Communication and Broadcast Engineering

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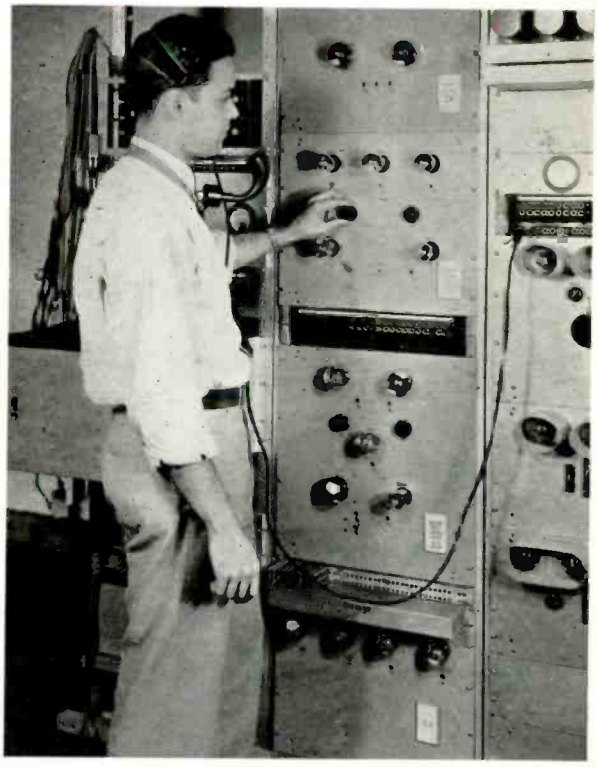

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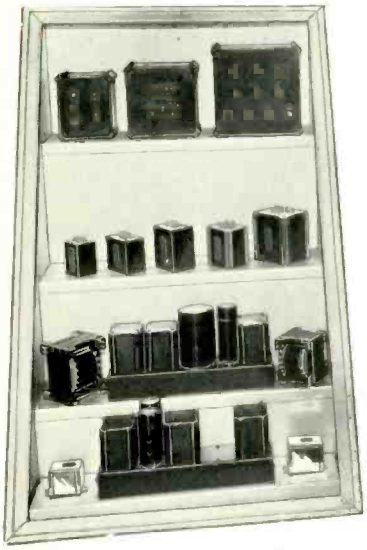

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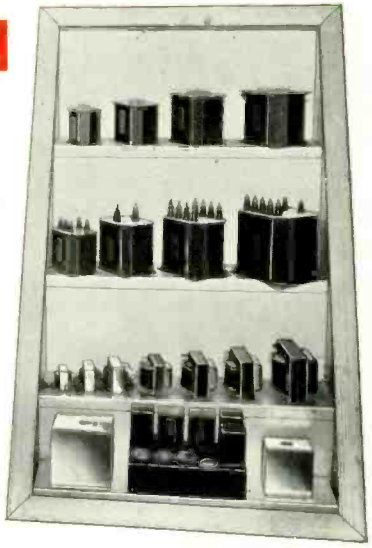

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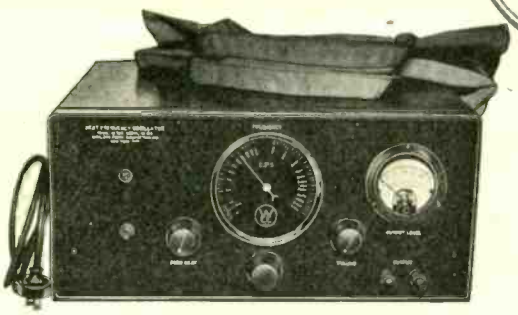

