control and monitoring equipment required to handle successfully two studios, the announce booth microphone, a control-room announce microphone, two transcription turntables and six remote lines. Full facilities are provided for simultaneously auditioning and broadcasting from any combination of the studio turntables or remote lines.

The amplifier and control equipment is mounted in a single metal console and the power supplies are located in a metal box designed for wall mounting.

The standardized, illuminated volume indicator meter is furnished calibrated in "VU's". This meter is also used to measure the plate current of all of the tubes in the program channel. The meter is switched to the various tubes by means of the rotary switch which is mounted to the left of the meter.

The console contains four preamplifiers, one high-gain program amplifier and one high gain 8 watt monitoring amplifier. A six position mixer is utilized with the

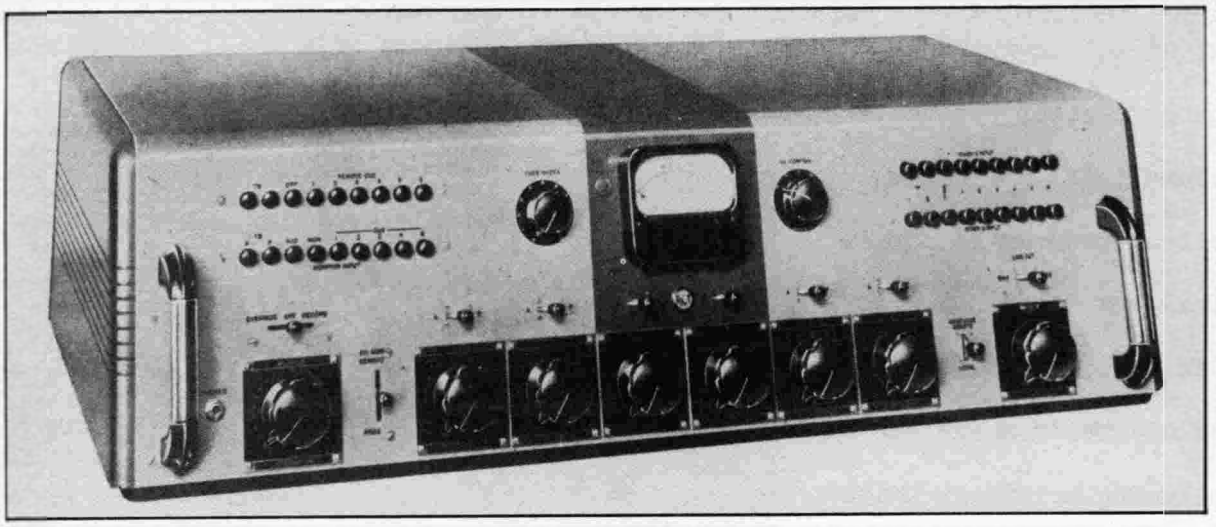


FIG. 3. Here is shown the RCA Speech Input Consollete, type 76-B2.

preamplifier connected to four of the mixers and banks of mechanically interlocked push-keys connected to the remaining two. The output of each mixer connects to lever keys so it may be switched to the input of the program amplifier for broadcasting or to the monitor amplifier for auditioning. These key switches are interlocked to disconnect the studio loud speakers and operate "on air" light relays. A three-position key switch in the input of the fourth preamplifier permits it to operate from a microphone in the studio, announce booth, or local control room. The push-keys on the fifth and sixth mixer positions allow any one of 6 remote lines and turntables to be instantly connected to the input of either of the two mixers. Additional push-key sets provide circuits for feeding cues (program starting signals) to remote lines and for bringing in monitor circuits such as transmitter or meter control outputs. A monitoring headset jack is supplied and the headphones may be connected to the output of the program channel, the remote line push-keys, or the incoming network by means of a three-position lever switch. Lever-keys permit using monitoring amplifier for program amplifier in emergencies. Talk-back facilities are included and push-keys permit talking back to either of the two studios or to the remote lines. The talk-back circuits are introduced to prevent feed-back or program interruption.

An "Over-ride-Record" switch is provided which permits the remote operator to call in on any of the six remote lines and over-ride the program to which the operator in the control room may be listening on his speaker. The "record" position of the switch furnishes a signal source for an external recording amplifier. Two remote line repeating coils (line matching transformers) and attenuator pads (volume controls) are provided.

The beautiful console is constructed of metal with wooden style plates on each end. A lid is provided for access to tubes, parts, etc. from the top and is equipped with sturdy concealed hinges. The handles on the front panel facilitate opening the chassis for inspection. When the chassis is open, all mixers (volume controls) are made accessible for servicing.

The metal power supply box is equipped with a hinged front door and a hinged chassis to enable quick repair. Two separate rectifier and filter units are provided for the program amplifiers, as well as the monitoring amplifiers, the three speaker interlocking relays and up to four external 12 volt relays for studio signal lights. A switch permits feeding the pre-amplifiers from the monitor power supply in case of emergencies.

Briefly, the special input consolette accomplishes a large number of requirements, which are found within a broadcast station studio, and truly is a remarkable development made by the engineers of the Radio Corporation of America whose headquarters are located in Camden, New Jersey, U.S.A. Each one of the facilities provided are of utmost importance in the smooth operation of a station. Easy access to the equipment in the case of circuit failure is of utmost importance for the loss of any broadcast time is extremely expensive to the station.

