New microphone technique (see page 3)

Western Electric OSCILLATOR

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"Liveness" in Broadcasting

A New Technique in Microphone Control and Placement

By J. P. Maxfield

Western Electric OSCILLATOR

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C. G. STOLL . . . . President
N. R. FRAME . . . . Secretary
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WILL WHITMORE, Editor

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THE COVER

This striking painting by Weimer Pursell pictures a new technique of microphone placement for a symphony orchestra in a large auditorium, as described by J. P. Maxfield in his article beginning on page 3. High above the orchestra seats, hangs the General Microphone, its field of sound pick-up represented by the blue concentric rings. The Accentuation Microphones may be seen below covering the violin section of the symphony on the right, the cello section on the left and including the woodwinds in their yellow-orange cone-like fields. The field of sound pick-up is strongest at the center of the cones and fades toward the edges. A diagram of this type of auditorium showing microphone placement appears on page 4.

THIS ISSUE

Another New Year in Communications

As a new year dawns, there's no better time to look back upon past accomplishments and toward progress to be made in the future.

Technologically, the communications art has grown so fast and reached out to provide services in so many fields, it is difficult to understand and appraise the benefits that have accrued from putting electrons to work. The things we take for granted today were not the marvels of yesterday—they didn't even exist!

The art grows so fast, it is possible to fill the pages of the *Oscillator* each issue with news and descriptions of new equipment, new techniques and new services. It is indicative of the rapid growth of the art, we believe, that an article in this issue is written by a man who contributed tremendously to the development of electrical recording and reproduction of speech and music. That was such a basic development and one which has become such a part of our daily lives, it is difficult to remember that it was done just little more than a score of years ago.

And now the same man comes up with a new technique for microphone placement and control which has already contributed to the improvement of broadcast quality and is destined greatly to increase the listener's enjoyment. We refer to J. P. Maxfield and his article, *Liveness in Broadcasting*, on page 3.

The technological march of communications may be seen in other pages of this issue. Only a few years ago Frequency Modulation was creating a storm of discussion, and perhaps it continues today, yet the stride of FM can be seen and appreciated in the four picture pages in this issue which show more than a score of Western Electric FM stations now installed and on the air.

Other pages in this issue show the rapid progress being made by the American Telephone and Telegraph Company in erecting the radio relay system between New York and Boston. This history-making installation is a major undertaking which may be the forerunner of the day when the Country's mountain tops will be dotted with sturdy buildings which relay the voices and scenes of a nation. W. W.

KOMA'S New Voice

In the Southwest, Radio Broadcasting is having a phenomenal growth. Even within one metropolitan center—Oklahoma City—there are four AM stations, two new FCC grants for 1 kw AM's, four FCC grants for FM stations and three additional FM applications. All this in an urban area of some 260,000 people! And in this nest of vigorous and successful stations on the air or hoping to go on the air, the most powerful is KOMA which inaugurates its jump from 5 kw to 50 kw this month. KOMA is a colorful station that grew up in a colorful region and the men who run it are young, enterprising and full of ideas on Radio's part in community life. The story begins on page 12.

Industrial Design and the Transview

What exactly can industrial design do for the engineer and manufacturer? That is a question which arises from time to time in the minds of many people in these fields. In an article which discusses the steps taken in designing the famous "Transview" type of broadcasting transmitter, Henry Dreyfuss, one of the most noted of industrial designers, tells something about his profession and shows the planning, study, research and labor which go into the designing of important and intricate industrial devices. The article begins on page 20.

Program Dispatching without Tears

Designed as a unit type system and now being prepared for manufacture in the form of standardized assemblies is a new Relay Type Program Dispatching System which should take some of the headaches out of complicated dispatching operations.

The System which heretofore had been available only for custom-built installation includes facilities to handle the line switching from ten studios to six output lines. It also has a new feature — the Flash Announce Control Circuit which provides ready facilities for handling news flashes, split commercial announcements and other "break in" conditions. The story of this switching unit is told on page 22.

World Standards for Air Communications

Giant airliners which fly the international airways underline the necessity of a system or systems of air communication and air navigation that are standard the world over. To work out such systems of worldwide air communications and navigation aids, an organization was formed in Chicago in 1944 by representatives of the nations of the world and given the name of *Provisional International Civil Aviation Organization*, generally known as PICAO. The story of this organization and its work, so important to the future of air transportation, is told on page 10 by a Western Electric Radio Division Engineer, F. C. McMullen, who attended the demonstrations of equipment at the PICAO meetings at Indianapolis and in England.

View of famed New York Philharmonic Symphony at Carnegie Hall, where technique of microphone placement and control described below is used in weekly broadcasts.

LIVENESS IN BROADCASTING

. . . It Gives Life, Reality and as much as 6 db Extra Coverage to AM and FM Broadcast Programs

By J. P. Maxfield
Bell Telephone Laboratories

• • One of the Nation's leading authorities on acoustic techniques as applied to recording and reproduction of sound, here "sits down" first with the radio listener and then with the broadcast engineer and discusses a new technique of microphone placement and control. This technique is now in use in CBS's New York Philharmonic Symphony broadcasts from Carnegie Hall and listeners have already commented on the remarkable quality in the broadcasts even when they did not know that a new technique was being employed. • •

When your friend tells you the news, do you prefer to have him sit comfortably in your home with you or to talk at you from a box? When you attend a concert, do you prefer to be in the audience and hear the sweep of the music through the hall, or to have the sound shot at you from a cabinet? Your radio can now bring your favorite newscaster, in living reality, to your home, or can transport you to the best seats in the concert hall. This article tells you how it is done.

Under normal conditions, you listen to an orchestra, a singer, or perhaps to someone telling you the latest news, with two ears. The binaural sense which results from the use of the two ears enables you to pay attention to the sound arriving from any desired direction and to partially exclude the sound from other directions. Similarly, you easily separate nearby sounds from the more distant ones. You have, therefore, two means of accentuating, at will, certain parts of the sound.

If, however, the sound has been picked up by one or more microphones, and reproduced through a single loudspeaker, your binaural ability to pay attention to the sound from any desired direction is completely lost. This results in an apparent increase in the "liveness" or reverberation present and also in the intensity of the incidental noises. However, your ability to distinguish between nearby and distant sounds is in no way impaired, but is frequently enhanced.[1,2]

Therefore, the situation may be summarized as follows:

(1) You have lost all ability to accentuate at will certain parts of the sound such as solo artists, by the help of the direction from which that particular sound comes.

(2) You still maintain your ability to

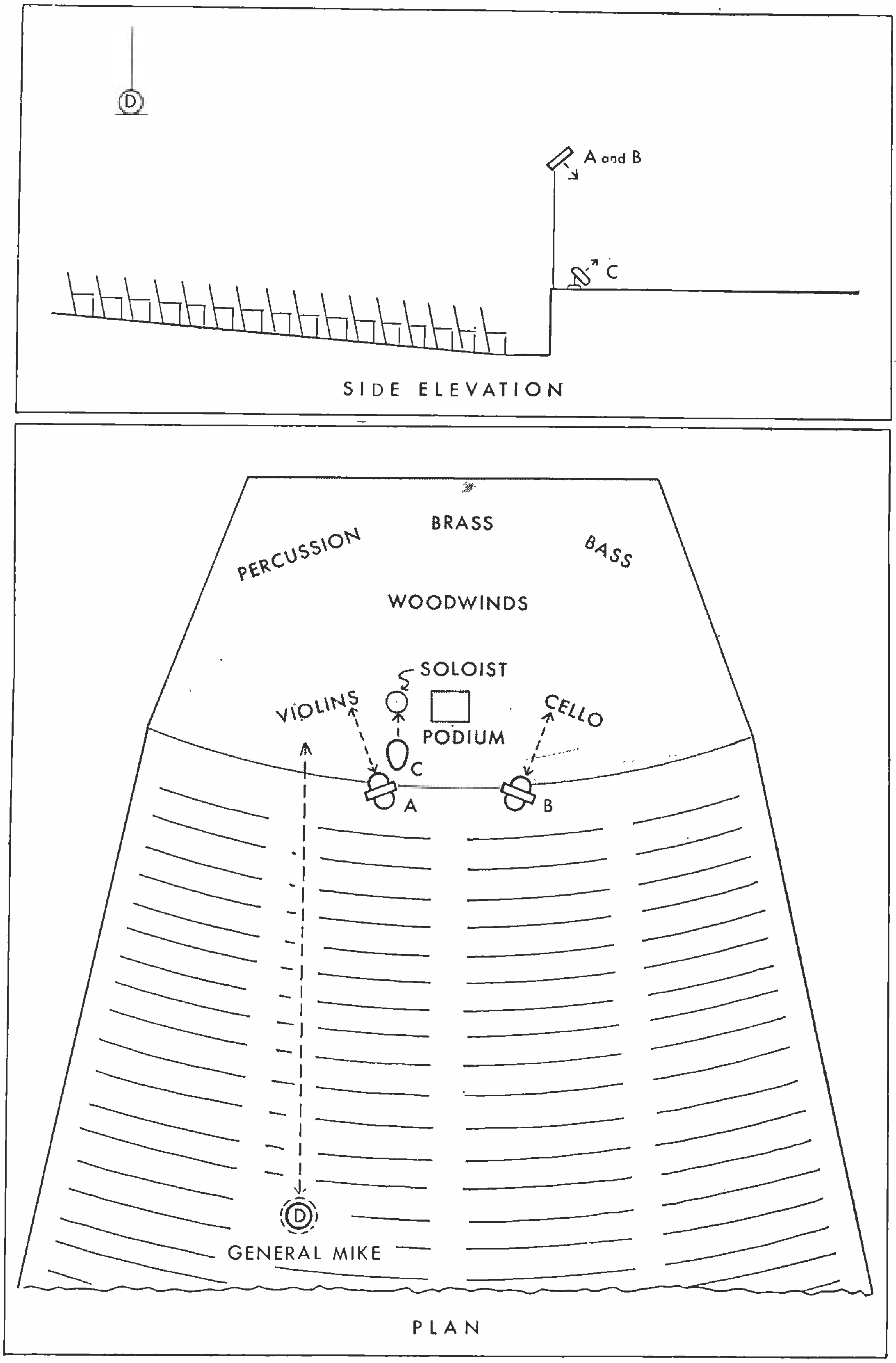


Figure 1 — Large auditorium with a symphony orchestra. A and B, accentuation microphones; C, solo microphone; D, general microphone. Dotted lines show distances which can be computed as described on page 7.

accentuate by the distinction between nearby and distant sounds.

(3) The liveness, i.e., the apparent amount of reverberation has been automatically accentuated.

Any studio technique which is to reproduce life-like and realistic programs must (1) provide the studio engineer with a means of supplying the necessary accentuation lost by the failure of the binaural sense, (2) provide the engineer with means of making full use of the distinction between nearby and distant sounds, (3) eliminate the undesired accentuation of the apparent liveness.

This is particularly true, as the sense of realism experienced by the listener is as much dependent on the microphone placement and the studio acoustics as it is on his home conditions.

Greater Coverage

The purpose of this article is to describe a technique of studio and auditorium sound pick-up which fulfills the above requirements and which places control of the desired accentuations on the dials of the studio mixer panel. Fortunately, the correction for the increased apparent reverberation can be accomplished by the initial placement of the microphones used.

One of the important advantages of this live type of pick-up is as much as 6 db gain in coverage at no extra expense to the sponsor or the broadcasting company.[3]

This unexpected gain is a result of the manner in which the ears of the listener perform. For a given power supplied to the loudspeaker, the loudness of a program picked up with this new technique can be 6 to 8 db greater than the loudness of programs from "dead" pick-ups. Since this gain in loudness permits the listener to operate his receiving set with a correspondingly lower electrical gain, static and other noises are reduced by this amount. Thus, this effect is a real gain in coverage.

In view of this apparently complicated situation, a search was made for some simple acoustic constant which would clarify the studio problems. Such a constant has been derived mathematically and checked by practical application to studio practice.

This constant is called *liveness* and represents the acoustic properties of an enclosed space, such as a studio or auditorium, including the effect of the distances from the artists to the pick-up microphones.[4] The properties of this constant are such that the formula can be readily applied to the use of one general or "over-all" microphone in combination with the necessary additional microphones for accentuation purposes.

The liveness formula is:

$$L = \frac{1000 T^2 D^2}{G_p V} \qquad (1)$$

where L = Liveness
T = Reverberation Time in Seconds
D = Distance from Sound to Microphone in Feet
V = Volume of Studio in Cubic Feet
G_p = Directivity of Pick-up Microphone from source to microphone.

The value of T used for the practical application of this technique to broadcast pick-up is an average of the values over the frequency range from 500 cps to 2000 cps. Where this average is unknown, the value at 1000 cps or even 500 cps may be used as a guide.

The range of the limits of liveness for satisfactory binaural listening is very great but is quite narrow for monaural or single channel reproduction. However, experience has shown that with single mike pick-up the limits of the value of liveness selected for best monaural pick-up always lie within those acceptable for direct listening. This means that in the concert hall, for example, the microphone position is always farther from the sound source than the front row of acceptable seats but nearer to the sound source than the rear row. The center of the monaural range is always closer to the source than that position generally rated as best for direct listening. This increased closeness of the monaural microphone automatically removes the accentuation of the apparent excess reverberation present.

The full useful range of liveness for monaural pick-up varies materially from one type of sound to another as, for instance, from symphony orchestra to solo singing to speech. Table 1 shows the values of the monaural liveness range for several different types of sound when picked up for reproduction in average living rooms. It may be of interest to know that where the reproducing space is abnormally live, both limits of the useful range are moved upward, not downward. Where the listening space is abnormally dead, the values must be decreased accordingly.

Table 1

Type of Sound	Liveness Range
Piano	4–16
Symphony Orchestra	5–20
Small Orchestra	3–12
Solo violin, cello, etc.	1– 4
Solo singing	$\frac{1}{2}$– 3
Speech	$\frac{1}{6}$–$\frac{2}{3}$

Increased Sense of Reality

If sound is reproduced from a pick-up in which the liveness is controlled within the useful range as shown in Table 1, the subjective effect might be described as the acoustic re-creation of the pick-up space around and behind the loudspeaker position. This effect adds greatly to a sense of reality and renders music or speech both natural and "easy to listen to". Under these circumstances, it is difficult to locate the position of the loudspeaker laterally, the sound appearing to flood in from behind it through an opening completely across the room. In other words, the effect is that of adding the studio space behind the plane of the loudspeaker without any intervening wall.

When the liveness is near the lower limit of the useful range, you get the impression that the sound is situated in the near end of this added space. In the case of a person speaking, there is the illusion of a real person speaking from the position of the loudspeaker.

When, however, the liveness is near the upper limit of the useful range, the source of sound appears to be considerably behind the plane of the loudspeaker as if it were coming to the hearer from a position in the

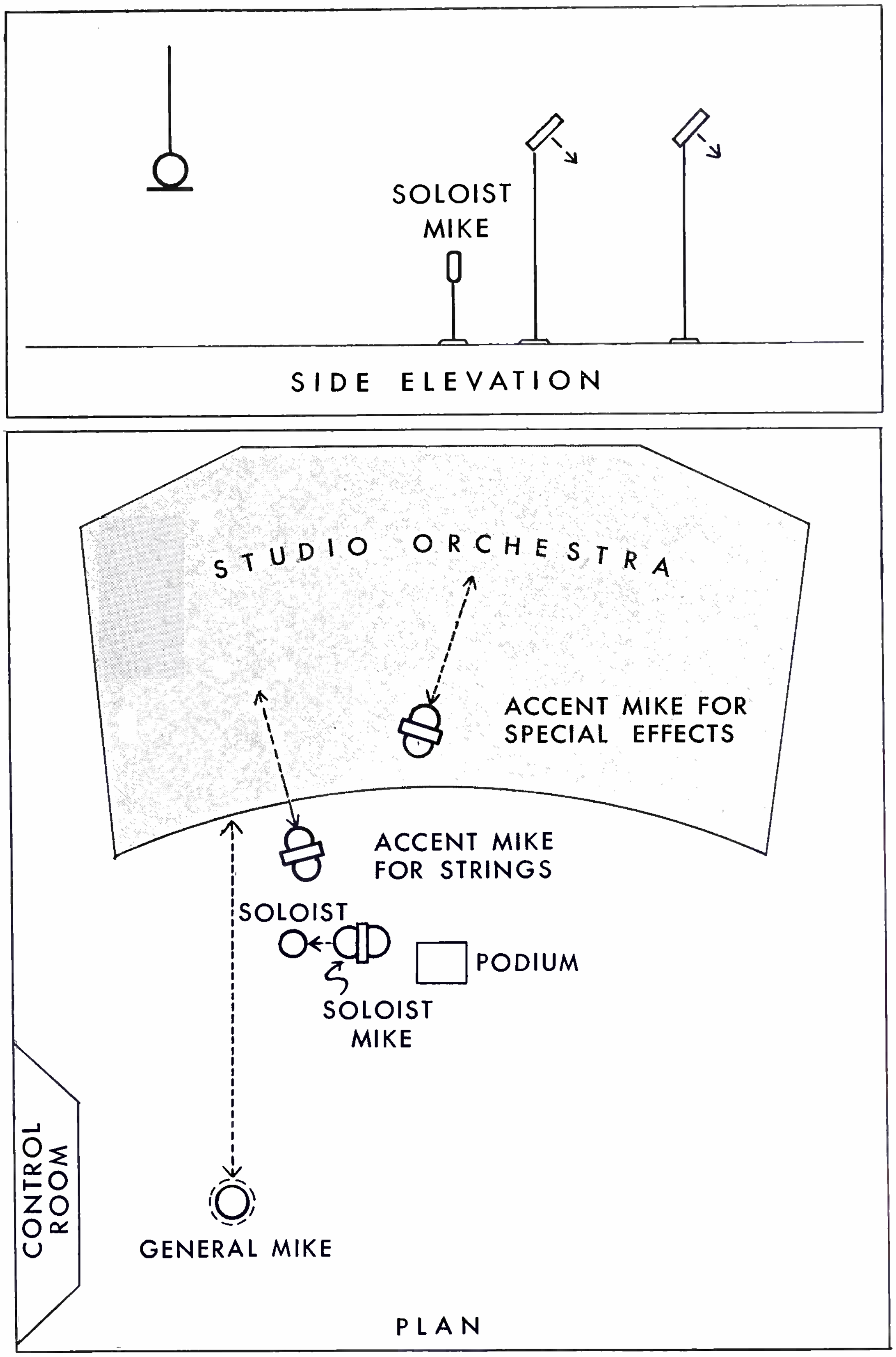


Figure 2 — Plan and side elevation of normal studio, set up for orchestra with vocals. It should be noted that all of the Accentuation Microphones in this arrangement are not necessarily used at the same time.

remote end of the added space. In the case of broadcasting large symphony orchestras, this control of liveness enables one to so broadcast a concert that the listener in his home may seem to occupy any seat from the front to the back row of the auditorium. Since most auditoria have seats which music critics consider to be best, it is desirable to control the liveness of the broadcast so that the listeners are placed acoustically in that portion of the auditorium.

