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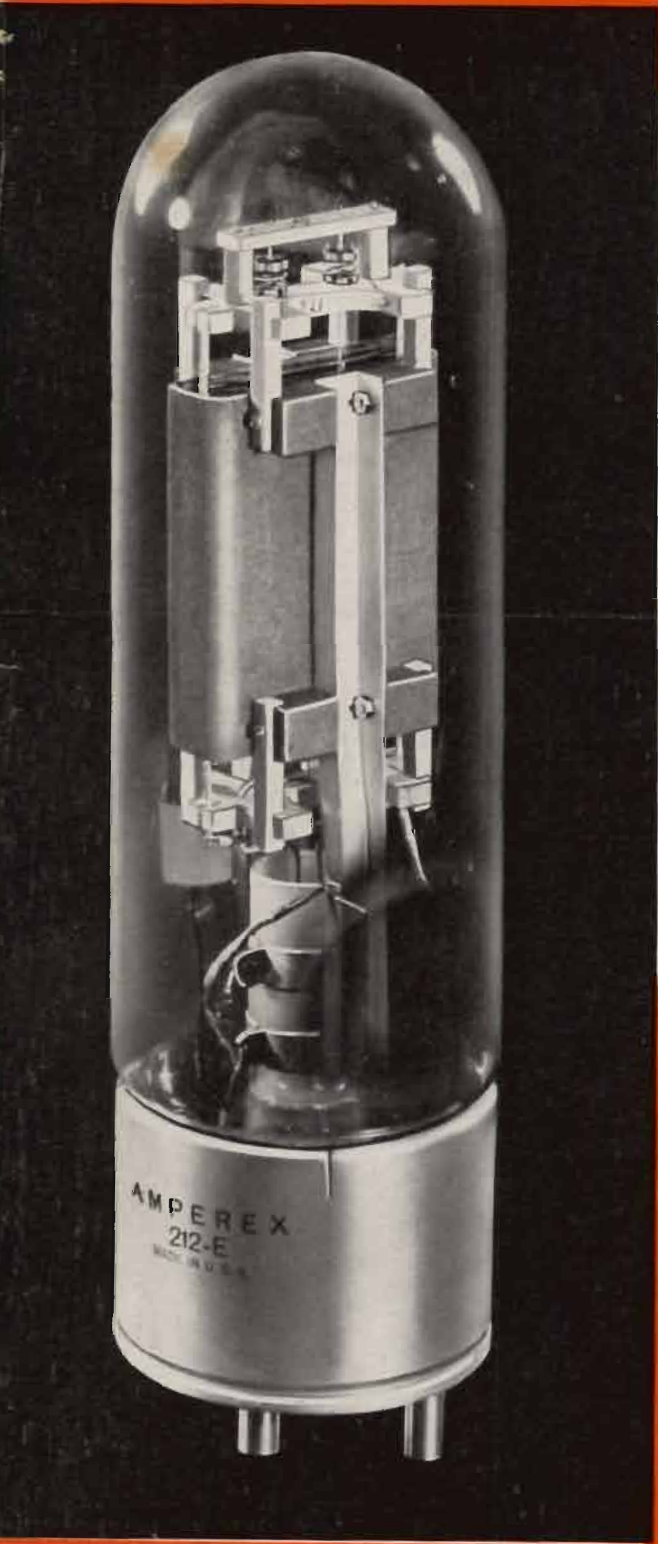
APRIL
1938

"After 9740 hours on a daily 24 hour schedule... still show full emission and are perfectly satisfactory"



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Filament current	6
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Mutual conductance, micromhos	8500
Maximum D.C. plate current, milliamperes	300

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THEY'RE READY—just in time for the opening games! The popular 22 type portable speech input equipments—re-designed to incorporate your suggestions—available in two models, 22B and 22C.

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RADIO TELEPHONE BROADCASTING EQUIPMENT

WITH THE EDITORS

NAB PRESIDENT

ON MARCH 30 the Board of Directors of the National Association of Broadcasters elected Mark Ethridge, of Louisville, Kentucky, as their temporary President. Mr. Ethridge will serve until his successor has been selected.

Mr. Ethridge accepted the position of temporary President with the understanding that the position would be non-salaried and that the NAB Board of Directors would continue its active search for a permanent head of the industry.

The new executive of the NAB is a native of Mississippi and has been in newspaper work for over 25 years. At the present time he is General Manager of the *Louisville Courier Journal,* owners of radio station WHAS.

Mark Ethridge is a well liked and capable man. We feel that the NAB has made no mistake in their selection.

ROCHESTER FALL MEETING

THE DATES for the 1938 Rochester Fall Meeting have been announced as November 14, 15 and 16. These meetings have become one of the most popular technical gatherings of the year for broadcast receiver and tube engineers. Further information of this convention will, of course, appear in a later issue of COMMUNICATIONS.

EXCISE TAX CAMPAIGN

THE CAMPAIGN in Congress to repeal or reduce the five percent radio excise tax has been renewed. At a public hearing on March 17, Chairman Harrison, of the Senate Finance Committee, assured the RMA that the industry's tax relief appeal would be given "most careful and thorough consideration," despite omission from the House bill of action on the radio tax. It is expected that the Senate Committee will act on the bill at an early date.

That radio, broadcasting as well as manufacturing, should be free of any special tax because of its public service and general use, was emphasized. Widespread support of the RMA's repeal movement has come from the trade in letters to the Committee and to the individual Senators, including formal resolutions from the Retail Merchants Association of San Francisco, and other trade organizations. Further, active support was given by the Radio Servicemen of America and its membership in many local sections. It is reported that Senators also are receiving appeals from many distributors and dealers.

We repeat that radio has certainly passed out of the luxury stage and that repeal of the tax seems to be the logical move.

PRESENTING . . .

ON PAGE 7 of this issue appears an article on "Selecting Speech-*Input* Units." In this article, Mr. Taylor thoroughly discusses the factors entering into the selection of speech-*input* units and points out the relative importance of these factors. This discussion should be of considerable interest to both the broadcast engineers who are contemplating the purchase of factory built equipments as well as those who must "build their own" in order to incorporate special designs.

A CONTROL ROOM switching method is discussed this month by J. G. Sperling. It was particularly designed for convenience, flexibility, and ease of operation.

ALSO of interest to broadcast engineers is the chart prepared by John J. Long, Chief Engineer, of WHAM, giving antenna heights for various frequencies, and the article by L. C. Sigmon on a 300 and 200 megacycle pack transmitter and receiver for remote pickup applications.

FOR THE broadcast receiver engineers, we present in this issue articles on "Electrolytic Capacitors in Filter Design," by Paul MacKnight Deeley, "Permeability-Tuned Push-Button Systems," by F. N. Jacob, and "A High-Fidelity 'Local' Receiver." The latter unit, in our opinion, represents a step in the right direction . . . toward the ultimate goal of real high-quality reception.

proving ground for radio *Insulators*

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At left, radio frequency generator and equipment for flashover, heat run, corona point, loss and capacitance determinations. Right, three million pound radiator base insulator being proof-tested in hydraulic testing machine.

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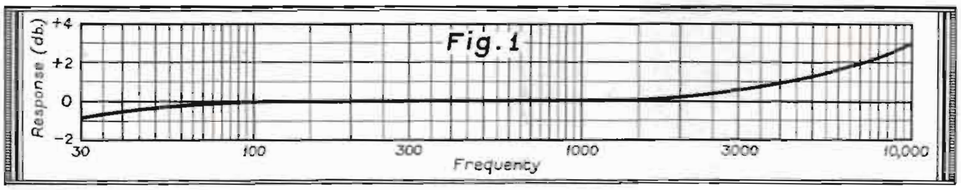
COMMUNICATIONS

FOR APRIL, 1938



SELECTING SPEECH-INPUT UNITS

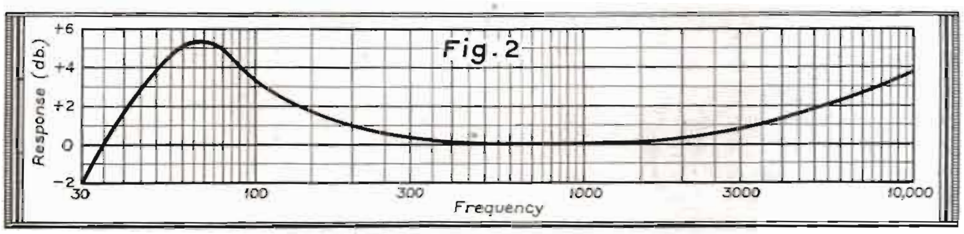


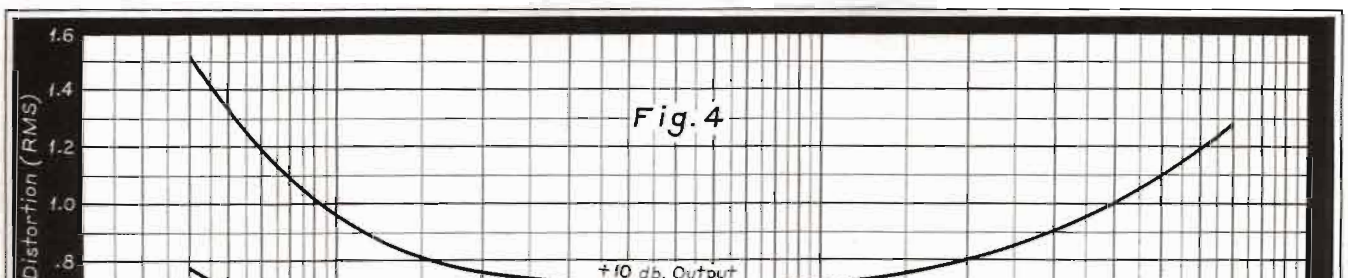
Fig. 1. Typical microphone - input - to - transmitter-line-output characteristic of a speech-input equipment designed for use with velocity microphones.

Fig. 2. Typical microphone - input - to - monitoring - loudspeaker - output characteristic of a speech-input equipment designed for use with velocity microphones and high-quality monitoring speakers. Note high-end and low-end compensation.

By JOHN P. TAYLOR

THE BROADCAST STATION engineer, faced with the problem of specifying equipment for a new studio installation, or for extension of an older installation, may follow one of two alternative courses. The first of these is to decide on the use of a factory-assembled equipment—standard models of which are now available in one-and-two-studio groupings, and on special order in larger arrays. The second is to select the proper speech-input units, either of one or of several manufacturers, and to assemble these in his own shop and according to his own preconceived ideas of a suitable layout. The former has the advantage of being "factory assembled, wired and tested" and offers assurance as to over-all performance — responsibility for which the station engineer would otherwise have to assume. Where standard groupings can be used, the cost is no greater, and sometimes less, than that of assembly in the field. However, if special features are to be incorporated the design falls into the "custom-built" category, and thereby becomes more expensive. Moreover, some stations—to gain experience, or to avoid labor difficulties, or for other reasons—prefer to assemble their own. The more or less standardized design of modern speech-

Distortion characteristic illustrating increase of distortion at high and low ends of the freqeuncy range.



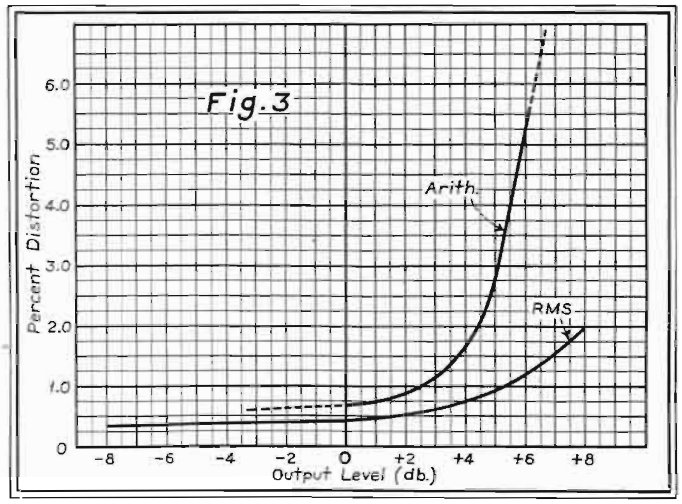
input units makes the latter course entirely practical—providing the required attention is given to the selection of the proper units. Most manufacturers now furnish sufficient information to allow of fairly dependable conclusions. However, different methods of presenting this information, and hasty conclusions on the part of station engineers and operators, often lead to disappointing results. A realization of all of the factors entering into the selection of speech-input units, and of the relative importance of these is, therefore, the first essential in the design of a speech-input system.

CONSTRUCTIONAL FEATURES

Generally speaking, the factors to be considered when choosing speech-input units fall into three categories. These may be classified as constructional and appearance features, electrical design features, and performance. The constructional features, of course, include such physical aspects as the size, and method of mounting of the unit, and such mechanical aspects as the arrangement of components, degree of accessibility, and the like. The appearance features include not only the overall appearance, but also the arrangement of the panel, the finish, and the symmetry, not only of the unit itself, but also as related to other units. Pages could be written on the subject, but as most of these features are recognizable by any experienced engineer, and as, moreover, they allow considerable leeway for individual preference, they need not be considered further here.

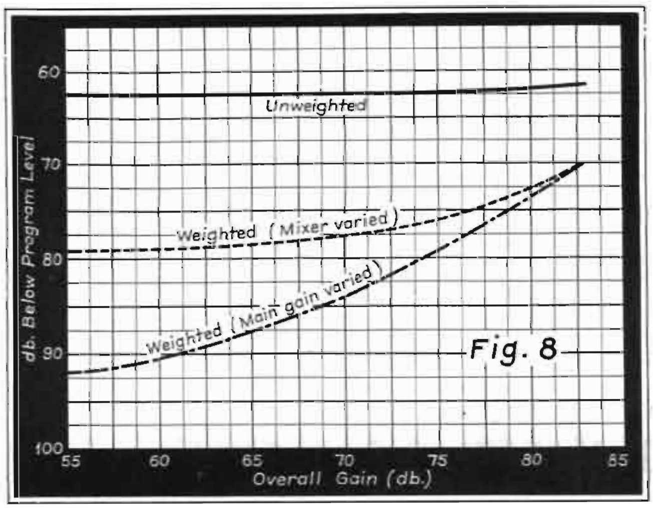
ELECTRICAL DESIGN FEATURES

The electrical design features involved in a proper selection include two quite different aspects. The first includes definite design features, such as input and output impedances, power-supply requirements, means provided for connection with other units, and details such as metering arrangements, jack provisions and the like. These can be stated quite definitely, since, for any particular application, there will be an obvious best choice. Of far less definite nature is the second classification. Within this fall such features as the types of tubes used, the number of stages, the location of gain controls (with respect to the circuit) and other circuit features which conceivably may operate equally-well for a number of different arrangements. This is a field in which the average station engineer or operator—lacking the experience, and usually the facilities, of the large laboratories—is at a loss for an adequate criterion. By keeping up-to-date with new developments, as described in the literature of the art, one can, of course, provide himself with general opinions as to the value of various circuit features. Certainly every possible effort along this line should be made. However, it must be remembered that minor disadvantages of a new development often become major drawbacks in application—in many instances factors which do not become apparent until they have been tried out over and over again will mitigate against the use of a new development which seems to have unbeatable possibilities. One course which can be followed is to observe carefully the use, or non-use, of particular developments by those manufacturers in whom the engineer feels he can place his trust. Often this will provide a hint on the answer to some otherwise unsolvable problem. For example, suppose that a year or so ago a particular station engineer was considering whether he should use metal tubes or glass tubes in his speech-input equipment. He looks at what the large manufacturing companies are doing—and finds that (at the time) they are not using metal tubes in speech units. Ipso facto, there must be a good reason (lest the wrong impression be given, it must be added parenthetically that the non-uniformity of metal tubes, which was apparently the factor mitigating against their use, seems to have been overcome, and these are now being used more freely in speech-input equipment). Many simi-

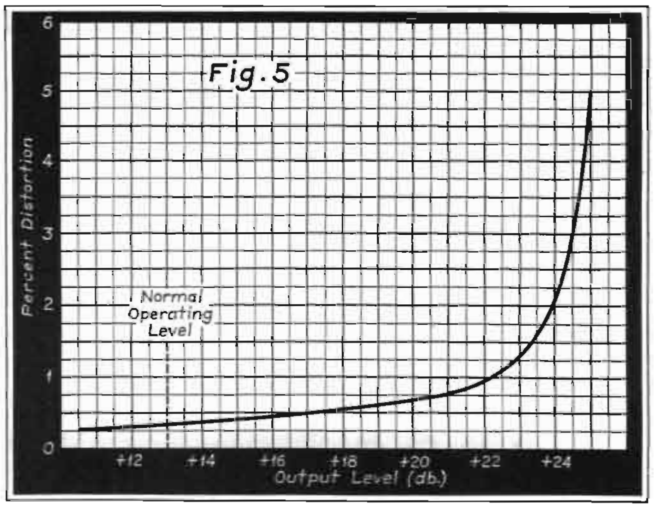


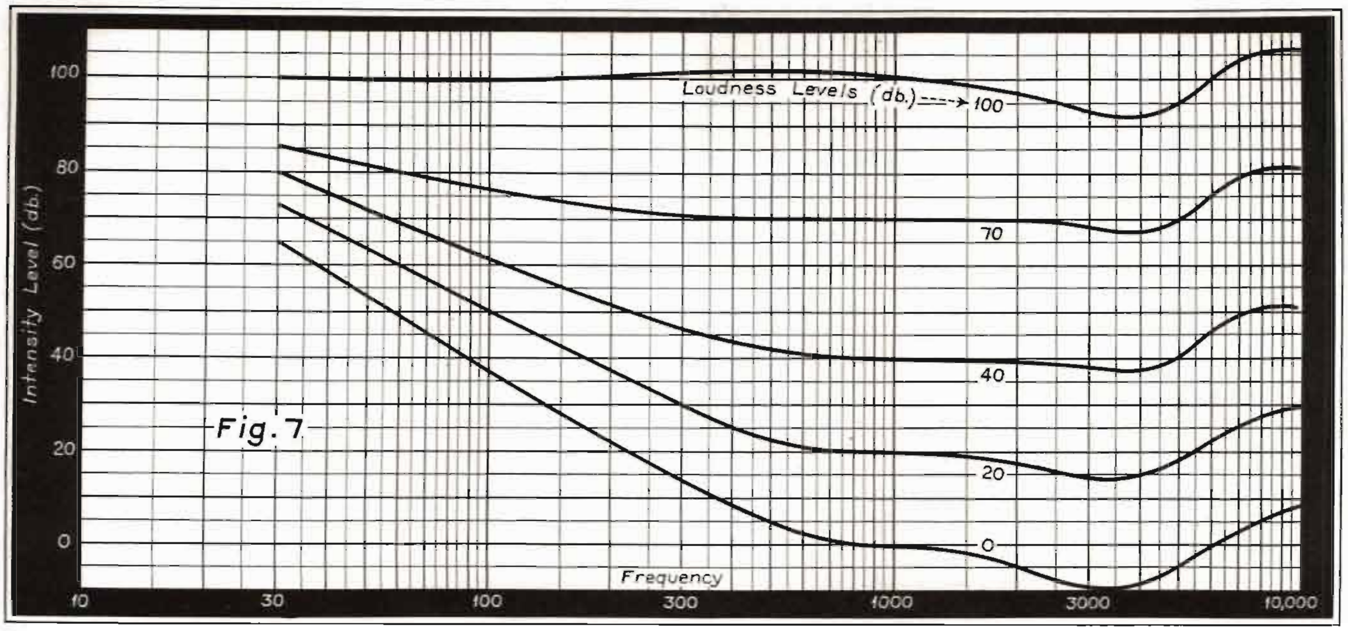
Distortion characteristic of a widely used remote-pickup equipment. Note divergence of arithmetic and rms values of distortion.

Comparison of weighted and unweighted measurements of background level for typical speech-input equipment.



Linear plot of distortion component in the output of a speech-input equipment. See Fig. 6.

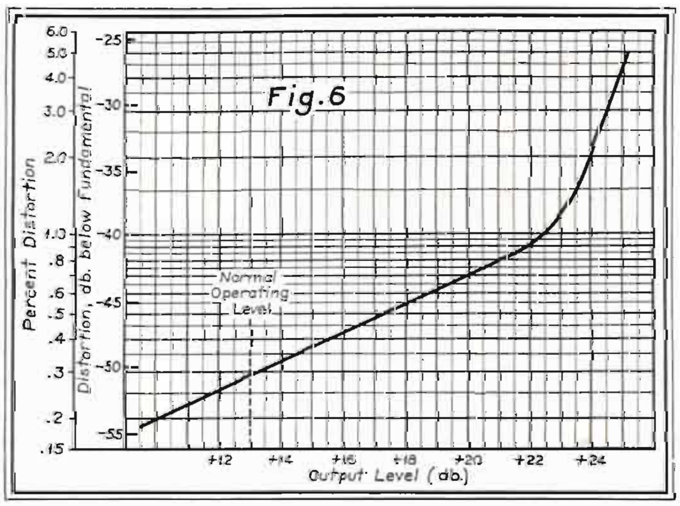




Curves of loudness levels as a function of frequency.

lar examples could be quoted. Certain tube types, for instance, must obviously be better-suited for broadcast use. This is a simple deduction from the fact that a manufacturer making available a hundred or more different tube types consistently uses not more than a score or so in his high-quality equipment.