EFFECTIVE SIGNAL STRENGTH - LIMITING AMPLIFIERS

The coverage of a broadcast station, that is, the useful service area is dependent upon the percentage of modulation which is maintained through the entire program. This can be readily appreciated when you stop to realize that a signal which has lost its fidelity of reproduction due to strong local radio interference is of little interest to the average listener. The noises which are heard in loudspeakers of radio sets

interferes with the program and for that reason it is of utmost importance to maintain the highest percentage of modulation of the carrier of a broadcast transmitter at all times. This is accomplished by many of the standard broadcast stations by employing limiting amplifiers. A photograph is shown of such an amplifier in Fig. 4.

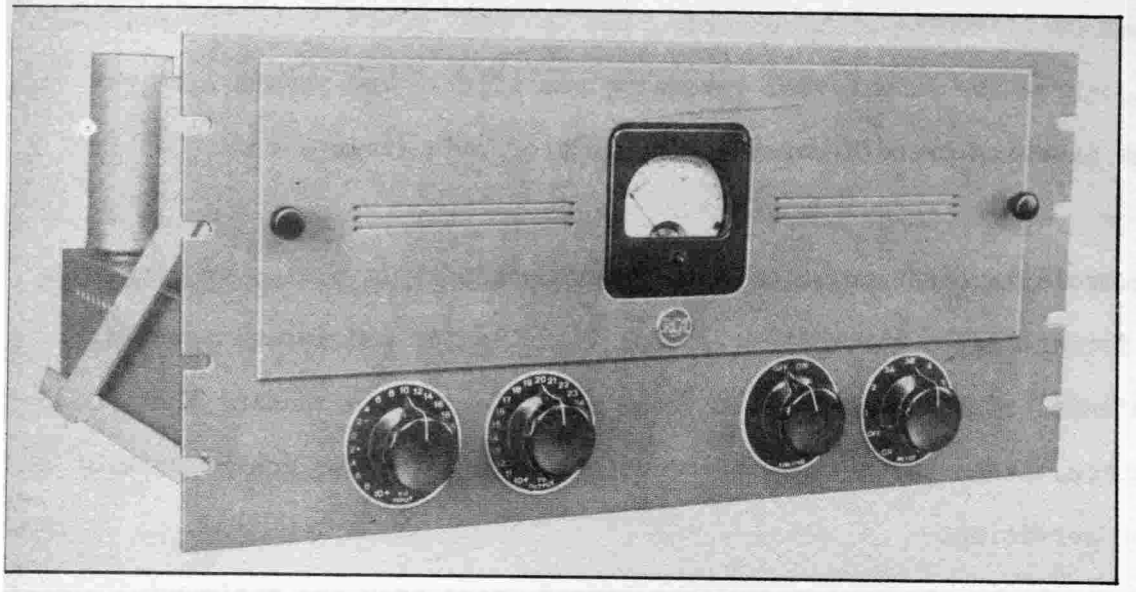


FIG. 4. The Limiting Amplifier known as the RCA type 86-A1 designed for rack mounting.

The RCA type 86-A1 limiting amplifier has been designed for use in the speech input channels of f-m and a-m broadcast transmitters. It serves to limit the audio signal peaks to a certain predetermined level, thereby preventing overmodulation with its consequent distortion and adjacent channel interference. That is, adjacent channel interference is kept at a minimum by preventing modulation in excess of 100%. This amplifier provides for a more effective use of the broadcast transmitter power by raising the average percentage modulation level without appreciably increasing the harmonic distortion. This limiting amplifier may also be used for recording applications where it prevents over-cutting of the recording disc on heavy passages of music or speaking, and thus permits a marked improvement in the signal-to-noise ratio at the

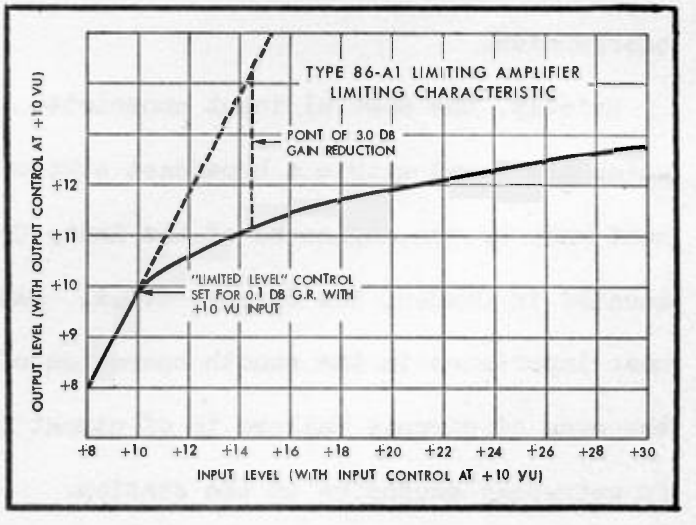


FIG. 5. The limiting characteristics of the RCA type 86-A1 Limiting Amplifier are shown. The input level is indicated from plus 8 to 30 db with the input level control set at plus 10 vu.

receiving sets in the outer service areas of a station when the recording is transmitted.

In Fig. 5 is shown how the limiting amplifier reduces the output above a predetermined signal level. It will be noted that there is but a 1.2 db gain increase for a 4 db rise in signal level above the plus 10 vu input level.

Limiting amplifiers employ variable mu tubes whose grid bias is automatically increased as the signal level rises, thus reducing the overall gain in the amplifier feeding the line to the amplifier at the transmitter.