When pick-ups are made with a liveness value well below the useful range, this effect of added space disappears and one is aware of the sound being projected from the box containing the loudspeaker. Under these conditions, it has an artificial quality which could never be mistaken for the presence of a real person or a real orchestra. This effect might be called "absence" as opposed to the much desired "presence" of good broadcast pick-up.

Under these dead conditions, the lateral position of the loudspeaker can be accurately located by ear and the interpretation of quality is quite sensitive to one's

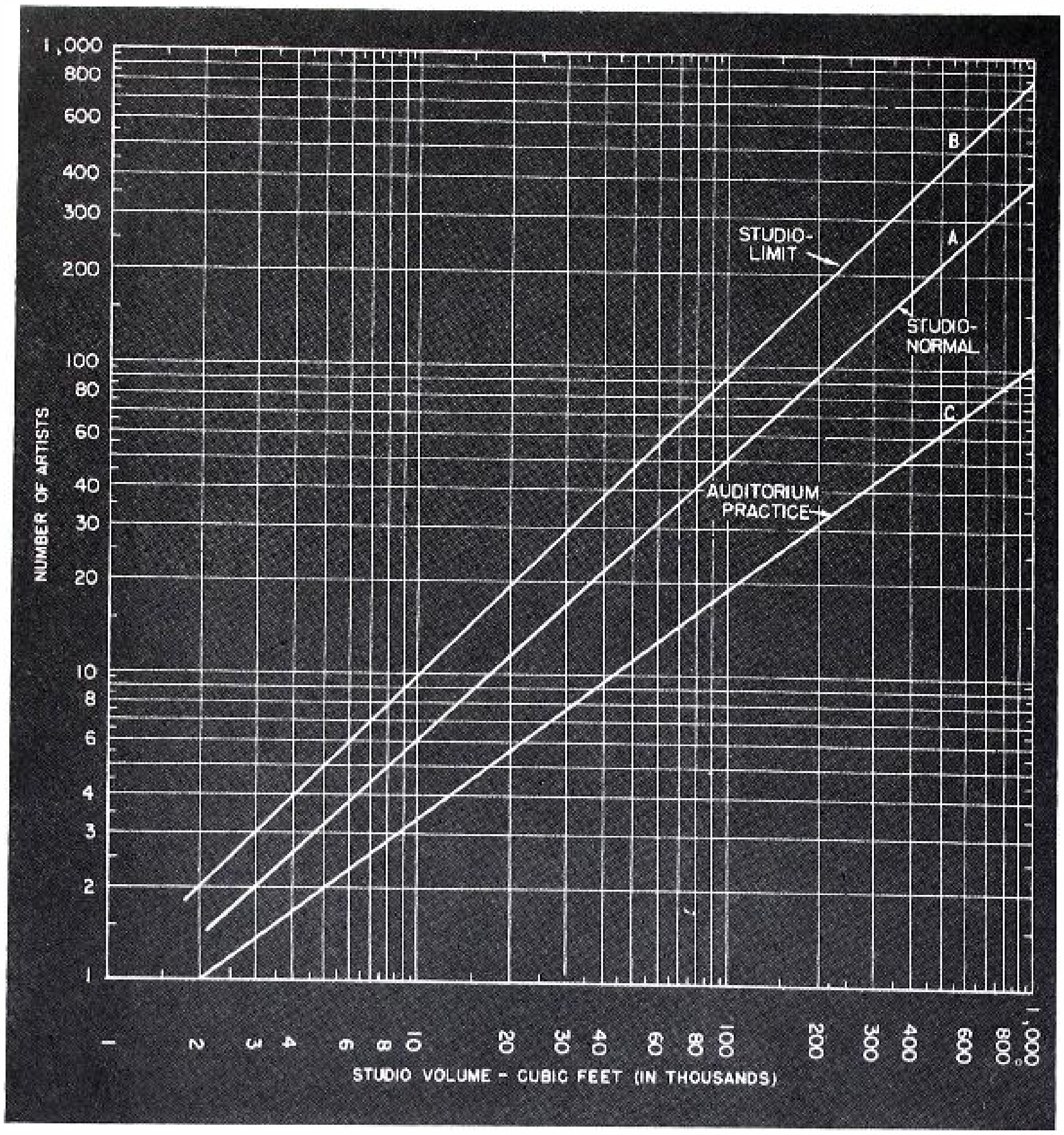


Figure 3 — Relation between number of artists and studio size. A shows good studio practice; B maximum crowding without loss of realism; C, for comparison, shows auditorium conditions for symphonic music.

position with respect to the high frequency beam of the loudspeaker and to the volume at which the sound is being reproduced.

On the other hand, when the liveness value is well above the upper limit of the useful range, one can again locate, with ease, the position of the loudspeaker. However, instead of feeling that the sound is being projected from a point source, the hearer experiences the effect of the sound reaching him through an open window from a room which is much more reverberant than the one in which he is listening.

Considerable evidence has been obtained that the public much prefers recordings made well within the useful range and in the case of orchestral music near its upper limit.

The advantages of this type of pick-up may be summarized as follows:

(1) The 6 db gain in coverage previously mentioned.

(2) When operating within the useful liveness range, the amount of manual volume control normally necessary with dead pick-up is markedly decreased without either overloading the equipment or causing the sound to sink into background noise, and therefore permits a higher average per cent modulation.

(3) For a given volume range as indicated by the vu meter, reproductions from monaural sound pick-ups made within the useful range have an apparent volume range nearly twice that of similar reproductions from dead pick-ups.

(4) The change in quality of the monaurally reproduced sound as a function of the loudness of reproduction is materially reduced. This characteristic may be best illustrated by two contrasting cases.

Case 1—Assume that the sound from an orchestra, for instance, has been picked up under conditions of liveness well below the useful range and that this sound has been balanced for reproduction at an average intensity level of 75 db at the ear.

If this sound is now reproduced at an average ear level substantially lower than 75 db, marked distortion of the balance takes place. The lower notes and the high harmonics appear to be greatly attenuated. A similar effect in the reverse direction occurs if the sound is reproduced at a level substantially higher than that for which it was balanced. An equalizer introduced into the reproducing circuit will correct this unbalance if its characteristics correspond with the differences in the loudness contours of the Fletcher-Munson curves.[5]

Case 2—Assume that the sound referred to in Case 1 has been picked up under conditions of liveness well within the useful range and as before, has been balanced for reproduction at an average ear level of 75 db.

If this sound is reproduced at either an average ear level substantially lower or substantially higher than 75 db, very little if any apparent change of quality is noticeable. This advantage is of great value to the listening audience as it enables the listener to reproduce a sound in his living room at any desired level without a corresponding loss of quality.

Two or More Microphones

The pick-up technique being described consists basically of the use of (1) a microphone situated at some distance from the performers to pick up the general blend of sound and (2) one or more accentuation microphones for accenting desired portions of the orchestra, soloists, etc.[6] This accentuation is obtained by controlling the liveness instead of the loudness.

The general microphone preferably has nondirectional characteristics as typified by the Western Electric 640 AA or the 633 Type. The accentuation microphones are usually of the bidirectional or of the cardioid type typified by the Western Electric 639 Type. Any high quality microphone, having the proper characteristics, will operate in an entirely satisfactory manner.

Figure 1 on page 4 shows a qualitative arrangement for a symphonic broadcast with soloist, and some orchestral accentuation, while Figure 2 on page 5 shows a typical studio set-up for orchestra with vocals. It should be realized, of course, that all of the accentuation microphones are not necessarily used simultaneously.

Arrangements such as these insure the fulfillment of the following requirements:

(1) Over-all liveness control is available to the sound engineer at all times during the broadcast.

(2) Accentuation control is similarly available at all times.

(3) The loss, by failure, of any one microphone does not render the pick-up unsuitable for broadcast.

(4) The arrangement is versatile and capable of rapid adjustment during rehearsal.

The employment of this technique requires studios with acoustic properties of a

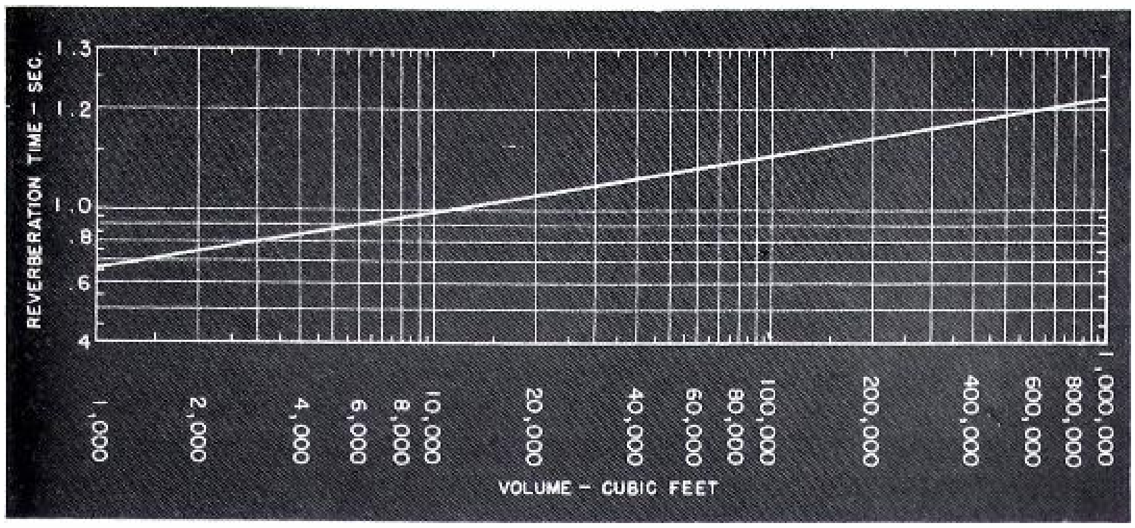


Figure 4 — Curve showing optimum reverberation time with artists in place, as a function of studio or auditorium size. Any values within 30 per cent of above can be compensated for by microphone placement.

"pleasing" nature, i.e., studios of good acoustic properties.[7] It also requires that studios shall not be overcrowded.

Figure 3 shows the relation between the number of artists and the studio size.[8] Curve A represents good studio practice while Curve B represents the maximum crowding possible without loss of realism. Curve C is given for comparison only and represents auditorium conditions for symphonic music.

Figure 4 shows the optimum reverberation time with artists in place, as a function of studio or auditorium size.[4] Any values within 30 per cent of those shown can be compensated for by a proper choice of microphone positions.

Placement and Control of Microphones

A. Positioning the General or Over-all Microphone.

1. Choose from Table 1 the maximum value of liveness necessary for any part of the program. For instance, for a studio pick-up of a dance orchestra with vocals the maximum value of L is 12 for small orchestra.

2. Choose a value 1.5 times this ($L = 18$) as suitable for the overall microphone. The increase of one and one-half is to allow you margin for leaving some accentuation microphones in circuit at all times without reducing the general liveness too much.

3. Determine the distance D from equation (2) below. D represents the distance of the microphones from the front of the orchestra.

Equation (1) may be solved for D and we get

$$D = \frac{\sqrt{L \times V \times G_p}}{31.6\,T} \qquad (2)$$

Where studios are in active use, a set of curves as shown in Figure 5 may be prepared. To aid you in preparing such a chart the following typical case is worked out in detail.

Assume a studio whose volume V is 30,000 cu. ft. and whose reverberation time T, with musicians in place, is 1.2 seconds. For nondirectional microphones $G_p = 1$ and for bidirectional or cardioid type $G_p = 3$ for sound sources on their beams. Assume a range of L from 0.3 to 30.

From equation (2) for a nondirectional microphone we get

$$D = \frac{\sqrt{30 \times 30{,}000 \times 1.0}}{31.6 \times 1.2}$$
$$= 24.6 \text{ ft. for } L = 30.$$

Similarly $D = 2.46$ ft. for $L = 0.3$

Plot these two points (A and B of Figure 5) and connect them with a straight line. From this chart the distance D corresponding to any desired value of liveness may be obtained for a nondirectional microphone.

To obtain the plot for bidirectional or cardioid microphones proceed in a similar manner letting $G_p = 3$. Then we obtain the points M and N, Figure 5. Connect these with a straight line.

This completed chart is now available for use in positioning the general microphone and, as described in the next section, for positioning the accentuation microphones also.

B. Positioning the Accentuation Microphones

1. Choose from Table 1 the minimum liveness for the portion of the orchestra, the soloist or other source to be accentuated. For instance, for solo parts in the string section choose $L = 1.0$ (Solo Violin, etc.) or for a vocalist choose $L = \frac{1}{2}$ (Solo Singing).

2. Choose a value which is two-thirds of that obtained from Table 1 as the practical operating liveness for the accentuation microphone. This decrease to two-thirds is to allow you margin for the increase in liveness due to the over-all microphone which is always in circuit.

3. Choose a suitable type of microphone, cardioid, bidirection or nondirectional. One of the directional types is usually preferred as the accentuation microphone, since it can be "beamed", i.e. partially limited to the sound sources on or adjacent to the high sensitivity axis.

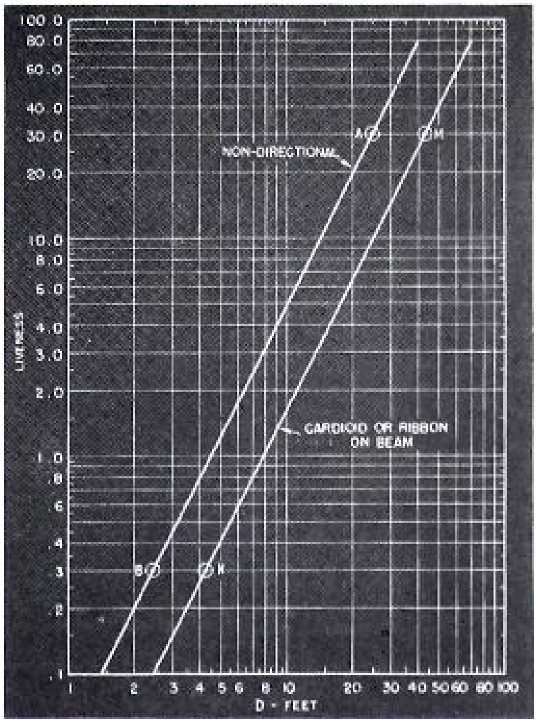


Figure 5 — Typical chart used for positioning General and Accentuation Microphones in active studios.

4. Determine the distance D from Equation (2) or from the studio chart typified by Figure 5. If you are using this microphone for accentuation of the string section or any other group of artists, D represents the distance from the microphone to the nearest artist in that group.

5. Proceed in a similar manner for any other accentuation microphones which may be necessary.

C. Determination of Approximate Mixer Dial Settings.

No hard and fast rules can be given for control of the amount of accentuation necessary. This amount depends upon the type of program and upon the nature of the esthetic or dramatic illusion you are trying to create for the listener.

However, there are some general considerations which will help you acquire experience more rapidly than is possible with mere "cut and try" methods. In the first place, make it a rule to start your rehearsal with the general microphone only—all others being out of circuit. Then slowly fade in the accentuation microphones until the desired result has been obtained. When in doubt, use less accentuation than appears desirable over your monitor. This is due to the fact that most monitoring rooms are both smaller and acoustically more dead than the average living room.

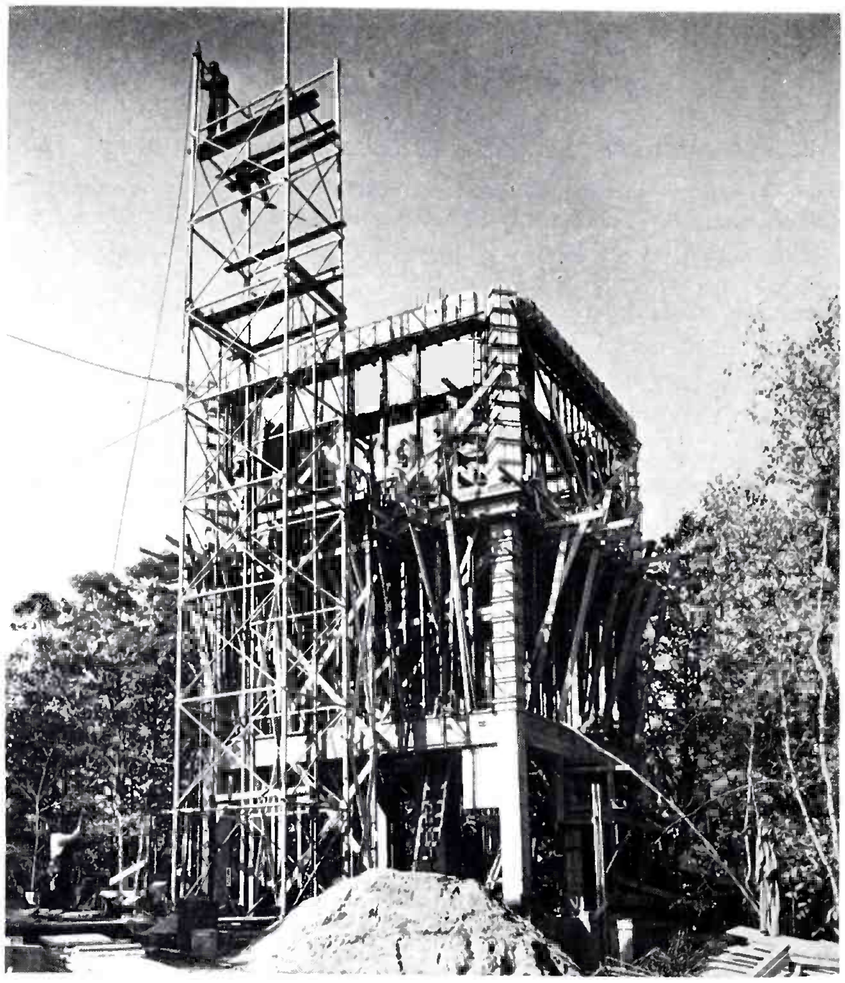
The details of this mixing technique are described in Appendix 1 on page 27. General adherence to the methods outlined there will result in the production of ac-

(Continued on page 26)

Building Radio Relay's Stepping Stones

Little more than a year ago, the American Telephone and Telegraph Company began work on its Radio Relay system consisting of two terminals and seven relay stations from New York to Boston. The purpose was to help determine the relative efficiency and economy of microwave radio transmission for sound and television programs and long distance telephone messages as compared with wire and coaxial cable methods of transmission. The photographs on these pages of the station on Jackie Jones Mountain, made during the past year, show one of the seven relay stations from wilderness to tower in various stages of construction. Work on the other six relay sites and the two terminals is going forward with about equal rapidity.

1. Preparation of site. Surveyors establish benchmark on rock at site of first relay station on Jackie Jones Mountain, 6 miles northwest of Haverstraw, N.Y.