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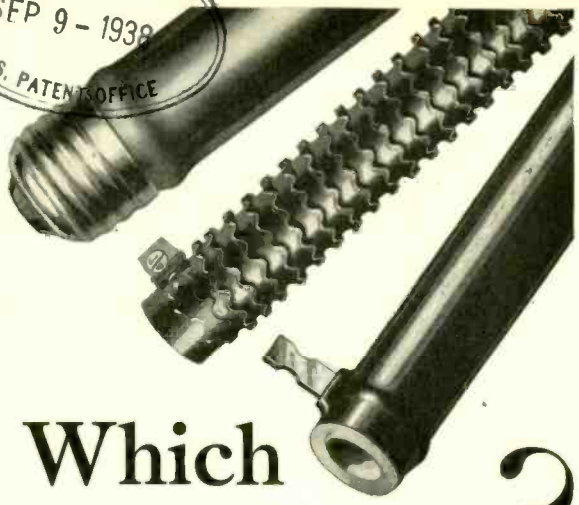

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THE JOURNAL OF WORLD COMMUNICATION

COMMUNICATION & BROADCAST ENGINEERING

M. L. MUHLEMAN
Editor

RAY D. RETTENMEYER
Associate Editor

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DEPARTMENTS

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EDITORIAL

ULTRA-SHORT-WAVES

THE FREQUENCIES ABOVE 28 megacycles are assuming greater importance with the passing of time. Frequencies of 56 megacycles have been successfully employed for communication over distances of 150 to 200 miles with the use of directive antennae. Frequencies in the vicinity of 400 megacycles have also been successfully employed for communication over shorter distances, with similar types of antenna systems which will beam the energy. A good part of the success may be attributed to the development of new circuits and new tubes especially designed for ultra-high-frequency work. Success has also been obtained with waves measuring but a few centimeters.

It may safely be said that all frequencies above 28 megacycles are of commercial importance, and those frequencies between approximately 28 and 60 megacycles of immediate value. The extent of their usefulness is not fully appreciated.

Ultra-short-waves have been in use for some time in connection with short-haul telegraph and telephone communication where the erection of overhead wire lines or the laying of cables has been impractical. So far most of these short-haul links have been over small bodies of water, but there is the possibility of extending this type of linkage between small towns, or from a central point to a number of small towns, for the sake of obviating the necessity of extending land lines to localities too small in population to effectively absorb the running overhead costs. There is also the possibility of a slow replacement of existing wire equipment used for short-haul work, with modern ultra-short-wave units as a means of eliminating the maintenance costs of overhead wire lines subject to damage by storms, etc.

A number of two-way, ultra-short-wave communication systems are now in use by police departments. These systems have already demonstrated their practicability for use over comparatively short distances and the indications are that there is a general movement toward these lower wavelengths for use by both police and fire departments. More recently these low wavelengths have been experimented with in connection with fire-signalling systems of numerous types and should the equipment be found foolproof, an entirely new field will be opened for its use.

Both police and fire departments are in a position to use portable equipment for the purpose of directing operations in cases of fires, riots, etc. There is also the possibility of using similar equipment in industrial plants as automatic fire and burglar alarms, with such transmitters set to the frequency of fire- and police-headquarters receivers.