The mechanical and electrical features have been discussed first in order to dispose of these and to allow more attention to the performance features which, of course, must be the preeminent consideration in any high-quality system. The requirements for high fidelity have been stated and restated so often as to become something of a bore. Generally the refrain runs: "uniform frequency response, low distortion, and low background noise level." Unfortunately, the performance of some equipment claimed to meet this standard, will in practice actually fall short of it. Usually, the reason for this will be found in lack of consideration of the external features which relate to the performance of the particular unit. For instance, an amplifier whose distortion content is entirely satisfactory at the level chosen for the production test of the unit, may be quite unsatisfactory at the level at which it is used after installation. Thus, it becomes of value to examine more carefully the concepts of high-fidelity performance—particularly as related to certain sometimes-overlooked factors relating thereto.

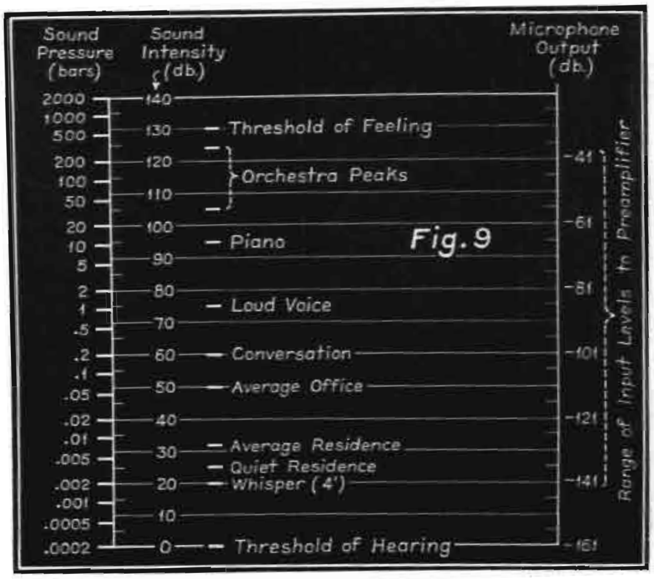


The curve of Fig. 5 plotted logarithmically in order to secure a comparison of the two methods.

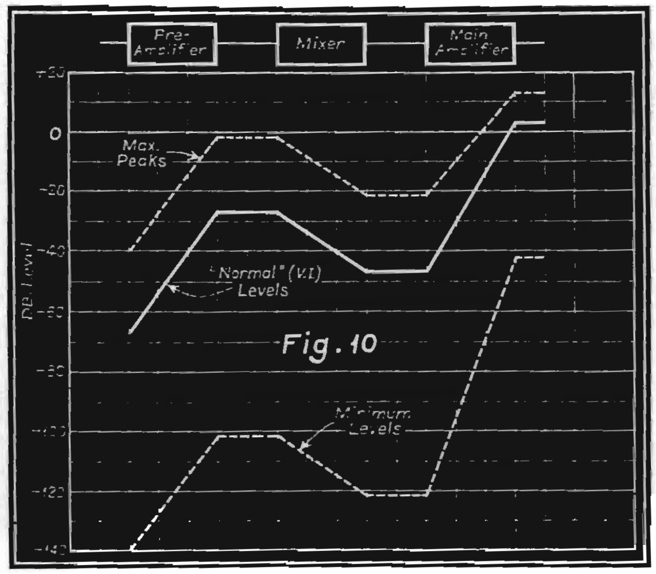
FREQUENCY RESPONSE

A flat frequency response for all units has always been considered the ideal—the theory being that if each unit of the chain is flat, the overall response must also be flat—and flexibility will be a maximum, since this factor will not need to be considered in interchanging units. No one would find fault with this as a goal. However, it is necessary to realize that some modification may be desirable. This follows from the fact that commonly-used accessories — microphones and loudspeakers, for instance—do not have a flat response. The velocity microphone, for example, is generally considered to have a smoother response than any other type in common use—but a close inspection of the frequency characteristics indicates that it does have one deficiency, namely, a falling off of response in the high register (amounting to about 3 db at 10,000 cycles). Now, 3 db in itself would hardly be important—the ± ¼ db specification of some manufacturers to the contrary. However, a slight drooping at the high end would likely be the more marked because of deviations in the following units of the system. Thus, the overall drop at 10,000 cycles—when added up for all of the units—may reach 7 or 8 db, which does become important. For this reason it is desirable to consider providing a compensating slope at some point in the system. This can most practically be done in the preamplifier—a response up 3 or 4 db at 10,000 cycles being easily obtained. Of course, other types of microphones, the "eight-ball" and "salt-shaker," for instance, have an increase of response at high frequencies which is more than enough to offset the usual loss of other units, and hence, should if anything be compensated in the opposite direction. Frequency response of speech-input channel for use with velocity mikes is shown in Fig. 1.

Another decidedly-not-flat unit is the monitoring loudspeaker. The monitoring system is too often neglected in present station practice. It would seem that stations desiring "high fidelity" ought to begin by improving their moni-



Relation of sound pressure, sound intensity and microphone output (Type 44-B velocity microphone) over the audible range.



Level curves for condition of Fig. 9, assuming operator rides master gain control. This type of curve useful in obtaining levels, distortion limits, etc.

toring systems. Overall speaker response can be improved by complicated systems using "Woofers" and "Tweeters" with the proper dividing networks—but this arrangement is clumsy for studio installations. Better results can be obtained by using improved-type loudspeakers—the "enclosed-rear types," for instance—of which some very excellent models are now available, in conjunction with compensation in the monitoring amplifier. Since the best of these speakers are still notably deficient at the very high and very low ends, quite marked compensation must be employed. A typical microphone-input-to-monitoring-loudspeaker-output curve for this purpose is shown in Fig. 2.

A similar line of argument might be followed with regard to line amplifiers—where some compensation for the line involved may be considered desirable. Similarly for the amplifier used following some types of record pickups. Thus, if we tabulate, we will find that, in actual practice, all of our preconceived flat responses have been modified, except that of the studio or main program amplifier.

OUTPUT DISTORTION

With the increasing attention being paid to high-fidelity operation, the distortion introduced by speech-input units becomes increasingly important. Until recently, the distortion introduced by the transmitter itself was ordinarily several times that occurring in the speech-input equipment, and hence, the latter was of importance only in that it was required to be below a certain maximum value. However, with new transmitters capable of operation with distortion of the order of 1 or 2 percent, attention must be paid to the distortion introduced in the audio chain, or else the latter may easily become the determining factor in overall fidelity.

The question of how distortion in individual speech units adds up is not an easy one to answer. Ordinarily, distortion content of audio units is given in percent rms—i. e., the root-mean-square value of all the harmonic components. The low values of the individual components presumably dictate this course. However, it is well to remember that the arithmetic sum of the components—generally considered a better index of their actual objectionable effect—may be much greater than the rms value. Fig. 3 shows the distortion component in the output of a typical remote-pickup equipment when plotted according to the arithmetic and rms values respectively. It will be noted that as the distortion increases, the arithmetic sum becomes rapidly greater than the rms sum. It is probably safe to say that for values of distortion leses than 0.5% the difference between the two need occasion no great worry. Above this value, it is desirable to remember that objectionable distortion may occur even while the rms sum still seems to be of reasonable value.

Another factor which must be taken into account, in interpreting the distortion data on a speech-input unit, is the variation of the distortion content with frequency. Until recently data was usually given for only one point—usually 400 cycles. Now, it is usually possible to obtain curves of distortion versus frequency. A typical curve of this sort is shown in Fig. 4. As will be seen, the distortion increases considerably at the low and high ends of the range. A small increase of this type is not especially objectionable—in that the energy in the very low and very high frequencies is small. However, the upward bends should not be too pronounced. Of the two curves shown in Fig. 4 that marked 0 db output illustrates a desirable curve, whereas that marked 10 db output shows rather too much high-end and low-end distortion.

Still another factor, and one which it should hardly be necessary to mention, is that of the relation of operating level to distortion content. Manufacturers usually rate amplifier units as having a certain "normal output" level and a certain "maximum output" level. Almost invariably the distortion value given is for the "normal output" level. In a well-designed amplifier this level can be exceeded by perhaps 5 db without introducing noticeable distortion. However, present-day competition is such as to make close ratings almost a necessity, and it will often be found that operation even slightly above the normal output rating causes very marked distortion. For instance, in the amplifier for which Fig. 3 was plotted, the normal output is 0 db. While the distortion at this level is good—for this type of equipment—it will be seen that the output cannot exceed this zero level by more than 3 or 4 db—if pronounced distortion is to be avoided.

While on the subject of distortion, it is interesting to note that it has recently been suggested that distortion be measured in db below the fundamental—somewhat as noise levels are measured in db below program level. The chief value of this suggestion is, of course, that it makes use of a logarithmic scale—which corresponds more closely to the actual effect of distortion as noticed by the ear than do the percent values. Figs. 5 and 6 show a typical speech-input-equipment curve plotted according to linear and logarithmic scales

(*Continued on page 32*)

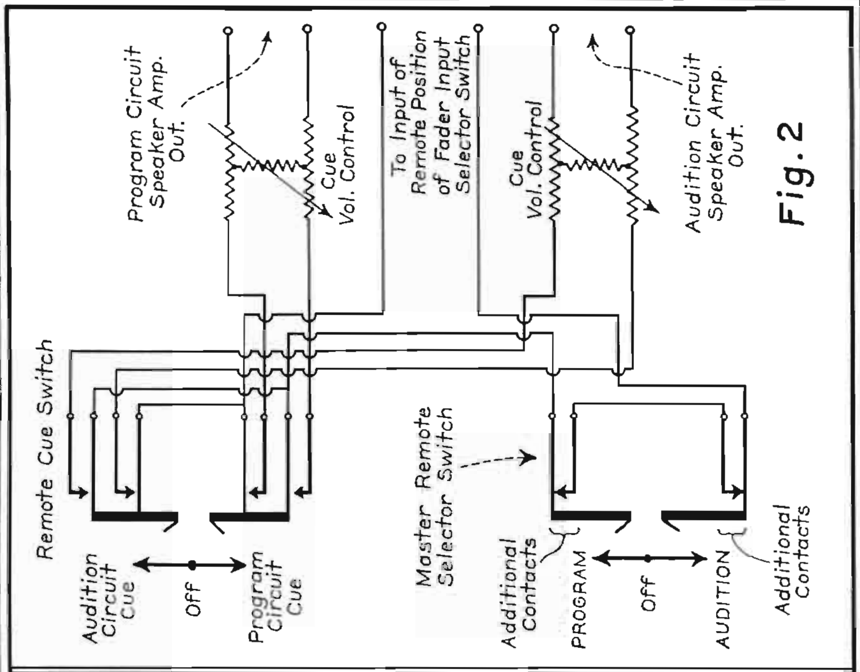


Fig. 2

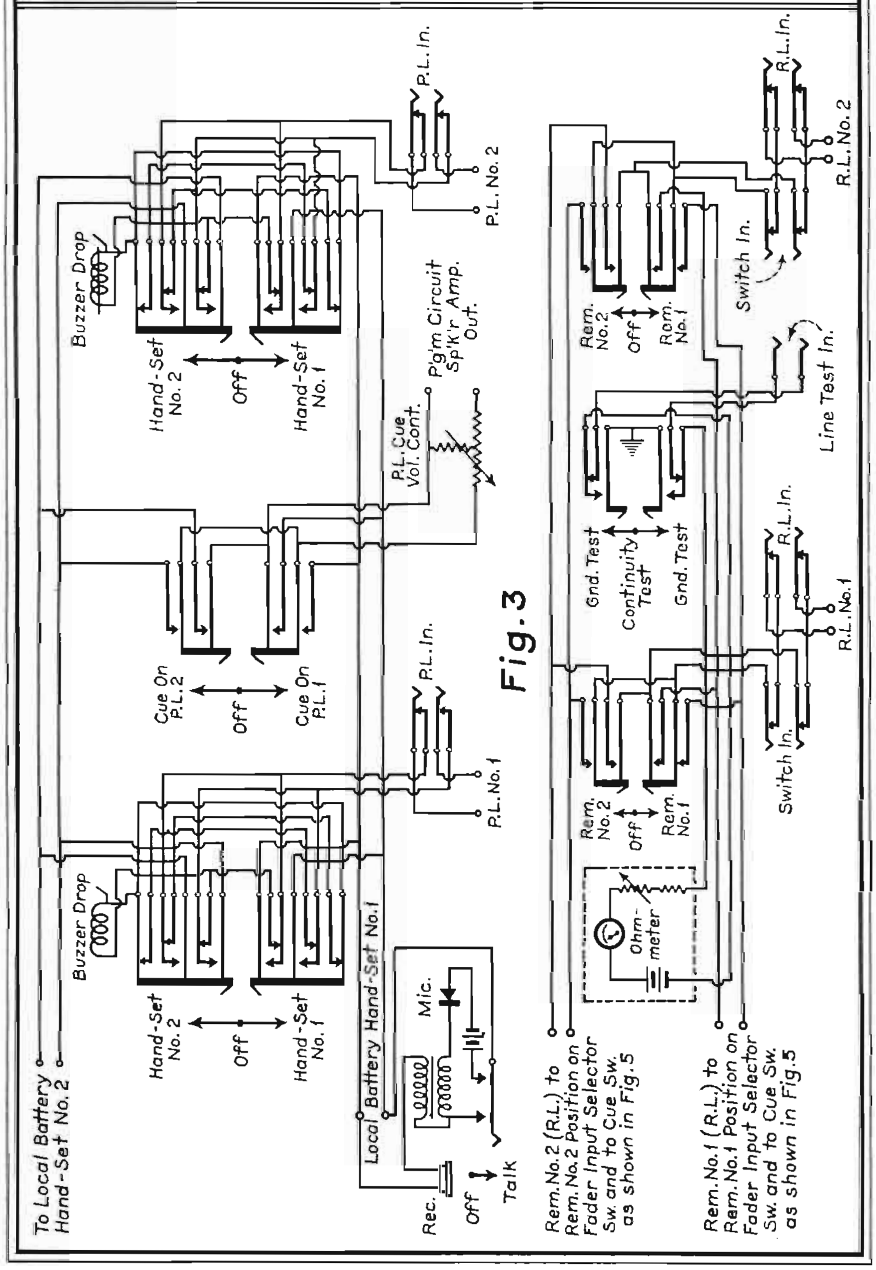


Fig. 3

(b) Immediate control of two amplifiers; one for use as a line amplifier, and the other as a line amplifier or as an audition-channel amplifier.

(c) Means for positive identification and switching of any program source, such as studio, remote or network, by suitable indicating lamps.

(d) Provisions for feeding cue to a remote about to go on the air, over the Radio Line (RL). This cue is to be automatically removed from the RL when on the air, in order to prevent feedback.

(e) Use of any 6 out of 12 inputs to the faders and a means of identifying which input is being used. By input, is meant a microphone circuit, transcription reproducer, etc.

(f) Automatic opening of the studio speaker circuit when the studio is in use, and instantaneous adjustment of the speaker load circuit, and operation of the warning "on the air" studio signal lamps.

No wiring diagram of the console has been included as each individual station may wish to modify it to suit their particular needs. However the wiring diagrams or schematics of the individual units that comprise the console are shown and described.

The key switches used in the master position have elaborate spring contact groups. All studio speaker circuits have compensating or "bug" resistors to automatically close the speaker circuit, in a proper terminating impedance when the studio is on the air or in rehearsal, in order that the volume level of the other speakers across the speaker-monitoring amplifier will not rise.

Bug resistors are also provided for in the fader input selector switches, to which amplifier circuit the faders are connected; compensating resistors equal in value to the fader impedance at the load are connected in the other amplifier circuit so that the fader load will be a finite impedance and not an open circuit (if a series-fader circuit is used). It will be noticed from Fig. 1 that the inputs to the master switch fader, the fader input selector switch and the output of the preamplifiers are normalled through to their respective circuits through jacks. Additional contacts are provided for on the fader input selector switch jacks to control the illumination of the various indicator lamps. If the input to the "A-1" position of the fader selector switch were opened, that is, if a patch cord was placed in the "A-1 Pre-Amp Out" jack the indicating lamp on that circuit of the switch would not be illuminated so the technician on duty would immediately inspect his patch cords to see what error had been made in switching. If it is desired to place a different input to a fader selector switch, it is merely necessary to patch from the necessary program source to the jack marked "Fader 1 Sel. Sw. Right" or "Fader 1 Sel. Sw. Left" depending upon which side it is desired to throw the selector switch. When this happens, the program source is lifted off of the other selector switch and its indicating lamp is left inoperative due to the voltage circuit being open. When the other end of the patch cord is placed in the proper fader selector switch jack the input previously lifted will be placed upon the desired switch, the input previously connected will be opened and the indicating lamp voltage circuit will be closed. Closed-circuit jacks are provided for on the master selector switch fader inputs so that if desired, varied inputs can be controlled from one master switch. For instance, several studio mikes, a remote RL, transcription, etc., can be patched into one master switch and a complete show handled at the flip of only one switch.

As previously stated, the master key switch is employed to place any studio or point of program origin on the air, or onto the audition channel. It will be seen that this lever key or key switch is the nerve center of the console. When in a neutral position it is so arranged that the fader is cut out of the circuit and the bug or compensating resistors are placed across the "Audition" or "Program" channels of the particular program source the key controls. While in the neutral position it will be observed that the speaker circuit to the studio is closed and the voltage circuits to the studio warning light relays and the console indicating lamps are open. However, when the key is thrown, for instance, to the "Program" position, the compensating resistor is cut out of that circuit and the fader is inserted. At the same time the speaker is cut out and the associated compensating resistor is shunted across the circuit before the speaker circuit is opened. It will be noticed that only one fader position has been shown in Fig. 1. If, however, the studio has more than one microphone it is merely necessary to duplicate the set of three contacts in each position (Program) and (Audition) for every microphone or program source. There is a limitation to the number of contacts that the switch can carry, however, and for that reason it is impossible to handle more than 6 program source inputs per switch. This should not be of much worry since there are few programs that will demand the use of six program sources simultaneously.

Since the studio "talk-back" system can be used only when the studio program is in rehearsal, as the program is automatically cut off when the con-

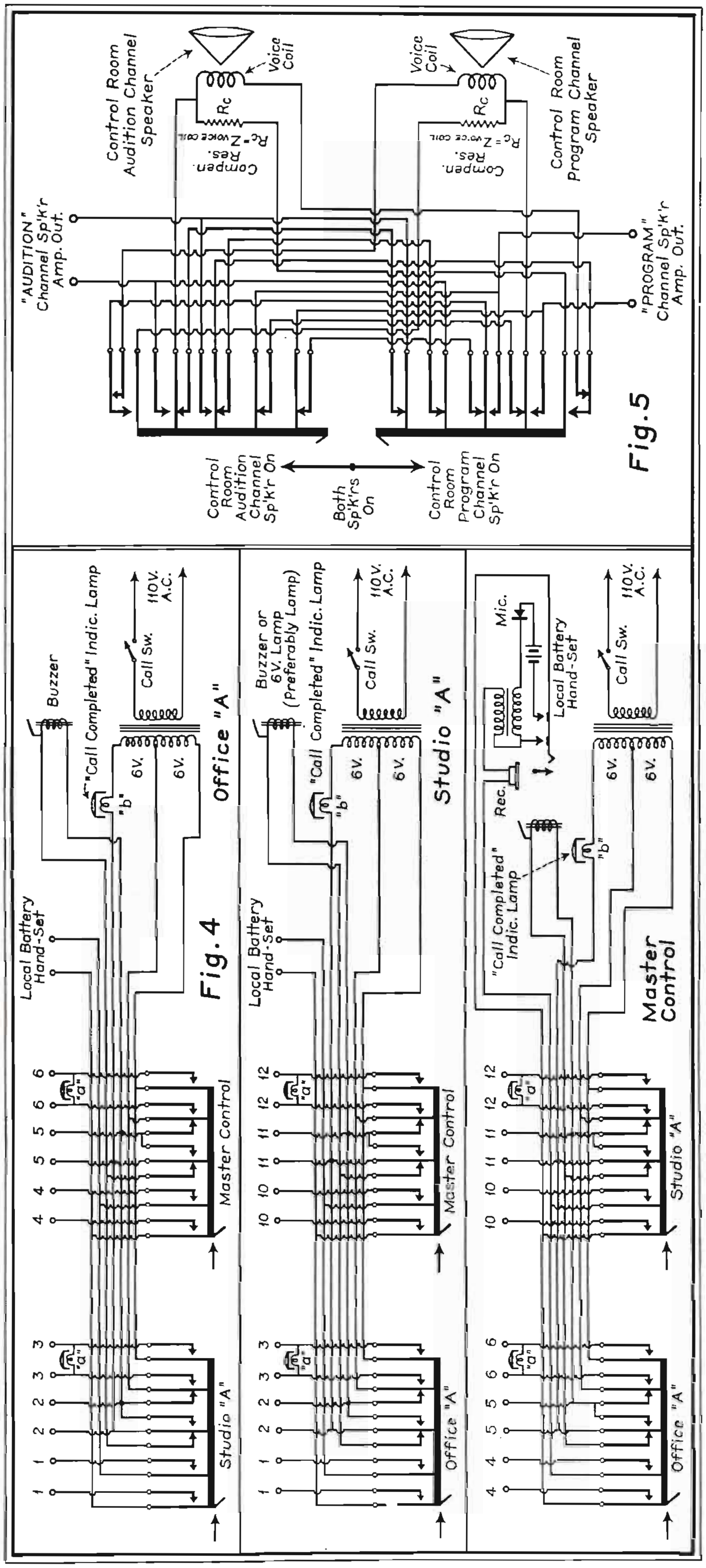


Fig. 4
Fig. 5

trol mike is used to converse with any studio, it is necessary to use it in conjunction with the "Audition" channels. This can be done in any number of ways employing only a single key switch. It is possible to use the audition or spare amplifier for this purpose, however, it is more practical to employ a separate amplifier and separate the two functions.