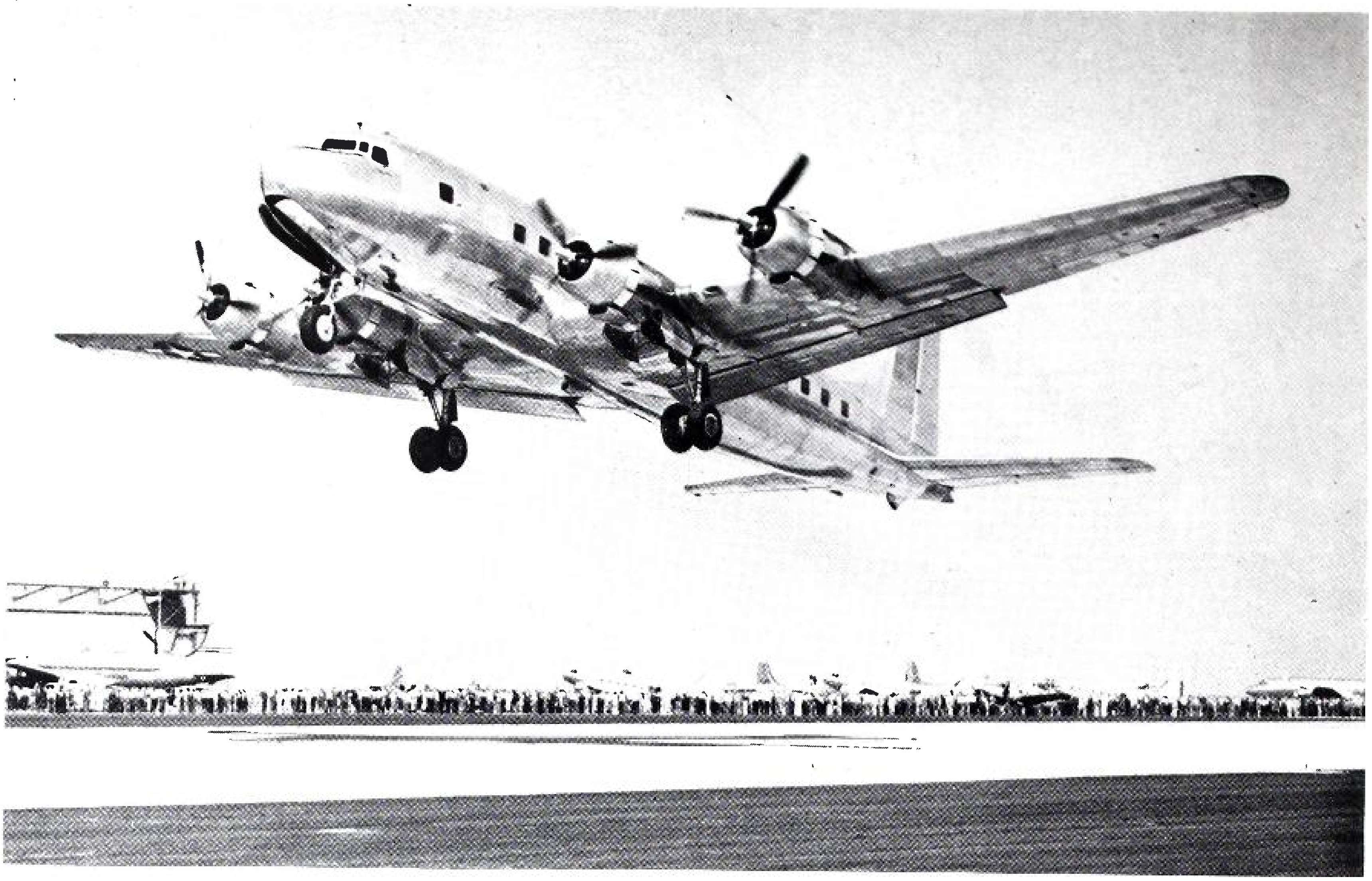


2. Construction of tower. By September 1946, work had progressed this far on tower at Jackie Jones. By this time work was in progress at other sites.

3. Tower building completed. Two months later, station was ready for antennas. The benchmark in foreground is the same one as that in first photo.

4. Antennas being assembled. By December, these metal lens antennas designed by Bell Telephone Laboratories were ready for hoisting to top of tower.

5. **Antennas in position.** Two of the four metal lens antennas are now in place atop the tower. The next step is the installation of the receiving and transmitting equipment to be completed shortly. Translucent sheets of plastic can be seen covering the lenses of the antennas to provide protection from the weather.



Giant planes like this great airliner whose flights will cover the globe are making standardized systems of radio communications and navigation a necessity.

PICAO

Key to the Future of Air Transportation

By F. C. McMullen

Western Electric Radio Division

DECEMBER 7, 1944, a date which is significant in the aviation field, saw a meeting of representatives of the nations of the world in Chicago. This meeting provided the starting point for a system of worldwide airways. An organization was formed and saddled with the tongue-twisting name, *Provisional International Civil Aviation Organization,* which fortunately has been shortened by common usage to PICAO. Within the PICAO organization was formed a Special Radio Technical Division, the immediate task of which was to standardize a system of radio aids to navigation to be used throughout the world by the international airways created through this December 7th meeting. The need of such standardization is obvious. Planes fly over and into many countries of the globe, and unless universally standardized systems of radio communication and navigation are provided, a prohibitive amount of radio and navigational equipment might be required in order to permit entry to and flying over these countries.

The safe and expeditious regulation and control of traffic is a worldwide problem, perhaps more pressing at present in some countries than others, but recognized as a "must" by all concerned.

Research in Radio and Radar

During the war a great volume of research on radio and radar was done by the United States and Britain, much of which was comparatively unknown to the other nations of the world. PICAO suggested to the British, Australian and American Governments that they conduct demonstrations for the Radio Technical Division of PICAO covering the various communication and air navigation systems which they employed or which they had in the process of development. The purpose of the demonstration program, of course, was to familiarize the PICAO member nations with these systems, so as to permit adequate consideration of them when the question of standardizing a worldwide system arose at a later meeting in Montreal. This met with immediate and enthusiastic response from these governments.

As a result, the British Government sponsored an excellent series of demonstrations in and about London during the period of September 9-25, 1946, and the United States Government, through the sponsorship of CAA, held their impressive demonstration in Indianapolis, October 9-23. The Australian exhibit was held in Canada, October 28-29. Thirty-seven nations were represented by official delegates throughout these meetings. The United States delegation was accompanied by technical advisers from industry and the armed services. As a result of these programs, the Special Radio Technical Division of PICAO convened in Montreal October 30, 1946 armed with first-hand knowledge of all available systems for the purpose of determining the systems to be used in international air transportation.

The exhibits and demonstrations in the United Kingdom and at Indianapolis were extremely comprehensive. It is not possible in the confines of this article to summarize adequately the systems and the thinking in back of them as put forth by the British, Americans and other nationals toward the solution of these problems. Approximately sixty pounds of technical data covering many thousands of pages were supplied to each delegate for his study and consideration, and many complete systems, each employing many pieces of equipment, were studied and tested. Most engineers, however, are interested in the general problem of air navigation, and an endeavor will be made to set forth a broad picture of the objectives and some of the equipment.

Four Navigation Zones

The main problem in aviation today is to provide aids to air navigation which will permit safe, regular and expeditious handling of traffic in bad weather, employing the same scheduling as exists during good flying conditions. To permit an orderly understanding of the subject the problem is divided into four zones which are as follows:

1. Long distance navigation and communication zone, which enters;
2. En route short range zone leading up to;
3. Approach zone which is under control of the airport controllers and finally;
4. The airport or surface zone which disposes of aircraft on the airdrome.


Lightweight Teletype Printer for aircraft shown during demonstration at PICAO Conference in Indianapolis, 1946, for study of air transportation aids.

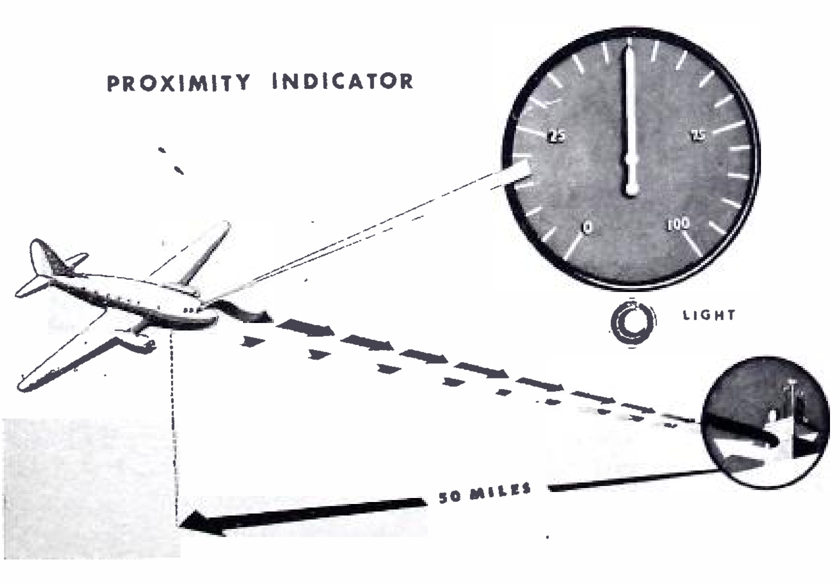
At present the long distance phase is not a serious problem and so the maximum effort is being directed toward a solution of problems affecting Zones 2, 3 and 4.

Systems were shown which give to the pilot, as he flies the airway under any weather condition, a visual presentation as to his position along the invisible radio track to which he is assigned, and his distance from definite points along the route. Position and location of other aircraft at his altitude—above or below—can be observed on an indicator, and positive indication of obstructions, such as mountains, is provided. Routine instructions from the ground can be given to him visually by an automatically operated visual display. The craft can be controlled by radio and radar devices within the plane with the pilot acting as the observer of the over-all operation of his craft. As the plane nears the end of the flight, an instrument landing system enables the pilot to bring the plane down on the runway even under conditions of extremely poor visibility—or to land it automatically, with the pilot entirely free of the controls. All this can and is being done today.

International Agreement

Whether the tools to do these things in the future will be "Gee", VHF omnidirectional ranges of the pulse or the CW type, CAA Instrument Landing System or one of the microwave systems; whether the Distance Measuring Equipment operates at 200 mc, 1000 mc or higher; or whether systems involving television, radar relay, ground control approach, or airborne radar be used is the question. Until such a course is charted by international agreement, the airlines are not in a position to invest in large amounts of new equipment, and progress is halted or seriously hindered.

The tremendous increase in air transportation has made the solution to the traffic control problem mandatory if the industry is to grow and prosper as it should. These demonstrations clearly indicated that the tools are available, but in such bewildering multiplicity that only by international agreement can a course be plotted and rapid strides to the eventual goal be taken. The Montreal PICAO Meeting has just completed its work. The delegates have adopted a standardized worldwide system utilizing currently available aids for the international air routes. They also provide for new types of equipment as they are developed. This cooperative effort now gives international aviation the green light, and world air travelers will directly benefit.



This diagram shows how the Distance Measuring Equipment (DME) works. Transmitter in plane sends pulse which actuates ground beacon. A replying pulse is sent by ground beacon and transit time of signal measured in miles for the pilot.

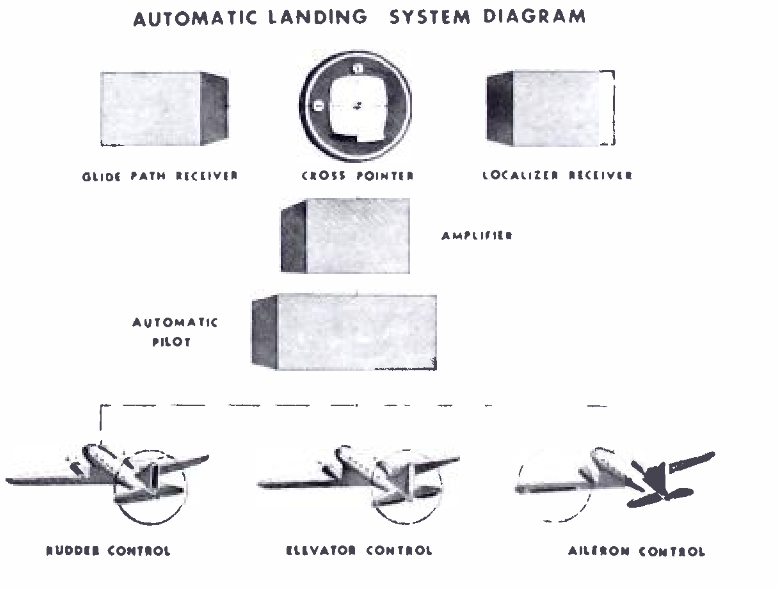


Diagram illustrates how CAA's Instrument Landing System works. Glide Path Receiver and Localizer Receiver on the plane pick up impulses from the ground station, transmit them to screen and actuate amplifier and automatic pilot.

KOMA—the Sooner State's New 50 KW Voice

A Colorful Western Station Goes from 5 to 50 KW of Power with a New Quarter-of-a-Million-Dollar Plant

By George de Mare

THE first thing you notice about KOMA—the Sooner State's new 50 kw "voice" at Oklahoma City—is how well it lives up to its signature. Its announcers say: "This is KOMA, your *friendly* Columbia station" and "friendly" is the word for the station and its people!

We flew out to Oklahoma City to see the remarkable transformation of this second oldest station in Oklahoma City from a 5 kw into a brand new 50 kw establishment, which makes it the most powerful voice between Tulsa and Denver. It is indeed a transformation! Kenyon Brown, KOMA's young, six-foot station manager, has really shot the works to the tune of more than a quarter of a million dollars in a new transmitter building, antennas, 50 kw transmitter and all the trimmings! Ken Brown is probably one of the youngest and certainly one of the most enterprising station managers in the country. Under his direction, KOMA has become one of CBS's star stations of the southwest, originating one network program and serving its colorful community against topnotch competition with conspicuous success. Year before last, in fact, KOMA won the coveted George Foster Peabody Award for outstanding community service by a local station. The credit for this major expansion and KOMA's remarkable achievements belongs squarely with Ken Brown and his staff of young, hard-hitting men. Ken Brown has some ideas about broadcasting and about what makes a good station.

What Makes a Good Station

"A good station, it seems to me," Ken told us as we talked together up in KOMA's handsome studios atop the Oklahoma Biltmore, "is a station that goes to the grass roots of its community's life. We talk a lot about serving our community, but how can a station serve a community when it doesn't even know much about that community? Now a station has to have something to give its listeners—something new and better in entertainment, preferably original, and some solid service that is based on community needs. Our new 50 kw transmitter building, for example, is situated on an experimental farm which the station intends to run for the benefit of its community and I'll tell you more about that later. Now about our present programs. Network shows take up only about two-fifths of our time and for the remaining three-fifths, we produce our own local and regional shows and services. And it isn't a one-way street either. The network —in our case Columbia—gives us good material, and because we want to be a real station we have added our efforts to the sum of the network's entertainment and put together a show right out of the heart of our region with all our region's flavor which is good enough to be fed into the network. That's our *Oklahoma Roundup* which we put on Saturday nights down here at Shriner Auditorium and which goes out nationwide Monday through Friday 8:15 to 9:00 P. M. our time . . . It's been called the Southwest's greatest radio-stage show . . ."

Ken paused and leaned back.

"Well, what would you say your contributions to your community and region are?" we asked. "What is the type of thing you feel this community wants and needs and how do you plan in your new power capacity to fill this need?"

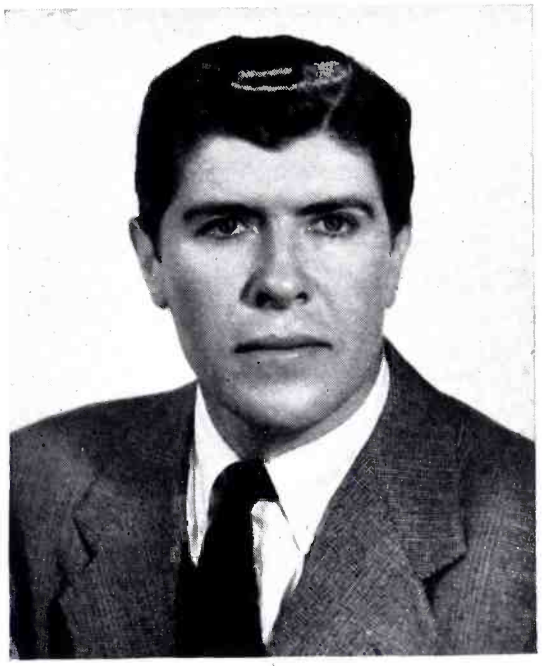
Studied Community Needs

"Naturally," Ken said, "we aren't going to neglect entertainment—that is, music, variety shows, quizzes, news and other services—but we want to do something more and we've scouted around to study the wants and needs of our region. You can't just wait for the postcards to come in; you have to get out there in your territory yourself sometimes and see what they want. Now in 1945, for example, our community was suffering like a lot of others from reckless driving, from careless handling of cars on the highways, from slap-happy drivers getting into cars for the first time in years and banging out on the roads. We ran a 'Save a Life' campaign worked out by our Bill Bryan to meet this situation. It won us the Peabody Award for that year of which we're pretty proud. This is just an example of a specific service. However, we have worked up for our new increased coverage an over-all plan based on this region's needs. Oklahoma is primarily an agricultural state. You hear a lot about oil here and we are one of the world's great oil-producing regions, but agriculture—wheat, cotton, broom corn, sorghum—still brings us our biggest revenue, year after year. So we intend to try to get together the best over-all agricultural programs in the country. With our new power we will be covering practically the whole state in our primary area and a huge prairie region

KENYON BROWN
General Manager

BILL BRYAN
Director of Public Relations

M. W. THOMAS
Chief Engineer



J. J. BERNARD
Director of Sales

ALLAN PAGE
Production Manager

BOB EASTMAN
Director of News and Special Events

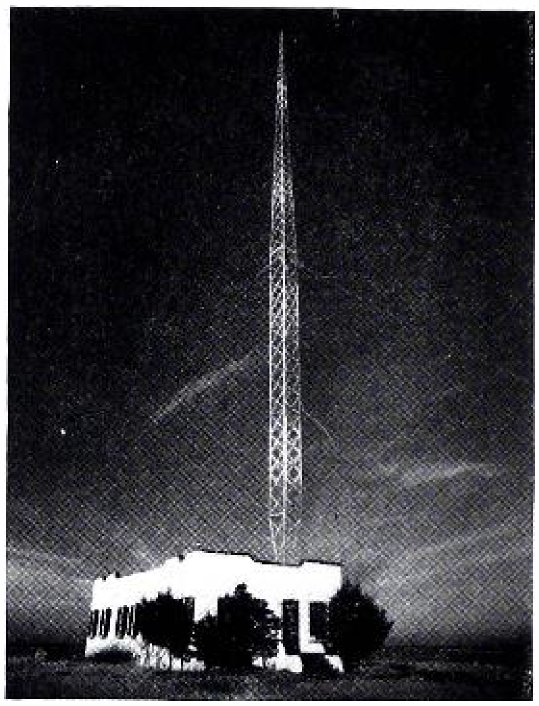
of farmers, ranchers, agricultural men, and cattlemen and market centers in the Southwest. We're going to try to put together shows that will not only please these people but give them essential services. This is where our experimental farm comes in. We hope that there we'll be able to carry on work in the interests of regional agriculture and broadcast the results over the station—experiments that we hope may add millions of dollars to farm income. We're going to call on the schools and higher institutions of learning around here to help us and we're going to try to present educational and informational programs that do a real job."