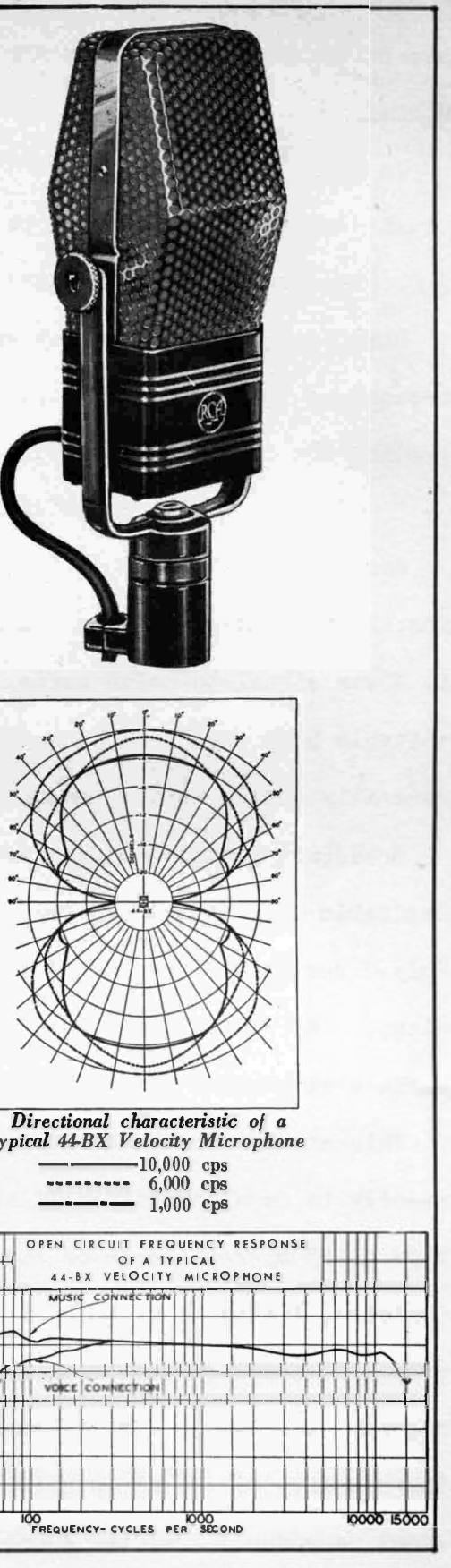
BROADCAST STATION AMPLIFIERS - MICROPHONES

Broadcast station amplifiers are employed for the purpose of raising and controlling the various signals in order to maintain the good frequency response and relatively lower signal-to-noise ratio. This is accomplished by employing amplifiers with suitable high quality volume controls. The output of a high fidelity microphone is generally so low that a preamplifier is required.

Broadcast stations employ several different types of microphones because they have desirable directional and frequency response characteristics. The RCA velocity and Poly-directional Types 44-BX and 77-D microphones respectively are used by many stations. The RCA velocity Type 44-BX microphone is primarily intended for studio use where a microphone of the highest quality of reproduction is desired.

This microphone can be used with practically any audio system and lends itself readily to usual or difficult studio problems. The bi-directional pattern of the Type 44-BX microphone is of the familiar "figure eight". Unlike other types of microphones, it has no diaphragm. Instead, this microphone employs a thin metallic ribbon so suspended as to be able to vibrate freely between the poles of a permanent magnet. Because of its lightness, the motion of this ribbon corresponds exactly to the velocity of the air particles and the voltage generated in it is, therefore, an exact reproduction of the sound waves which traverse it. Moreover, since it is open in construction so that air flows freely through it, the effects of diaphragm resonance and pressure doubling is not obtained when using this microphone. The effective output level of this microphone is minus 55 db.

FIG. 6. The RCA type 44-BX Velocity microphone is shown at the right, as well as its directional and frequency response characteristics.



Control room operators within many broadcast stations have developed very critical ears which enable them to distinguish the difference between the fidelity received from various microphones within their respective studios. They have found from experience that a poly-directional microphone, such as the RCA Type 77-D, has desirable characteristics which enable its satisfactory use under certain studio pickup circumstances. With this one microphone, a variety of non-directional, uni-directional and bi-directional characteristic patterns may be obtained by operating a screw drive adjustment which is conveniently located on the back of the microphone.

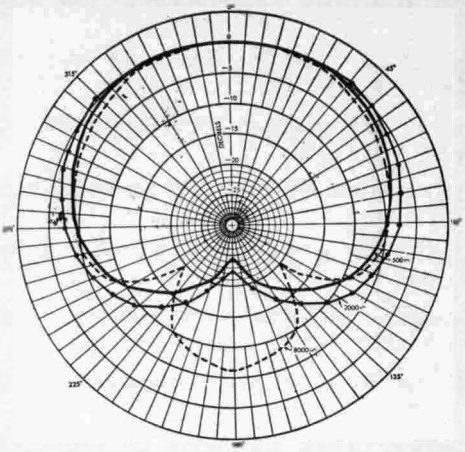
The poly-directional characteristics of this microphone aids materially in obtaining a better balance, a clarity of naturalness and selectivity in studio pickups. It is also of considerable value where difficulties are encountered in the reverbient locations since the undesired sound reflections may be reduced by a choice of the proper directional pattern. In Fig. 8 are shown the three different

FIG. 7. This is a close up view of the RCA Polyderictional Microphone Type 77-D.