The method of wiring the cue switch for the remote RL's is shown in Fig. 2. It will be seen that the cue signal parallels the input of the incoming RL: that is, the signal is across the line when the master switch is in neutral. When in an operating position the cue circuit is automatically cut off. It is simple yet fool-proof.

The mechanical layout of the switching console and desk should deserve more attention than has been accorded them. One common fault with most installations has been the placement of the faders in a vertical plane at a height of three or more inches above the shelf or table top upon which the studio engineer may rest his arm. This, as all can see, results in operation of the faders at an awkward and cramped position. The ideal method would be the placement of the faders at an angle of approximately thirty to forty-five degrees and at not more than three inches above the table top. This simple point would clear up a lot of senseless aggravation resulting from cramped arm and wrist muscles while manipulating the faders. The table top, if possible, should not be flat but laid at an angle of 15 degrees.

All jacks should be mounted in a special section, either on the right or the left of the switching console. All amplifier and pre-amplifier inputs and outputs, pads, bridging transformers, microphone inputs, RL's, etc., should terminate at these jacks and should normal through to respective circuits.

The remote line switchboard is shown schematically in Fig. 3. Only two positions are shown but more may be added if desired. All remote private lines (PL's) terminate in a switch and buzzer drop. There are two positions on each switch so that two separate conversations can be carried on at the same time with separate handsets. A cue switch for feeding cue over the PL is provided. One or more remote points can be fed cue providing the respective PL switches are thrown in the same position as the cue switch. It need not be necessary to provide a hand ringing magneto at the control room as a small electric motor can be coupled by means of a reduction drive to the magneto and operated by a switch.

It will be noticed that an ohmmeter has been included in the RL section. This instrument has been provided so that the line continuity and resistance measurements, as well as line ground tests may be easily and conveniently made. To test a radio line, merely patch from the radio line to the "Line Test In" jacks. Have the radio line shorted or terminated in a known resistor of small value for the continuity measurement and ground check. With the key switch in the neutral position, the continuity of the RL is read on the ohmmeter, and the ground check is made with the key switch in the up or down position. If it is desired to know whether both sides of the line are grounded remove the short or resistor from the far end of the line and test as before. If there is any indication on the ohmmeter it means that there is some leakage to ground.

A most useful addition to any station is an inter-office and studio phone system. The operation of this unit is simplicity personified. Let us assume that Master Control wishes to speak to Office A. MC depresses the key marked "Office A" and then depresses momentarily the call key. When the "Office A" key is depressed, the indicating lamp over "A" lights up on the MC switchboard, and at the same time, the lamp in the Office A switchboard over the "Master Control" key lights up. This indicates to the party being called just who is calling him. When the call key is depressed at MC it also energizes a buzzer in "A" so that his attention is secured. Office A merely depresses the key marked "Master Control," lifts up the hand-set and starts talking. Incidentally the indicating lamp marked "Call-OK" lights up at the MC switchboard symbolizing that the call was completed and that Office A was not talking to another party.

If however Office A were talking to Office B, when MC called, the lamp marked MC would light up at the Office A switchboard but the buzzer would not operate. At Master Control the "Call-OK" lamp would not light, thus notifying MC that Office A was either talking to someone else or that one of the key switches there had been inadvertently depressed. Office A can cut MC into his conversation, and either one of the three can call any one or all of the remaining offices and thus have a round robin.

The only disadvantage of the system is that it has no common battery system but uses a separate battery supply for each station. This should not be a costly burden since the cost of the dry cells are quite reasonable and the battery current drain is negligible. Only three positions are shown in the schematic of Fig. 4. More positions may be added by duplicating the existing stations.

It is advisable under certain conditions to listen to two separate programs at the same time. A switch for rapidly enabling the technician to select either or both of the control room speakers is shown in Fig. 5. The diagram is self explanatory and no further comment is necessary.

The mechanical layout of the console as shown in Fig. 6 may be regarded as an ideal type. All faders are mounted in a position most suited for convenience and ease of operation. The master key switches are mounted in a vertical plane and away from the normal movements of the control-engineer's arm. All major switches have their associated indicating lamps close by. Several volume indicators are provided for the engineer's convenience. In other words, everything that is needed for the successful operation of any program is located at one central spot.

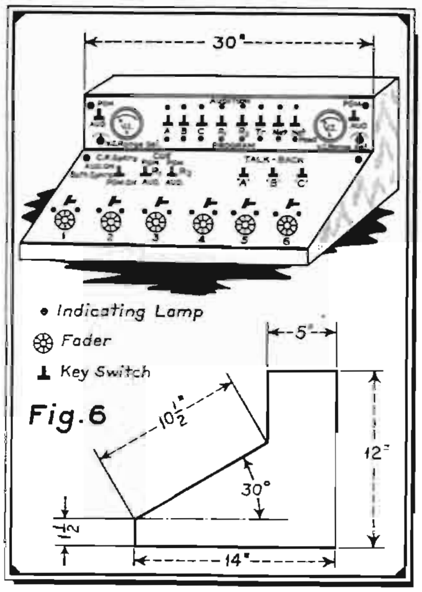


Fig. 6

REFERENCES

[1] "Mixer Circuits, Their Design and Operation"—L. W. Barnett—*Communication and Broadcast Engineering*, January, 1936.

"Microphone Switching Systems For Broadcast Stations"—L. W. Barnett—*Electronics*, May, 1934.

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TELEVISION STANDARDS

IT HAS BEEN ANNOUNCED by A. F. Murray, Acting Chairman, RMA Television Committee, that the following television standards have recently been approved:

Item No. 11—It is the recommendation of RMA that the sound carrier for a television channel shall be located .25 mc lower than the upper frequency limit of the channel.

Item No. 12—It shall be standard in television transmission that black shall be represented by a definite carrier level

(*Continued on page* 35)

PERMEABILITY-TUNED PUSH-BUTTON SYSTEMS

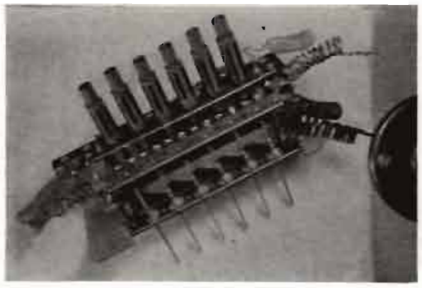
By F. N. JACOB

Engineering Department
ALADDIN RADIO INDUSTRIES, INC.

WITH THE ADVENT of automatic tuning in receiver design, varied and novel forms of mechanisms appeared on the market designed to provide reception of any one of several selected stations, merely at the push of a button by the listener. Among the first was the motor-tuned system, which required the use of a self-starting motor, some sort of selective commutator, and the push-button assembly, and which was usually intended to be used with afc. This arrangement, while satisfactory from many angles, has the disadvantage of being costly, and requiring a short lapse of time from the moment the button is pushed until the station is in tune. The cost angle made it almost prohibitive to incorporate such an elaborate device in the lower-priced receivers, but since automatic tuning was definitely established, other means were not long in making an appearance.

One of the simplest means of producing this push-button tuning was the use of a bank of trimmer condensers in conjunction with a button switch, which merely substituted pretuned trimmers for the ordinary variable gang tuning condenser when any of the buttons was depressed.

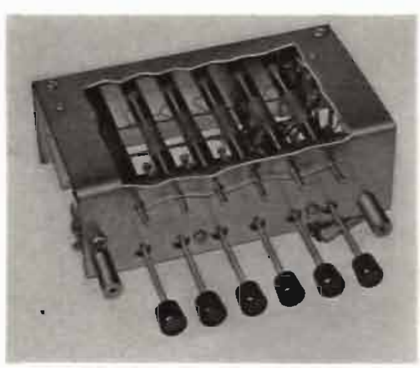
In an attempt to eliminate some of the faults of the initial systems, and at the same time remain within the lower price bracket, permeability tuning has been found highly satisfactory. While some receivers employ one permeability-tuned circuit in conjunction with one or two trimmer-tuned circuits for automatic tuning (see Fig. 5, page 19, COMMUNICATIONS, March, 1938), it was recognized that inductance tuning might well be applied to all these circuits. A unit was accordingly designed in which the antenna stage and the oscillator tank circuit are permeability-tuned when the push buttons are depressed, while normal two-gang variable-condenser tuning is retained for all other operation. One of the better type gang push-button switches was selected, providing six positions each having a double-pole single-throw switch in connection. This was mounted on a small foundation frame. Immediately above this switch and opposite each of the buttons were mounted six coil forms attached to the frame by threaded bushings. These forms were made out of selected grade bakelite having a thin wall and being accurately dimensioned, and each form supports two identical solenoidal coils.



Diameter of oscillator coils on this unit larger than that of the antenna coils.

Within the tubes are mounted two cores, molded of high-frequency ferromagnetic material, one of which is provided with a threaded stud for engagement with the threaded bushing in the frame. The end of this stud is slotted to permit the use of an ordinary screwdriver in adjusting its position relative to the coils. The cores are fastened together with a spacer having a length corresponding to the separation of the coils. Thus the inductance of both circuits is adjusted equally and simultaneously. Naturally, since the oscillator circuit is intended to be tuned to a frequency differing from that of the antenna circuit by the intermediate frequency, some means must be provided to permit tracking the two circuits. It is possible to accomplish this in several ways, one of which would be to provide a special winding for the oscillator section instead of two identical windings, but this involves difficulties in that special windings are necessary to insure reasonably good tracking. A core of special shape and lower permeability may also be employed. Another method is to wind a straight solonoid as the oscillator section, but on a larger diameter form so as to provide a shorter oscillator frequency range, while using identical cores in both sections.

Unit employing identical coils in the antenna and oscillator circuits.

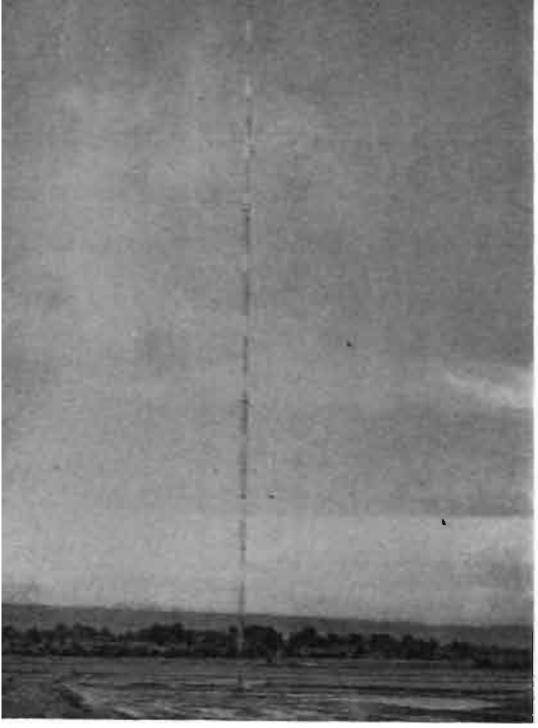


To provide a more flexible means of aligning the coil system, both a small series inductance and a shunt oscillator coil are included in the assembly. Only one of each of these coils is required to serve all the tuning coils on the frame. The series coil, connected in series with the coil, the inductance of which is varied, is fixed, its inductance value depending upon the inherent capacitances of the particular receiver design of which the device is to form a part, but the shunt coil is preferably made adjustable through the use of an iron core. This coil, which is connected across the other two coils in series, may, however, be made as a fixed inductance. This coil arrangement, in conjunction with the proper tuning capacitor, completes the tank circuit. There are several ways of securing feedback, either through the use of two fixed tuning condensers, as in the Colpitts design, or by the use of an additional winding coupled to the shunt coil, and inserted in the plate circuit of the oscillator tube.

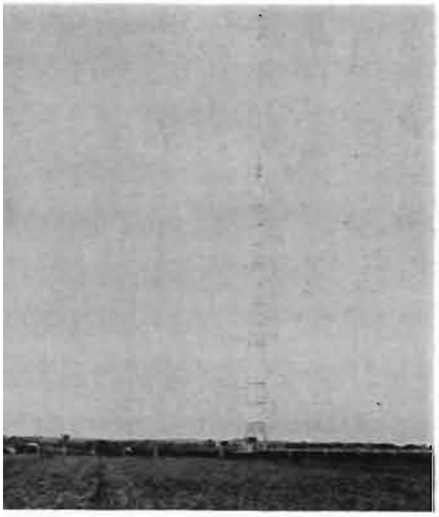
Only stabilized condensers are recommended for use in the antenna and oscillator circuits. A low-capacitance trimmer is provided in the antenna stage to allow for differences in receiver capacitance. For the antenna coupler, use is made of a high-impedance primary coupled very tightly to a small secondary. This latter coil is connected in series with the proper permeability-tuned circuit by the push-button switch. While the antenna gain is not high, all the advantages of a high-impedance primary are retained when this assembly is applied to a home receiver. The relatively low gain is not objectionable, since in most cases

(*Continued on page* 38)

VERTICAL

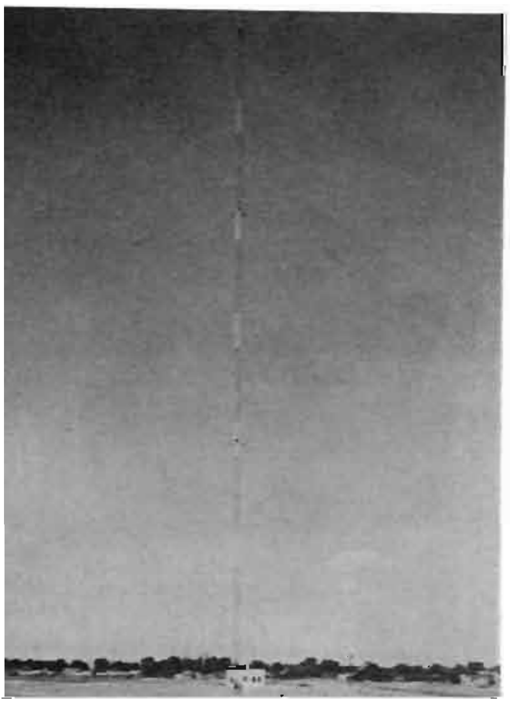


KGW, Portland, Oregon. This 625-foot guyed radio tower was built by the Truscon Steel Company.

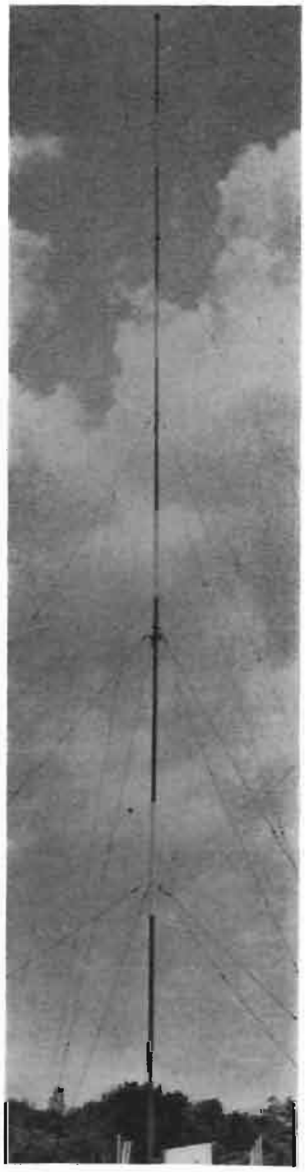


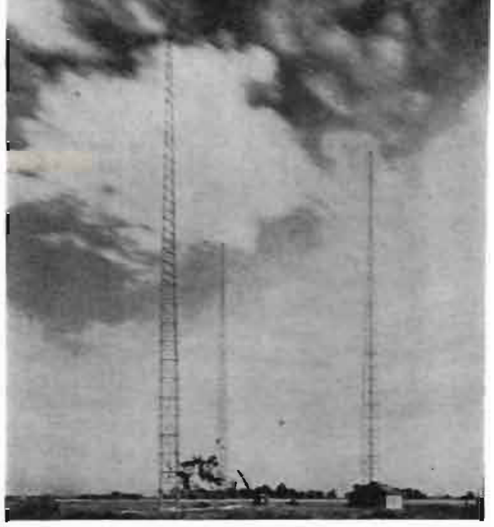
The Truscon radio tower of KMA, Shenandoah, Iowa.

KECA's (Los Angeles, Calif.) 365-foot vertical radiator built by The International Derrick and Equipment Co.

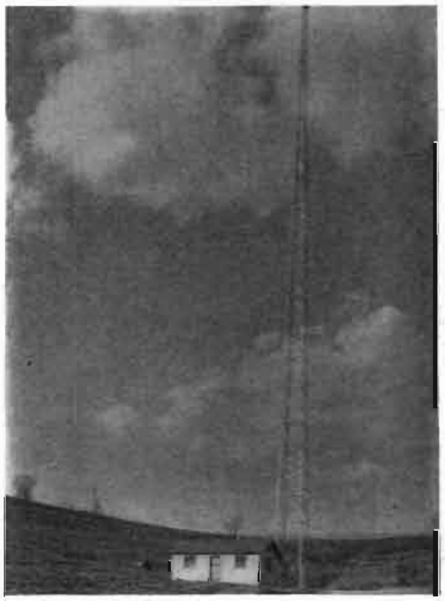


The 330-foot tubular steel radiator at WRTD, Richmond, Va. This tower was constructed by John E. Lingo & Sons, Inc.





The three 350-foot radiators built by Lehigh Structural Steel Co., for WHIP, Hammond, Indiana.



The 239-foot Lehigh radio tower at WBLK, Clarksburg, West Virginia.

WBLY, Lima, Ohio. This self-supporting type Ideco antenna is 154 feet high.

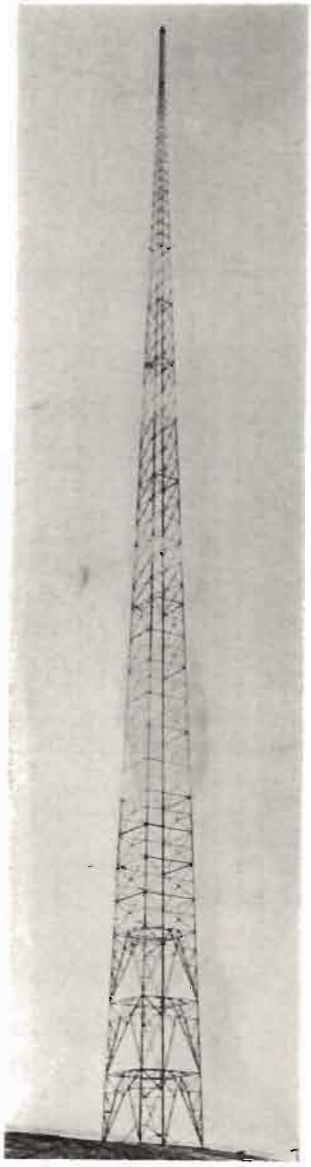
RADIATORS

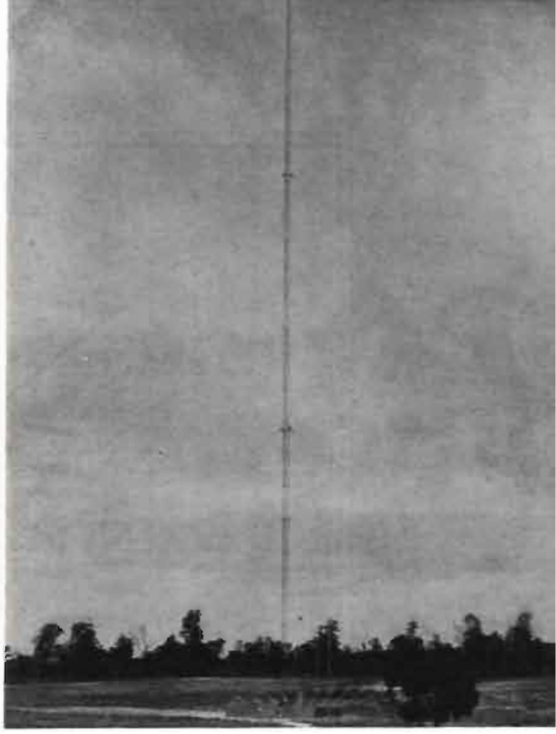
The 625-foot tower at General Electric's station WGY, Schenectady, N. Y., under construction by The American Bridge Company.