"How about your technical facilities and what about FM—are you going in for that?"

"Well, we expect to have about as fine a technical plant as there is in the country when we get through," Ken said. "I read my friend Herb Pettey's statements on FM* about how it will eventually supplant AM broadcasting, *except in the big clear channel stations* out here. I believe he's right. In a metropolis like New York or Chicago or Los Angeles, yes, but in a huge rural area like the southwest, I think the top-power AM stations will still be here, still giving the best service. But don't think we're going to neglect FM. We don't believe a plant is complete without FM and the FCC has granted us a CP for an FM station with an assignment of 100.1 megacycles, channel 261 and an effective radiated power of 243 kw. Though most all efforts of the entire staff have been bent toward getting the 50 kw AM on the air, we have plans for temporary FM operation with an interim antenna up on top of the Biltmore and a temporary transmitter at the studios. Actually, the new transmitter building you're going to see was designed to accommodate both AM and FM equipment. FM should be a valuable complement to our AM operation and give added and superior service to a section of our greatly enlarged audience."

New Building and Equipment

We went with Bill Bryan, KOMA's Director of Public Relations and Assistant to Ken, to see the station's new transmitter building and equipment. Oklahoma is a wide, flat, blue-skied land with fine weather. As we drove, we could see the long line of oil wells marching toward the city. The oil fields in this area stretch for 42 miles from Moore to Edmond. They are about a mile wide and Bill told us they had taken a total of seven billion dollars worth of oil from these fields. The oil derricks march right into Oklahoma City straight up to the Capitol building itself and one derrick can be seen lazily sucking the oil out from beneath the capitol building. The new transmitter building lies about nine and one-half miles south of the city at Moore, Oklahoma. It is one of the handsomest buildings of this type in the country (see photograph, page 12). Lying low on the wide flat countryside, it nestles near its three 325-foot Blaw Knox guyed antenna towers. The station has a circular pattern in the daytime but at night uses its three-unit directional array to avoid interference with a station in Guatemala. It operates on a 1520 kc channel. At the transmitter building, we met M. W. "Tommy" Thomas, KOMA's friendly, able chief engineer, who showed us the equipment. The building is well designed to make maximum use of space. The units of the new 50 kw Western Electric transmitter have been installed in the central area and opposite is a space for the FM equipment to come. The control desk stands to the back and center. Although the main speech input equipment is at the studios, there is a standby speech input unit in a special glassed-in area of the new transmitter building for use in programs which might originate there. The building has office, entrance hall, double garage and other necessary rooms, including sleeping facilities.



KOMA's old transmitter building with its 195-foot antenna. Building houses early 5 kw transmitter.

The site of this beautifully designed building is the large farm area which the station intends to use as an experimental farm.

To show us the extent of the transformation between the old and the new layouts, Tommy drove us back to the other side of town—some 18 miles—to the old transmitter building with its 195-foot antenna tower. This small building houses the old 5 kw Western Electric transmitter. The transmitter is one of the early models, coded D-94992, and both Tommy and Ken Brown couldn't praise it enough. "We've had this Old Faithful since around 1932," Tommy said, "and never been off the air once from transmitter trouble! I don't think any transmitter around here has stood up as well as this, and after fifteen years it still meets all FCC quality requirements 100 per cent!"

A Colorful Region

Back in the studios, we talked to Bill Bryan about the station's coverage with its new power and about the type of region and the type of audience it serves.

"We expect to cover about 70 per cent of Oklahoma in our primary area," Bill said. "The secondary area should include territory north and west that isn't adequately served by any station. Oklahoma's a colorful country," Bill continued. "Ken's already mentioned its major occupation which is agriculture. This State ranks first in broom corn, third in all wheat production, third in grain sorghums and pecans, fourth in spinach and ninth in cotton and cotton seed. The State also ranks as the fifth turkey producing state in the nation. Population wise, it has more farm youth club members than any state in the country. Her F.F.A. and 4-H Club members rank first in blue ribbon winning at national livestock shows from coast to coast, so you can see why we're interested in agriculture here as a station.

"I don't need to tell you much about oil here. Everybody associates the state with its oil wells. Actually, Oklahoma City, including West Edmond, is the largest producing area in the state. One of the latest fields is the West Edmond oil field discovered during the war, and at one time it had more drilling rigs on it than any field in the world. We rank third in oil production. As a state we also rank first in zinc production, fifth in lead mining and ninth in bituminous coal reserves. The state's most recent acquisitions as far as industry is concerned are a B. F. Goodrich plant at Miami, Oklahoma, and the headquartering of American Airlines in Tulsa. The rubber plant has a $3,000,000 annual payroll. Tinker Field in the city (Oklahoma City) is the world's largest maintenance and supply depot for the Army Air Forces and during the war Douglas Aircraft selected the state as the location of two huge plane building plants. There is an unusually large proportion of clear, fair days each year here. So that's the general economic picture of this region that we take into account in our programs.

"Another factor is the region's colorful

*"WHN Does It Again . . . in FM" Western Electric Oscillator, Oct. 1946.

View of KOMA's new 50 kw Western Electric transmitter with KOMA's chief engineer M. W. "Tommy" Thomas seated at the Transmitter Control Desk. This equipment is housed in the brand new transmitter building shown on page 12. Standing are Western Electric Radio Engineers J. C. Herber (right) and K. K. White.

history." Bill continued, "From tepees to towers, as they say, Oklahoma City is only about half a century old. The site of the city was opened to settlement April 22, 1889. An old reference book states that by night it had a population of 10,000 under tents. At noon, on the date mentioned—April 22, 1889—about 40,000 people rushed into the Oklahoma territory in covered wagons, by horseback and on foot. The city itself was chartered in 1890. The State is called the "Sooner" State after the people who had evaded the regulations and stolen in before the settlement rush. All the state was, of course, part of the Indian Territory in those days and that section of the panhandle near Texas was known as 'No Man's Land'. Now the state has a population of 2,336,400 people and about 421,320 radio families and the region we hope to reach, considerably more . . ."

"What are some of the programs KOMA offers now?" we asked.

A Network Show

"Well, Ken has already mentioned our major radio-stage show hit, the *Oklahoma Roundup*. This show was started back in 1943 when Ken brought Hiram Higsby, radio's original rube, to Oklahoma City to give the Sooner capital city an indigenous barn dance type of entertainment. It was an almost immediate hit and continued to grow and to draw audiences for its Saturday night sessions. Many of the show's stars are now being heard on the networks, and this past summer the big show itself went coast-to-coast on Columbia. It has continued to post excellent ratings, and the *Roundup's* stars have signed contracts with Apollo records which will soon make their western music available on platters throughout the country.

Row of seven mercury vapor rectifier tubes at KOMA.

"Most popular of our daytime shows is *Eddie's Corner Store* a lively and heavy-pulling platter party put together by Eddie Coontz, a former Tulsa program director and ex-Marine officer. This daily hour and a quarter of records rated highest of our daytime programs during the summer and attracted many new advertisers to the station. Another Saturday night party for teen-agers put together by Eddie has also become one of our drawing cards. With hosts and hostesses each week from the various high schools in the city area, Eddie conducts an hour of "disc jockeying" then clears the dance floor of the dining room of the Biltmore Hotel and presides over another hour of dancing and fun."

Sports Program

"Finally," Bill went on, "we come to the series of programs which has given this station a lot of distinction in this part of the country. These are our sports programs. For many years, we've been recognized as the outstanding sports station in Oklahoma. For the fourth consecutive year, we have put on the air the entire football schedule of the University of Oklahoma, the highlight game of the season being the game with Army broadcast from West Point in September 1946. We boast in Curt Gowdy, a former basketball and tennis star of the University of Wyoming, one of the best sportscasters in mid-America. We're also pretty successful around here

(Continued on page 25)

THESE STATIONS—ON THE

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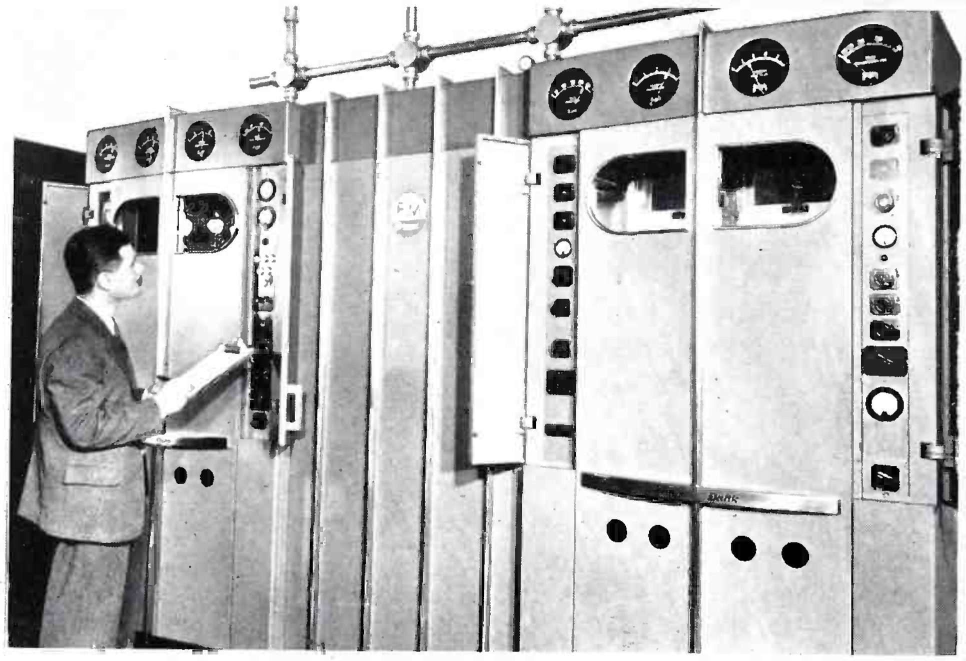


WBAM

NEW YORK, NEW YORK
Theodore C. Streibert, President and General Manager
J. R. Poppele, Chief Engineer
Owned by Bamberger Broadcasting Service Inc.
Affiliated with Station WOR
Frequency 96.5 mc
(In photo: R. H. Davis)

KHJ-FM

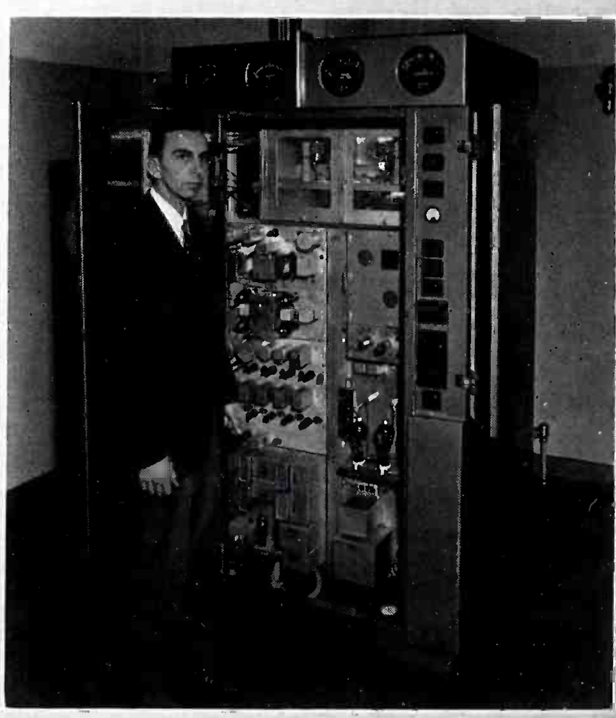
LOS ANGELES, CALIFORNIA
Lewis A. Weiss, Vice President and General Manager
Frank M. Kennedy, Chief Engineer
Owned by Don Lee Broadcasting System
Affiliated with Station KHJ
Frequency 99.7 mc

KJBS-FM

SAN FRANCISCO, CALIFORNIA
E. P. Franklin, General Manager
William Nielsen, Chief Engineer
Owned by KJBS Broadcasters
Affiliated with Station KJBS
Frequency 98.5 mc
(In photo: William Nielsen)

KPFM

PORTLAND, OREGON
Stanley M. Goard, General Manager
W. K. Dallas, Chief Engineer
Owned by Broadcasters Oregon, Ltd.
Frequency 94.9 mc
(In photo: Stanley M. Goard)



KUSC

LOS ANGELES, CALIFORNIA
William H. Sener, Manager, Radio Dept., U.S.C.
C. E. Donaldson, Chief Engineer
Owned by Allan Hancock Foundation, University of Southern California
Frequency 91.7 mc
(In photo: C. E. Donaldson)

AIR-SHOW MARCH OF FM

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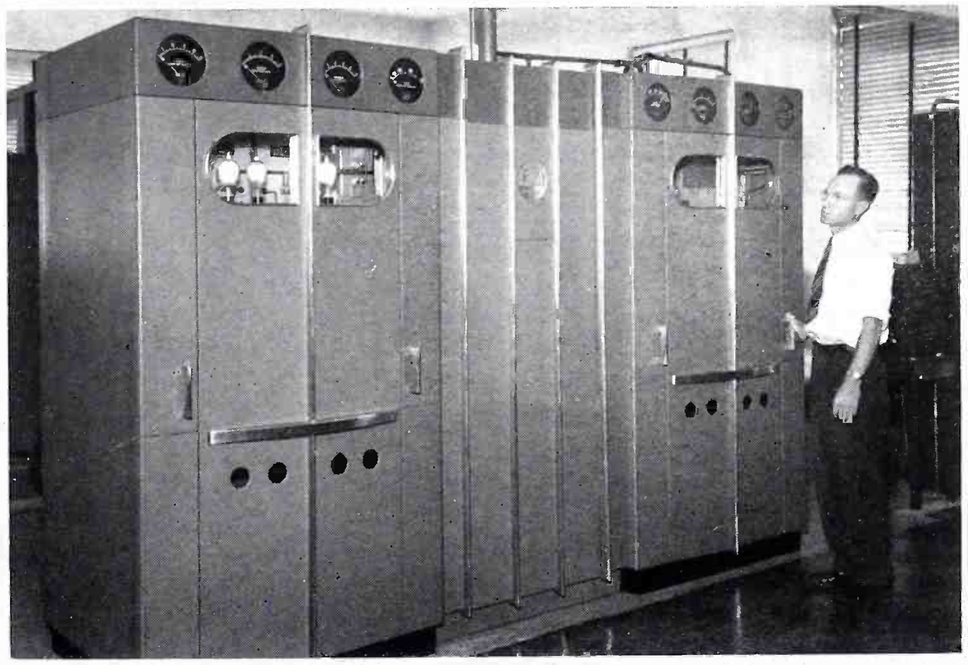
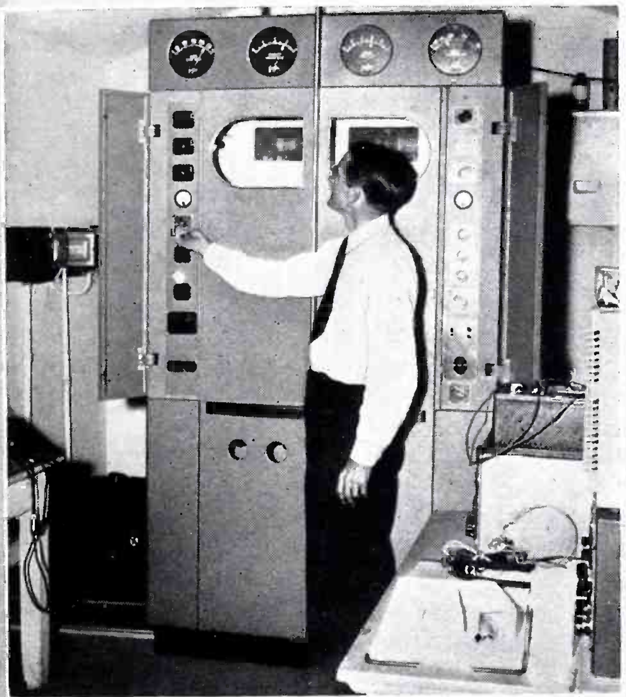


W9XEK

LOUISVILLE, KENTUCKY
W. L. Coulson, General Manager
Orrin W. Towner, Chief Engineer
Owned by Courier-Journal and Louisville Times
Affiliated with Station WHAS
Frequency 92.3 mc
(In photo: Louis A. Williams)

WABF

NEW YORK, N. Y.
Ira A. Hirschmann, President and General Manager
John Basso, Chief Engineer
Owned by Metropolitan Television Inc.
Frequency 98.5 mc
(In photo: Julius Ecking (left) and John Basso)



WAFM

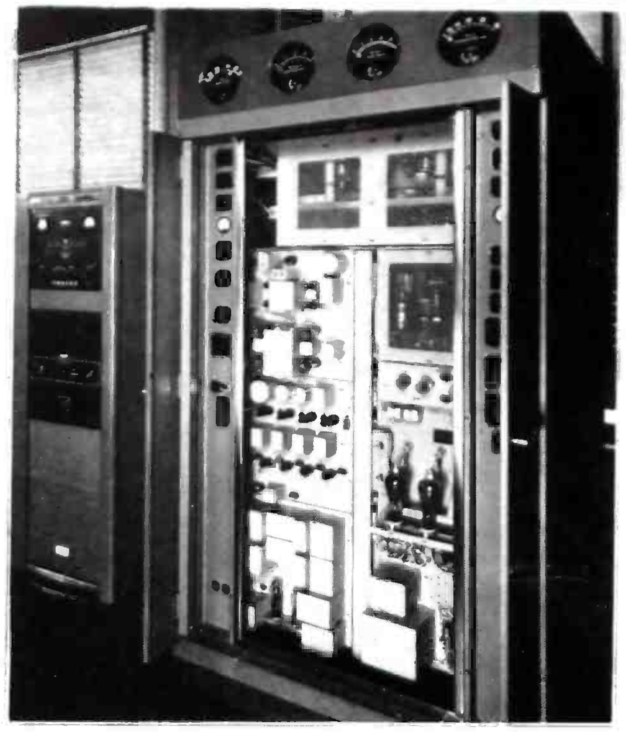
BIRMINGHAM, ALABAMA
Thad Holt, President and General Manager
Norman S. Hurley, Chief Engineer
Owned by Voice of Alabama Inc.
Affiliated with Station WAPI
Frequency 94.3 mc
(In photo: N. S. Hurley)

WBCM-FM

BAY CITY, MICHIGAN
H. A. Giesel, General Manager
Ralph Carpenter, Chief Engineer
Owned by Bay Broadcasting Company, Inc.
Affiliated with Station WBCM
Frequency 97.9 mc

WDLM

CHICAGO, ILLINOIS
Henry C. Crowell, General Manager
A. P. Frye, Chief Engineer
Owned by Moody Bible Institute
Affiliated with Station WMBI
Frequency 99.7 mc
(In photo: A. P. Frye)



WELL-FM

BATTLE CREEK, MICHIGAN
D. E. Jayne, General Manager
Earl Stone, Chief Engineer
Owned by Federated Publications, Inc.
Affiliated with Station WELL
Frequency 102.1 mc

WGHF

NEW YORK, NEW YORK
W. G. H. Finch, President and General Manager
Herbert C. Florance, Chief Engineer
Owned by W. G. H. Finch
Frequency 99.7 mc

WIOD-FM

MIAMI, FLORIDA
James M. Le Gate, General Manager
Milton C. Scott, Chief Engineer
Owned by Isle of Dreams Broadcasting Corp.
Affiliated with Station WIOD
Frequency 97.5 mc
(In photo: Milton C. Scott)

WIP-FM

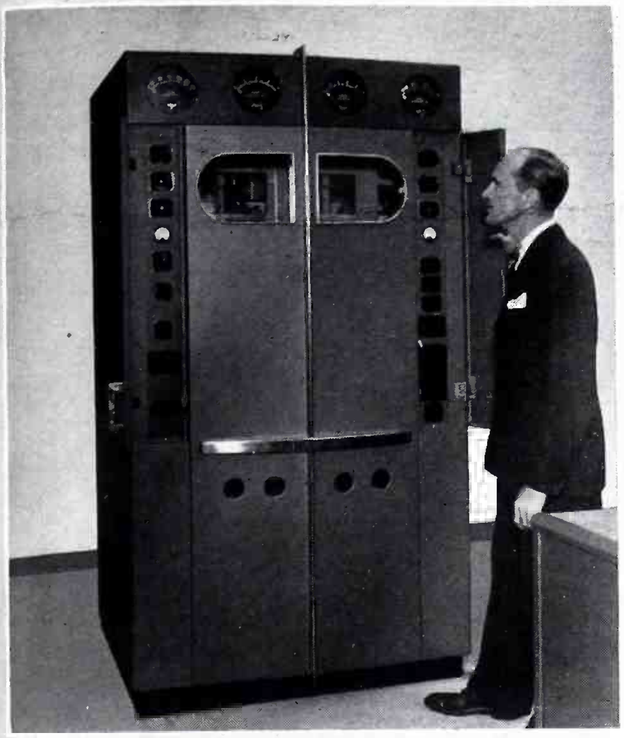
PHILADELPHIA, PENNSYLVANIA
Benedict Gimbel, Jr., President and General Manager
Clifford C. Harris, Chief Engineer
Owned by Pennsylvania Broadcasting Company
Affiliated with Station WIP
Frequency 97.5 mc
(In photo: Benedict Gimbel, Jr.)