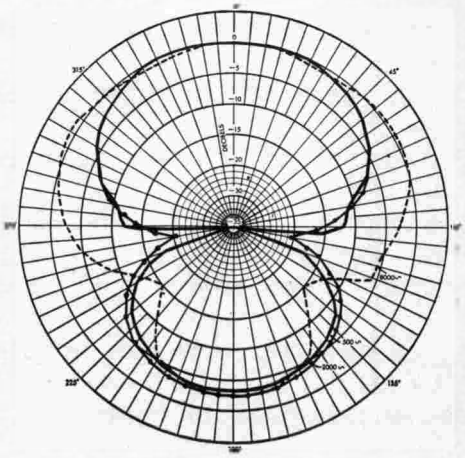
directional response patterns obtained from the RCA Type 77-D Poly-directional Microphone are shown above.

The construction of the RCA type 77-D poly-directional microphone is rather unique in that it consists of a single ribbon placed in the air gap between the pole pieces of a permanent magnet, a variable acoustic network, a well-shielded matching transformer with low hum pickup, and a perforated metal case housing. Effective shock-mounting is used between the

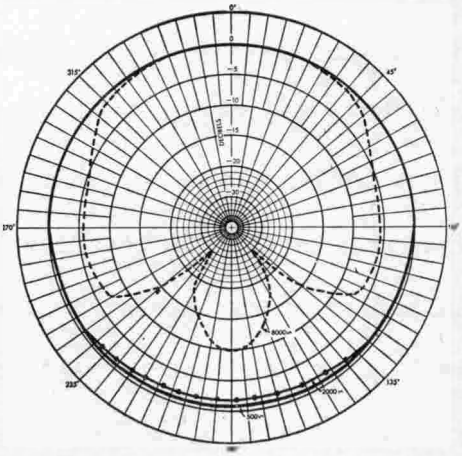
Directional Response Patterns



Uni-Directional Position



Bi-Directional Position



Non-Directional Position

FIG. 8. The directional response patterns for the RCA type 77-D Poly-Directional Microphone are shown above.

microphone and the floor stand to reduce building rumble. One side of the microphone ribbon is completely closed by a connector (air) tube which, in turn, is coupled to a damped pipe or labyrinth. An aperture, placed in the connector (air) tube directly behind the ribbon, is made variable in size by a "damper" or a valve control. The directional characteristics of the microphone are controlled by varying the area of the aperture in the labyrinth connector. When the aperture is so large that the back of the ribbon is effectively open to the atmosphere, as with a velocity microphone, the acoustic impedance is zero and a bi-directional characteristic pattern is obtained. When the aperture is completely closed, the acoustic impedance is infinite and the characteristic pattern is non-directional which is typical of a pressure operated microphone. By varying the area of the aperture, a variety of characteristic patterns between bi-directional and non-directional may be obtained.

On the back of the upper shell of this microphone, the wind screen, is a slotted shaft control adjustment which is brought out flush with the designation plate mounted on the screen. The plate is marked "U", "N", and "B", as designations for the unidirectional, non-directional, and bi-directional response curves. These three markings are used as reference points for other patterns which may be obtained with this continuously variable control.

The lower half of the microphone case contains the acoustical labyrinth, the output transformer and a selector switch for voice or music. This switch will attenuate the low frequencies - below 300 cycles for voice pickup and has three positions designated as "M", "V1" and "V2". This switch is operated by a screw driver and is accessible from the bottom of the cylindrical shell.

Inasmuch as the RCA broadcast microphones are designed to feed into a microphone preamplifier whose input transformer is unloaded, that is, whose secondary does not connect to or feed into a resistor but rather directly into the grid-cathode circuit of a tube, working as a Class A amplifier, this precaution must be observed for good frequency response. The input stage of the preamplifier may employ a circuit similar to the one shown in Fig. 9. Notice that the primary winding of the high fidelity transformer has a center tap for balanced pickup which is necessary for the reduction

of noise and hum pickup due to induction. Any noise voltage which is induced in one lead will be transmitted to the other through the primary winding of the input transformer because its center tap is connected to ground. The taps 3 and 2 on the primary winding allow for matching at lower input impedance valves. The usual input impedance valves are 200 and 600 ohms, while the lower valves may be 30 to 50 ohms. In every case an impedance stepup transformer is mounted with the microphone for efficient transfer of the audio frequency currents developed and furthermore, for the maintenance of the frequency response specified by the manufacture for the microphone. The RCA type 1620 tube is generally used as the input tube because of its low internal noise. This tube is carefully assembled, that is, loose elements are kept at a very minimum. Then, too, the entire tube and socket is shock-mounted from its chassis.

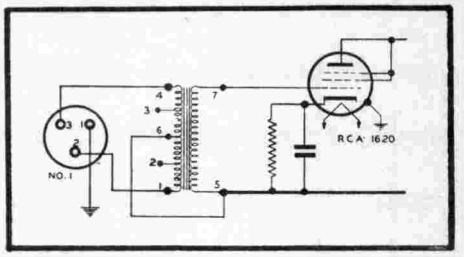


FIG. 9. This is the input circuit of the RCA type OP-7 Portable Preamplifier showing the unloaded transformer input.