WMAS, Springfield, Mass. This 350-foot radiator was built by the Blaw-Knox Co.

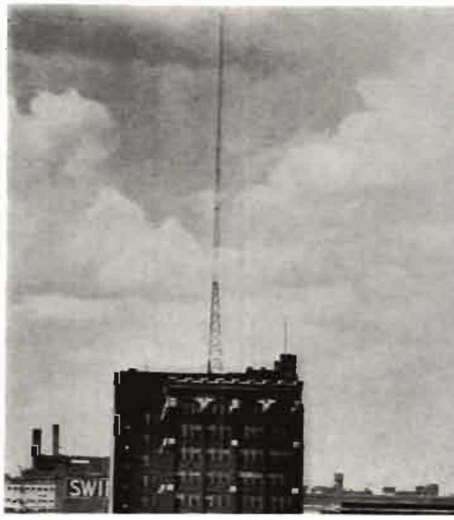
The 390-foot guyed type Blaw-Knox vertical radiator at KWK, St. Louis, Missouri.

The 450-foot Blaw - Knox shunt-excited vertical radiator at WHAM, Rochester, N. Y.





WNOX, Scripps-Howard Radio, Knoxville, Tenn. This Ideco radiator is 475 feet high.



The 231-foot Truscon self-supporting radio tower at WAAF, Chicago, Illinois.

The Lingo tubular steel vertical radiator at CFAC, Calgary, Alberta, Canada.

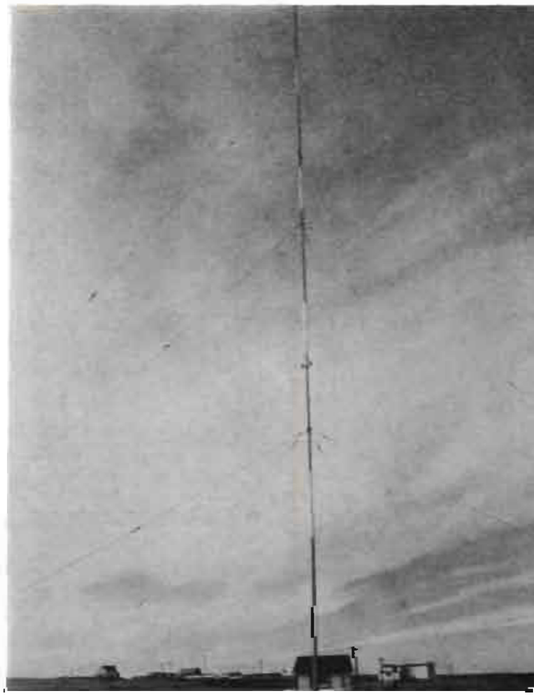


TABLE FOR BROADCAST TOWER HEIGHTS

Prepared by JOHN J. LONG, JR., Technical Supervisor WHAM

KC.	METERS	FEET	1/2 WAVE	1/4 WAVE	KC.	METERS	FEET	1/2 WAVE	1/4 WAVE
550	545	1787.6	893.8	446.8	1080	277.8	911.1	455.5	227.7
560	536	1758.0	879.0	439.5	1090	275.2	902.6	451.3	225.6
570	526	1725.3	862.6	431.3	**1100**	272.7	894.4	447.2	223.6
580	517	1695.7	847.8	423.9	1110	270.3	886.5	443.2	221.6
590	509	1669.5	834.7	417.3	1120	267.9	879.0	439.5	219.7
600	500	1640.0	820.0	410.0	1130	265.5	870.8	435.4	217.7
610	492	1612.7	806.3	403.1	1140	263.2	862.6	431.3	215.6
620	484	1587.5	799.7	396.8	1150	260.9	855.7	427.8	213.9
630	476	1561.2	780.6	390.3	1160	258.6	847.8	423.9	211.9
640	469	1546.3	773.1	386.5	1170	256.4	840.9	420.4	210.2
650	462	1515.3	757.6	378.8	1180	254.2	834.7	417.3	208.6
660	455	1492.4	746.2	373.1	1190	252.1	826.8	413.4	206.7
670	448	1469.4	734.7	367.3	**1200**	250.0	820.0	410.0	205.0
680	441	1446.4	723.2	361.1	1210	247.9	813.1	406.5	203.2
690	435	1426.8	713.4	356.2	1220	245.9	806.3	403.1	201.5
700	429	1407.1	703.5	351.2	1230	243.9	799.1	399.5	199.7
710	423	1387.4	693.7	346.8	1240	241.9	793.7	396.8	198.4
720	417	1367.7	683.8	341.9	1250	240.0	787.2	393.6	196.8
730	411	1348.0	674.0	337.0	1260	238.1	780.9	390.4	195.2
740	405	1328.4	664.2	332.1	1270	236.2	774.7	387.3	193.6
750	400	1312.0	656.0	328.0	1280	234.4	768.8	384.4	192.2
760	395	1295.6	647.8	323.4	1290	232.6	762.9	381.4	190.7
770	390	1279.2	639.6	319.8	**1300**	230.8	757.0	378.5	189.2
780	385	1262.8	631.4	315.7	1310	229.0	751.1	375.5	187.7
790	380	1246.4	623.2	311.6	1320	227.3	746.2	373.1	186.5
800	375	1230.0	615.0	307.5	1330	225.6	739.9	369.9	184.9
810	370	1213.6	606.8	303.4	1340	223.9	734.7	367.3	183.6
820	366	1200.4	600.2	300.1	1350	222.2	728.8	364.4	182.2
830	361	1184.0	592.0	296.0	1360	220.6	723.2	361.1	180.5
840	357	1170.9	585.4	292.7	1370	219.0	718.3	359.1	179.5
850	353	1157.8	578.9	289.4	1380	217.4	713.4	356.2	178.1
860	349	1144.7	572.3	286.1	1390	215.8	707.8	353.1	176.5
870	345	1131.6	565.8	282.9	**1400**	214.3	703.5	351.2	175.6
880	341	1118.4	559.2	279.6	1410	212.8	696.9	348.4	174.2
890	337	1105.3	552.6	276.3	1420	211.3	693.7	346.8	173.4
900	333	1092.2	546.1	273.0	1430	209.8	688.1	344.0	172.0
910	330	1082.4	541.2	270.6	1440	208.3	683.8	341.9	170.9
920	326	1069.2	534.6	267.3	1450	206.9	678.6	339.3	169.6
930	323	1059.4	529.7	264.8	1460	205.5	674.0	337.0	168.5
940	319	1046.3	523.1	261.5	1470	204.1	669.4	334.7	167.3
950	316	1036.4	518.2	259.1	1480	202.7	664.2	332.1	166.5
960	313	1026.6	513.3	256.6	1490	201.3	660.2	330.1	165.0
970	309	1013.5	506.7	253.3	**1500**	200.0	656.0	328.0	164.0
980	306	1003.6	501.8	250.9	1510	198.7	651.7	325.8	162.9
990	303	993.8	496.9	248.4	1520	197.4	647.8	323.4	161.7
1000	300	984.0	492.0	246.0	1530	196.1	643.2	321.6	160.8
1010	297	974.1	487.5	243.7	1540	194.8	639.6	319.8	159.9
1020	294.1	964.6	482.3	241.1	1550	193.5	634.6	317.3	158.6
1030	291.3	955.3	477.6	238.8	1560	192.3	631.4	315.7	157.8
1040	288.5	946.2	473.1	236.5	1570	191.1	626.8	313.4	156.7
1050	285.7	937.1	468.5	234.2	1580	189.9	623.2	311.6	155.8
1060	283.0	928.2	464.1	232.0	1590	188.7	618.9	309.4	154.7
1070	280.4	919.7	459.8	229.9	**1600**	187.5	615.0	307.5	153.7

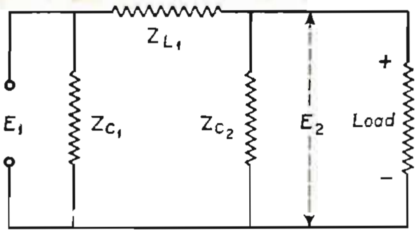


Fig. 2

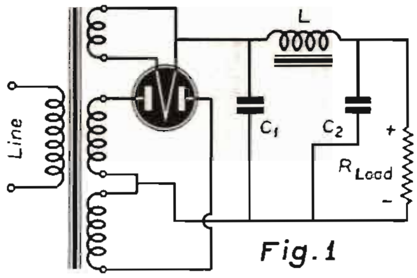
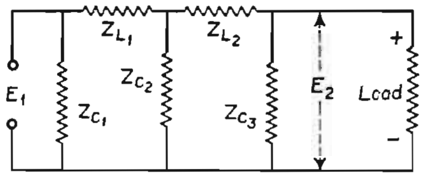


Fig. 1



$$E_2 = \frac{I\,Z_{C_1}\,Z_{C_2}\,Z_{C_3}}{(Z_{L_1} + Z_{C_2})\;(Z_{L_2} + Z_{C_3})}$$

Fig. 3

ELECTROLYTIC CAPACITORS IN FILTER DESIGN

By PAUL MacKNIGHT DEELEY

The effect of power factor on operating characteristics of electrolytic capacitors used in vacuum-tube rectifier filter networks.

BASICALLY, an electrolytic capacitor consists of three elements, namely, a metallic conductive plate of aluminum, a dielectric medium of aluminum oxide and a conductive surface of electrolyte. The uni-directional conductivity or asymmetric characteristics of such a capacitor arrangement is due to the difference in rate of cold electron emission from the surface of the aluminum and from the electrolyte. Due to this basic fact, it can be readily realized that the ion concentration or electrical conductivity of the electrolyte employed, in an electrolytic capacitor, has a direct bearing on such characteristics as voltage breakdown, direct-current leakage, power factor, idle shelf recovery leakage current and ultimate useful life. The effects of increased ion concentration in the electrolyte on these various characteristics can be enumerated as follows.

(a) Increased ion concentration lowers the breakdown voltage of the capacitor because, for any given field strength, more electrons can be emitted from the electrolyte.

(b) Increased ion concentration increases the direct-current leakage of the capacitor because of increased electron emission from the electrolyte.

(c) Increased ion concentration increases the electrical conductivity of the electrolyte, thus lowering the equivalent series resistance and the power factor.

(d) Increased ion concentration causes an increase in the rate of hydration of the outer surface of the dielectric film. This causes an effective reduction in film thickness with time and the net result is an increase in recovery leakage characteristics with idle shelf time.

(e) Increased ion concentration increases the rate of corrosion in an electrolytic capacitor structure in proportion to the percentage of corrosive impurities present.

Summarizing these effects, it is fairly obvious that a lowering of equivalent series resistance or power factor values by increased ion concentration in the electrolyte causes a lowering of breakdown voltage, an increase in direct-current leakage, poorer shelf life and increased tendency towards corrosion. It also becomes obvious that the design of an electrolytic capacitor becomes a problem of compromise between various values rather than a problem capable of solution by the application of fixed laws. This is extremely unfortunate but nevertheless true and the fact remains that increased values of power factor automatically improve all other characteristics. This being the case, it is only hard common sense to desire to employ electrolytic capacitors of relatively high power factors if their electrical operation in rectifier filter circuits is satisfactory.

The ordinary filter theory which applies to low-pass transmission-line filters can not be applied to the same general type of filter where it is connected to the output of a vacuum-type rectifier tube. This is essentially true because of the complex nature of the voltage impressed on the filter network and the

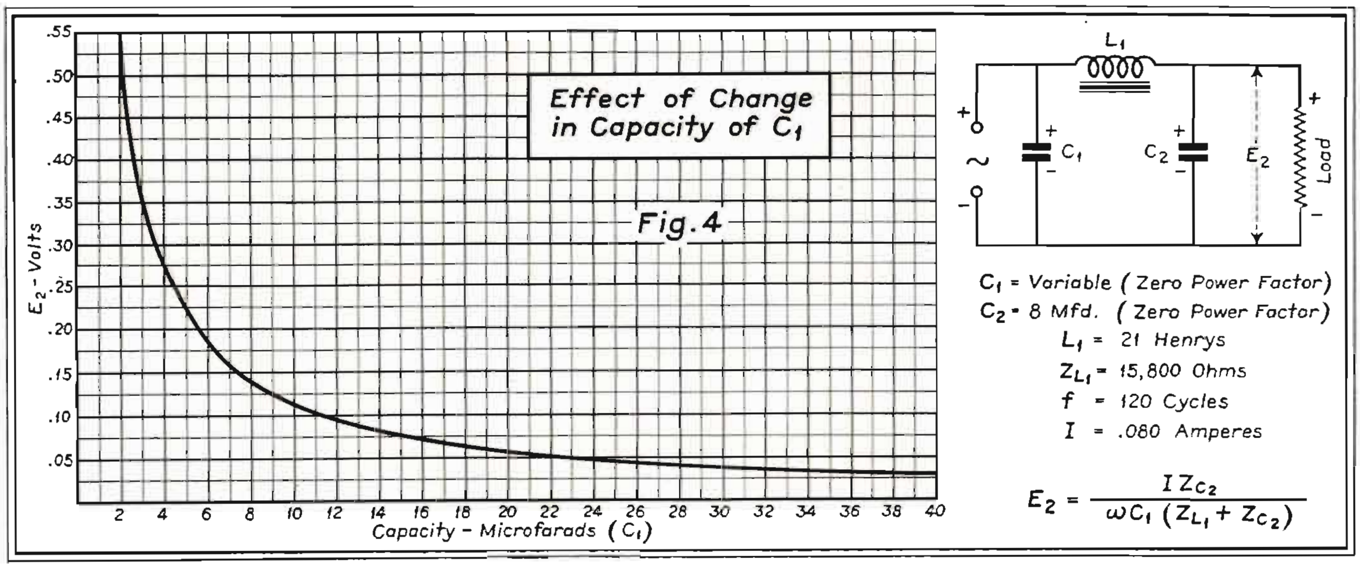


Fig. 4

multiple functions the capacitive elements must perform.

Referring to the circuit diagram of Fig. 1, it is observed that the value of the first capacitor C_1 determines two things, namely, the initial value of the ripple voltage fed into the network and the magnitude and regulation of the direct current supplied to the load. The initial value of the ripple voltage or superimposed alternating-current component voltage will therefore be found to be equal to the product of the alternating-current component passing through the first capacitor C_1 times the impedance of the capacitor at the ripple-voltage frequency. An increase in power factor of C_1 will therefore cause an increase in the impedance with a proportional increase in ripple voltage. The important consideration is, however, the magnitude of this resultant increase in ripple voltage.

measurement. It is because of this fact that the specific values shown happened to be selected. It is also pointed out that power factor in these illustrations is equal to $\frac{R}{Z}$ and not ωRC, which obviously is equal to $\frac{R}{X}$, although the expression is generally used to determine the power factor in terms of determined values of equivalent series resistance.

The value of final ripple voltage in a two-section filter network may be obtained in the same manner employed for the previous determinations. The equivalent impedance diagram of a two-section filter network is shown in Fig. 3.

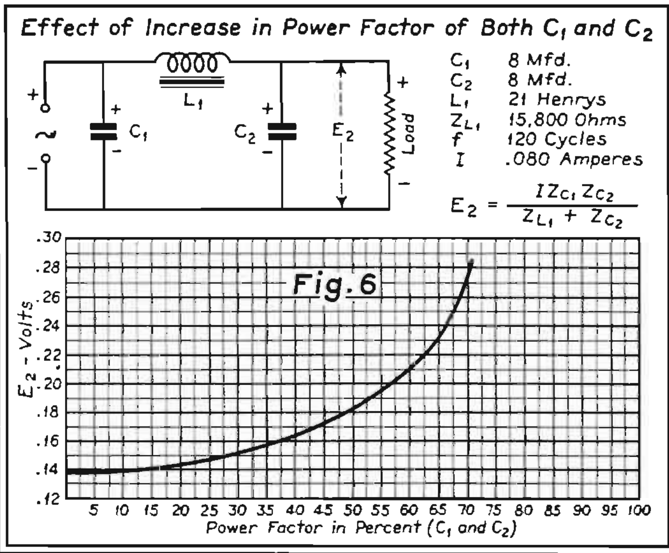
The impedance of the load circuit has not been considered because it is normally so much higher in impedance than the last capacitor section that it will

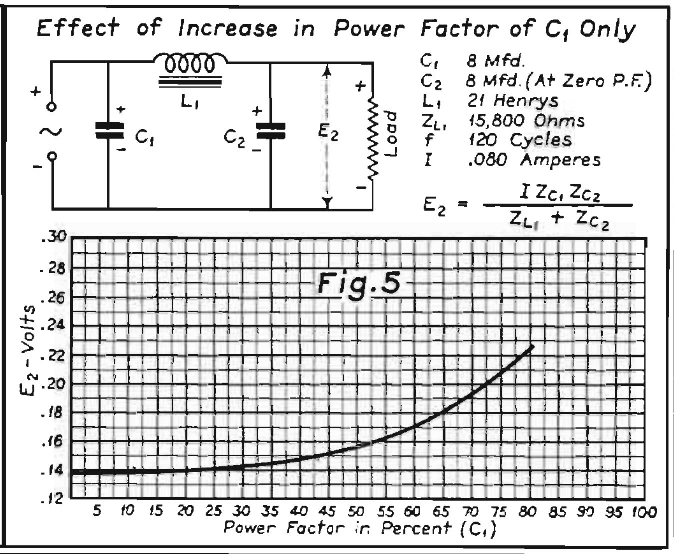
common impedance in the plate-voltage supply circuit of a radio receiver and instabilities of operation will result.

This being the case, a higher power factor capacitor would appear to result in an increased radio-frequency impedance path. In actuality, this is not the case with electrolytic capacitors because there is no relation between the power factor at 60 or 120 cycles and the impedance at radio frequencies.

The reason for this phenomena is quite simple when it is considered that, in an electrolytic capacitor, one of the conducting surfaces is an electrolyte. In an electrolyte, the conduction of current is by ionization and it is rather difficult to picture a relatively massive ion moving at speeds corresponding to frequencies of from 500 kilocycles to 30 megacycles.

Laboratory investigations have demonstrated that at radio frequencies the





For the sake of convenience, the filter network may be illustrated by the equivalent impedance network of Fig. 2.

Attenuation of the ripple voltage E_1 is accomplished by the relative ratio of Z_{L1} and Z_{C2} and the value of E_2 may be obtained in terms of the values of the impedances and the ripple current passing through first capacitor C_1 by use of the following equation.

Where $E_1 = I Z_{C1}$

And $E_2 = \frac{I Z_{C1} Z_{C2}}{Z_{L1} + Z_{C2}}$

By setting up actual values of capacity and inductance in this equation and varying the power factor of C_1 and C_2 the exact effect of increase in power factor can be determined.

An actual illustrative case is shown in Figs. 4, 5, and 6. In studying this data it might be mentioned that all values shown were verified by actual

not materially effect the results obtained.

As the total attenuation of the ripple voltage is greater in a two-section filter, the power factor of the capacitors becomes of proportionally less importance.

The function of the last capacitor in a filter network is not only as one element of a voltage dividing series but also as a sort of supply reservoir. The electrical size of this capacitor must therefore be great enough to provide the necessary stability of direct-current load-voltage regulation.

In addition to these functions, the last capacitor must provide a low-impedance return path for alternating currents of radio frequencies, in such cases where the radio-frequency currents are not properly by-passed at other points, in radio-receiver structures. If the last capacitor does not provide a low-impedance radio-frequency path, then overall coupling will result from too high a

electrolyte in an electrolytic capacitor becomes an effective insulator and dielectric and the anodic film no longer plays any part in the structure. The effective impedance of an electrolytic capacity at radio frequencies therefore becomes a function of physical structure only and the effective capacity, a purely electrostatic arrangement of metallic anode and cathode plates, or foils, separated by the electrolyte which has effectively become a dielectric medium.