WITH-FM

BALTIMORE, MARYLAND
R. C. Embry, General Manager
James Duff, Chief Engineer
Owned by Maryland Broadcasting Company
Affiliated with Station WITH
Frequency 107.3 mc
(In photo: R. N. Chell)

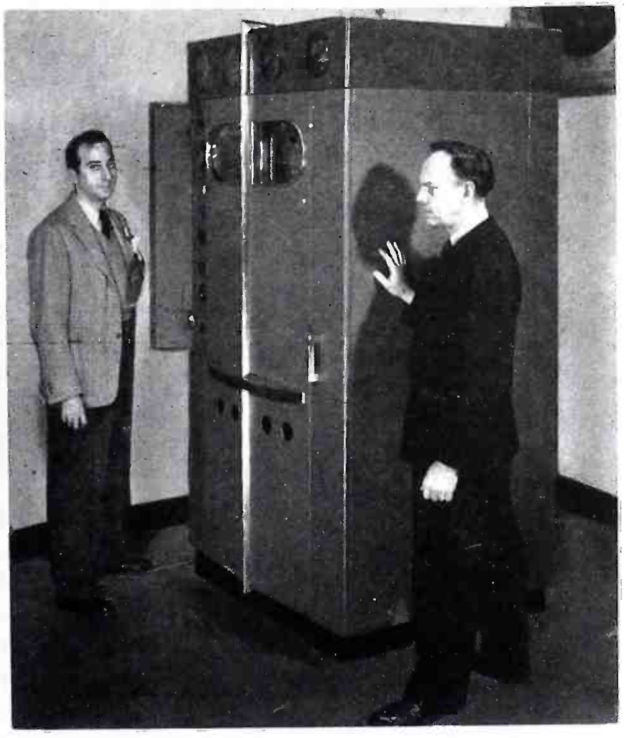
WMGM

NEW YORK, NEW YORK
Frank Roehrenbeck, General Manager
Paul Fuelling, Chief Engineer
Owned by Marcus Loew Booking Agency
Affiliated with Station WHN
Frequency 99.3 mc
(In photo: Paul Fuelling)



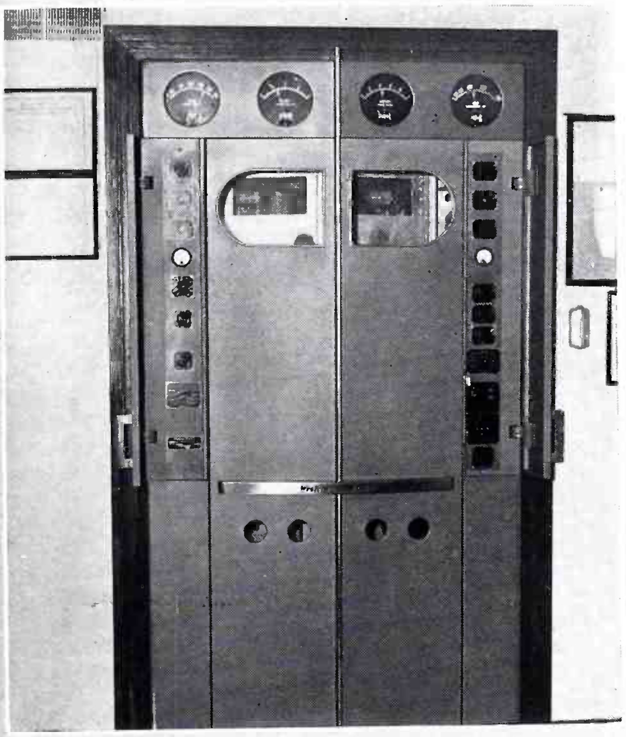
WNYC-FM

NEW YORK, NEW YORK
Seymour N. Siegel, Station Director
William H. Pitkin, Chief Engineer
Owned by the City of New York
Affiliated with Station WNYC
Frequency 95.3 mc
(In photo: Seymour N. Siegel (left) and William H. Pitkin)



WTPS

NEW ORLEANS, LOUISIANA
H. F. Wehrmann, Manager
Owned by Times Picayune Publishing Company
Frequency 94.5 mc
(In photo: H. F. Wehrmann)



W4XAG

ATLANTA, GEORGIA
Frank Gaither, General Manager
Ben Ackerman, Chief Engineer
Owned by Georgia School of Technology
Affiliated with Station WGST
Frequency 99.4 mc

W8XMV

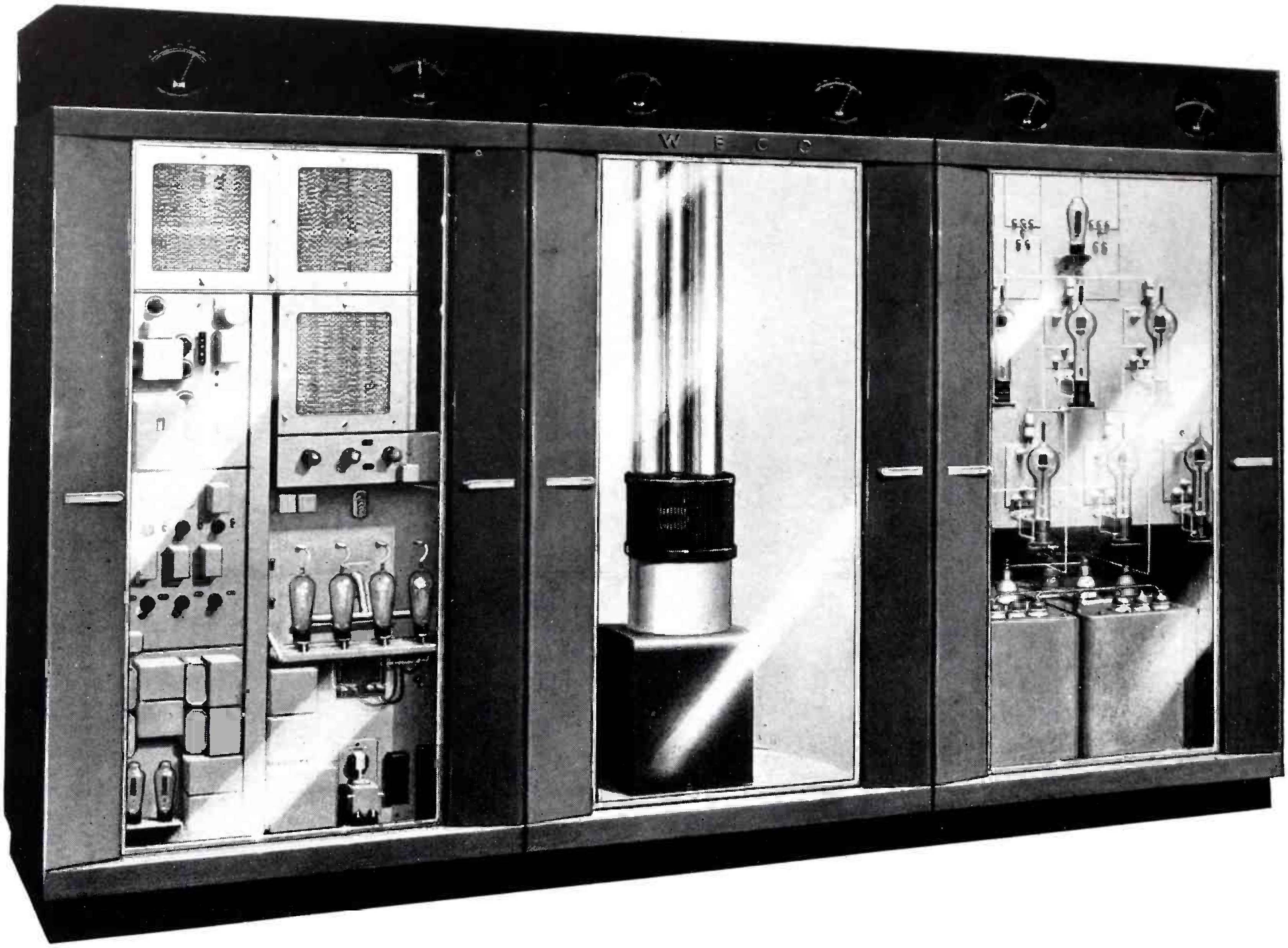
DAYTON, OHIO
R. H. Moody, General Manager
Ernest Adams, Chief Engineer
Owned by Miami Valley Broadcasting Company
Affiliated with Station WHIO
Frequency 99.8 mc

W8XUB

CLEVELAND, OHIO
K. K. Hackathorn, General Manager
R. H. De Lany, Chief Engineer
Owned by United Broadcasting Co.
Affiliated with Station WHK
Frequency 107.1 mc
(In photo: H. K. Carpenter (left) and Carl E. Smith)

W9XLA

DENVER, COLORADO
H. B. Terry, General Manager
H. Wehrman, Chief Engineer
Owned by KLZ Broadcasting Company
Affiliated with Station KLZ
Frequency 92.1 mc



Better Products Through Industrial Design

By Henry Dreyfuss

• • A famed industrial designer talks about his art and tells how he applied it to an FM transmitter — and thus created the distinctive "Transview" design. • •

WHILE radio transmitters are more complex than the average product, the new "Transview" line of Western Electric FM transmitters is an example of the attractive utility that can be achieved in a manufactured article by the cooperation of engineers, in this case those of Bell Telephone Laboratories, with an industrial designer.

The "Transview" line exemplifies a trend to make the components of high quality mechanisms visible to the eye. To meet the public's desire to "watch the wheels go around," lucite was employed, for example, in transparent telephones over which the public talked at the American Telephone & Telegraph Company exhibit at the New York World's Fair. Visitors showed an enormous interest in the beautiful simplicity of the apparatus.

There is an inherent beauty in apparatus and machinery. It is a beauty that derives its appreciation from an orderly conception, from magnificently machined parts, from integrity of engineering. All these contribute to an integrated, perfectly functioning product or machine.

Industrial design has three principal considerations in addition to improvement of appearance. These are (1) convenience of use; (2) ease of maintenance for the consumer; and (3) ease of fabrication or manufacture for the producer. By attention to these points, improvements may be made in many directions.

Good styling, first of all, may serve a manufacturer by creating a new product generally more attractive and acceptable. It may save weight, a matter of great importance in any article that moves and may also provide a means of simpler, more efficient fabrication. A new physical design may provide advantages over the old in simplicity of operation, increased usefulness, greater safety or easier maintenance. A new design may sometimes do all of these things, though any one would be valuable alone.

That exterior form follows interior function is still the principal axiom of design. Industrial designers and engineering designers work hand-in-hand. Their jobs are complementary, and complete and harmonious cooperation can be achieved. Above all, they must determine the true, current and future function of the product on which they are working.

This may have to be discovered or confirmed by surveys, interviews with or observation of consumers, or through some other form of market research. This may be as elaborate or as simple as the time and money available but it should be done.

As an example of our own practice in this direction, we recently kept 58 persons for 24 hours in the mock-up of a giant airliner for Consolidated Vultee, in order to obtain their reactions. In designing alarm clocks, standing behind the counter in stores where the clocks were sold and observing the customers and listening to their remarks about the products proved very profitable. Learning to operate a tractor and several weeks on a farm were part of the redesign of farm machinery for Deere & Co. A line of implements, sleek in appearance, easy to operate and maintain, and, perhaps most important of all, much less dangerous to use than previous equipment, resulted from this study.

It may be pointed out here that design must always be considered an integral part of the whole. It is not mere decoration and to be fully effective cannot be added, and the simplest is usually the best.

Importance of Color

Color in modern design has a role even more important than decoration. While ofttimes a designer cannot create more space, his knowledge of color can contribute to the illusion of space. Ceilings can be made to seem inches higher, and small areas seem larger through a combination of colors. Color must be fitting. Some things must be made to be unobtrusive, others eye-catching. And all must be pleasing.

The development of a new design usually follows the same general routine. The first step is often a round-table discussion at which management, engineering, production, sales and advertising departments are represented. The desires and limitations of each department are discussed. Factory facilities are visited. Competitive designs, if any, are studied for their strong and weak points.

With this information, possibly supplemented by independent research, the industrial designer then makes numerous design sketches. At a later meeting, the more promising of these are selected for further development. Models in wood, clay, cardboard or other material follow. These may be made up in different colors. Finally, working molds are constructed and, with possibly further modifications, are put into production.

In cooperating, through the Bell Laboratories, on the new "Transview" transmitters for Western Electric, we determined to remove the mystery of the closed cabinet which for so long had hidden the apparatus. The transmitter cabinets developed have for the first time an entire front of heat-hardened herculite glass, giving complete, unobstructed vision for the operator and for interested observers.

In designing the new transmitters, these were some of the steps necessary: After exhaustive planning, color renderings were made. From these a wooden mock-up, complete with glass door was built and painted in accordance with the renderings. It was this wooden mock-up that was used as a final "testing ground" for over-all appearance and exterior design details.

As an example of the thoroughness with which each detail was tested, several designs of the handles for the two side panels were presented in blueprint. Wooden models were then made. These were attached to the dummy cabinet and tested for finger depth, ease of opening, general appearance and suitability to the over-all design. Both vertical and horizontal handles were tried and the horizontal handles proved superior in every respect.

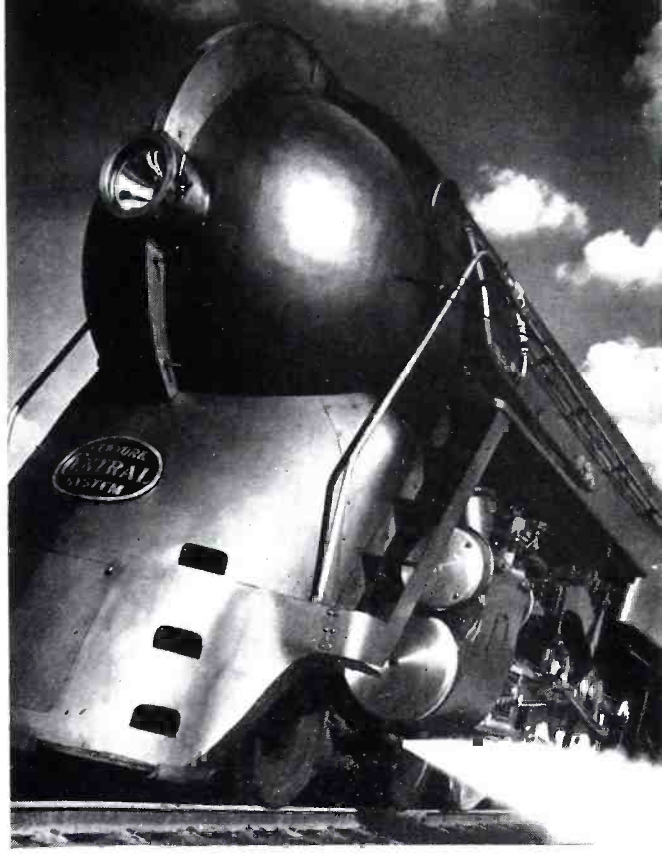
Another example was in the selection of the design for the station call letters. Such considerations as letter style and color were important in giving a pleasing appearance and readability. For this, a version of the "Twentieth Century" design of letter, widely spaced and modified to make possible fabrication from plastic, was worked out.

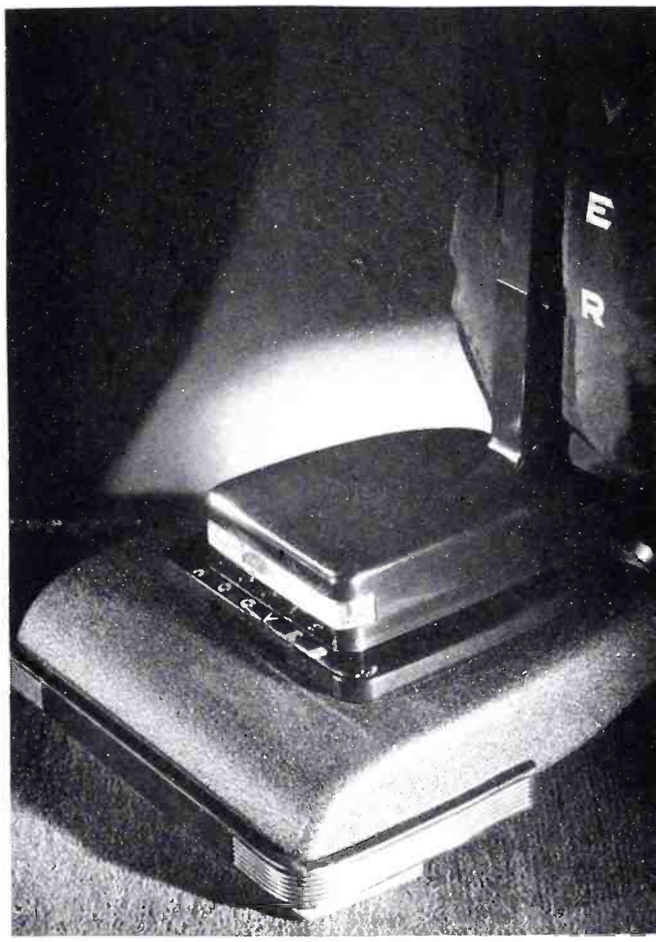
Finally, the selection of proper glass for the front of the transmitter cabinet may be cited as a major design factor. A glass was needed which met requirements of extreme strength, transparency and general practical value. Full size panels of both uncolored glass and glass tinted in various shades were tested on the mock-up and studied under every type of lighting and from every angle. With soft fluorescent lighting inside the cabinet the decision was overwhelmingly in favor of clear glass to avoid deep shadows and show the interior in all its beauty.