The effective output level of a microphone is expressed in the terms of "db" (decibels) power level as no appreciable power is consumed by the open circuit terminals. As a result, the microphone output ratings are given as <u>effective output level</u>. The effective level is so calculated that when the amplifier gain in db is added to the microphone output level in db, the correct output level from the amplifier will be obtained. To do this, the effective output level rating is based upon the assumption that the microphone works into a load impedance which is equal to its own rated output impedance. The voltage corresponding to the effective output level is actually 6 db, below that which is obtained when the microphone is working into an open circuit preamplifier input. This 6 db difference is brought about by the fact that the high input impedance of a preamplifier does not offer a load to the output of the microphone. Thus, the 6 db apparent increase in gain is a function of the preamplifier input terminals and not of the microphone itself.

The "gain" ratings of a preamplifier takes into account this 6 db increase in gain so that it becomes necessary to rate the microphone output at its <u>effective level</u> for the purpose of computing the overall gain of the system.

PREAMPLIFIERS

It is necessary to amplify the low output of a high fidelity velocity or pressure type microphone. Various types of preamplifiers are used in broadcasting stations. In Fig. 10 is shown the RCA type BA-1A Preamplifier. This unit employs two stages and has extremely low noise level and low distortion. It may be placed directly in a control console, control desk or transcription turntable. The tubes are mounted vertically and are shock-mounted to prevent microphonics. The circuit is conventional with an unloaded transformer circuit. Resistance-capacitance coupling is employed between the two stages with an output transformer in the plate circuit of the last stage. The distortion and hum level has been reduced to a very low level through proper circuit design and through the use of a stabilized feedback circuit. The stabilized feedback circuit introduces about 11 db feedback from the plate of the second tube to the cathode of the first tube. This is sometimes referred to as inverse feedback. When mounting two of these preamplifiers side by side, it has been found that the cross talk between the units is minus 75 db. This means that a signal of any frequency between 50 and 15,000 cycles of one unit will be 75 db down in the output of the other unit. The power requirements for this unit are 6.3 volts AC or DC at .6 amperes and 250 volts DC at 3.4 milliamperes.

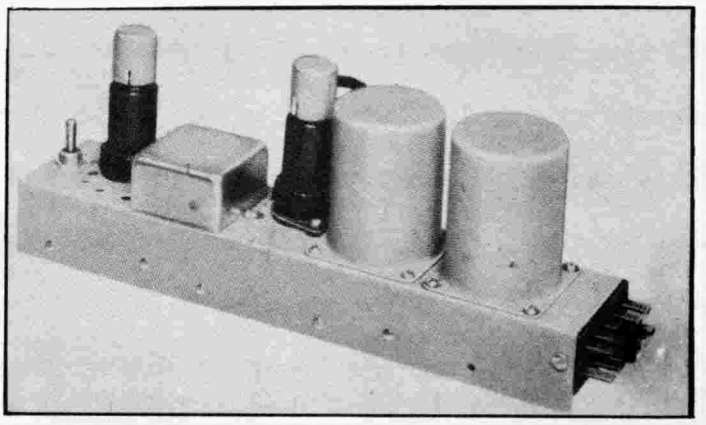


FIG. 10. RCA type BA-1A stage Preamplifier showing the two tubes, the input and output transformers, as well as one of the filter capacitors. The chassis is equipped with a multi-conductor plug for quick removal and replacement in case of circuit failure.

VOLUME INDICATORS

The volume indicators used in consoles and in the output circuit of remote pickup equipment have a special scale which is calibrated in volume units, abbreviated VU. On the other hand, the scale of the volume indicator may be calibrated in decibels, abbreviated DB. The use of both systems in broadcast equipment is due to the fact that the VU scale was introduced in 1938. The operators of broadcasting stations

decided to use the same system of indicating the program level as that used by various telephone companies. The indicator employing the volume unit was adopted as a standard monitoring instrument.

The VU indicator developed in 1938 has, over the intervening years, become the standard in radio broadcasting for monitoring and control of gain and loss in transmission lines. The value of this instrument results from the carefully controlled damping and speed of the pointer movement. The VU indicator is a rectifier type instrument with a permanent magnet moving coil mechanism operated from a full wave bridge rectifier.

After the VU indicator was developed, definition of what the instrument indicated had to be evolved. To express the measurement, the designation VU was selected and defined as the relative strength in decibels from a reference level of 1 milliwatt fed into 600 ohms. The designation VU is a contraction of "volume unit" and is defined as the reading of the particular instrument on the circuit in question after having been calibrated on a sine wave source.

The scale of the VU indicator is calibrated for both 0 to 100 per cent voltage and minus twenty, zero, and plus 3 VU. The 0 to 100 per cent scale is provided for ease in monitoring since a per cent scale is easily read and useful to indicate per cent modulation. The color of the scale is a special buff selected as the best compromise between high contrast and reduced eyestrain and fatigue. As the instrument is used both for monitoring and control of gain and loss in line transmission, two different scales have evolved.

To hold the speed and damping of the VU indicator to the close limits required, it was necessary that the manufacture controls be rigid. For example, every moving element, before being mounted within its magnetic system, is timed to determine if its speed is such that when mounted and adjusted for its proper sensitivity and pointer overswing of 1 to 1.5%, the deflection time is 0.3 second plus or minus 10% to within 99% of final reading.

The care taken to secure its exact ballistics makes the instrument broadly useful in many fields allied to broadcast and communication. Among applications of the Vu

indicator other than for broadcast monitoring are: control of volume in record cutting, the study of supersonics, sound measurement of water depth, noise measurement and the study of transient phenomena in electronic circuits.