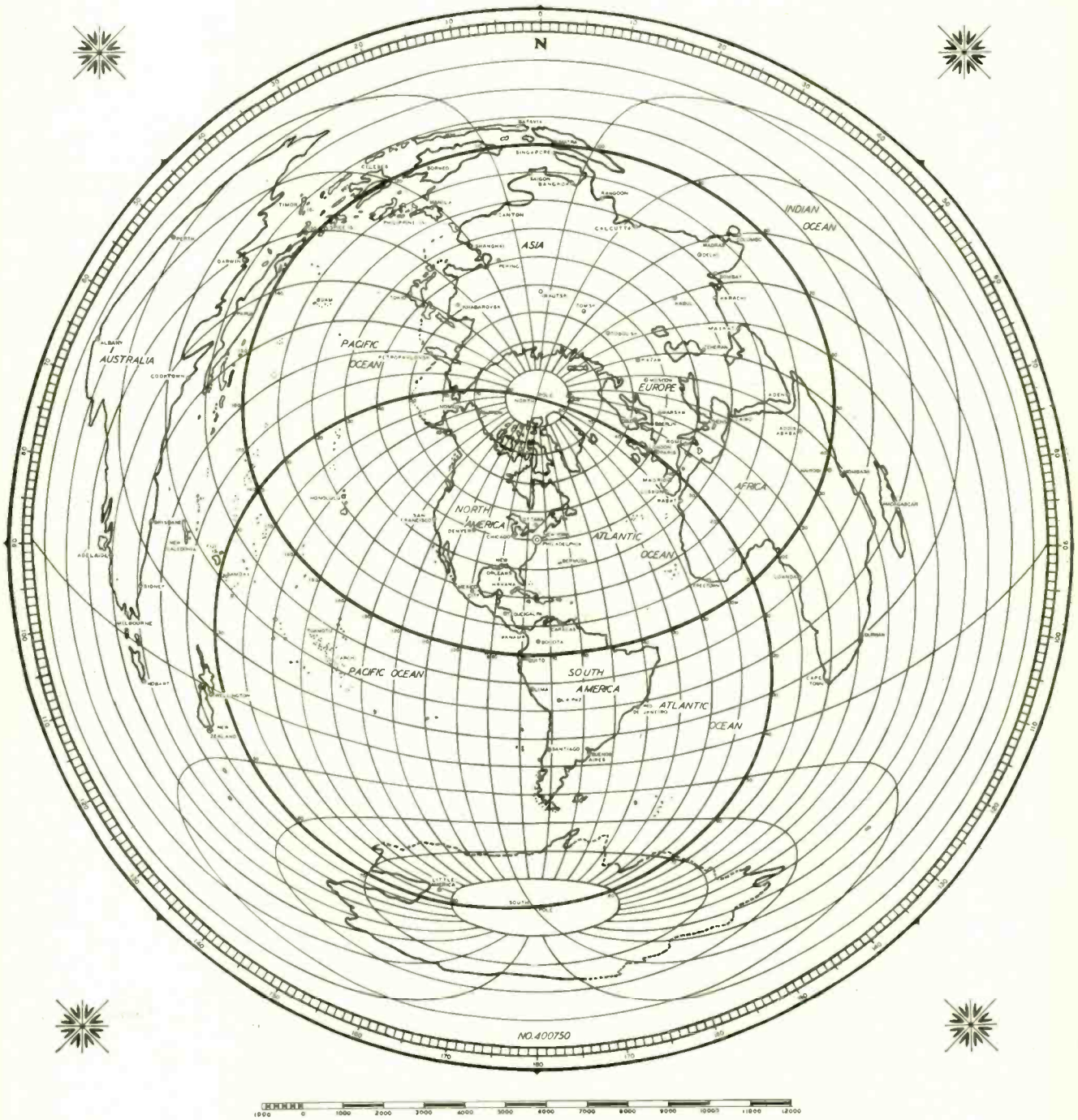
Considerable interest has been shown in the use of portable and semi-portable ultra-short-wave transmitters as remote broadcast pickup units. A number of such systems are in use, one of which is described in this issue. Attention has also been drawn to the use of stationary ultra-short-wave equipment as the connecting link between chain broadcast stations operating in the standard broadcast band. The system has been put to trial and found to be adequate for practical use. It holds the advantage of economy in chain operation and for this reason alone should prove of interest to a number of the new 100-watt chain systems under consideration where economy will be a vital factor.

The ultra-short-wave broadcast transmissions from the headquarters of WBEN, Buffalo, reported on in the October issue of COMMUNICATION AND BROADCAST ENGINEERING, have been going on for a sufficient length of time to indicate a wide-spread public interest. Similar stations are contemplated and will offer the possibilities of high-fidelity programs for those listeners willing to construct, or purchase complete, good ultra-short-wave superheterodyne receivers. As a matter of fact, it appears that there may be so much interest aroused in these transmissions that a sizable consumer market may develop for ultra-short-wave receivers and receiver kits.