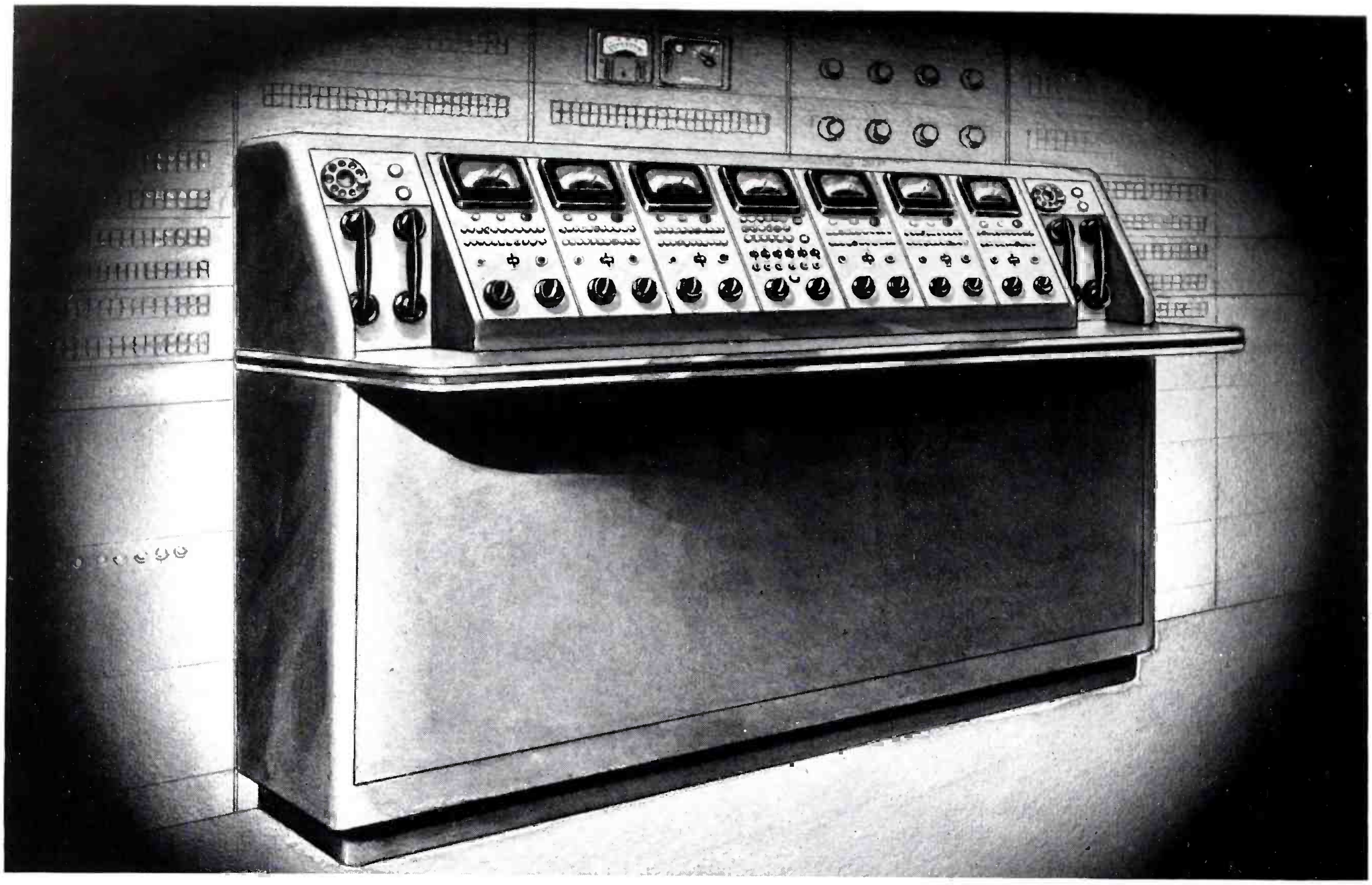
The functional aspect of the transparent cabinet allows the operator to observe at all times any emergencies that occur. The vertical panels which flank the glass front door open to give the operator complete access to the controls.

In these transmitters, this physical design serves as a silent salesman, providing crystal-like visibility for studying the results of hours of painstaking work on the part of engineers. Illuminated by fluorescent light, the intricate apparatus presents a sculptured picture that symbolically portrays the science of radio broadcasting transmission.

Shown at right are three examples of industrial design by Henry Dreyfuss. At top is a steam locomotive for the New York Central's 20th Century Limited. Center photo is the modern Hoover vacuum cleaner. Bottom, a Warner & Swasey spindle bar automatic machine with transparent machine section.







The Master Control Panel for the new Western Electric relay type output switching system includes a Control Panel for each line and one Group Release Panel.

Program Dispatching Made Easy

A new switching unit simplifies and speeds up even the most complicated dispatching operations

By H. F. Scarr

Western Electric Radio Division

One of the "hits of the show" at the October 1946 NAB Convention in Chicago was a "line unit" for a new Relay Type Program Dispatching System. Heretofore available only for custom built installation, Western Electric is now preparing this system for manufacture in the form of standardized assemblies which will make it available to an increased number of outlets such as AM and FM transmitters, networks and other destinations served from each station's studio installation.

The system expedites, makes simpler and coordinates the large number of concurrent dispatching operations needed to serve the several destinations with rapidly interchanged studio, line and transcribed programs and announcements required for interesting and attractive programming. Many broadcasting stations, both large and small, will find that their Master Control switching requirements will be admirably met by this flexible system.

For more rapid and unerring operation, a desired set of operating conditions can be preset ahead of actual switching transfer or "release". Control of release then can also be transferred to the most convenient point and program line switching effected with the movement of a single key, if desired. Operating coordination between the Master Control Dispatcher and the Control Booth Engineer is assured by positive lamp indication of operating conditions. The degree of completion of the switching operation is always evident and provides a means of cross check between operators. Thus, there is almost no loss of program time or delayed starts due to misunderstandings or lack of operator coordination.

Designed as a unit type system to facilitate installation, and housed in attractively finished cabinets with all operating controls and indicators readily accessible, a typical rack-mounted arrangement of this system is shown in the artist's conception above. The equipment illustrated can be either rack or desk-mounted and includes facilities to handle the line switching from ten studios to six output lines. In this system any studio can be connected to any one or to any number of lines. However, to insure proper coordination, each line can accept program from only one studio at a time. Where a single program requires combinations of more than one studio or program line source, a main studio should be chosen and all other sources fed through it to maintain constant supervision of program balance.

In addition to the regular program dispatching functions, a new feature incorporated in this system is a Flash Announce Control Circuit providing ready facilities for handling news flashes, split commercial announcements, split station breaks and other "break in" conditions where the previously existing program connections are to be re-established following the "break in". Switching facilities for two Flash Announcing Channels are included and described in more detail below.

Figure 1, which is a functional schematic of the system, will assist in describing the operational and equipment features of this Relay Type Dispatching System. Shown near the upper left in Figure 1 is a Studio Control Signal Indicator Panel, one located in each studio booth. Near the lower left of Figure 1 is the Flash Booth Control Signal Indicator panel, one required for each flash announce booth. All of the remaining equipment in Figure 1, consisting of the relay and apparatus assembly and control panels, is located in Master Control. For each outgoing line there is a corresponding Line Control Panel (six are shown, all identical). One Group Release and Flash Control Panel is required for each six outgoing lines (one shown).

The features and flexibility of this system can be readily understood by a review of the functions of the controls and indicators on the Individual Line Control Panel for Channel 1 and the Studio Control Signal Indicator Panel for Studio 1 shown in detail in Figures 2 and 3, page 24. The control panels of the other five lines and nine studios are identical. The Group Release and Flash Control panel is also shown detailed in Figure 4, page 24, and will be described below.

Line Control Panels

The ON and OFF push buttons and associated POWER ON lamp are located on each Line Control Panel (see Figure 2) immediately beneath the Line Volume Indicator Meter. These push buttons control d-c energizing power to the lamps and relays of the respective line unit. This enables positive control by the Master Control Operator of program dispatching to each line and prevents unauthorized connection to the line.

In turning on the power for any line channel, if the manual PRESET switch (lower left-hand corner) is in the OFF position, the POWER ON lamp and the OFF lamps in both the ON AIR and PRESET rows together with the OFF lamps in both the LINE ON and LINE PRESET rows on the Studio Control Signal Indicator Panel (see Figure 3), will be illuminated. The manual PRESET knob is used to select the studio to be connected to the line at the next operation of the LINE RELEASE key. When this knob is turned to 1, the number 1 PRESET lamp illuminates on the Line Control Panel, and the corresponding number 1 PRESET lamp on the Control Signal Indicator Panel in the respective Studio No. 1 will give a like indication showing that the Studio No. 1 is preset for connection to line 1. The respective OFF lamps, of course, extinguish.

The "Line Release" operation to transfer from an existing OFF or LINE condition to the condition PRESET can be effected in several ways. For release of a single line the Master Control Dispatcher can operate the LINE RELEASE Key on

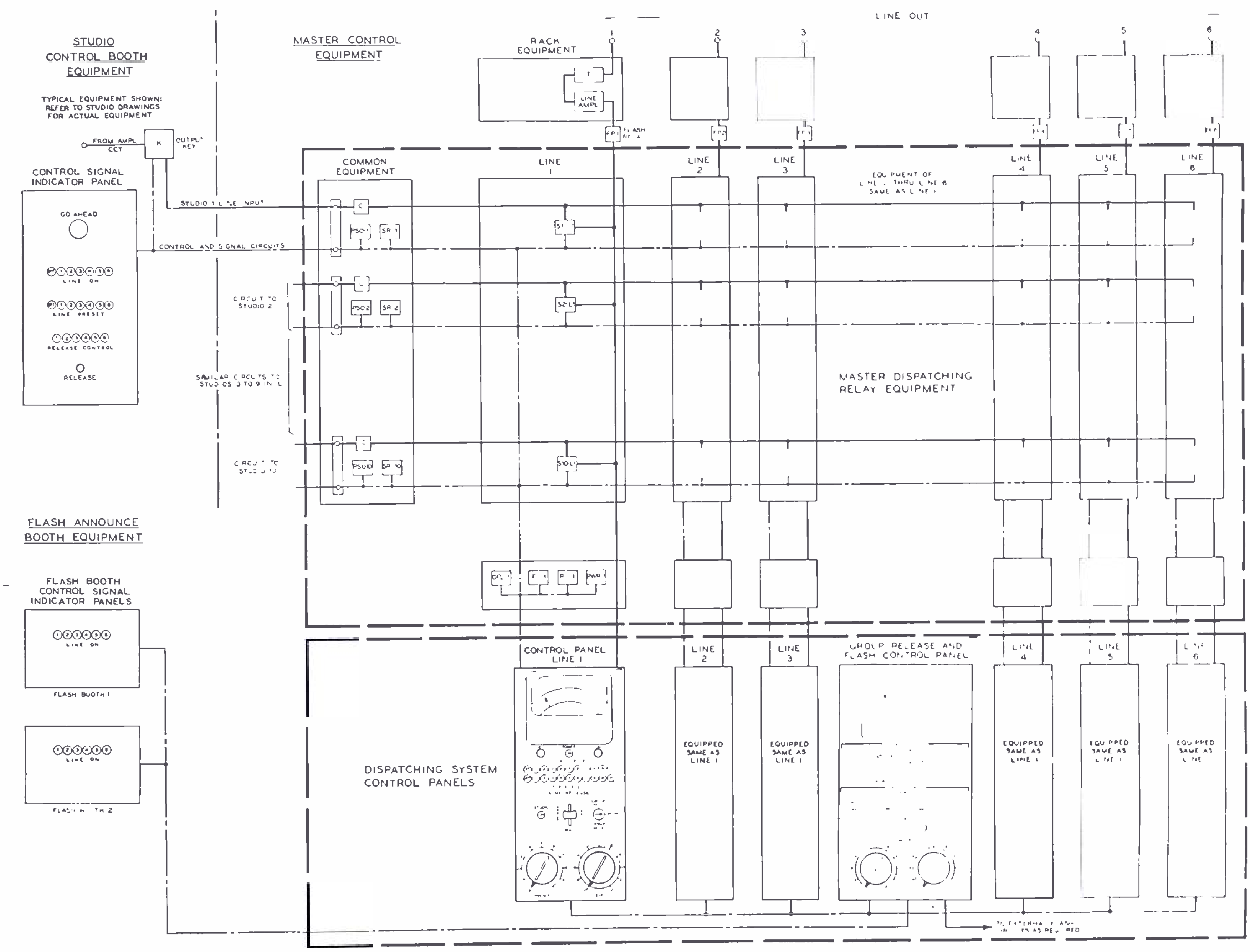


Figure 1: Block schematic of new relay type output switching system. The circuit flexibility and positive lamp indications insure smooth operation.

CONTROL PANEL LINE 1

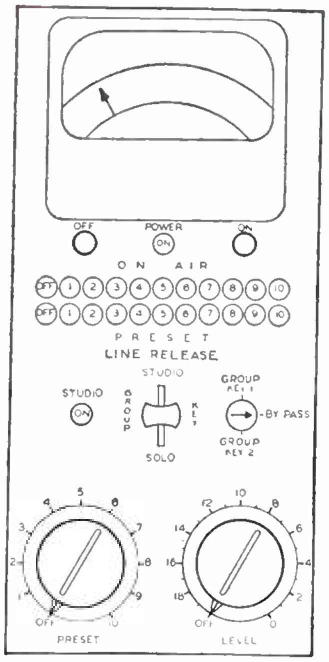


Figure 2

CONTROL SIGNAL INDICATOR PANEL

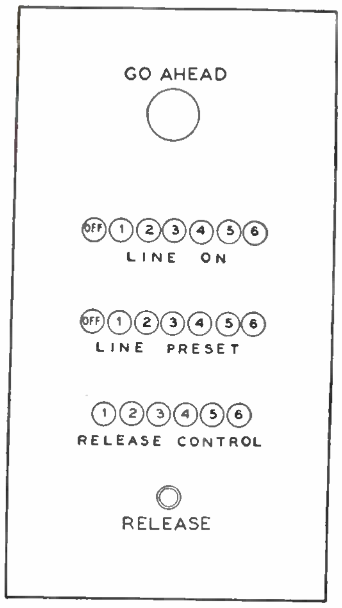


Figure 3

GROUP RELEASE AND FLASH CONTROL PANEL

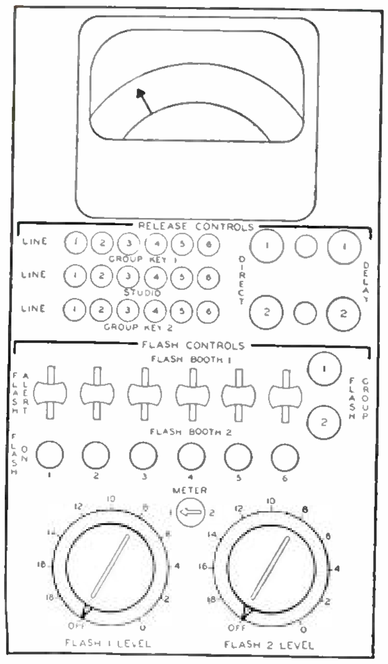


Figure 4

FLASH BOOTH CONTROL SIGNAL INDICATOR PANELS

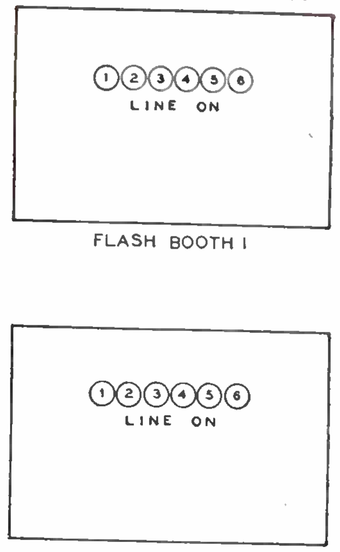


Figure 5

the Individual Control Panel for that line downward to the SOLO position. This key is non-locking in this position. The existing connection is released at once and the new connection established as the key returns to normal. Line release control can also be extended to Grouping Keys for release of a number of lines simultaneously or to the studio for placing release under control of the Booth Operator. These features are described more fully below.

At the time of release, the previous connection is disconnected and the desired condition preset performed, thereby extending the respective studio trunk to the outgoing line. Concurrently, the Studio Booth Operator will receive a GO AHEAD signal on the Bullseye GO AHEAD lamp, and the number 1 LINE ON lamp of the Control Signal Indicator Panel will be illuminated as will the ON AIR lamp of the associated Line Control Panel in Master Control. (Other LINE ON lamps will light for other lines). These lamps show both the Control Booth Operator and Master Control Operator that each phase of the relay switching cycle has been completed.

Studio Output Connection

The next step is for the Control Booth Operator to operate the Studio Output Key connecting his amplifier system to the trunk which has been extended to him by Master Control. This automatically lights the STUDIO ON lamp in Master Control on the respective Line Control panel, signifying that the extended trunk has been "picked up", the connection between the Studio and the outgoing line completed and the program can start.

The LEVEL knob at the lower right hand corner of the Control Panel (Figure 2) and the Volume Indicator meter are to adjust the line level for the proper operating range. Proper maintenance of level for a program is the responsibility of the Control Booth Operator. However, the Master Control Dispatcher can compensate for special conditions.

Above it was mentioned that release control can be extended to other points than the individual line release key. When the line is to be released only at the end of a program, the RELEASE control can be extended to the Control Booth Operator by placing the Line Release Key in the STUDIO position. When the RELEASE function has been transferred to the Control Booth Operator, the Release Control Lamps show what lines are subject to his release. In this condition, the release function is controlled by the RELEASE button on the Studio Control Signal Indicator Panel (Figure 3) in the Studio Booth to which the line is connected.

The three-position switch designated GROUP KEY 1—BY PASS—GROUP KEY 2 (see Figure 2) on each line control panel is used to transfer the release function to either of the respective Group Keys on the Group Release and Flash Control Panel. This panel, Figure 4, includes three rows of indicator lamps immediately beneath the Volume Indicator Meter to show what lines are under the release control of GROUP KEY 1, STUDIO, and GROUP KEY 2. The two Group Release Keys (located at the right of their accompanying row of indicator lamps and marked DIRECT) serve to switch the one or more lines simultaneously. Adjacent to the DIRECT Group Release keys are two additional keys with associated lamps for Delayed Switching.