The VU indicator has been made in panel type instruments from 2.5 inches to 7 inches in diameter. The basic requirements are that the inertia, torque and magnetic flux be such that the proper damping and speed be obtained with the necessary electrical characteristics. The smaller instruments require heavy moving systems while the large ones require light moving systems to obtain suitable moments of inertia. The current sensitivity of the VU indicator is high so that a large number of turns on the moving coil are necessary to obtain the high torque required for the necessary rapid speed of response. Then the flux in the air gap has to be high so that the closely controlled damping of the VU indicator is obtained.

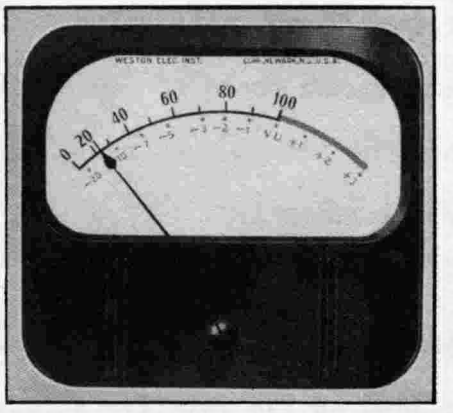


FIG. 11. The Weston Model 862, type 30 B VU Meter is shown here and described in the text.

The inertia, torque, and magnetic flux are by no means independent of each other and the design of the VU indicator requires proper consideration of the mutual dependence of all these factors.

ELECTRICAL CHARACTERISTICS

The VU indicator is adjusted to 163.7 microamperes alternating current at the zero VU scale mark, with the full scale reading of plus 3 VU and with the current being approximately 240 microamperes AC. The voltage adjustment is always made with 3,600 ohms in series. With this 3,600 ohms in series, the overall voltage required is 1.228 volts alternating current, at the zero VU scale mark and 1.734 volts AC at full scale.

Voltage and resistance adjustments are made at 1,000 cps. The tolerance over the audio frequency range of 25 to 16,000 cycles is held to close limits and the frequency error over this range can be ignored. The temperature error is within, plus or minus 2% over the temperature range of minus 50 to plus 130 degrees F with negligible error at usual room temperatures of 65 to 95 degrees F.

In the transmission of audio frequencies over telephone lines, we find that the higher frequencies are attenuated. This attenuation is introduced because of the high distributive capacity between the conductors over which the program is transmitted.

Equalizers are available in various types and many broadcast stations employ the RCA type BE-1A Variable Line Equalizer. As can be seen in Fig. 12, this unit is designed to mount within a standard rack. The unit is provided with knobs which allow the introduction of the required amount of equalization to compensate for the high frequency attenuation required in standard telephone lines.

The RCA type BE-1A variable line E i s very good for the equalization of telephone lines up to ten miles in length and to introduce a frequency response correction within plus or minus 1 db from 30 to 15,000 cycles. In addition to the different parallel resonant circuits used in equalizers, this equalizer has additional tuned networks which provide a variable frequency boost of 2 to 14 db in 2 db steps at a frequency of 15,000 cycles. This feature aids materially in obtaining an overall flat frequency response to 15,000 cycles. More than 1,000 attentuations versus frequency curves are available through adjustment of the front panel controls on this equalizer.

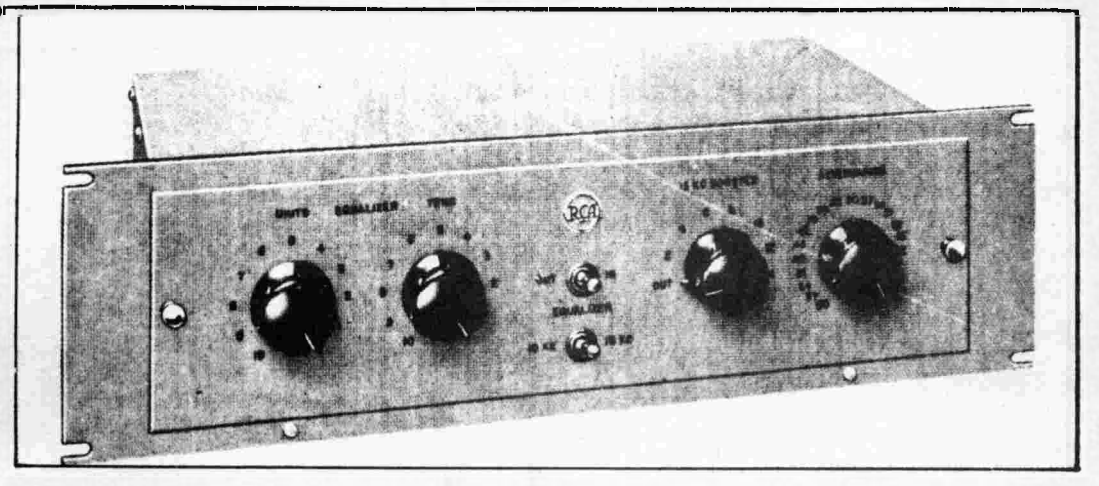


FIG. 12. The RCA type BE-1A Variable Line Equalizer.

The RCA type BE-1A Variable Line Equalizer consists of tuned equalizing circuit, isolating transformer, attenuating pad, 15,000 cycle booster circuit and another isolating transformer in the output.