WORLD MAP for DISTANCE DETERMINATION

Published through courtesy of C. D. Haigis and J. J. Cummings, Maple Shade, N. J.

Azimuthal map of the world on which a straight line from the central area to any other place in the world represents the shortest or great circle route. The map is accurate only for that area indicated by a small circle, this area including New York, Connecticut, Pennsylvania, New Jersey, Long Island, Maryland and Delaware. Distances are measured with a ruler and computed from the scale of miles below. An extension of the ruler line to the edge of the map indicates the number of degrees east or west of true north from which the radio waves arrive at the central point. The directions given along the periphery apply only to the central point. At other points on the map the North and South direction is indicated by the direction taken by the longitude reference lines joining the two poles. East and West direction is shown by the latitude reference lines crossing them.



Miles along any straight line from the center.

AN OPEN LETTER TO THE COMMUNICATION AND BROADCAST INDUSTRIES

INDUSTRIAL concerns, eligible to borrow funds from the Reconstruction Finance Corporation for the purpose of maintaining and increasing employment, have not yet taken full advantage of the assistance which the Corporation is prepared to extend.

Congress provided that such loans might be made to industrial and commercial businesses subject to the following requirements:

(1) That the business must have been established prior to January 1, 1934.

(2) That such loans be adequately secured.

(3) That maturity of loan must not exceed five years.

(4) That borrower must be solvent at the time of disbursement of the loan.

(5) That credit at prevailing bank rates for loans of the character applied for not be available at banks.

(6) That reasonable assurance of increased or continued employment of labor be given.

(7) That the aggregate of such loans to any one borrower made directly or indirectly shall not exceed $500,000.

(8) That such other provisions as the Reconstruction Finance Corporation may impose be complied with.

The Directors of the Reconstruction Finance Corporation feel that these loans should be made in such a way that the available funds can be utilized as fully as possible for the advance of permanent business recovery. This objective can be accomplished best if the moneys loaned by the Corporation are used principally to supply funds for the payment of labor and the purchase of materials incident to the normal operation of the business, rather than for the payment of existing indebtedness, though in exceptional cases a small part of the loan may be used for payment of existing debts or for the financing of construction, improvements and/or repairs that do not materially increase capacity. When a loan is to be used primarily for labor and materials, a small portion of the loan may be applied to these latter purposes when necessary to assure ordinary and efficient operation.

The Corporation will make loans in cooperation with banks, or by the purchase of participations in loans made by banks. In cases of national banks, only the bank's participation in such loans, rather than the full amount of the loan, must be within the legal limit which may be loaned to any one customer, and accordingly this plan will allow substantially greater credit to be extended through such channels to borrowers who are already borrowing up to their legal limit.

The depression years have left many enterprises in very much involved and weakened positions, but our experience has led us to believe that where present creditors are willing to cooperate by a proper adjustment of existing debt structure, many such enterprises may be safely supplied with additional funds that will enable continuing operations on a sound basis.

Accordingly, we suggest to industrial concerns, to which credit at prevailing bank rates for loans of such character is not available but which can offer adequate security (even though such security may be frozen and therefore not generally acceptable to banks) and which can profitably use additional funds for labor and materials, that they communicate with the local loan agency of this Corporation serving the territory in which such concerns are located.

Each Loan Agency of the Corporation will, when requested, assist and advise with applicants in determining their eligibility and in the preparation of applications.

JESSE H. JONES, *Chairman,*
Reconstruction Finance Corporation,
Washington, D. C.

COMMUNICATION & BROADCAST ENGINEERING

FOR NOVEMBER, 1934

The Voice-Operated Compandor

"Compandor," a portmanteau-word, suggestive of the functional operations of a "compressor" and "expandor" system which permits an extension of volume range on radio telephone circuits

By N. C. NORMAN

Transmission Research
BELL TELEPHONE LABORATORIES

TELEPHONE HISTORY records a steady extension of the distance over which it is possible to convey the spoken word with enough of its original character to make the speaker as well as the message readily recognizable by the listener. Such extension is beset with certain difficulties which are due as much to the varied characteristics of speech as to the limitations of the means of transmission available.