Thus it may be seen that a lower power factor electrolytic capacitor has no advantages at radio frequencies, as a low-impedance by-passing medium, over a higher power factor unit.

The radio-frequency characteristics of electrolytic capacitors are doubly important in radio receiver structures such as are used in automobile receivers, due to the generation of very complex cur-

(*Continued on page* 41)

A 300 & 200 MC. TRANSMITTER BROADCAST PACK AND RECEIVER

Fig. 1. The 300-mc transmitter and receiver.

By L. C. SIGMON
Chief Engineer
KCMO

IN DESIGNING a pack transmitter to be used for relay broadcasting, the following facts are considered of primary importance. The transmitter must be as light in weight as practical for good voice quality and frequency stability. The pack must be of such size that it will not interfere with the normal movements of the person wearing it . . . especially in buildings and other congested places. The antenna system is also of importance in that it must be used both inside and outside of buildings during broadcasts . . . the antenna must be short enough to pass through standard doors. Still another important consideration is electrical interference when broadcasting from varied locations.

The ultra-high frequencies of 500, 300, 200, and 100 megacycles were chosen for the experimental licenses of KCMO's pack transmitters. The frequency of 100 megacycles was abandoned because of the length of the rods required in the plate and grid circuit of the oscillator for the required degree of frequency stability, as well as the antenna length.

The frequencies now in actual use for the relay pack transmitters are 200 and 300 megacycles. The 200-megacycle frequency is used more than the 300 because of the variation in signal strength on 300 megacycles when working under low steel ceilings and near metal objects. The 300-megacycle transmitter is used mainly for the talk-back circuit between the remote engineer and the operator of the 200-megacycle transmitter and receiver. Another advantage of working at 200 and 300 megacycles is the lack of any noticeable interference.

Fig. 1 shows the pack transmitter with the 300-megacycle transmitter attached to the projecting pipe. Each end of the pipe contains a plug so that transmitters of different frequency may be plugged in. The antenna projecting out of the transmitter is a quarter-wave. The antenna to the right is the receiving antenna and is also a quarter-wave. All transmitting controls are locked in place after the transmitter is set on frequency. The modulating unit is enclosed in the upper left-hand corner of the pack transmitter proper; the upper right-hand part contains the receiver. The meter on the front reads the total plate current of both transmitter and receiver, the current being approximately 20 mils. The left-hand dial is the regeneration control and the right-hand dial the receiver tuner. The central bar knob is for audio gain control. The switch breaks both the "A" leads and "B" minus voltage. The lower part of the pack transmitter contains three "B" batteries (45-volt) and two 3-volt "A" batteries. The total weight of the batteries is only four pounds, eight ounces. In testing the pack trans-

Fig. 5. Side view of 200-mc transmitter. Note ⅜" rod tapped for antenna coupling condenser.

Fig. 3. Schematic diagram of pack transmitter and receiver.

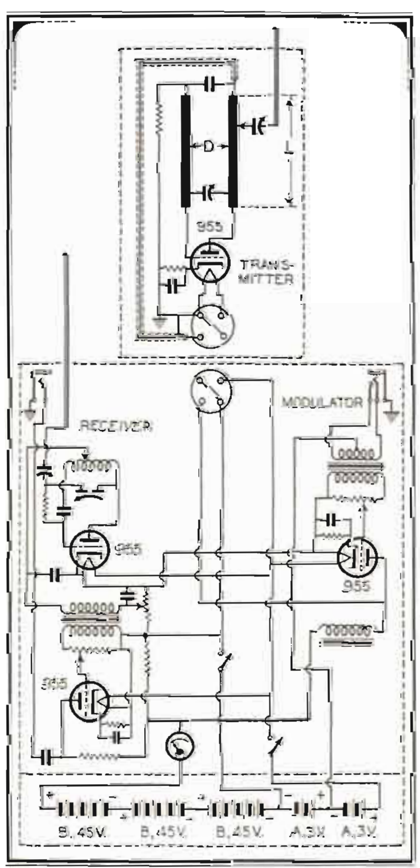
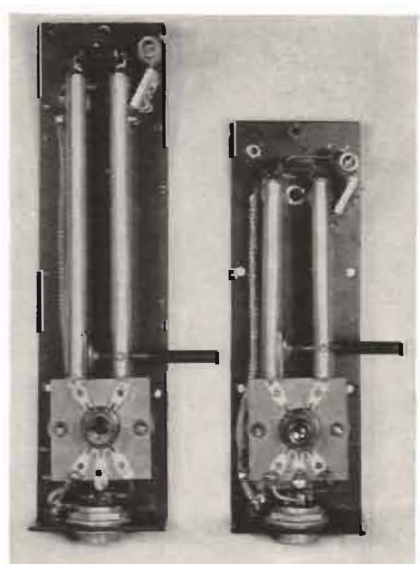


Fig. 4. The 200 and 300-mc transmitters uncased. Note tuning condenser next to socket.



mitters, a small power supply was constructed to replace the batteries.

The jacks for the microphone and headphones are located in the left and right-hand corners on top of the pack unit. The back plate of the transmitter pack is attached with self-tapping screws. Four rubber sponges are provided, one on each corner of the back plate so that the pack will fit comfortably as shown in Fig. 2.

The microphone used is a double-button carbon type. Dynamic microphones have been used with excellent results, but are somewhat heavier.

The transmitter is elevated above the pack so that the antenna projecting from the top of the transmitter is in the clear of the person wearing the pack and others in the vicinity. This is shown clearly in Fig. 2. Fig. 4 shows the 300 and 200-megacycle unit out of the case. The construction is almost self-explanatory. The tuned lines in the grid and plate circuits were used to provide the required degree of frequency stability, as well as improve the circuit efficiency. The rods used are ⅜-inch, solid brass, and less than ⅛-wavelength long. The spacing between centers of the brass rods is ¾ of an inch. The distance between the rods can be varied but longer rods will be required.

The problem of insulation is not serious at these ultra-high frequencies with the construction shown. The voltage is slightly less than maximum at the tube socket and at a voltage node at the end of the rods. A standard socket is used for the 955 acorn tube. The condenser shunted across the end of the grid and plate rod is a special high-frequency unit. It was found necessary to shield the plate voltage lead. The transmitter should be grounded at only one place on chassis, this being near the grounded filament lead.

The tuning of the transmitter is accomplished by means of a penny soldered off-center to an 8/32 threaded brass rod. The reason for the penny being soldered off-center is to give a vernier tuning effect. Another small plate is soldered to the grid rod to complete the tuning condenser. The details of this construction are shown in Figs. 4 and 5. The plate rod is also tapped every quarter of an inch from the end with a 6/32 tap for approximately 1¾ inches. This is to locate the proper coupling point for the antenna condenser. The transmitter proper is constructed on 16 gauge aluminum, but copper is preferable when weight is not an important factor. The case of the pack transmitter is made of 22 gauge cold rolled steel.

The modulator unit is of the Heising type, using another 955 tube. See Fig. 3.

The quality of voice transmission from the pack transmitter is very good, provided the transmitter is not modulated too heavily. The greatest source of distortion was due to the nonlinear characteristics of the regenerative detector used in the receiver. If a low percentage of modulation is used the distortion is not at all objectionable. All programs broadcast from the relay pack transmitter go through an equalizing circuit which also helps to improve the quality of transmission.

Fig. 2. Showing 300-mc transmitter in use at Kansas City Airport.

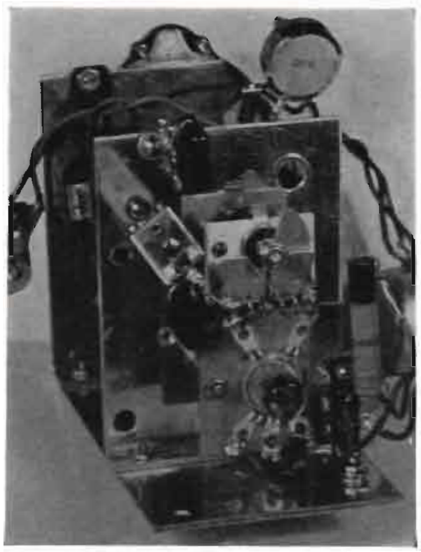


Fig. 7. A view of the 300-megacycle receiver removed form the pack.

Fig. 6. The receiver and remote amplifier feeding the broadcast equipment.

The farthest distance so far tried for reception was three-quarters of a mile over open country. No doubt greater distances can be covered with higher power. The approximate power of the transmitters is 0.1 watt.

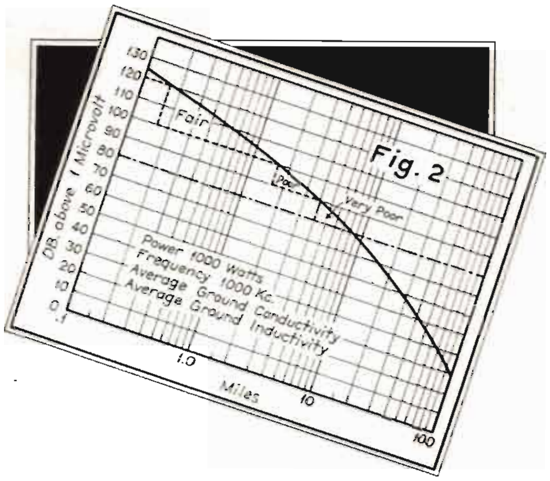
The 300- and 200-megacycle pack transmitter for KCMO was not designed to cover a great distance, but to be used inside large auditoriums and for the man-on-the-street broadcasts, etc., where it is usually necessary to use several hundred feet of microphone cable. The signal received is piped back to the station through a remote amplifier and telephone lines. Fig. 6 shows the ultra-high-frequency receiving equipment with antenna and remote amplifier as used for broadcasting.[1]

The reason for incorporating the receiver in the pack transmitter is to permit the person wearing the pack to receive instructions from the remote engineer, or so that when two pack transmitters are used in conjunction, each announcer carrying the pack will know what the other is saying and doing.

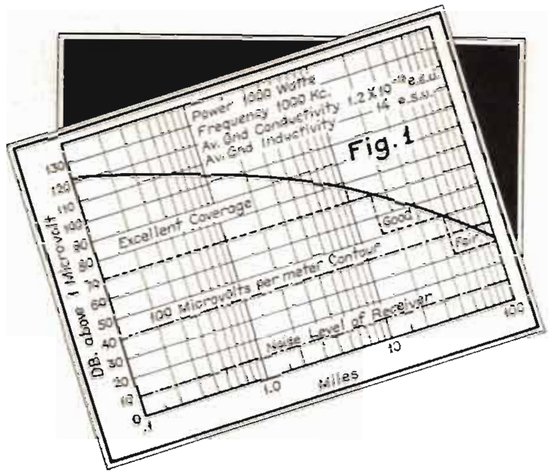
Fig. 3 shows the circuit diagram of the receiver used in the pack transmitter. The receiver is shown separately in Fig. 7. It was found necessary to make some slight changes in the receiver so that it would tune to better than 300 megacycles. The removal of two stationary plates from each of the tuning condensers and the spreading of the turns of each coil will usually accomplish this. Transformers were also added to the receiver so as to match a 500 or 50-ohm line, these transformers being bridged across the grid circuit of the 6C5 audio transformers. The antennas used with the receiver are of the tuned type, being made from a 72-ohm concentric transmission cable. The outside copper tubing is an odd number of quarter wavelengths, the projecting wire being a half wavelength long. In our first test quarter-wave antennas were used on both transmitter and receiver. It was found that by using half-wave antennas on the receiver and the transmitter about 4 or 5 db gain could be expected. The antennas now being used are one-quarter wavelength long for transmitters and half-

(*Continued on page* 41)

[1] "Midget Remote Amplifiers," by Loyd C. Sigmon, COMMUNICATIONS, *September*, 1937.



REAL vs. APPARENT



STATION COVERAGE

By R. L. HASKINS & C. W. METCALF
TOBE DEUTSCHMANN CORPORATION

THE PRACTICAL UTILITY of the supposedly adequate signals in primary service areas claimed for broadcast transmitters is sometimes so limited by the interference resulting from operation of electrical devices as to demand consideration of man-made static when primary areas are being defined.

There is wide variation in methods now employed to determine the coverage of a transmitter but, in the final analysis, it will be agreed that the only real coverage is that which allows consistent daily reception of signals, unhampered by fading, and unaffected by extraneous disturbances from other transmitters or from man-made interference. We have found that such coverage is amazingly rare. Despite the efforts that have been made to secure maximum coverage through improved design of antennae and ground systems, analysis of soil conditions, proper selection of transmitting frequency for the area to be served, and—of course—increased power, there is today hardly a territory in which the useful or "real" coverage of the transmitter is equal to the "apparent" coverage as checked in the customary fashion. And this holds true almost regardless of transmitter power.

Table 1

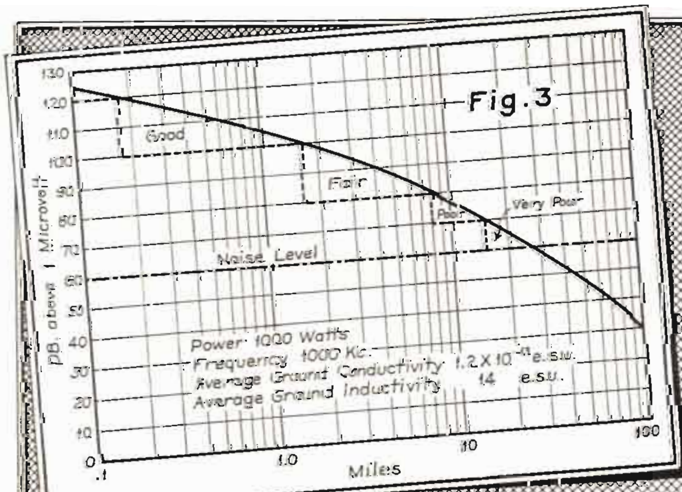
APPLIANCE	VOLTAGE BETWEEN LINES (Microvolts)	VOLTAGE BETWEEN LINES AND GROUND (Microvolts)
VACUUM CLEANER	3,000	3,500
ELECTRIC RAZOR	40,000	5,600
DIATHERMY MACHINE	250,000	37,000
PORTABLE ELECTRIC TOOL	20,000	25,000
HIGH-SPEED DRILL	15,000	12,000

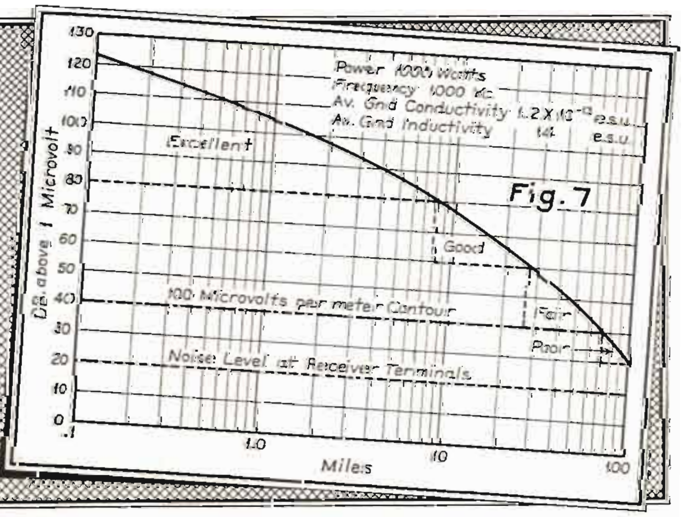
To illustrate real coverage, a number of curves have been prepared showing the effect of receiver noise and man-made interference upon quality of reception at various distances from a 1000-watt transmitter operating at 1000 kilocycles. In the preparation of these charts, the following conditions were assumed:

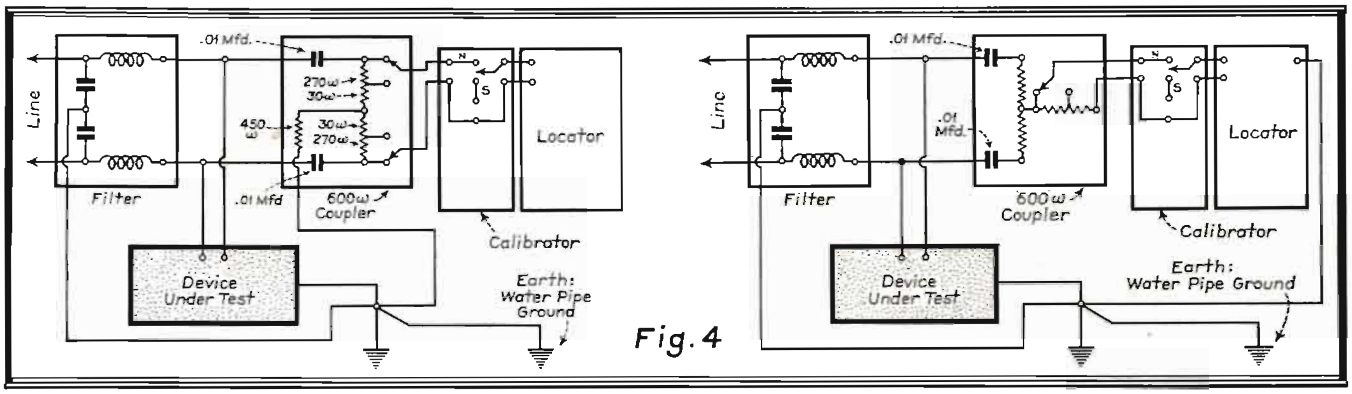
1. Ground conductivity ...... 1×10^{-15}
2. Adjacent frequency fields ....nil
3. Atmospherics ....nil

These conditions may be considered to relate to daytime reception in most of the thickly settled parts of the country. It is further assumed that the internal noise level of the receiver does not exceed 10 decibels and that the effective height of the antenna is one meter.

For convenience of interpretation, the data indicated on the graphs are ex-







Setup for measuring line-to-line noise voltage. **Setup for measuring line-to-ground noise voltage.**

pressed in terms of db above 1 microvolt rather than in terms of microvolts field strength.

Fig. 1 shows the type of coverage that is assumed in the conventional survey in which the only admitted factor limiting reception is receiver noise. According to this graph, the 100 microvolt per meter contour extends about 70 miles from the transmitter and at this distance the signal is 30 db above receiver noise—a value considered to provide reasonably good reception. At a distance of 16 miles, the signal is 60 db above the receiver noise—a value providing excellent reception. This is the ideal situation, assumed in many optimistic coverage reports.

But what is the actual situation? Figs. 2 and 3 show conditions that can and do exist in many locations. These graphs take into consideration the man-made static or inductive interference that must be acknowledged to be present and they show the effect of such interference on receivers having varying degrees of susceptibility to pickup of extraneous r-f voltages.

There are two major factors governing the effect of electrical apparatus operation on radio reception: the first is the magnitude of noise voltages on the power system; the second is the susceptibility of the receiver to influence by such voltages. Table I shows the 1000-kc noise voltage impressed on the electric power system by the normal operation of several common types of electrical equipment.

These voltages are as actually measured according to the standard test procedure established by the Joint Committee on Radio Co-ordination for EEI, NEMA and RMA. The test circuit and instruments for noise measurement are shown in Figs. 4 and 5. The appliances listed in Table I, and many other types of interference-creating electrical equipment, may be operated at any time and in any part of the area normally claimed to be served by the transmitter. The effect of the noise voltage is, therefore, indicated by a horizontal line corresponding to the db above one microvolt per meter for the noise voltage and receiver susceptibility.

The susceptibility of the receiver to noise voltages depends upon its construction as regards shielding and filtering of various circuits, upon the type of antenna and ground employed, and upon the relation between the antenna and ground and the wiring systems on which man-made noise is being distributed. The over-all effect of these variables may be expressed as a noise coupling factor evaluated in minus db.

An example of one extremely bad condition, that is altogether too common, is shown in Fig. 2. It is assumed that the receiver is being used with a so-called antenna eliminator the effect of which is to connect the power-supply line to the r-f input of the receiver through a small condenser. Under this

Showing the radio noise output of a hand type vacuum cleaner.