A single pole double throw switch is provided for cutting the equalization in and out of the circuit. Attentuation versus frequency curves are shown for external boost

control settings of "booster out" and "14 db boost" in Fig. 13. Intermediate attenuation values will be obtained for intermediate setting of the boost control.

TURNTABLES

In order to secure satisfactory reproduction of both the vertical and the lateral types of recording on discs, RCA engineers have developed a special type of turntable which incorporates the advantages obtained by using a heavy stabilizer fly wheel coupled directly to the record platter. Then by using a special coupling mechanism, which prevents the driving synchronous motor from transmitting a rumble to the stabilizer, the turntable is rotated at a constant speed. In Fig. 14 is shown the RCA type 70-C1 turntable complete with universal pickup head.

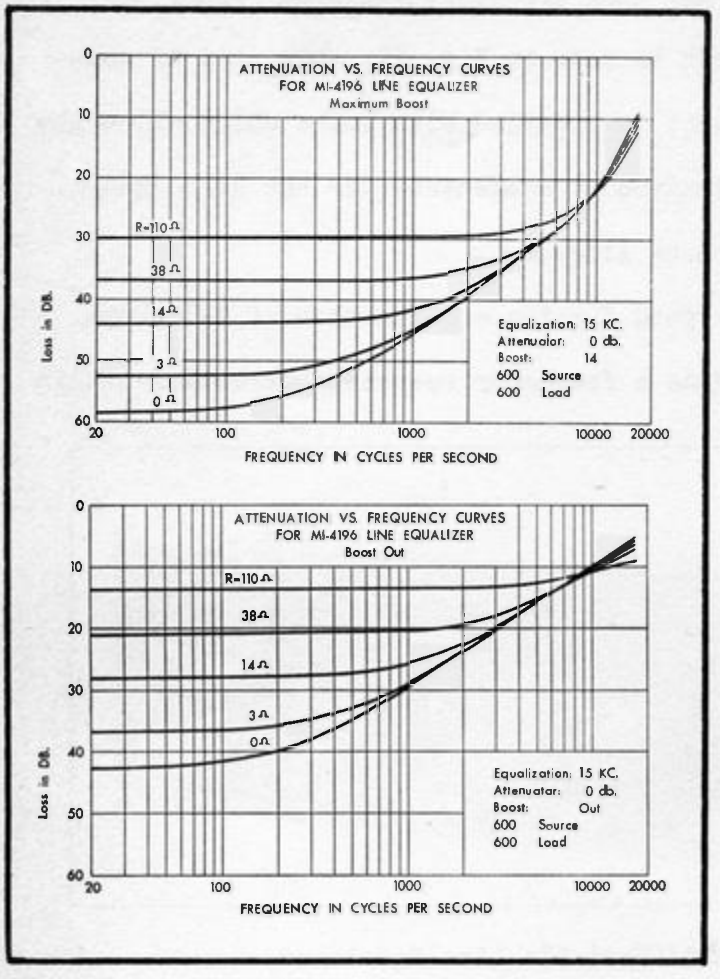


FIG. 13. Attentuation versus frequency curves for the variable line equalizer are shown above covering the maximum boost and the boost out conditions.

FIG. 14. The RCA type 70-C1 Transcription Turntable is shown complete with pickup head.

RECORDING EQUIPMENT

Many of the broadcast stations are equipped to record transcriptions of many of the programs which are received throughout the day from their network lines for presentation at a later hour. Generally, the equipment consists of two turntables which are associated with the amplifier equipment so that the second one may be turned on at the proper time for the complete recording of a long broadcast.

In Fig. 15 is shown a pickup employing two separate turntables, as well as the associated equipment, such as volume indicator, the monitoring loud speaker, the telephone, the overhead lights above each one of the respective turntables for careful examination of the cuttings. Recording studios also have an additional playback turntable.

STUDIO ACOUSTICS

In the broadcasting of radio programs, careful consideration must be given to not only the acoustical characteristics of the studios in which the entertainers or speakers are to deliver their messages, but also attention must be given to the facilities provided to insure smoothness of operation. Generally, the control room is located adjacent to, and common to, several studios so that all of the monitoring facilities may easily be accomplished from one point and without the necessity of furnishing or moving additional equipment. Furthermore, this arrangement enables the delivery of the proper signals to the respective studios and thus assists in the synchronization of the various programs broadcast from the studio. In Fig. 16 is shown the composite broadcast layout having three studios.