The Group Release and Flash Control also incorporates the pertinent controls for the two Flash Channel Announcing circuits. Each outgoing line has a three-position key designated FLASH ALERT and a push button key for FLASH ON. The FLASH ALERT key is to automatically preset the outgoing line or lines to either one of two flash announce booths, simultaneously sending a synchronized signal to the respective studios where program is to be interrupted. This synchronized signal will appear concurrently at three places for each individual line in the form of (1) Flashing the LINE ON and GO AHEAD lamps on the associated Studio Control Indicator Panels (2) the ON AIR lamp on the Line Control Panel indicating to Master Control the studios and (3) lines being alerted. The Flash Announcer also receives a like indication. This synchronized ALERT signal continues until the desired Individual Line FLASH ON push button or FLASH GROUP key is operated, thereby "picking up" on all lines which were preset for flash by the FLASH ALERT keys. The Flash Announcers Indicator panel lamps, shown in Figure 5, then remain steadily illuminated for the designated outgoing lines being fed providing an automatic synchronized GO AHEAD signal to the Flash Announcer.

Program Interrupted Signal

In cases where a studio may be supplying program to several outgoing lines and all but one line is to receive the "flash announcement", the studio GO AHEAD lamp will not flash, indicating program is to continue, but the respective LINE ON lamps will operate with the synchronized signal showing program interruption and restoration of the selected lines.

Upon completion of the flash announcement, Master Control restores the *status quo* by pushing each three-position FLASH ALERT key to the normal position. This restores each line and indication back to the interrupted studios, and programs may be resumed on the normal basis.

The two FLASH LEVEL Knobs at the bottom of the Group Release and Flash Control panel adjust the output levels of the two Flash Circuits as indicated by the Volume Indicator meter at the top of the panel. The meter switch is used to connect the meter to either of the two Flash Circuits for pretesting the announcing level.

A summary of the Controls and Indicators on each of the four types of panels with their functions follows:

INDIVIDUAL LINE CONTROL PANEL — Figure 2, page 24 (Located in Master Control)

Meter	Indicates line level.
ON-OFF push buttons	Control DC relay power to individual line Switching Circuit. Prevents unauthorized connection to line.
POWER ON lamp	Lights when relay power is on.
ON AIR lamps	Indicate which studio is using the line.
PRESET lamps	Indicate studio preset to use the line next.
STUDIO ON	Lights to indicate that studio trunk is connected to outgoing line and connection to trunk is made in studio. (Output key thrown.)
LINE RELEASE	Releases Control.
STUDIO Position	Transfers release control to studio then connected to line.
GROUP Position	Transfers release control to Group Control keys through group control selector.
SOLO Position	Effects release for the line individually.
GROUP CONTROL SELECTOR	Provides selection of either of two Group Keys or By-Pass Key.
PRESET Switch	Selects next studio (or "OFF" condition) to use line.
LEVEL Control	For supervisory adjustment of line level.

CONTROL SIGNAL INDICATOR PANEL — Figure 3, page 24 (Located in Studio Control Booth)

GO AHEAD Lamp	Signals that the studio trunk is connected to a line.
LINE ON Lamps	Indicate which line or lines are connected to Studio Trunk.
LINE PRESET Lamps	Indicate line or lines to be connected next.
RELEASE CONTROL Lamps	Indicate that release control for which line or lines has been transferred to the studio.
RELEASE Button	Push button to effect release on lines with release control lamps illuminated.

GROUP RELEASE AND FLASH CONTROL PANEL — Figure 4, page 24 (Located in Master Control)

Meter	For checking level of Flash Circuits.
RELEASE CONTROL Lamps	Indicate which lines are under the release control of the respective Group Keys or the studio.
FLASH PRESET Keys	Preset either of two flash circuits to the respective lines.
FLASH ON Buttons	Used to connect Flash Circuits to individual lines.
FLASH GROUP Buttons	Used to connect Flash Circuits to lines by groups.
METER Switch	Connects Volume Indicator meter to either of two Flash Circuits.
FLASH LEVEL Knobs	Adjust level of respective Flash Circuits.

FLASH ANNOUNCERS INDICATOR PANEL — Figure 5, page 24 (Located in Flash Announce Booth)

FLASH ON Lamps	When flashing indicate lines about to be connected for flash announcement. Steady illumination indicates "GO AHEAD" to flash announcer.

The simplicity of controls, flexibility, and ease of operation of this equipment are typical of systems engineering by Western Electric. The highest quality components are combined into an over-all system that increases the efficiency and smoothness of operation.

KOMA—Oklahoma City

(Continued from page 15)

with our big basketball broadcasts. Basketball is one of the major sports here and we carried an extensive schedule of Oklahoma A. and M. and Oklahoma University basketball games with remote pick-ups.

Average Age of Staff 31

The men who run this major station in the heart of Oklahoma seem to put the accent on youth. They themselves are young, their average age only 31. Ken Brown, 33, one of the youngest managers of a 50 kw station in the country, began his career as an engineer-announcer in Kansas City. He still holds his first class telephone operator's ticket issued by the old Federal Radio Commission in 1933, obtained for this first full-time job at KXBY. At this station, no longer in existence, Ken "discovered" Count Basie playing in a night club and introduced him to KXBY listeners, one of whom was Benny Goodman. The Negro band leader's career was launched. From there, Ken went to KCKN as announcer and then north to the Cowles stations, KSO-KRNT, Des Moines, also as announcer. From there, he became head of special events for the Iowa Broadcasting Company (Cowles) stations. At KVOO, Tulsa—Ken's next major job—he was so successful in local, regional and national selling that in 1942 the late J. T. Griffin, owner of KOMA, placed him in charge of that station's operations. Ken is a member of CBS's Advisory Board, president of the Ad Club of Oklahoma City, has held important state radio chairmanships in war bond and infantile paralysis drives and helped organize the Oklahoma City Little Theatre, serving as its first president.

One of Ken's right hand men is Bill Bryan, already mentioned. Bill, a quiet, able, hard-working man, who seems to have a knack for "getting things done," was a former instructor at Washburn College in Topeka, Kansas.

Another of KOMA's stars is J. J. "Joe" Bernard, director of sales. Joe began his career with WKY, another Oklahoma City station. He spent a lot of time in the Navy and saw plenty of action in the Pacific before being discharged as a lieutenant.

As production manager and the man who supervises all talent and announcer activities, KOMA boasts Allan Page, former program director of KVOO, Oklahoma's only other 50 kw station. He produces and announces *Oklahoma Roundup* on CBS. Bob Eastman, formerly of WILL, Champaign, Ill. and WKY, is KOMA's ace director of news and special events.

The station is particularly fortunate in its technical staff. Headed by M. W. "Tommy" Thomas as chief engineer, KOMA's technical men form a remarkably experienced and resourceful team with the accent on practicality. Tommy himself with the station's longest record of service, nine years, is one of the best known and best liked engineers in Southwest radio. He began his ether career as an instructor and ship radio operator aboard the *U.S.S. Parker* during the first World War. With a B.S. degree from the School of Engineering at Milwaukee where he was also chief engineer of the school's radio station, WIAO, he went with the school's station when Hearst Radio acquired it in 1927. The call letters became WISN. In 1937, Tommy was given the job of KOMA's chief engineer. KOMA's excellent technical record is a personal triumph for Tommy.

Assisting him are Harry Edwards, chief transmitter engineer; George Berry, maintenance engineer; John Straiton and Allan Watson, transmitter engineers. To Harry Edwards and George Berry belongs the credit for the excellent construction work on the new 50 kw transmitter and transmission lines. Studio engineers, under Charles Parker as supervisor, are Dick Tullius, Ross Brink and Dale Clovis. Four of KOMA's engineers hold amateur licenses: Harry Edwards, W5AKD; George Berry, W5IFB; Allan Watson, W5ERY and Ross Brink, W5GWW.

Station History

KOMA began life as KFJF in 1928, owned by the National Radio Manufacturing Company with studios in the Security Building in Oklahoma City. Its power was 5 kw on a frequency of 1480 kc. In 1932, the transmitter location was changed to six miles north of the State capitol building and a new Western Electric 5 kw transmitter was installed. At that time, the station acquired its present call letters, KOMA. In 1936, ownership was acquired by Hearst Radio and in March of 1939, the FCC approved its sale to J. T. Griffin, wholesale grocery operator, banker and manufacturer of Muskogee, Oklahoma, also owner of KTUL, Tulsa. The ownership became KOMA, Inc.

Of KOMA's new stature and power, Ken Brown says: "We feel that KOMA at 50,000 will be able to offer a new and better service to thousands of listeners not now enjoying the full benefits of radio. We are going all out to try to meet our responsibility and merit the confidence of our new friends."

Liveness in Broadcasting

(Continued from page 7)

ceptable programs with very little rehearsal.

Important Applications

There are three broad classes of programs to which this technique has been successfully applied: namely, (1) Large concert hall pick-up, such as symphony orchestra, opera, choral singing, etc., (2) Studio music programs with or without vocals, (3) Speech only, such as news, lectures, announcements, etc.

1. *The Large Concert Hall Type of Program.* The most pleasing broadcast of a symphonic or operatic program is the one which creates for the listener the illusion that he is actually present in the auditorium. That effect is obtained when the liveness of the orchestra, including accentuation of any section such as strings, woodwinds, etc., lies between 8 and 20. A good average value for heavy music is 16 while for light delicate music a value of 10 is often preferable.

If the orchestra is accompanying a soloist, for instance, a violinist, a singer or a pianist, the liveness value for the soloist should never be less than one-quarter of the orchestral liveness and should preferably be between one-half and one-third. When the one-half of orchestral liveness is used the soloist is well out in front of the orchestra. As the solo liveness is increased the voice or solo instrument seems to move back and finally becomes merely an accentuated part of the orchestra itself.

The method of determining the dial settings to obtain these effects will be described in detail in Appendix 1. If you will use the quantitative method for setting the dials on your first few rehearsals with this new technique you will soon find that you easily recognize the desired effects by ear and no longer require the computed values, except for an approximate check.

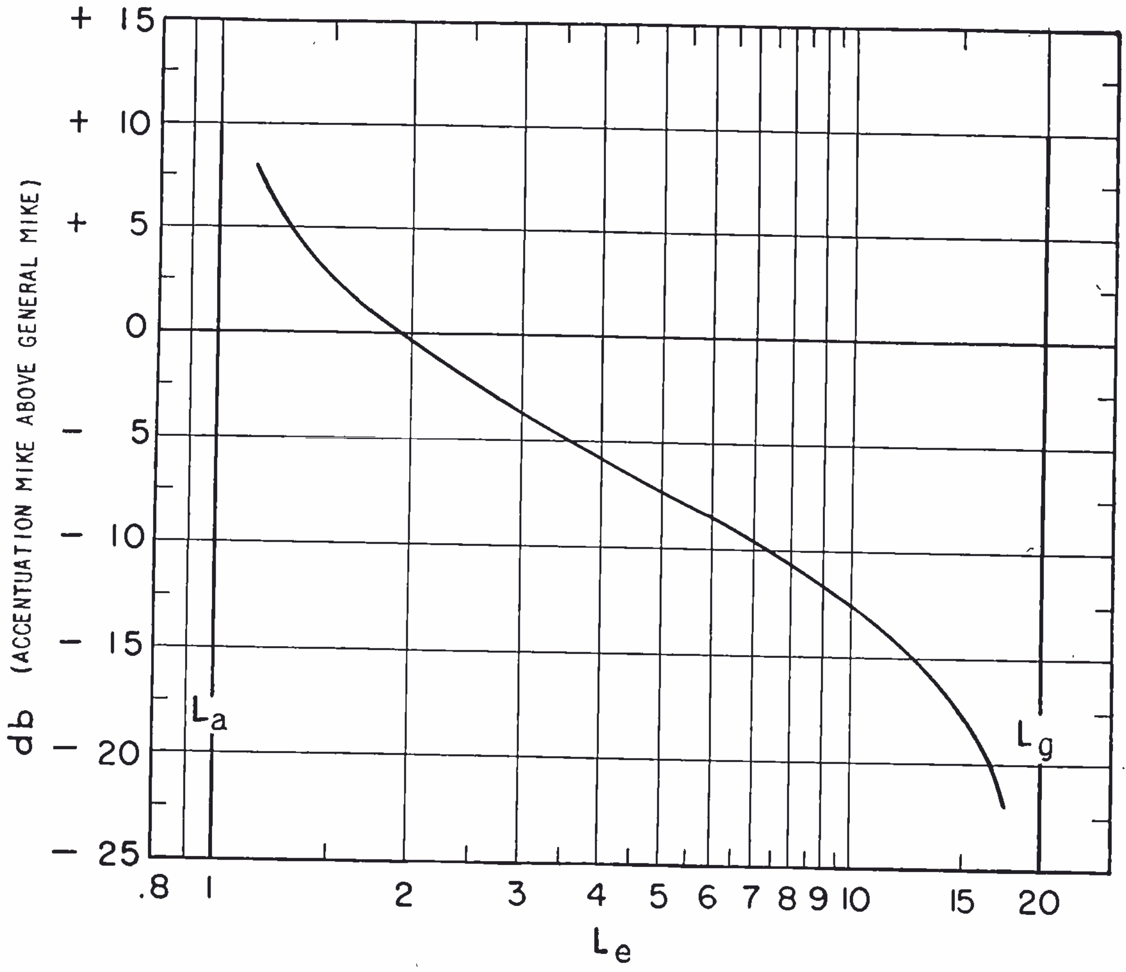


Figure 6 — Chart showing effective liveness of two microphone combinations as function of relative level.

Figure 1, page 4, shows the approximate arrangement of the microphones for the broadcast of the New York Philharmonic Symphony concerts by CBS on Sunday afternoons. This arrangement was arrived at in cooperation with Howard A. Chinn, CBS's Chief Audio Engineer after experimentation, with the valuable assistance of engineers and production personnel of the Columbia Broadcasting System.

Table 2 shows the liveness value for each of the three microphones and the power used, expressed in db above (+) or below (−) the power supplied by the over-all microphone D, Figure 1.

Table 2

Mike	L	db
D (general)	21	0
A (violin section)	0.6	—18 to —12
B (cello section)	0.6	—18 to —12
C (soloist)	0.5	not used

The effective liveness of this arrangement is about 13, which value is well within the useful liveness range shown in Table 1.

2. *Studio Music Programs with or without vocals.* As before, the most pleasing result is obtained when listener feels that he is present in the studio. A liveness between 6 and 12 for the orchestra yields this effect. Solo voices should have a value ½ to ⅓ of the orchestra value, while crooners may operate as low as ⅙ of it. These values are easily obtainable in a good studio which is not overcrowded much beyond curve B in Figure 3.

Figure 2, page 5, shows a typical studio set-up. The method of setting the distances and choosing the types of microphone has already been described. However, a sample computation may be helpful.

Assume a 20-piece orchestra and a crooner in a studio crowded to the curve marked B, Figure 3. Therefore, the studio volume is about 22,000 cu. ft. and it should have a reverberation time of about 1.1 seconds (see Figure 4) with orchestra.

Assume

(1) the desired liveness, L, for the orchestra is 10.

(2) the desired liveness, L, for the crooner is about 1.6.

(3) the general microphone has non-directional characteristics.

(4) the microphone for the crooner and any accentuation microphones for parts of the orchestra have bidirectional characteristics.

Proceed as follows:

a. Set liveness of general microphone at a value $1.5 \times 10 = 15$.

b. Set liveness of crooner microphone at a liveness not greater than $1.6 \times \frac{2}{3} = 1.0$ approximately. Use 0.5 if in doubt, as slightly more flexibility is assured.

c. Set orchestral accentuation microphone at a liveness not greater than $2.0 \times \frac{2}{3} = 1.3$. Use 1.0.

From equation (2) you get the values in Table 3.

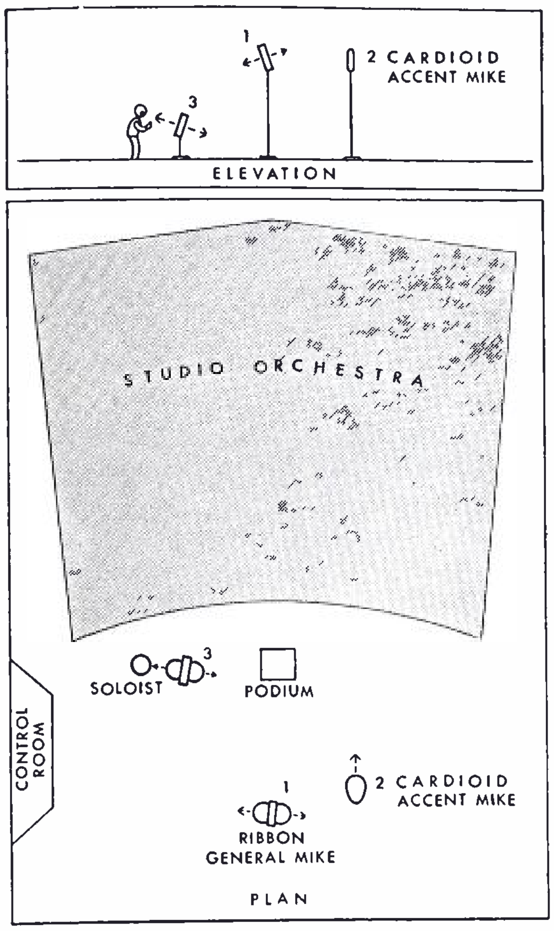


Figure 7—Plan and elevation of overcrowded studio.

Table 3

Microphone	Type	G_p	L	Distance
General	Non-direct	1.0	15	16′ — 17′
Crooner	Bidirect	3.0	½	4′ — 6′
Accentuation	Bidirect	3.0	1.0	7′ — 9′

If the distance of 4′ — 6′ for the crooner worries you cut it down to any value not less than 2′ and mix accordingly (see Appendix 1).

3. *Speech such as announcers, newscasters, lecturers, etc.* These programs usually originate in small rooms of 1000 to 2000 cu. ft. with reverberation times of the order of ½ second.

They get the full benefit of the extra coverage and naturalness due to liveness, for values of L greater than ⅙ to ¼. From equation (2) the distance for a non-directional microphone for a 2000 cu. ft. studio, having a reverberation time of ½ second, would be 1¼ ft. and for a ribbon or cardioid microphone on beam would be 2 ft.

APPENDIX 1

Method of Setting Relative Gain for General and Accentuation Microphones

Let L_a = liveness for the accentuation mike, and

L_g = liveness for the general mike, and

L_e = effective liveness of the combination

P_r = equal the ratio of the power contributed by the accentuation microphone to the power contributed by the general microphone; then db = 10 log P_r.