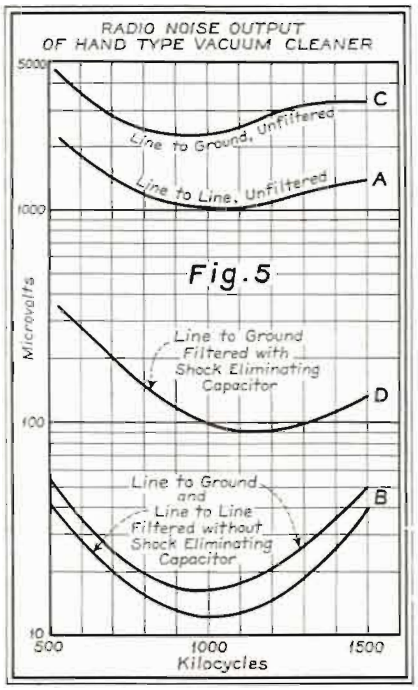
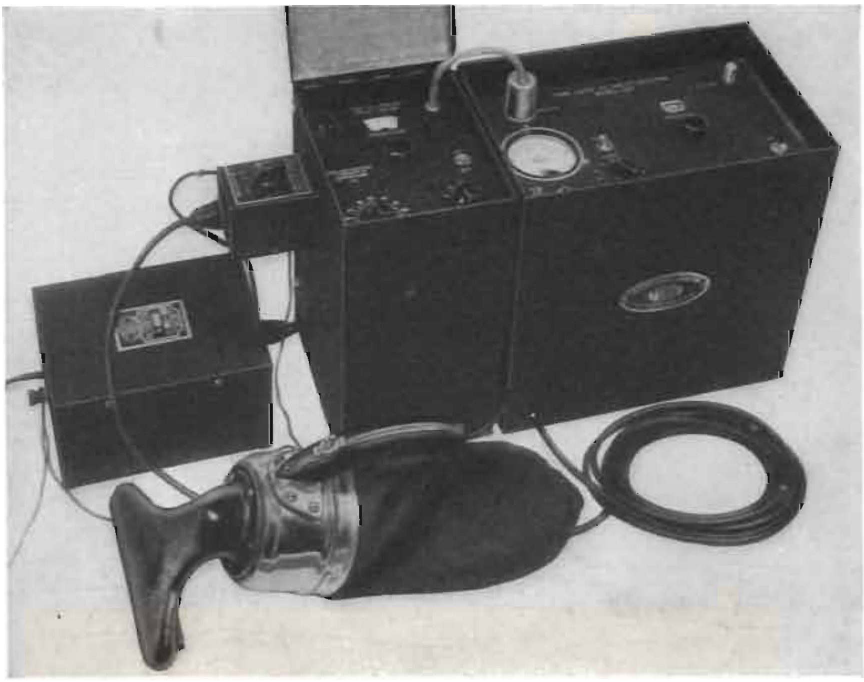


Fig. 6. Showing setup used for making certain noise measurements.



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(1) With the flip of a finger, you can now *lower or raise the response of the microphone*—without introducing any peaks or other undesirable effects. (*Not a volume control.* Gradually changes operation of the microphone from constant velocity to constant pressure.)

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MODELS RBHK, RBMk, with Acoustic Compensator. Frequency range 40 to 11000 CPS. Output, -65 db. Complete with switch, cable connector and 25' of cable . . . **$42.00 LIST.** Chrome, $43.00 List.
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P. A. Men, you can improve those "price" jobs by using the popular Amperite Model RAH (or RAL). You will get better results because (1) it is excellent for both speech and music; (2) has flat response without undesirable peaks; (3) reduces feedback; (4) stands up under tough handling, changes in temperature, pressure or humidity. . . . Frequency range 60 to 7500 cps. Output, -68 db.
MODEL RAH (Hi-imp.) with 12' of cable; MODEL RAL (200 ohms) with 8' of cable . . . . . . ONLY $22.00 LIST

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The success of our Model KTH ($22.00 List) has created a demand for a popular-priced Amperite Contact Microphone. The new model listed below can be used on most radio sets made since 1935 and on all P.A. systems. It "makes an ordinary violin sound like a Strad" . . . gives a small piano the tone of a Grand. And yet, there is no *distortion. No unnatural effects. No "fingering noises."* Installation is simple . . . no changes in strings or instruments . . . attached without tools.

Operates with either high or low gain amplifiers. Has frequency response of 40 to 9000 cps. Output, -40 db. 20' of cable.

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Professional Model KTH (or KTL) . . . . . . $22.00 LIST

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Station KVOL, of Lafayette, La., writes us, unsolicited: ". . . the Amperite mikes have been in service here for almost three years, and have proven themselves to be "tops" in mikes. They have broadcasted in the rain and in the hot sun. They have even been dropped, but they always came through in fine shape . . ." The *Amperite Studio Velocity Model SR80n now has -56 db output.* Frequency range 40 to 15000 cps. Triple shielded, fitted with switch, (*optional*), cable connector, and 25' of cable.
MODEL SR80n (200 ohms): $80.00 LIST
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VELOCITY **AMPERITE** MICROPHONES

condition, practically all the line-to-ground noise voltage present on the power circuit will be fed into the receiver and the coupling factor will be zero db. Thus the effect of the operation of the high-speed drill, for example, is to raise the noise level to 80 db. This noise level may be developed at any distance from the transmitter and, as Fig. 2 shows, it causes the original satisfactory reception to become wholly unsatisfactory as little as four miles from the transmitter. Thus it is evident that many listeners are placed outside the service area of the transmitter whenever electrical appliances are in use in the neighborhood. In fact the real coverage of the transmitter, under such conditions, extends only 0.10 mile for dependable excellent reception, only 0.16 mile for good reception, and only 1.8 miles for fair reception. It is emphasized that this is an extreme case yet it is one which is not uncommon, particularly in urban areas where erection of proper receiving antennae is difficult.

As a rule, correct antenna facilities are more often found outside the urban areas with the result that the condition illustrated by Fig. 3 may represent the "real" coverage of the transmitter. For this condition, the receiver is assumed to have normal shielding, a modern noise-reducing antenna and lead-in system, and an effective power-line filter, the effect of which is to give a coupling factor of minus 20 db. This means that, with the 80 db appliance noise previously assumed, the noise input to the receiver is only 60 db and the real coverage of the transmitter is extended to 0.7 mile for consistent excellent reception, 1.5 mile for good reception, and 8 miles for fair reception. This is believed to be a fairly accurate representation of the average receiving condition in the United States. Field strengths are sufficient to provide satisfactory reception under ideal conditions but the presence of radio noise sources likely at any time to bury programs beneath high noise levels causes "real" coverage to fall far below apparent coverage. And because present practice is to locate transmitters away from the densely populated centers, the large cities that should be well served may reasonably be considered as having only the type of service indicated by Fig. 3.

With these facts in mind, it is obvious that the listener must make some contribution to better receiving conditions if the coverage broadcasters are trying to provide is to be of value to him. The effect of proper receiving antenna and power-line filter has already been shown. Further improvement in signal-to-noise ratio is dependent on the reduction of noise voltages impressed on the power circuits by appliance operation. Such noise reduction can be secured through the use of simple, inexpensive, capacitive filters installed during manufacture of the appliance or, in the case of the millions of unfilterized appliances now in use, added by the radio listener. Fig. 6 is a photograph of a typical filter installed inside a vacuum cleaner motor. Fig. 5 shows the radio noise voltages developed by the appliance before and after filterizing. After addition of the filter providing a 40 db noise reduction, the condition shown in Fig. 3 becomes that shown in Fig. 7. The reduction of man-made noise permits a listener with a properly protected receiver and antenna to be sure of excellent reception at any point within an 8-mile radius of the transmitter, good reception as much as 24 miles away, and fair reception up to 60 miles. Thus, in an area adequately protected against man-made interference, "real" coverage can approach "apparent" coverage.

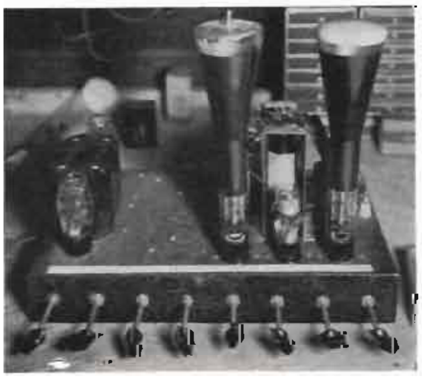
Admittedly, the elimination of man-made noise is not the function of radio broadcasters but broadcasting service can be complete only when such noise is overcome. An effort should, therefore, be made—perhaps by dissemination of information showing the listener his responsibility for existing bad receiving conditions—to validate present coverage claims.

THE MONOTRON

A NEW television tube, called the Monotron, has been developed by National Union Radio Corporation. The Monotron resembles in appearance a 3-inch cathode-ray tube. It is suitable for generating a single image for television experiments or for servicing television receivers in the field when the need arises.

In the Monotron, a metallic signal plate takes the place of the usual fluorescent screen. Upon this metallic plate and facing the beam of electrons within the tube is printed a test pattern. This test pattern is fixed and may not be varied in so far as any one tube is concerned. The test pattern, however, may be different for each tube.

An equipment built by M. P. Wilder. Monotron tube at left.



The test pattern when scanned by the beam causes the emission of secondary electrons. The intensity of this secondary emission is determined by whether the beam is scanning the bare metal or the ink of the design involved. When the Monotron is used in an *instrument* which might be called a television oscilloscope, the current is returned to ground through a 25,000-ohm resistor and the difference of potential developed is amplified by a wide-band amplifier. This amplifier should have a gain of approximately 20. A Type 6C6G and 6L6G with 2500-ohm load resistors will have an adequate wide-band frequency response for the purpose. The cathode-ray gun and deflection plates are operated the same as in the standard National Union 3-inch Videotron, Type 2003.

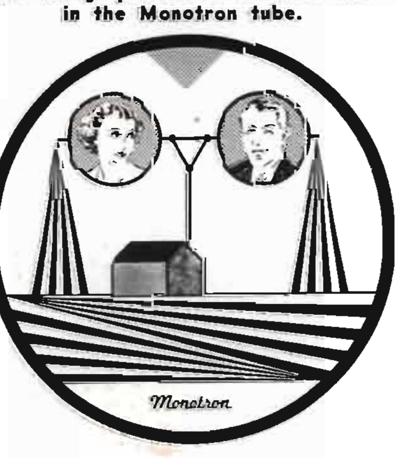
The image generated is viewed on a second tube, such as a Type 2003 Videotron, with elements wired in parallel through the Monotron. The output of the amplifier is applied to modulate the grid of the Videotron.

AMERICAN AIRLINES' GROUND TRANSMITTERS

AMERICAN AIRLINES, INC., has just placed an order for five new radio transmitters of the very latest design in aviation radio ground equipment,

(*Continued on page 28*)

The design printed on metallic disc in the Monotron tube.



A HIGH-FIDELITY LOCAL RECEIVER

A front view of the RCA HF-1 high-quality local receiver.

A RADIO RECEIVER, designed specifically for high-quality reception in metropolitan areas, has been introduced by RCA Victor.

The new instrument, designated as Model HF-1, is unique in several respects. It is a purely "local" receiver, for use only within the service areas of the local stations . . . within approximately 100 miles. As shown in the accompanying circuit diagram, electric tuning has been provided for eight stations in the standard broadcast band. It has a 6-position selectivity-fidelity-phonograph switch, which permits selection of sharp, medium and broad tuning. In the full-range position, the reproduction is said to be faithful from 50 to 7000 cycles.

The frequency range of the HF-1 is from 540 to 1550 kc. This permits push-button selection of two stations between approximately 540 and 1160 kc, three stations between 630 and 1230 kc, and three stations between 780 and 1550 kc.

Referring again to the circuit diagram, it will be seen that this receiver is an 8-tube super, using a 6A8 as first detector-oscillator, a 6K7 i-f amplifier, a 6R7 for second detector—a-f amplifier—and avc, a 6J5 driver, a 6J5 phase inverter and driver, two 6F6 power output tubes, and a 5T4 full-wave rectifier.

Features of design include: magnetite-core oscillator coils, and a special temperature-compensating capacitor (C26) for permanence of electric tuning adjustments; two tuned circuits between the antenna and first detector; two special tapped i-f transformers between the first detector and i-f tube; magnetite-core i-f transformers; automatic volume control; aurally-compensated manual volume control; phonograph jack; phase inversion; push-pull output; inverse feedback; and a 12-inch electrodynamic loudspeaker. There are three adjustments for each push-button (antenna, link circuit and magnetite-core oscillator coil).

•

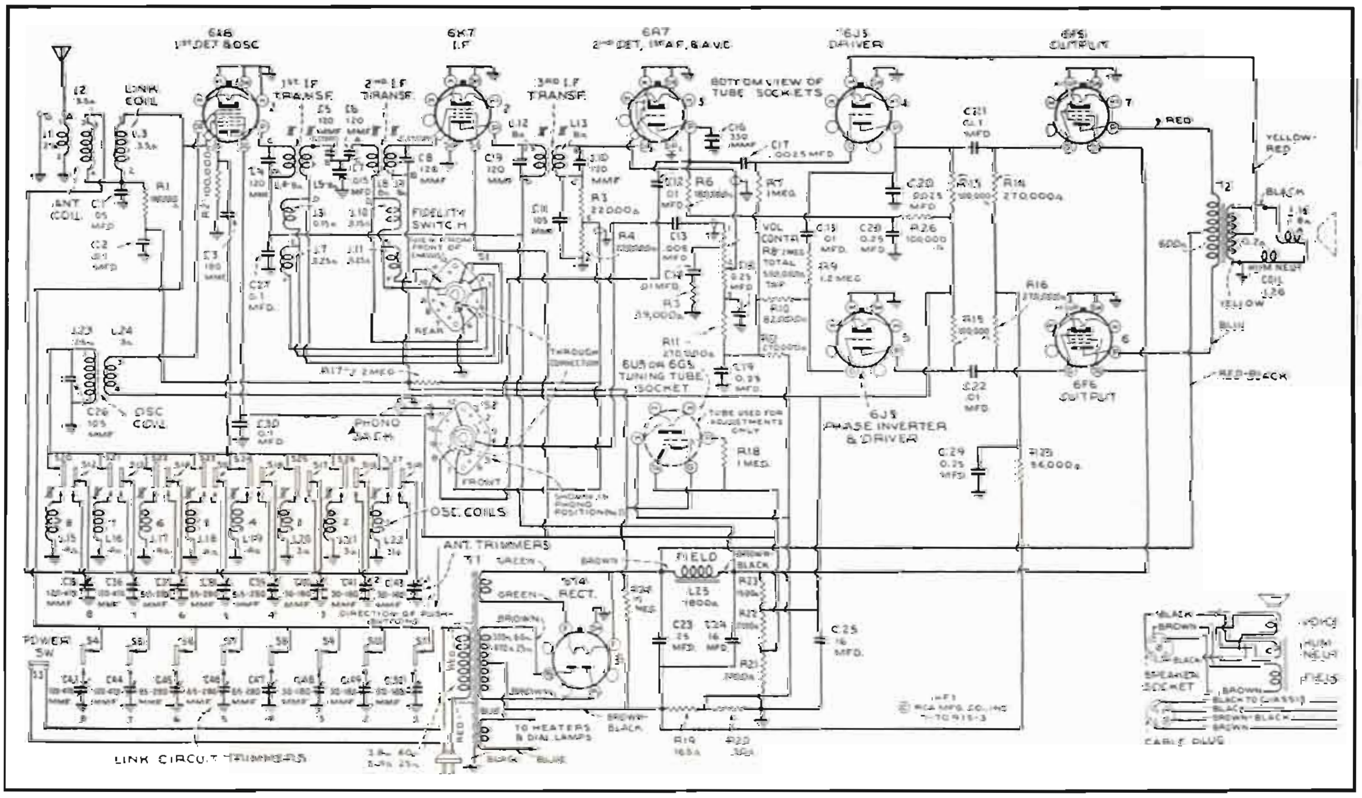
AIRLINES TRANSMITTER

(*Continued from page 26*)

which will permit transcontinental operation on either radiotelegraph or radiotelephone. In announcing the purchase, C. R. Smith, President of the air line, stated that the new transmitters will enable Flight Superintendents in the five Flight Control areas where they will be installed—Newark, Chicago, Nashville, Ft. Worth, Los Angeles—to talk direct with the pilot in charge of the airplane at the most distant point in the division.

The present radiotelephone transmitters in use by American have an output of 250 watts, and radiotelephone transmitters of 400 watts. The new transmitters of Bendix Type TG-6A are capable of instantaneous frequency change to any of ten frequencies.

Circuit diagram of the HF-1. Note the electric tuning arrangement.



THE PHASMAJECTOR

THE PHASMAJECTOR is a new source for video signals for use in demonstrating television, testing viewing cathode-ray tubes, or receiver performance. It provides a uniform television test signal with relatively inexpensive associated equipment. This modified form of cathode-ray tube is a development of the Allen B. DuMont Laboratories.

In place of the usual fluorescent screen swept by the cathode-ray beam, there is in the Phasmajector a metallic plate on which is printed the desired picture or test pattern. Also, the tube includes a collector electrode as well as the conventional cathode-ray tube gun and deflecting electrodes. When used with proper sweep circuits and amplifiers, the picture printed on the metallic plate can be readily scanned and transmitted to a receiver for reproduction on a standard television viewing tube. It is also possible to use the standard oscillograph cathode-ray tubes for viewing.

The Phasmajector operates on the principle of varying secondary emission from the image plate. In other words, as the cathode-ray beam scans the image on the metallic plate, varying amounts of secondary electrons are re-

leased depending upon whether the beam impinges upon metal or special ink used to print the picture. A larger number of electrons are released when the ray strikes the metal than when it strikes the ink. The varying voltage output is picked up by the collector electrode and fed to the grid of the video amplifier. This signal is said to be stable and of better quality than can be obtained from a photo-electric mosaic pickup tube because of the absence of capacitance effects. The amplitude of the signal may be as high as 10 volts with high-impedance coupling and can modulate a television viewing tube directly without any video amplifier. The signal is 0.2 volt across a 10,000-ohm load.

For a simple television demonstration, two standard oscillographs such as are used by radio servicemen, can be used. For instance, two DuMont Type 164 (3-inch tube) oscillographs, one equipped with a Phasmajector tube in place of the usual cathode-ray tube, and the other with its usual tube, can be employed. Certain slight modifications are required, but the oscillographs can still be used for their normal purposes when desired. With such a sim-

(*Continued on page* 35)

AEROVOX
PART NO. 311
V.D.C. 150
PATENTED.

SPEECH-INPUT UNITS

(*Continued from page* 10)

respectively. The latter obviously gives a truer visual picture of the actual operation.

BACKGROUND LEVELS

High-fidelity reproduction requires, of course, a background level low enough for transmission of an adequate volume range. It has been estimated by Jones[1] that the maximum usable range approximates 55 db, the figures being obtained by assuming that a maximum level of + 80 db represents the loudest sounds it will be desirable to reproduce in the home, and that the noise level in a quiet residence is approximately + 25 db (the intervening range being that allowed for ordinary reproduction). It is to be noticed that these levels are of sound intensity as measured in decibels above the threshold of hearing (.000204 bars).

Before beginning a discussion of levels it is desirable to say a word about "weighted" and "unweighted" measurements. A survey of manufacturers' literature indicates that some are using one method of specification and some the other. In the past there has been no standard of weighting, and for this reason manufacturers have held that none could be properly employed. However, tentative standards for noise measurements have recently been adopted, and it seems probable that before long some method of linking these standards to measurements on broadcast units will be worked out. In the meantime an understanding of the problem is required in order to make certain allowances in figuring levels. The difficulty results directly from the fact that the loudness levels perceived by the ear vary with frequency and level. Thus, for a loudness level perceived by the ear as 40 db (at 1,000 cycles), the actual sound intensities required vary from about 35 db up to about 80 db—as shown in Fig. 7. In other words, at low levels the ear discriminates sharply against low-frequency sounds, and somewhat less so against high-frequency sounds. If a weighting network, having a response characteristic inversely proportional, is used, the results more closely approximate the general effect at the receiver than do measurements made with a flat response. Since the distribution of noise frequencies in a speech equipment will vary, and since the loudness level curves themselves vary in shape according to the level, it is impossible to make a flat statement as to how much difference there would be between the weighted and unweighted noise specifications of amplifier units in general. Fig. 8 is a typical example—showing differences from 8 db to 30 db, depending on the gain.

If we assume that a range of 55 db is required at the input to the transmitter, it is easy to figure the maximum noise level which can be tolerated in the program or line amplifiers—in that this must simply be 55 db, or more, below the operating output level of these units. However, in figuring the levels to be maintained in the preamplifier it is necessary to begin at the other end of the chain—namely, with the microphones. There is no real good agreement between authorities as to the exact range of sound levels a microphone must handle. However, the table shown in Fig. 9, which is based on a comparison of the results of a considerable number of investigators, will serve as a basis of estimate. The important points to be determined are the minimum and maximum sound levels required to be handled. The evidence points to a minimum level of + 20 db, or approximately .002 bars. The maximum level will be that of symphony orchestra peaks. These are given by various observers at values all

(*Continued on page* 34)

[1]L. F. Jones, "The Specific Transmitter Performance Required for High Fidelity," *Broadcast News*, Feb., 1935.

SPEECH-INPUT UNITS

(*Continued from page 32*)

the way from 30 bars to 300 bars. The first seems somewhat low, and the latter is almost certainly excessive. If we assume, as a convenient compromise, the value of 200 bars, we find that we have a range of sound intensities of 100 decibels. High-fidelity operation will require something approaching this range.