SIGNAL POWER RATIO

In long telephone circuits of all sorts, the input signal energy received from the subscribers varies over a wide range. The power ratio of the strongest to the weakest significant sounds often amounts to ten million to one or 70 db. This range may be considered to consist of two components. One, the volume range, of 40 db, is due to the differences in the speech powers of different talkers, in the ways they talk into the transmitter, and in such variable circuit characteristics as the lengths of terminal circuits and the properties of transmitters. If necessary these volume differences can be reduced to a considerable extent by manually operated gain controls.

Even when these differences have been eliminated, however, there remain the other variations, of about 30 db, due to the natural differences in energy intrinsic to different speech sounds, modified by variation in emphasis, and variation in the efficiency of the transmitter with frequency and load. These variations are great enough so that on such circuits as the transatlantic radiotelephone channels, there is danger that the intensity of the strong vowel sounds will overload the amplifiers when speech is transmitted at high enough volumes so that weak consonant sounds are above the noise level.

INTENSITY REGULATION REQUIREMENTS

The telephone engineer is thus faced with the problem of providing transmission facilities which will carry not only a wide enough frequency range but which will also convey in unimpaired ratio both strong and weak speech sounds. The intensity range of a circuit may be expressed as the difference in decibels between that lower extreme at which speech sounds would be masked to an objectionable degree by noise or crosstalk and that upper extreme at which the circuit begins to introduce noticeable distortion due to overloading. Obviously, when the intensity range of a circuit is in the neighborhood of 30 db—the same range as that intrinsic to speech sounds—very careful regulation is needed to insure transmission without loss in speech intelligibility. When the intensity range of a circuit becomes less than this figure, as it often does on radio-telephone circuits, transmission degradation of some sort seems unavoidable.

Up to the present time, improvement in this situation has been along two lines. The intensity range of the circuit has been increased either by reducing noise or crosstalk, or by using amplifiers and other equipment which will carry more power without distortion. But there are circuits where further extension of the intensity range by either of these two methods would be very costly.

COMPRESSION AND EXPANSION

For such cases, a third method of improving transmission has been devised and is now in commercial operation over the long-wave radio-telephone channel between New York and London. This method consists of automatically compressing the intensity range of the speech before transmitting it, and expanding it to its original intensity range after it has traversed the transmission medium. One device which accomplishes this improvement in signal-to-noise ratio without overloading the circuit equipment is called the

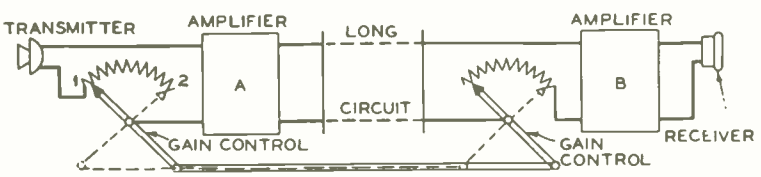


Fig. 1. The compandor is not unlike a pair of gain controls, one at each end of a circuit, so connected that when one is at maximum the other is at minimum and vice versa.