It can be shown that

$$P_r = \frac{1 - L_e/L_g}{L_e/L_a - 1} = \frac{L_a}{L_g}\cdot\frac{L_g - L_e}{L_e - L_a} \qquad (3)$$

and

$$L_e = \frac{L_a L_g (1 + P_r)}{L_a + P_r L_g} \qquad (4)$$

For example if $L_a = 1.0$ and $L_g = 20.0$ we may use equation (3) and compute the data shown in Table 4.

Table 4

L_e	P_r	db	Approx. db
1.25	3.75	+ 5.8	+6
1.50	1.85	+ 2.7	+3
2.0	0.90	— 0.5	0 or —1
3.0	0.43	— 3.7	—4
4.0	0.27	— 5.7	—6
6.0	0.14	— 8.5	—8 or 9
8.0	0.086	—10.7	—10 or 11
12.0	0.036	—14.4	—14
16.0	0.013	—18.8	—19

Where a studio or auditorium is in regular use, it is worth the time to plot this data as a curve. Figure 6 shows such a plot.

In Table 4 and Figure 6, negative values of db mean that the level of the accentuation mike is below that of the general mike by the number of db shown.

Since the sensitivities of the various microphones are not equal, the following procedure must be used to determine this relative gain value.

During rehearsal, set the general microphone attenuator control and master gain control as if the broadcast were to be made on this microphone alone. Read attenuator dial setting for maximum peaks on vu meter.

Then turn off general microphone and turn up accentuation microphone, until maximum peaks have the same vu reading. Read attenuator dial for the accentuation mike. This becomes the zero of the db scale illustrated in Table 4 or in Figure 6.

For example, assume the general microphone had an attenuator dial setting 10 db and the accentuation microphone had a dial setting of 14 db for the same maximum peaks as read by the vu meter. This means that with a setting of 14 db the accentuation microphone is contributing the same power as the general microphone.

Then if the desired over-all liveness is 9 we find from Figure 6 that the accentuation microphone should be operated at —12 db. Therefore, the setting would be 26 db on the attenuator dial of the accentuation mike.

It sometimes happens that this low setting of the accentuation microphone causes a blend of the sound which does not seem to have given the accentuation to the desired instruments. This usually indicates that the general mike has been placed in a poor spot and that the accentuation mike is being used to mask this trouble.

Therefore, seek a new location for the general mike as a first step of correction.

APPENDIX 2

Music Programs in Overcrowded Studio

Under these conditions it is usually impossible to place the general microphone at a sufficient distance from the front row of the orchestra. Therefore, a trick must be resorted to.

(1) Place a bidirectional microphone, such as "1", Figure 7, with its insensitive direction pointing toward the orchestra. In practice this microphone will act as if G_p (see Equations 1 and 2) had a value of ¼ to ⅓.

(2) Place the necessary accentuation microphones in the standard manner except that bidirectional microphones must not be placed too close to the studio wall. Where the crowding is extreme the use of cardioid microphones for accentuation purposes is preferred.

(3) Use the minimum contribution from the accentuation microphones, necessary to obtain the desired effect. Too much accentuation does more damage under overcrowded than under normal conditions, and can easily push the pick-up into the region below the useful liveness range. You then obtain "absence" instead of "presence".

This article has attempted to describe a semi-quantitative sound pick-up technique. If followed as a general guide, experience has shown that these methods can almost insure programs with a new realism — programs that can give your station as much as 6 db gain in coverage and your listeners the sense of being in the presence of the living artists.

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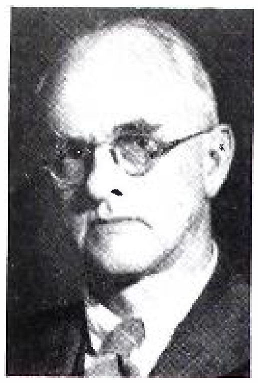
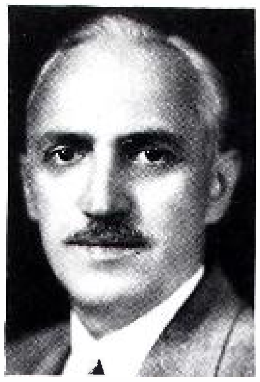


J. P. Maxfield

Henry F. Scarr



F. C. McMullen

Henry Dreyfuss

Contributors to This Issue

J. P. MAXFIELD, author of *Liveness in Broadcasting* (page 3) is one of the Nation's foremost authorities on acoustic techniques as applied to broadcasting and the recording and reproduction of sound. His work in this field dates back to 1914 when, after four years of research in physics at the Massachusetts Institute of Technology, he joined the Engineering Department of Western Electric. In 1926, he was loaned to the Victor Talking Machine Company where he organized and headed the Research and Engineering Department. In 1929, he returned to join Electrical Research Products, Inc., known as ERPI, where he made important contributions to electrical recording of sound in perspective for motion pictures. In 1936, he became ERPI's Director of Commercial Engineering. From 1942 to 1946, he was on leave of absence with Duke University as Director of the Division of Physical War Research and is now at Bell Telephone Laboratories engaged in the study of acoustic techniques.

HENRY F. SCARR, author of *Program Dispatching Made Easy,* (page 22) graduated in 1923 from Rutgers University, New Jersey, with an Electrical Engineering degree. He then joined the Engineering Department of Western Electric where he received special training in telephone equipment development. Serving in central office and panel dial switching trial installation, toll system standardization and radio receiver design, he gained wide experience in circuit and equipment design. Among the early "firsts" to which he contributed are Automatic Volume Control, Single Dial Gang Tuning and all a-c operation. He next worked on switchboard program planning and designing of telephone systems for non-Bell customers and from this returned in 1933 to radio in the Broadcast Studio Equipment field. He currently heads the group of application engineers and sales people responsible for Western Electric's Custom Built and Standardized Audio Equipments and other apparatus components for Broadcast services.

F. C. McMULLEN, author of *PICAO —Key to future of air transportation,* (page 10) is the aviation sales engineer of Western Electric's Radio Division. Mr. McMullen's radio experience goes back to 1914 when he owned and operated amateur station "UHS". He attended West Virginia University and Pennsylvania State College, receiving the B.S.E.E. degree in 1924. After six years of broadcast radio work with Frederick Company and Brunswick, he joined Western Electric Aviation Department in 1930 where he became associated with the Company's aviation activities, in addition to Marine, Hearing Aid and Trans-Oceanic Radio Sales. He was Chairman of the Radio Manufacturers Association, Marine Section, in 1944 and of the Aviation Section in 1945-1947. At the PICAO Meeting in London, he was appointed by the State Department as Technical Adviser to the U. S. Delegation.

HENRY DREYFUSS, author of *Better Products Through Industrial Design* (page 20) is one of the Nation's best known industrial designers. His early studies were at Ethical Culture Fine Arts School in New York and later under Norman Bel Geddes. Starting at the age of 18, Dreyfuss soon established his reputation as a stage designer for RKO and other motion picture houses. In 1929, he entered the then new field of industrial design where his clean lines, practicality and versatility brought him almost immediate recognition. His work includes such noted productions as the interior design of the New York World's Fair Perisphere, the World's Fair A. T. & T. building and the elaborate strategy rooms used by the Joint Chiefs of Staff in Washington, D. C. Mr. Dreyfuss has served as vice president of the Society of Industrial Designers and received both the Lord and Taylor Design Award for 1939 and 1943 and the American Designers' Institute Award for outstanding contributions to American Design. Author of: *Ten Years of Industrial Design* (1939).

Book Reviews

CAPACITORS — Their Use in Electronic Circuits. By M. Brotherton, Ph.D. 107 pp. New York: D. Van Nostrand Co. $3.00.

The basic factors which control the characteristics of capacitors and determine their proper operation are explained in this clear, well written book by a Bell Telephone Laboratories engineer. Mr. Brotherton here answers questions that arise in the mind of the circuit designer in transforming capacitance from a circuit symbol into a practical item of apparatus. There is much essential knowledge which has hitherto been scattered widely in books, technical journals and catalogs presented in a most useful form. Aided by simple words and diagrams, a broad view of major types of capacitors is given.

THE ELECTROLYTIC CAPACITOR. By Alexander M. Georgiev. 191 pp. New York: Murray Hill Books, Inc. $3.00.

The literature of the electrolytic capacitor is brought up to date in this book which describes the design, construction, manufacture, function and testing of dry and wet types. Operating characteristics of the various types of electrolytic capacitors are explained and their useful applications and their limitations are indicated. A glossary of technical terms and a list of patents dating from 1891 are included.

CIRCUIT ANALYSIS BY LABORATORY METHODS. By Carl E. Skroder and M. Stanley Helin. 328 pp. New York: Prentice-Hall, Inc. $5.35.

The entire content is given to considering electrical circuits in the laboratory. It provides the information needed for laboratory work, and for interpreting and analyzing results. A chapter is devoted to the important subject of Kirchoff's Laws and to the interpretation of single and double subscript notation. Several problems (experiments) dealing with the laws are included. The authors also give extensive treatment to reactive volt-amperes, a subject of growing importance.

FUNDAMENTALS OF ELECTRICAL ENGINEERING. By Fred H. Pimphrey. 384 pp. New York: Prentice-Hall, Inc. $5.35.

This new work treats basic theory and fundamentals and applies them to the various fields of engineering. The emphasis is placed upon circuits, machines and electron tubes. Application of electrical engineering is studied by a series of chapters in which the application is the central problem rather than an illustration of a theory.

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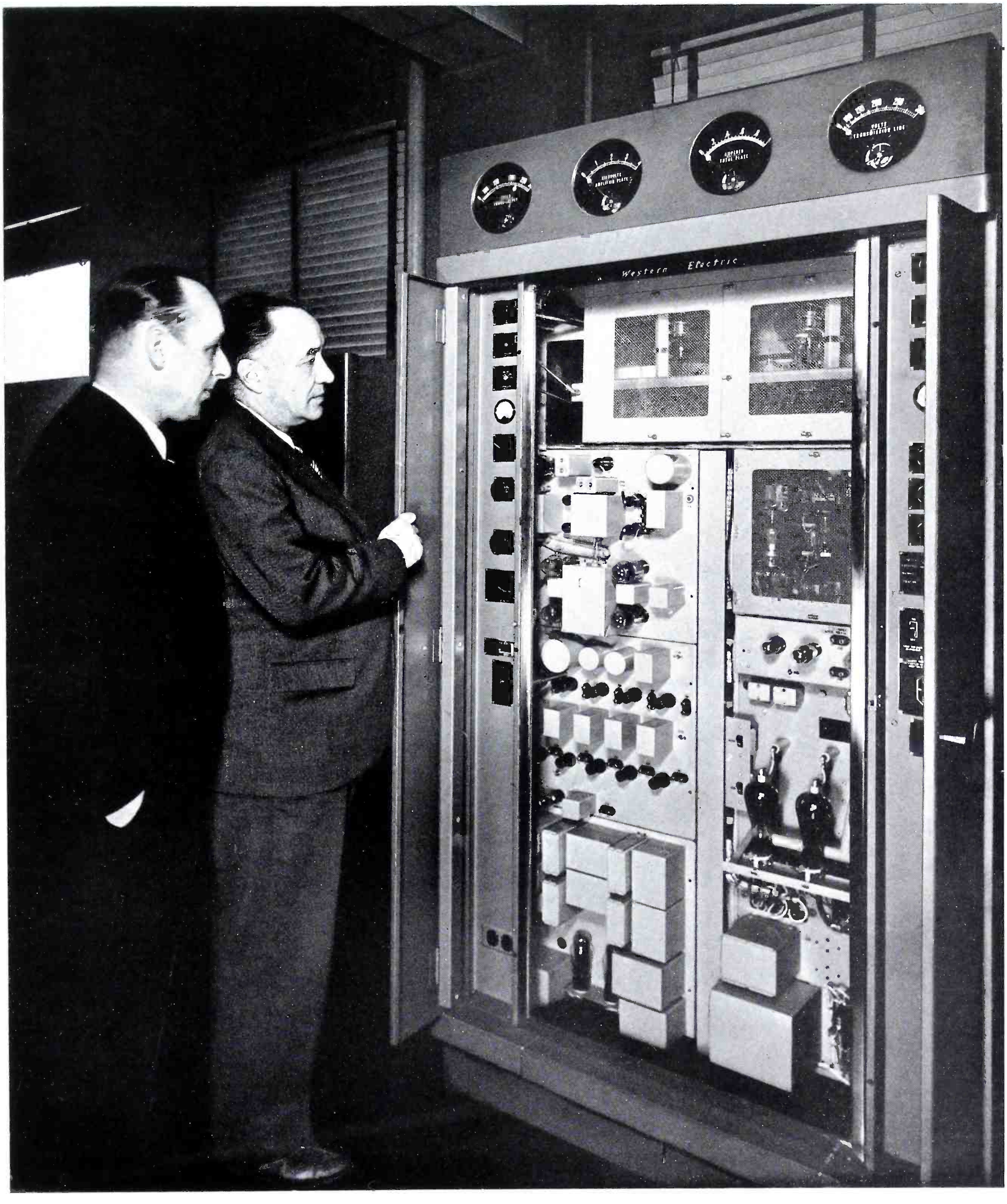
The Western Electric Oscillator

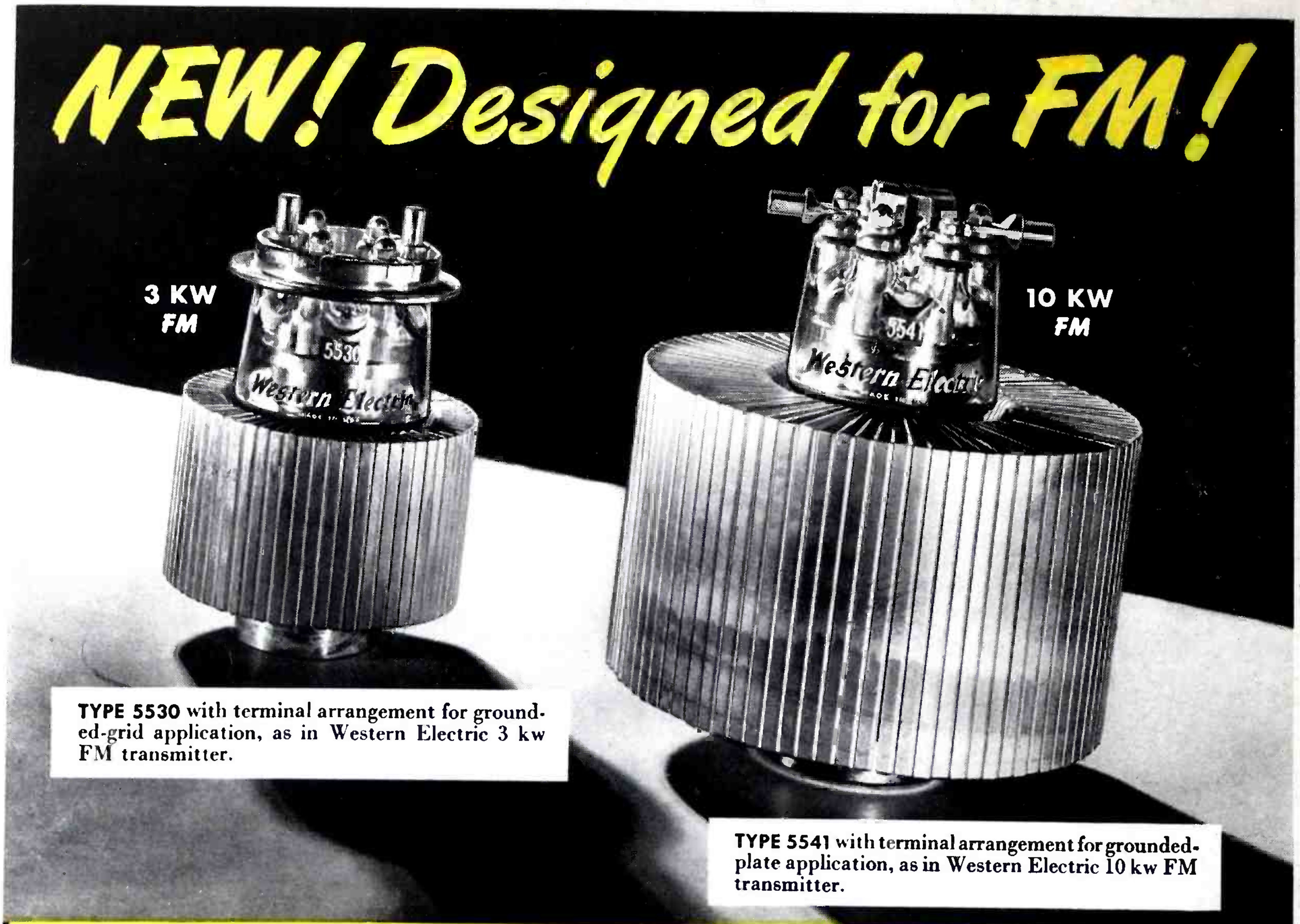
Issues No. 1-6 inclusive   September 1944 through January 1947

AUTHORS

First "Transview" FM Transmitter Goes on the Air



Station WELL-FM, Battle Creek, Michigan, is first to install Western Electric's new "Transview" FM Transmitter. Shipped direct from its preview at the NAB Convention in Chicago, this 1 kw 503B-2 Transmitter is already in operation. Standing above are Chief Engineer Earl Stone (left) and General Manager D. E. Jayne.



TYPE 5530 with terminal arrangement for grounded-grid application, as in Western Electric 3 kw FM transmitter.

TYPE 5541 with terminal arrangement for grounded-plate application, as in Western Electric 10 kw FM transmitter.

Western Electric

Forced Air Cooled Transmitting Triodes

Designed by Bell Telephone Laboratories, these new triodes are tops in performance in the 88 to 108 megacycle FM band.

Their filaments are of thoriated tungsten—the most efficient emitter for power tubes of these ratings.

Their rugged construction—brazed and welded metallic joints, Kovar-to-glass seals, protected metallic vacuum "seal-off", and self-supporting filament structure—insures long dependable service.

Their terminal arrangements are designed for maximum flexibility of application. Tubes having identical electrical characteristics can be "factory tailored" with suitable attachments for special terminal requirements.

For further details: Call your local Graybar Broadcast Representative—or write Graybar Electric Company, 420 Lexington Avenue, New York 17, New York.

—QUALITY COUNTS—

	TYPE 5530	TYPE 5541
Filament—Thoriated Tungsten		
Filament Voltage	5 volts a-c	7.5 volts a-c
Filament Current	55 amperes	55 amperes
Amplification Factor	26	26
Maximum Ratings (Apply at frequencies up to 110 megacycles)		
Direct Plate Voltage	4500 volts	8500 volts
Direct Plate Current	2.25 amperes	3.25 amperes
Plate Dissipation	3 kilowatts	10 kilowatts
Interelectrode Capacitance		
Plate to Grid	*23.0 mmf	25.0 mmf
Plate to Filament	* 0.6 mmf	1.5 mmf
Grid to Filament	*20.0 mmf	21.0 mmf
Maximum Dimensions		
Height	7-11/16 inches	9-25/64 inches
Diameter	5-5/32 inches	8-1/32 inches

*Tube shielded as in grounded-grid operation

Western Electric

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