Conversion of this microphone range into microphone output levels requires consideration of another point. Some manufacturers rate their microphones at a certain output level corresponding to a sound of 10 bars at the microphone. This is a convenient system, but has disadvantages where the output is not a commonly known impedance—such as 250 ohms. The other method of specifying microphone output is in volts per bar. To convert this latter it is necessary to take into account the output impedance of the microphone, and the manner in which it feeds into the preamplifier—that is, through a transformer (providing a considerable step-up ratio) in the case of low-impedance microphones, or direct to the grid of the first tube in the case of high-impedance microphones. Taking the example of the velocity microphone, the actual output level corresponding to various sound intensities is given in the right-hand column of the table (Fig. 9). As will be seen, the range required is from —40 db to —140 db. A preamplifier commonly used with this type of microphone has a gain of 40 db. Thus the output of the preamplifier may range from approximately 0 db to —100 db. Distortion at the former level must not be too high, and background noise level must be of the order of the latter level. Actually, the manufacturers specification indicates a level of —88 db for unweighted measurement. The weighted measurement would probably be of the order of 100 db. Such an extreme range may be considered as too idealistic—however, it is a practical goal.

The range of levels in the preamplifier is, of course, reduced by the gain riding of the operator—either in the mixing system, or in the master gain control—in order that maximum use of the available 55 db overall range can be made. A diagram such as that of Fig. 10 is useful in predicting the levels to be handled at various points in the system, and for figuring the necessary noise-level tolerances. The heavy line of this diagram corresponds to a sound input of 10 bars, which may satisfactorily be taken as the ordinary peak level indicated by the V. I. The dotted upper line shows the maximum levels which

(*Continued on page 38*)

TELEVISION STANDARDS

(*Continued from page* 14)

independent of light and shade in the picture.

The wording of the following two existing standards has been changed to read:

M9-120—Positive Transmission occurs when an increase in initial light intensity causes an increase in the transmitter power.

M9-121—Negative transmission occurs when a decrease in initial light intensity causes an increase in the transmitter power.

In connection with these standards, Mr. Murray's article, "RMA Television Transmission Frequencies and Standards," page 20, COMMUNICATIONS for November, 1937, will be found of interest.

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THE PHASMAJECTOR

(*Continued from page* 30)

ple, inexpensive arrangement all the principles of a complete television system can be readily demonstrated. Either horizontal or vertical scanning of any desired number of lines and any interlacing arrangement can be used.

The circuits and principles involved in this simple television demonstration equipment are part of the DuMont simplified high-definition television system which has been completed and tested in the DuMont Laboratories. Field tests are dependent upon the issuance of an experimental television license from the FCC, the application for which was filed over a year ago. This method of television uses no synchronizing or blanking impulses at either transmitter or receiver, and has no sweep circuits at the receiving end. This makes possible the simplification of the receiver. It is said that the receiver need be little more than a high-grade short-wave receiver with a cathode-ray tube in place of the usual loudspeaker. Such a receiver can pick up television signals of any number of lines, any number of frames per second, and any interlacing scheme, without changes of any sort. With the usual television system the receivers will operate only when designed for specific transmitting conditions and become obsolete if the picture detail is improved at the transmitting end by a change in scanning technique. The DuMont method requires a much narrower frequency band than that now needed for usual television transmission. Four transmitters can be operated where only one can operate at present. This narrower band means that television can be assigned to somewhat higher wave lengths or lower frequencies, thereby greatly extending the service area covered by a given transmitting power.

OVER THE TAPE . . .

NEWS OF THE COMMUNICATIONS FIELD

G-E APPOINTMENTS

At the meeting of the Board of Directors of the General Electric Company, held in New York City, March 25, Charles E. Wilson, Executive Vice-President, and Philip D. Reed, Assistant to the President, were elected Directors, to fill existing vacancies on the board.

UNIVERSAL MICROPHONE CATALOG

Universal Microphone Co., Ltd., Inglewood, Calif., this month will issue its annual catalog which, as usual, will contain illustrated data on its microphones, recorders, and accessories. This year a new section will also be devoted to airplane microphones.

UNITED-CARR APPOINTMENT

With the announcement of new and improved laminated phenolic insulation from the laboratories of United-Carr comes word that the production and marketing will be under the direction of Mr. Lester W. Tarr. Recently appointed to the executive staff of United-Carr, Mr. Tarr has an experienced and commendable record in the field of chemistry, and is well identified with all phases of laminated synthetic plastic products.

DUN & BRADSTREET REPORT

Attention of RMA members is called to a special report on the radio industry issued recently by Dun & Bradstreet, Inc. The report stated that stocks of manufacturers on March 1 were not excessive, but sales for the first two months this year were below 1937. Other interesting comment stated that there was no evidence of a definite upturn in either production or sales to March 15, but that sales volume, especially in automobile sets, was improving notably in the South and on the Pacific Coast. Recent excessive stocks of distributors and dealers, causing severe price cutting, and low-priced sets also were commented on.

SYLVANIA APPOINTMENT

The appointment of E. F. Carter as Assistant Chief Engineer for Sylvania radio tubes has been announced by Sylvania Chief Engineer R. M. Wise. Mr. Carter has been a member of the Sylvania Engineering Department since September, 1932, when he was appointed Consulting Engineer on tube application problems. In 1933 he was made division tube engineer for the Emporium, Pa., plant.

RMA BOARD OF DIRECTORS' MEETING

President Leslie F. Muter is arranging to hold a meeting of the RMA Board of Directors as soon as possible, probably April 21 or 22. Acute merchandising and production problems developing from present business conditions will make the spring meeting of the RMA directorate unusually important. Also it may be the last Board meeting before the fourteenth annual RMA convention and the national radio parts trade show at Chicago next June. The final convention program will be approved by the RMA Board.

POPPELE ON TOUR

J. R. Poppele, Chief Engineer of WOR, embarked April 6 on a seven-week tour of Europe to conduct an exhaustive survey of radio broadcasting and its allied industries in the Old World. Nine countries are on the itinerary, including England, Germany, France, Holland, Belgium, Switzerland, Italy, Norway, Sweden and Russia.

MALLORY VIBRATOR PRICES

As a result of the standardization and wider application of universal types, substantially lower list prices on Mallory replacement vibrators have been announced by P. R. Mallory & Co., Inc. The price changes are included in a new listing of recommended replacements, by make and model of receiver, available from all Mallory-Yaxley distributors. Ask for Form No. E-551.

CORNELL-DUBILIER CATALOG

Cornell-Dubilier catalog flyer 154-A lists two new C-D products, the type BR "Beavers," tiny etched-foil dry electrolytic filter capacitors, and the type 2R silver-plated mica capacitors, units with stable frequency characteristics. Address requests to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

ANACONDA BULLETIN

A publication treating on the characteristics of ANW cable, is now available through the Anaconda Wire and Cable Company. A general description of its use in industrial applications and large buildings is given based on the National Electrical Code indicating that this cable is now suitable for use in places where heretofore only lead covering has been acceptable. This publication is available through the Anaconda Wire and Cable Company, 25 Broadway, New York, N. Y.

FRYLING BACK FROM EUROPE

Mr. W. H. Fryling, Vice-President of Erie Resistor Corporation, Erie, Pa., has recently returned from an extended tour of Europe. Mr. Fryling spent several weeks in England at the British factory of the Resistor Corporation, near London, and with their representative in Paris, France.

The radio and plastics business in England has not suffered to the same degree as in this country, Mr. Fryling found. However, a good deal of the huge buying is a direct result of the armament program being carried on by the British Government.

BAKELITE BOOKLET

A new booklet, "Bakelite Laminated," has just been published. It describes the range of Bakelite laminated products that are available and their diversified applications. This 48-page illustrated booklet discusses the individual physical, electrical and mechanical properties of laminated sheets, tubes and rods. Copies may be secured by writing to the Bakelite Corporation, 247 Park Avenue, New York City.

WARD LEONARD REPRESENTATIVE

Ward Leonard Electric Co., announces the appointment of Mr. Charles D. Southern, 430 W. Rudisill Blvd., Fort Wayne, Indiana, as their representative for the sale of Ward Leonard radio products. Mr. Southern's territory covers the entire state of Indiana.

CERAMIC PROPERTY CHART

American Lava Corporation, Chattanooga, Tennessee, have recently issued a ceramic property chart of their insulating materials. The information contained in this chart has been compiled in a concise and easily accessible form. Copies may be secured from the above organization.

DR. STOEKEL DIES

Dr. Erwin R. Stoekel, Vice-President of the Globe-Union, Inc., battery and radio apparatus manufacturers, died on March 14. Dr. Stoekel was known in scientific circles chiefly for his pioneer discoveries and developments in the field of the electron tube, particularly the radio vacuum tube.

INSTRUMENT BULLETIN

Bringing together instrumentation and machinery for the betterment of industry is the primary purpose of a new house organ entitled "Instruments in Industry," which will be issued periodically by the Meter Division of the General Electric Co. The many ways in which electric instruments can bring more and greater benefits to industry are presented and illustrated, and new products are announced in the columns of this periodical. This publication, printed in small newspaper form, is distributed free of charge to industrial plants.

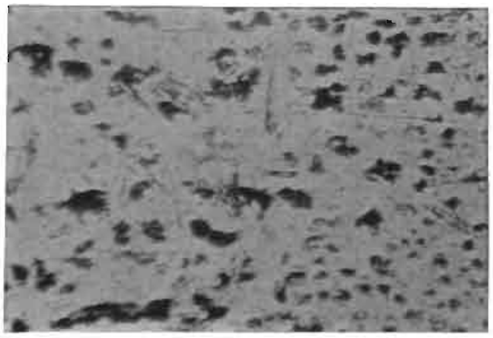
TUBE DEFINITION RECOMMENDED

A definition of what constitutes a radio "tube" has been agreed upon by a special committee of the RMA Tube Division of which Meade Brunet of Harrison, N. J., was chairman. The proposed tube definition would exclude the ballast resistor type. The recommended definition, following meetings of the special committee and also the RMA vacuum tube and broadcast receivers committee, is now being considered by the entire RMA Tube Division, and will be acted upon finally by the RMA Board of Directors to constitute an industry definition covering advertising and merchandising practices.

RCA APPOINTMENT

Sidney M. Robards, for the last year and a half a member of the Publicity Department of the National Broadcasting Company, has joined the Department of Information of the Radio Corporation of America, RCA Building, New York. Robards has served since last May as Assistant Editor of the Press Division of the NBC. Before joining the NBC, Robards was Day City Editor of The Louisville Courier-Journal.

CHEAPER . . . yes, but—

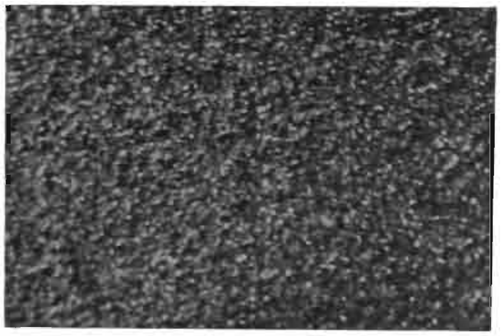


This photomicrograph shows why we do not offer electroplated strip. Note the effect of corrosion on this nickel plated strip as sold for radio tube use.

WE CANNOT AFFORD THE RISK! *CAN YOU?*

YOUR PROTECTION IS SVEACOTE which is well worth the slight additional cost

Here is a photomicrograph of Sveacote with the same magnification (100X) made after the same corrosion test.



(Darkness due to low reflection from matte surface.)

THE REASON

Sveacote is a definite alloy made by a special process to resist rust. Note compact structure, uniformity and freedom from impurities.

Swedish Iron & Steel Corporation

17 BATTERY PLACE NEW YORK, N. Y.

SPEECH-INPUT UNITS

(*Continued from page* 34)

may be encountered, and the dotted lower line the minimum levels.

The above completes the important aspects of performance in so far as most units are concerned. One factor, phase shift, has not been mentioned, as it is ordinarily not of importance in audio units (although it becomes so in television design). There is, however, another factor which relates to certain speech-input units and which also would deserve consideration in laying out specifications for a speech-input system. This is the group of transient effects which are of importance in considering such units as volume indicators and limiting amplifiers. For instance, the question arises as to whether the V. I. should have a quick response or a slow response—a peak reading, or an average reading. Similarly, there is the question as to how quickly the limiting amplifier should take hold, and what should be the subsequent release time.

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PUSH-BUTTON SYSTEMS

(*Continued from page* 15)

only the stronger stations will be tuned in automatically. Where such a set-up is applied to an auto receiver, a shunt-tuned antenna circuit may be used with its higher gain, since the antenna capacitance may be definitely taken into consideration.

With the above-described arrangement three-point tracking is obtained and, with the points of crossover selected at convenient frequencies in the band, only very slight departure from perfect tracking over the band is secured.

Because of the form factor used in the coil winding and by employing a "Polyiron" core of high permeability, it is possible to cover the major portion of the broadcast band in one step, or the entire band may be covered with two ranges of coils having considerable overlap. Typical ranges are as follows: Set No. 1, 1630 kc-945 kc, Set No. 2, 1070 kc-535 kc; Set No. 1, 1540 kc-870 kc, Set No. 2, 1070 kc-535 kc.

By proper choice of the number of buttons assigned to such ranges, it is possible to avoid special designs in handling all but extremely unusual conditions. Because of the single adjustment, which is not critical but smooth, provision may be made in the escutcheon for access to the studs from the front of the receiver.

The fact that afc is not considered essential in receivers including this unit is based upon the stability of the tuned circuits. Since the stability of the oscillator circuit lends itself to checking much more readily than the antenna circuit and is by far the more important, tests were made on this circuit. In the test set-up, the receiver proper with all tubes in position was placed immediately adjacent to a chamber in which the temperature could be controlled, and the push-button unit mounted within the chamber. The necessary connections were made through the cabinet wall. The button positions were adjusted to frequencies corresponding to received signals of 1400 kc, 1100 kc, 900 kc, 800 kc, 700 kc, and 600 kc. The corresponding oscillator signals were picked up on another receiver, which was also fed from a standard signal generator. Starting from room temperature the chamber temperature was raised in convenient steps, held constant at each level for several minutes, and the generator adjusted to zero beat with the push-button oscillator. Readings of frequency were taken for each button. The temperature was raised to a maximum of 140° F. and then lowered step by step to room temperature. A number of runs were made with the frequencies set up on the buttons, interchanged. The maximum drift observed at each frequency for 35° C. rise from room temperature is as follows: 1400 kc-4.0 kc; 1100 kc-5.9 kc; 1000 kc-4.1 kc; 800 kc-4.9 kc; 700 kc-5.8 kc; 600 kc-4.8 kc. The average maximum drift is thus less than 5 kc over the frequency range. Furthermore, it was observed that the temperature drift curves were practically linear and essentially coincidental whether the temperature was rising or falling. As a result the oscillator frequency always returned to its initial value when the unit returned to the same room temperature.

Thus in use it is necessary merely to follow the usual practice in receiver alignment of not adjusting the unit until the receiver has reached its approximate operating temperature, in order to insure that stations once set up will always remain in tune.

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BOOK REVIEWS

ELECTROLYTIC CONDENSERS, by Philip R. Coursey, published by Chapman & Hall, Ltd., 11 Henrietta Street, W. C. 2, London, England, 172 pages, price 10s, 6d.

A complete treatment of electrolytic condensers, their properties, design and uses; is given in this compact volume, which summarizes the still scattered literature of the subject. Beginning with a general discussion of condensers and dielectrics, the author reviews briefly the early experiments with electrolytic capacitance, going back to 1855; then discusses the details of the three types in ordinary use today, the wet, semi-dry and dry. The separator and its influence on performance, electrical characteristics, methods of testing and commercial applications are treated under separate chapter headings.

HANDBOOK OF CHEMISTRY AND PHYSICS, 22nd Edition, Charles D. Hodgman, Editor-in-Chief, published by Chemical Rubber Publishing Company, Cleveland, Ohio, 2069 pages, price $6.00.

The latest issue of this widely-used handbook devotes increased space to thermionic tubes. As against twelve pages given to the tube data in the preceding handbook, the 22d Edition has 25 pages, listing 454 tube types classified as follows: receiving tubes, 122; telephone and industrial tubes, 76; transmitting tubes, 115; gaseous rectifiers, 58; high-vacuum rectifiers, 51, and grid-controlled rectifiers, 32. The usual data is given opposite each tube. Thirty-five base connections are indexed and diagrammed, against 15 shown in the 21st Edition.

Meteorological material and a more convenient table of standards of weight and measure are among other improvements of interest to radio men in this convenient reference, which includes almost all the more commonly required data of physics and chemistry.

COMMUNICATIONS★

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No other technical publication in the radio and communications industry even closely approached COMMUNICATIONS in presenting, during the past twelve months, such authoritative and instructive articles as those submitted by the men named above among others.

But more important is this fact: COMMUNICATIONS "scooped" its contemporaries by having 30 to 90 day prior release on many new and important technical developments made during the year.

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★ Communications resulted from merging Radio Engineering with Communications and Broadcast Engineering.

PACK TRANSMITTER

(*Continued from page 22*)

wave antennas on the receivers that feed the remote equipment.

Some tests of interest that have been made are the enclosure of the pack transmitter in a completely copper plated cabinet. The receiver was at a distance of approximately two hundred feet. There was very little drop in signal when the transmitter was completely enclosed, either on 200 or 300 megacycles. One of the most remarkable things about the 300-megacycle signal is that no interference of any kind has been received, and very little on 200 megacycles.

One of the most serious problems so far experienced on 300 megacycles is the variation of signal strength due to some interference effect in and around metal structures. This condition is not noticed in the open until a half mile or more away from the receiver. Rapid movements of the person carrying the pack transmitter had no effect on the reception within reasonable distances.

Twenty 15-minute periods of broadcasting using the 300-megacycle pack transmitter was completed from the Kansas City 1938 Auto Show, held in the Exposition Hall of Kansas City's New Municipal Auditorium. The results from the equipment as a whole has been very gratifying.

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ELECTROLYTIC CAPACITORS

(*Continued from page 20*)

rents of extremely high frequencies by the vibrator type of current inverters usually employed. In such applications, voltages of frequencies of the order of from 10 to 30 megacycles are impressed on the filter network and the ordinary filter network does not attenuate at these frequencies.

The explanation for this fact is that at such frequencies the filter network becomes an effective high-pass filter because the choke coils become effectively capacitive in function. If the electrolytic capacitors have sufficiently low values of impedance at these frequencies, some of the extremely high-frequency voltages can be effectively attenuated. The power factor value, at 60 and 120 cycles, of the electrolytic capacitors has absolutely no bearing in the matter.

Low power factor, as such, may be a convenient sales weapon of capacitor salesmen, but the fact remains that ultimate user satisfaction will be increased if radio-receiver engineers use electrolytic capacitors with power factors that have not been lowered at the sacrifice of lowered breakdown voltages, shortened life and poor shelf life characteristics.

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATIONS FIELD

FREQUENCY-LIMIT MONITOR

Type 775-A frequency-limit monitor is designed for monitoring high-frequency transmitters between 1500 kc and 45 mc.

Warning lamps are used to indicate frequency deviations outside a predetermined limit. When the transmitter frequency exceeds this limit on the low side, one lamp lights; a similar deviation on the high side lights the other lamp. Operating limits are set by a dial on the panel calibrated in cycles per second.

The indicating system operates on the beat frequency between the transmitter and a self-contained crystal oscillator. Space is provided for mounting four crystals, so that four separate channels can be monitored. The monitor is a-c operated and mounted on a 19-inch relay-rack panel.

Further information may be secured from the *General Radio Company*, 30 State Street, Cambridge, Mass.—COMMUNICATIONS.

AUTO-RADIO TUNER

The new Stewart electric push-button tuning unit for use on all types of auto radios is shown in the accompanying illustration. The push-button control unit features the same non-glare lighting arrangement used in other Stewart remote controls. It can be mounted on either the instrument panel or the steering post. The tuning mechanism is contained in a compact metal case approximately 4½" x 3½" x 3", which can be mounted either on the fire wall or attached to the radio receiver. By simply pushing a button, the desired station is obtained among five pre-selected stations.

This control is a product of the *F. W. Stewart Manufacturing Corp.*, 340 West Huron Street, Chicago, Illinois.—COMMUNICATIONS.

CATHODE-RAY TUBE

A new RCA low-voltage cathode-ray tube of the high-vacuum, electrostatic deflection type has been made available. This new tube, designated as RCA-902, will be of interest to the radio engineer, serviceman, amateur, and experimental laboratory.