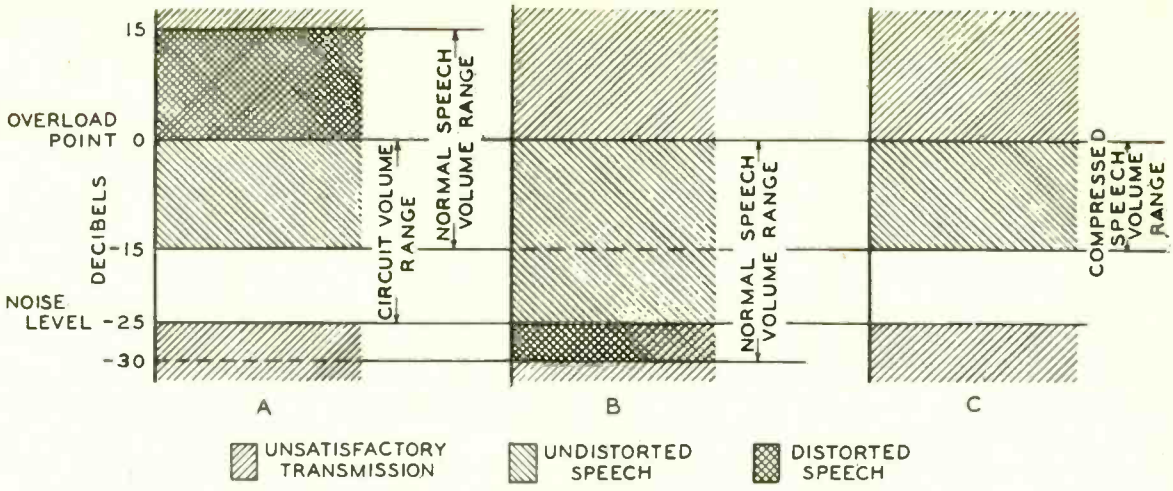


Fig. 2. If the controls of Fig. 1 are permanently set in position 1, the strong speech sounds would overload the amplifiers (A); if set in position 2, the weak sounds would be masked by noise (B); but if varied from 1 for the weakest sounds to 2 for the strongest, transmission will be neither distorted nor masked (C).

compandor. The name is a combination of "compressor" and "expandor," suggesting the functional operations of the two component parts of the apparatus.

ADVANTAGES GAINED

The advantages to be gained by compressing and expanding the speech volume range can be seen from Figs. 1 and 2. Fig. 1 shows a one-directional speech transmission circuit consisting of a transmitter, a gain control, an amplifier, a long line or radio channel, another gain control, another amplifier, and a receiver. The gain controls are so linked together that when either one is set at maximum the other is at minimum. The range of gain of the gain control and associated amplifier at the transmitter is from 15 db to zero, and at the receiver from minus 15 db to zero. Thus the equivalent of the circuit is zero at all settings of the gain controls. The overload point of amplifier A is arbitrarily taken as a reference point and the noise level on the channel is assumed to be 25 db below this point.

ILLUSTRATION OF OPERATION

Now suppose speech currents varying in intensity between 0 db and minus 30 db are coming from the transmitter. If the gain controls are set in position 1 the speech will be amplified 15 db, and the weak sounds will enter the noisy circuit at minus 15 db intensity, 10 db above the noise level. But the strong sounds of speech will be 15 db above the overload point of amplifier A, and consequently will be distorted. Intensity ranges assumed to illustrate this condition are shown graphically in Fig. 2-A.

If the gain controls are set in position 2, shown by the dotted lines, the speech will encounter no gain, and amplifier A will just transmit the strong speech currents without overloading, but the weak speech currents will be 5 db below the noise level as heard at the receiver. Transmission under this condition is shown in Fig. 2-B.

But if the setting of the gain control is varied continuously between position 1 for weakest speech currents and position 2 for strongest speech currents, and proportionally between these positions for intermediate currents, no overloading will occur, and the received speech will be at least 10 db above the noise level at all values of signal intensity. Transmission conditions on the noisy circuit with such a system of operation are shown in Fig. 2-C. As the gain controls operate slowly and simultaneously in opposite senses, there is no effect on speech quality or intensity variations as heard in the receiver.

EXPANSION OF RECEIVING POINT

The operation of the gain control at the receiving end of the noisy circuit causes the noise at the receiver to vary between minus 25 db and minus 40 db. The received noise will have the higher value only when the speech currents are strongest, and will be masked by the speech. When speech currents of minus 30 db intensity are transmitted, the noise at the receiver will be minus 40 db. In effect, the speech intensity range at the input of amplifier A has been compressed from 30 db to 15 db and then expanded at the input of amplifier B from 15 db back to 30 db. Amplifier A and its associated gain control form a compressor, and amplifier B and its gain control an expandor.