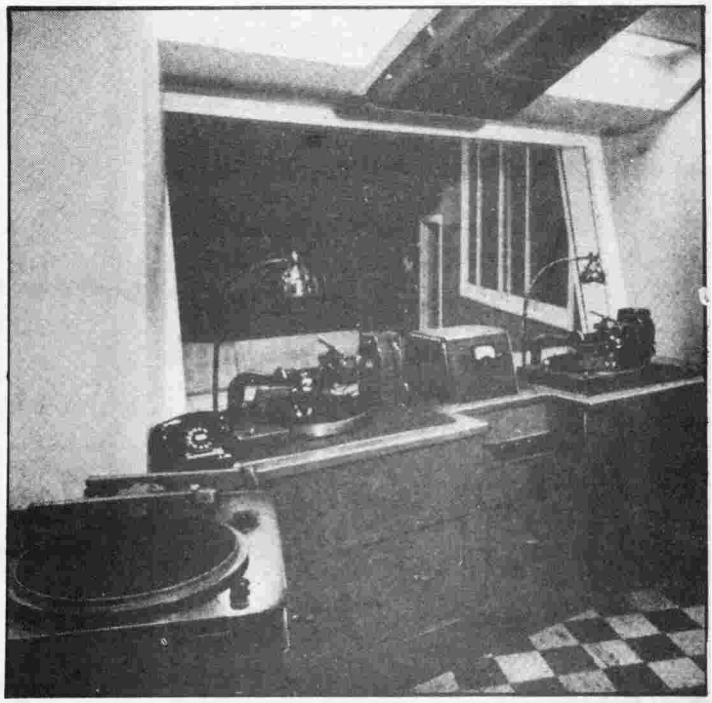


FIG. 15. This photograph shows a typical recording layout and at one time used by station WREC at Memphis, Tennessee.

A careful examination of the broadcast studio layout shown in Fig. 16 will disclose that there is a large lobby and four main offices, each equipped with desks and chairs. There are three studios properly referred to as Studio A, Studio B and the Announce Studio. It can be seen that the control room is common to all three studios, as well as the record storage room. On each side of the operator's chair can be seen two turntables.

The walls of large Studio A are properly treated to keep sound vibrations which exist outside of the Studio from entering the Studio.

The walls of the studio are covered with sound absorbing material, such as celotex, rockwool, and cork. The covering on the inside surface of the walls of the studios are generally covered with woolen curtains to give the studio the proper reverberation period and furthermore, the height, width, and length ratios are maintained within certain values. Small studios usually have a width 1.25 times the height while the length should be 1.6 times the height. Studios with low ceilings should have a width 2.5 times the height while the length should be 3.2 times the height. Long studios are best suited for broadcasting purposes when the width is 1.25 times the height and the length is 3.2 times the height. These ratios have been found most satisfactory from the design data available and from actual experience.

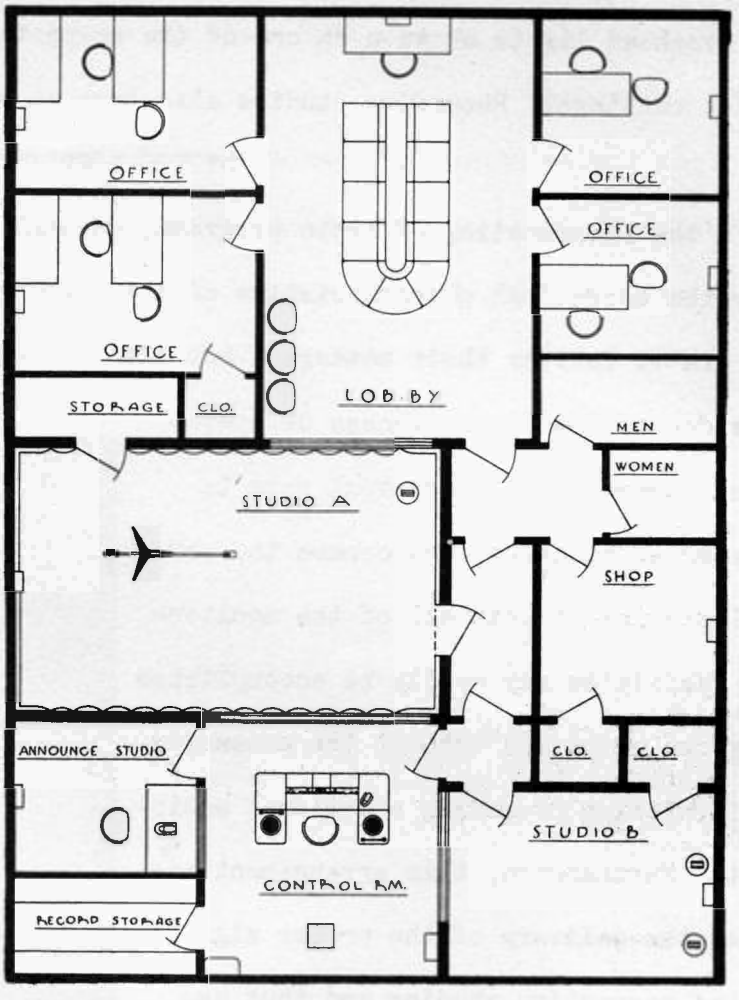


FIG. 16. A typical broadcast studio layout.

The heavy carpets placed on the floors of studios also effects the reverberation period and when the ceiling is covered with celotex, a sound absorbing material, the area of walls that are covered with curtains must be taken into consideration.

Proper air conditioning with the necessary sound filters in the incoming and outgoing ducts are provided to prevent the transmission of sound into the studio via this channel during the recording and transmission of a program.

Proper "ON THE AIR", time signals and illumination are provided in all studios and operating rooms so that operation will be unaffected due to the time of day.

Simple sound effects equipment are generally provided within broadcast studios to assist the artists that may appear in making their programs realistic.

A careful examination of the door arrangement in the studio layout shown in Fig. 16 will reveal that there is a small hallway near the entrance door to Studio A. This hallway has doors on each end which are to be kept closed at all times during the use of this studio.

From the information given above it is evident that careful consideration has been given every phase of radio broadcasting and including the ascoustic properties of the studios. In fact, this is a specialized field and there are but few qualified organizations located in several of the larger cities throughout the country who specialize in this work.

EXAMINATION QUESTIONS ON FOLLOWING PAGE