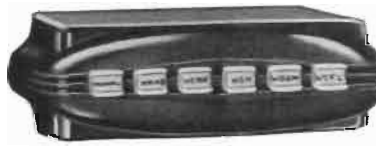
The 902 is small in size, has a 2-inch diameter fluorescent viewing screen, and operates with an anode No. 2 voltage as low as 400 volts and as high as 600 volts. It is provided with two sets of electrostatic plates for deflection of the electron beam. The brilliant luminous spot produced by this new tube has a greenish hue. The 902 is electrically interchangeable with the RCA-913, provided the anode No. 2 supply is 400 volts or more.

Because of its relatively low cost, small size, and its ability to produce a bright image at low voltages, the 902 is suited for use in portable oscillographic equipment.

Further details of the characteristics and rating of the 902 may be secured from RCA transmitting tube distributors, or from *RCA Radiotron Division, RCA Manufacturing Co., Inc.*, Harrison, N. J.—COMMUNICATIONS.

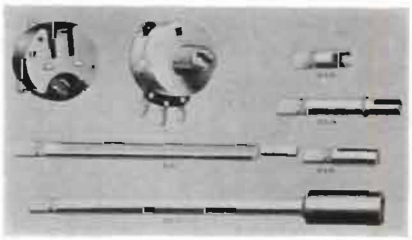
General Radio's Frequency-Limit Monitor.

Webster-Chicago Amplifier.



The F. W. Stewart Auto-Radio Control.

Mallory-Yaxley Volume Controls.



The RCA Cathode-Ray Tube.

WEBSTER-CHICAGO AMPLIFIER

Webster-Chicago have just announced a new 25-watt amplifier, Model 2L-25, which is said to be particularly adapted to critical installation. The following specifications for this amplifier were announced by the manufacturers: distortion, 2½% at 25 watts; frequency characteristic plus or minus 1¼ db from 50 to 10,000 cycles; multi-stage degeneration.

For further information write to the *Webster Company*, 5622 Bloomingdale Ave., Chicago, Illinois.—COMMUNICATIONS.

GLASS COVERED MAGNET WIRE

Modern research has made possible the production of an inorganic textile. This new textile is made of glass. It is used by Anaconda Wire and Cable Company in making their Vitrotex magnet wire and coils.

In appearance Vitrotex magnet wires resemble silk. An outstanding characteristic is said to be the ability to withstand high temperatures for long periods of time. The dielectric strength and insulation resistance is high and not seriously affected by high temperature nor high relative humidity.

The insulation is mechanically strong and Vitrotex wires can be wound into coils by following the same general methods that are used for other magnet wires. The space occupied by Vitrotex magnet wires is less than double cotton of the same gauge.

For specifications and description of this product write *Anaconda Wire and Cable Company*, 25 Broadway, New York, N. Y.—COMMUNICATIONS.

VOLUME CONTROLS

Mallory-Yaxley announces a new line of midget volume controls—plain, single-tap, double-tap and duals—available in resistance values from 5,000 ohms to 3 megohms inclusive and in all necessary tapers.

A feature of this new development is a line of 17 plug-in shafts (Pat. applied for) which give the 56 controls a range of over 1,000 exact replacements. A special or exact replacement is made by merely plugging in the required type of shaft.

Complete information is available from any Mallory-Yaxley distributor. *P. R. Mallory & Co., Inc.*, Indianapolis, Indiana.—COMMUNICATIONS.

SPEECH-INPUT EQUIPMENT

Gates have recently announced their 20-B console type speech-input equipment for radio broadcasting stations. This equipment is said to be designed with all the common required features to make a flexible studio setup. Negative feedback is used in the audio circuit to secure low distortion. It is said that the cabinet was designed by a leading cabinet maker. The cabinet body is of walnut and the top of inlayed foreign Ragutta wood.

This equipment is completely described in a catalog on speech-input equipment. Write to *Gates Radio & Supply Co.*, Quincy, Illinois.—COMMUNICATIONS.

BRUSH PICKUP

Shown in the accompanying illustration is the new Brush high-fidelity pickup. This unit has been designed to give flexibility, minimum record wear, and high-quality reproduction. The frequency response is said to be flat up to 10,000 cycles.

Complete information is available from the *Brush Development Company*, 3322 Perkins Avenue, Cleveland, Ohio.—COMMUNICATIONS.

IRC RESISTORS

Eight new units recently introduced bring the total of IRC Precision wire-wound resistor types to twelve, thus giving a complete range of inductive and non-inductive resistors. The additions include five new resistors of the present IRC design and three new designs to allow for vertical mounting in small spaces.

The new Types WW-5, WW-6, WW-7, WW-8 and WW-9 represent intermediate sizes for flexible mounting. They also provide, as in type WW-5, high ohmages non-inductively wound on a small form. Types WW-8 and WW-9 are center tapped units, inductively wound, for economy of space.

A feature of the new Types WW-12, WW-13 and WW-14 is the method for bringing both terminals out at one end. The resistance wire is returned to the lead internally through the ceramic and insulated and protected from windings and mounting bolts. All units are wound on ceramic cores with high grade Nichrome or Copper Nickel wire. Special impregnation is employed to protect the windings.

These new precision resistors, along with a complete listing of the many other IRC types are described in the 1938 IRC Resistor Catalog. A copy may be obtained by addressing your request to *International Resistance Company*, 401 North Broad Street, Philadelphia, Pa.—COMMUNICATIONS.

FREQUENCY STANDARD

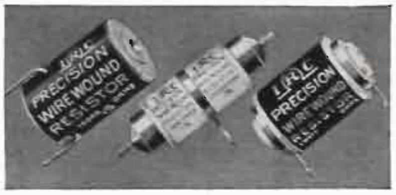
The Ferris Model 33 Calibrator contains three crystal-controlled oscillators having fundamental frequencies of 100, 1,000 and 10,000 kilocycles, and arranged to generate harmonics which are usable up to about the 30th or 40th of each crystal fundamental. In addition, there is a multivibrator controlled by the 100 kc oscillator, giving fundamentals of 50, 25, 20 and 10 kc, the harmonics of these being usable up to about 3,000 kc so as to provide finer subdivisions of the main frequency intervals.

The frequencies generated in the Calibrator can be picked up by an external receiver, as in receiver calibration, or will produce beats against any externally-generated frequency such as that coming from a signal generator or oscillator which is to be checked or calibrated. For this latter purpose a self-contained detector and audio amplifier is provided, so that no additional equipment other than a pair of earphones is required for this use.

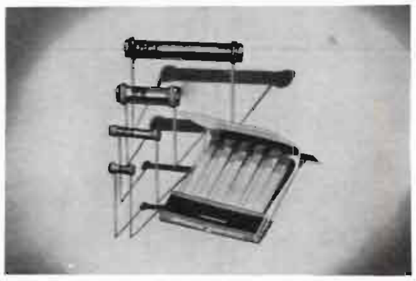
The three crystals are of the low-drift type, ground and adjusted to an accuracy of .01 percent, or 100 cycles per megacycle. Temperature drifts will not cause variations greater than about this amount, so that the total possible error under any normal condition should not exceed about .02 percent.

This Calibrator is a product of the *Ferris Instrument Corp.*, Boonton, N. J.—COMMUNICATIONS.

Above: The Brush Pickup. Below: IRC Resistors.



Above: Shure Microphone. Below: Centralab Condensers.



Above: Utah Speaker. Below: Ferris Calibrator.

SHURE MICROPHONES

A series of new carbon and crystal "Military-Type" hand microphones has been announced by Shure Brothers.

One of the features of the new microphone is the case design which eliminates the conventional handle and makes the microphone fit in the palm of the hand. The "Military-Type" microphone is small, light and compact, may easily be slipped into the pocket when not in use. An improved spring-lever tvne positive-action switch (which operates both "press-to-talk" and On-Off) is optional. Relay contacts can be furnished.

In addition to the standard units, Shure "Military-Type" hand microphones are also available in new anti-noise "close-talking" models based on a design principle which is said to make possible close-talking performance with practically complete elimination of background noise.

For further information write to *Shure Brothers*, 225 W. Huron Street, Chicago.—COMMUNICATIONS.

CENTRALAB CONDENSERS

Centralab has announced their new ceramic fixed condensers. These units are available in ranges from 10 mmfd to 1,000 mmfd. These capacitors are available with controlled temperature coefficients to compensate for temperature changes in radio chassis. The capacity-temperature coefficient is said to change in the right direction to maintain the oscillator frequency constant. The capacitor's low mass is also said to allow it to follow the chassis temperature closely and thus adjust the resonant frequency of tuned circuits without a time lag.

Bulletin No. 20 contains further information. Write to *Centralab*, 900 E. Keefe Ave., Milwaukee, Wisc.—COMMUNICATIONS.

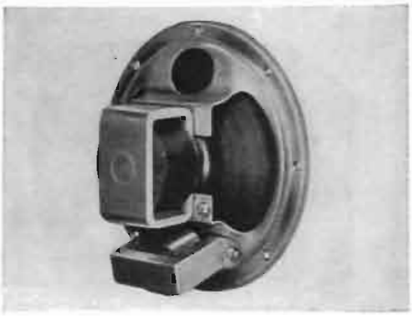
UTAH SPEAKERS

Two new 3½ inch speakers have been announced by Utah. One is a permanent-magnet dynamic type, while the other is an electro-dynamic unit (shown). Improvements are claimed in the performance of the speakers, among them the proportioning of the generated harmonics in the cone surface to produce better tone quality. Complete information is available from *Utah Radio Products Co.*, 820 Orleans Street, Chicago, Illinois.—COMMUNICATIONS.

RESIN ADHESIVE

A new phenolic resin adhesive is announced by General Plastics, known as their 5116 Resin Adhesive. It is stated that this material, in solution in a hydrocarbon solvent, has exceptionally high bonding strength, is particularly efficient in bonding asbestos to sheet steel, rubber to metal or cellulose acetate materials, plastic molded parts, porcelain enameled parts, cellophane or treated papers to steel, copper wire or wood. It is said to be unaffected by water, moderate heat, alkalies and mild acids; used as a coating, it withstands a 50% caustic soda solution indefinitely; retains its bonding strength up to 100° Centigrade; softening point between 115° and 120° C. (ASTM).

For additional data, write to *General Plastics, Inc.*, North Tonawanda, N. Y.—COMMUNICATIONS.



JENSEN SPEAKERS

With the intention of meeting the demands for replacement speakers, Jensen has just announced a new line of speakers. These speakers are being manufactured now in 5, 6 and 8-inch sizes. They are compact, light, and ruggedly built. All are offered with adjustable-impedance transformers or fixed-impedance transformers and are available with an assortment of field coils.

Full descriptive literature is available from the *Jensen Radio Manufacturing Company*, 6601 South Laramie Avenue, Chicago, Illinois.—COMMUNICATIONS.

RECORDING AMPLIFIER

A professional recording amplifier, incorporating frequency compensating networks and allowing accentuation in either high or low frequencies or both, has been placed on the market. The equalizers employed are continuously adjustable and settings may be changed while in actual use. The equalizers are said to add amplification to the circuit.

This amplifier is a product of the *Universal Microphone Co.*, Inglewood, California.—COMMUNICATIONS.

COMPACT VELOCITY

The new Amperite compact velocity is shown in accompanying illustration. It is complete with output transformer, cable connector and switch. In spite of its size it is said to have the output of a large velocity,—70 db open line, a frequency response from 60 to 7,500 cps, ± 2 db. Can be used for speech or music and is obtainable in either low impedance (model ACL) or high impedance (model ACH).

Complete information may be secured by writing to the *Amperite Company*, 561 Broadway, New York City.—COMMUNICATIONS.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President — RCA Building, 30 Rockefeller Plaza, New York, N. Y. — H. H. PARKER, Secretary

HONOLULU

THE HONOLULU *Star-Bulletin* of February 12 reports (under a picture of George Street) "Street Heads Wireless Men." It further states: "George Street is the new Chairman of the Honolulu Chapter of the Veteran Wireless Operators Association succeeding S. Maddams. He was elected at the Thirteenth Annual 'cruise-party' of the association held Friday, February 11, at his home at Kahala. The group elected Werner Dietz, Secretary. He succeeds H. F. McIntosh.

"The meeting began with a steak barbecue at 6 p.m. About 45 members were present. They represented the following communication companies and services: Commercial Pacific Company, Mackay Radio Telegraph Company, Press Wireless, Pan American Airways, Transradio, Inc., U. S. Army Signal Corps., U. S. Naval Service and RCA Communications.

"The Veteran Wireless Operators Association is a world-wide organization. The Honolulu Chapter held its meeting concurrently with the meeting of the New York Chapter at the Hotel Astor.

"The program of the New York meeting was broadcast over the blue network of the National Broadcasting Company and by special arrangement the local group listened in and exchanged messages with the New York meeting.

"Next meeting of the association will be a summer picnic party."

H. F. McIntosh, retiring Honolulu Chapter Secretary, reports:

"The Surfboard Chapter celebrated the Thirteenth Annual Cruise with a mighty swell barbecue steak dinner on the attractive and spacious lawn at George Street's home at Kahala. Messrs. Street, Maddams and a few others presided at the barbecue gadget by the light of a typical Hawaiian moon, coconut oil torches and the ruddy glow of the charcoal fire. Cocktails were served before the dinner and beer with the dinner—altogether it was a very tasty meal.

"Chairman Maddams made a speech outlining the aims and purposes of the VWOA and thanked those present for their cooperation and attendance. He pointed out the splendid progress made by the Honolulu Chapter in increased paid-up membership during the past year.

"L. D. Paulson gave a brief talk on his connection with the ill-fated 'Samoan Clipper.' Mr. Paulson served as alternate operator to T. J. Findley, who lost his life in the disaster. Actually it was Paulson's trip out, but an injury sustained while aboard the company's schooner 'Trade Wind' at Kingman Reef on a previous trip prevented his going. At the conclusion of his talk a half-minute silence was observed by all hands in solemn tribute to the memory of Mr. Findley. Mr. Findley was an about-to-become member of the Honolulu Chapter, for he took his membership application with him intending to mail it back to the secretary. Fate intervened, and neither Mr. Findley nor the application ever came back.

"After dinner ballots were distributed for the annual election of officers. George Street was elected Chairman and Werner Dietz was elected Secretary."

"On behalf of our Association we extend heartiest thanks to S. B. Maddams, retiring Chairman, and H. F. McIntosh, retiring Secretary of the Honolulu Chapter, for their splendid contributions to the progress of our Association in the 'Paradise of the Pacific.' A swell job, SBM and HFM.

"And to George Street, Chairman-elect (an old and eminently successful hand at the chairman's job), and to Werner Dietz, Secretary-elect, we send greetings and best wishes for their success in furthering the advancement of our Association's activities in their community."—MC.

BOSTON

HARRY CHETHAM, Chairman of the Boston Chapter of our Association, reports:

"One hundred attended the 'Yankee Chapter' cruise on the 11th of February. The Honorable J. Frank Sullivan of Providence, R. I., a member of our 30-Year group, acted as Toastmaster. The fellows from Providence were all in attendance. Elmer H. Walters, Testimonial Scroll recipient, was present. Charles C. Kolster, Past Chairman, Tom Chetham, my fifteen-year-old son, Jack Dodge, Chief Engineer WAAB-WNAC, Arthur E. Ridley, Ed. Tierney, Jimmie Greene, Arthur E. Ericson, Howard Thornley, J. A. Prior were all there.

"Lieut. Col. David S. Boyden, formerly of the U. S. Signal Corps, was the principal speaker. Inspector Walter Butterworth of the F. C. C. spoke of the days when he and Chairman Chetham were 'bunkies' in the Signal Corps. 25 years ago. A. C. Paine, Supt., RCA Communications in Boston, gave an interesting talk. A marvelous demonstration of police radio was given by Lieut. Watt and Sgt. Arthur H. Vickerson of the Boston Police Department. We contacted all Divisions and the Police Boat from the head table.

"All in all, a fine party and worthy of the name Veteran Wireless Operators Association Cruise."

SCHOLARSHIP

MR. C. J. PANNILL, President of R. C. A. Institutes, Inc., replied to a letter from our President William J. McGonigle as follows:

"Receipt is acknowledged of your letter of the first instant suggesting that a scholarship to be known as the 'Marconi Memorial Scholarship' be made available in competition by the RCA Institutes under the sponsorship of the Veteran Wireless Operators Association.

"We heartily endorse the suggestion and accordingly you are authorized to make the announcement to that effect as well as to include the details of the scholarship in the forthcoming Year Book of the Association.

"I regret very much that my absence from the city next week will prevent my being able to attend the dinner, but the association has my very best wishes for its welfare and success. I am very proud of my life membership in this Association. With all good wishes, sincerely yours, C. J. Pannill, President RCA Institutes, Inc."

We quote from our Marconi Memorial 1938 Year Book:

"The Scholarship represents a value of well over seven hundred dollars and includes the Matriculation Fee, full Tuition and text books. The Scholarship is in the General Course which provides a thorough general knowledge of the radio industry as a whole. In addition to the broad scope of the fundamental training, the student will receive practical and complete training in each of the basic specialized branches of the art. He is, therefore, not limited to one particular field of endeavor, but is in a position to choose intelligently the field which he wishes to follow as a career. He will also possess the diversified training necessary to take immediate advantage of opportunities in related fields as they arise. The course requires eighteen months, days, or four years, evenings, for completion.

"The manner in which the Scholarship will be awarded will be determined by the Scholarship Committee of our Association, Mr. J. R. Poppele, Chairman.

"We invite inquiries and suggestions, and when published, the details will be mailed to all interested persons and groups."

PERSONALS

A RECORD job by H. A. Steinberg, V. W. O. A. Special Representative, in bringing in new members. Keep up the good work, HAS. . . Our grateful appreciation to L. L. Adelman, Sales Manager, and Bill Bailey, Chief Engineer, Cornell Dubilier Company, for their fine support of Year Book and Dinner. We were very glad to see them there with several other members of the Cornell Dubilier staff. Come again next year, L. L. A. and B. B. A cordial welcome awaits you. . . Sincere thanks to V. P. Villandre, Radiomarine Chief Operator, for an excellent job as Chairman of the Ticket Committee. . . And to the officer, who next to the V. P. usually gets the least mention, our worthy Treasurer "Bill" Simon deserves high praise for his cooperative efforts as Chancellor of our Exchequer. Thanks, "Bill." —MC. . . . A kind letter from our Lady Veteran, Anna A. Hughes, thanking us for our invitation to the Thirteenth Annual and her regrets at having been unable to attend. We now extend an invitation to Mrs. Hughes to be our honored guest on the occasion of our 14th Annual Cruise.

DON'T FAIL TO ATTEND THE ANNUAL MEETING

INSTITUTE of RADIO ENGINEERS

HOTEL PENNSYLVANIA **NEW YORK, N. Y.**

JUNE 16-17-18

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When the transmitter deviates from the assigned frequency by a predetermined amount, one of the warning lamps on the panel lights and indicates direction of deviation.

From one to four low-temperature-coefficient quartz plates, housed in a simple temperature control box maintained at 50 deg. C, can be used to monitor any one of four frequencies. The desired channel is selected by a switch on the panel.

AS SIMPLE AS STOP AND GO

With the New G-R High-Frequency Visual Monitor

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FEATURES

- *Visual* indication of deviation outside legal allowance
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Type 775-A Frequency-Limit Monitor. . $240.00

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TURNTABLES

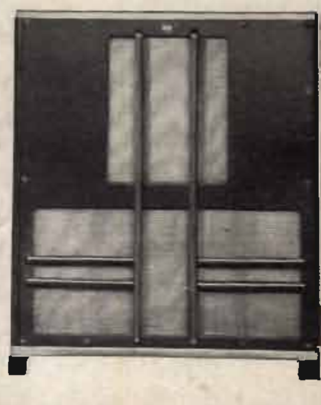
New! RCA announces the 70-B Transcription Turntable! Equipped with permanent stylus tone-arm, variable cutoff scratch filters, this turntable produces even higher fidelity on lateral records than the popular 70-A. Owners of 70-A Turntables may modernize by purchasing the MI-4857 lateral tone-arm kit. No needle to change. Allowance on old tone-arm.

AMPLIFIERS

New RCA Economy Line Amplifiers permit additions to existing facilities. They are available at little cost, require but a small space. Pre-amplifier, program amplifier, bridging and monitoring units are available for rack or chassis mounting.

MICROPHONES

A microphone for every purpose. The RCA 74-B Jr. Velocity Microphone improves inside remote pick-ups. This fine microphone is inexpensive, offers fine quality. The 77-A *(left)* Unidirectional Microphone avoids troubles in mike placement in small studios, helps prevent excessive reverberations in large rooms.



LOUDSPEAKERS

RCA 64-A Monitoring Loudspeaker covers the audio band with unusual smoothness of response. Double voice coil speaker, exponential chambers in the cabinet enable you to monitor programs without the necessity of making allowances for the speaker. Typical RCA high quality.

For full information about any of this equipment write nearest district office

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