AUTOMATIC COMPANDOR

The compandor now in use compresses and expands the speech-intensity range automatically without the use of a mechanical link or an auxiliary pilot channel between the sending and receiving ends of a circuit. Distortion in the transmission circuit is minimized by making the compression and expansion nearly linear when measured in db. Other considerations made it desirable that the compressor halve the volume variation in db and the expandor double it. As an insurance against loss of speech quality due to distortion, caused by the limited frequency range of the circuit between the compressor and expandor, it was necessary to make the corresponding gain changes follow the envelope of the speech wave rather than the instantaneous current values.

Simplified schematics of the compressor and the expandor are shown in Figs. 3 and 4. Each consists of a voice channel, and a branch circuit which controls the gain or loss in the voice channel.

THE COMPRESSOR

The voice channel of the compressor contains a "vario-losser," an amplifier, and a high-pass filter. The vario-losser is made up of a pair of three-electrode vacuum tubes with their plate circuits bridged across a section of the voice channel which has an impedance high compared to the impedances of the tubes. The voice channel gain is dependent on the voltage applied by the branch circuit to the grids of the vario-losser tubes, which are biased normally to operate near their cut-off point.

The branch circuit of the compressor contains an amplifier, a linear rectifier, and a low-pass filter. It picks off part of the output of the voice channel, rectifies the speech voltage linearly, filters out the speech-frequency components of the rectified voltage, and applies the resulting envelope voltage to the grids

of the vario-losser tubes. When the input voltage to the compressor increases, the grid biasing voltage applied by the branch circuit also increases and thus tends to cause a decrease in the gain of the voice channel. Proper adjustment of the gain of the branch circuit amplifier insures that this decrease will be so related to the increase in input voltage that the output intensity range of the compressor will be only half the input intensity range. The cut-off point of the low-pass filter in the branch circuit is made lower than that of the high-pass filter in the voice channel in order to prevent regeneration.

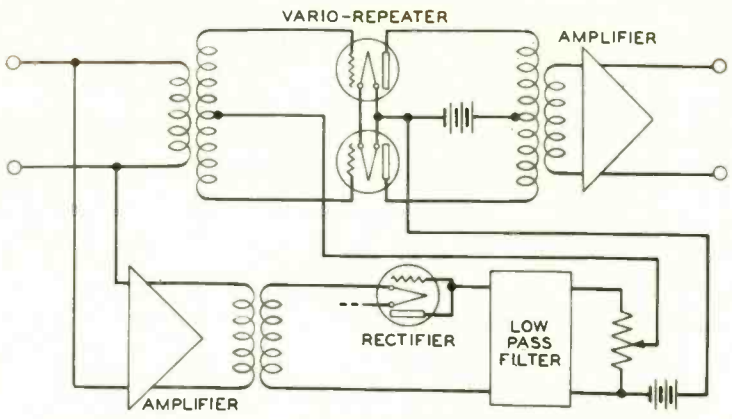


Fig. 4. The expandor, at the receiving end of the circuit, consists—like the compressor—of a main voice channel controlled by a branch channel.

THE EXPANDOR

The voice channel of the expandor (Fig. 4) contains a "vario-repeater" and an amplifier. The vario-repeater is a push-pull amplifier so connected that the plate circuits of the tubes are effectively in series with a transformer whose input impedance is low compared to the impedance of the tubes. The tubes are biased to a point near the cut-off, so that when no voltage from the branch circuit is applied to their grids, they afford so little gain that the loss through the vario-repeater is high, just offsetting the initial gain in the compressor. When a positive potential is added by the branch circuit to the initial negative bias, the series plate impedance of the tubes decreases, and the loss decreases in the same manner that the gain decreases in the compressor. Both the incoming speech and the branch circuit output are applied to the grid circuits of the vario-repeater tubes. But the relative magnitudes of the voltages applied to the grids from these two sources are such that only the branch circuit output can cause any appreciable variation in vario-repeater gain. This condition is obtained by using a step-down transformer at the input of the vario-repeater and a step-up transformer at the input of the branch circuit.

The branch circuit of the expandor performs the function of picking off a portion of the speech current at the input, and applying the demodulated and filtered speech-voltage fluctuations to the grid circuit of the vario-repeater. The variation in gain of the vario-repeater expressed in db equals the variation in input to the expandor for expansion which will offset the compression previously accomplished. The circuit contains an amplifier, a linear rectifier and a low-pass filter. It applies an opposing grid bias to the vario-repeater, which is high when the speech current received is strong, and proportionally lower when the current is weak, thereby causing a higher gain in the vario-repeater for strong speech sounds than for weak ones. Thus the expandor undoes what has been done by the compressor.

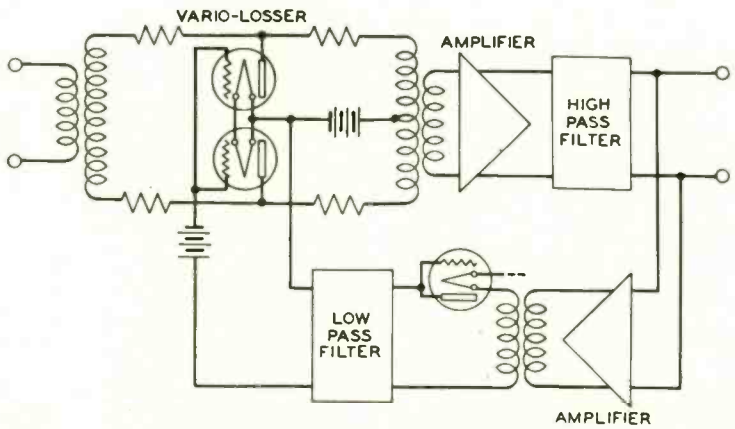


Fig. 3. In the compressor the intensity of the voice current in a branch channel controls the gain in the main voice channel.

RESULTS OBTAINED

Commercial operation of the compandor on the long-wave radio circuit to London has yielded encouraging results. Soon after the compandor was placed in operation, it was found that under most conditions satisfactory service could be given with static 5 db stronger than the old commercial limit. Because of the improvement in signal-to-noise ratio due to the compandor, it is usually possible to deliver at least 5 db more volume to the subscriber without failure of the voice-operated switching devices at the terminals, a factor of great importance when long extension circuits are involved. Another important advantage gained is the reduction of the usual background noise at noise levels somewhat below the old commercial limit, which markedly increases the ease of conducting conversations under such conditions on the long-wave transatlantic radio channel. This improvement, while difficult to evaluate quantitatively, is probably equivalent under those conditions to increasing the power of the radio transmitter considerably more than would suffice to raise the commercial noise limit by 5 db.

THE MAGNETRON SUPPRESSOR HUM ELIMINATOR

Westinghouse engineers have worked out a device which permits the operation of transmitting-tube filaments from raw alternating current. It is known as the Magnetron Suppressor.

The device puts current of the right phase and amplitude into the power amplifier of the radio transmitter to neutralize the hum and noise produced by the use of ac on the tube filaments. The device is mounted on a small panel and forms a part of the equipment in the control room.

The Magnetron Suppressor is to be used in conjunction with the new transmitter for KYW, Philadelphia.

WTOC-SAVANNAH

Description of the new one-kilowatt transmitter and vertical radiator, put into operation on August 31st

By JAMES R. DONOVAN
Chief Engineer
SAVANNAH BROADCASTING CO.

DEPARTING FROM THE beaten path to a considerable extent in a number of features applicable to improved transmission and radiating systems, WTOC put into operation on August 31 its new one-kilowatt transmitter and, with the celebration of its fifth anniversary, on October 15, went on the air for the first time with its new antenna system consisting of a vertical 206-foot guyed steel pipe.

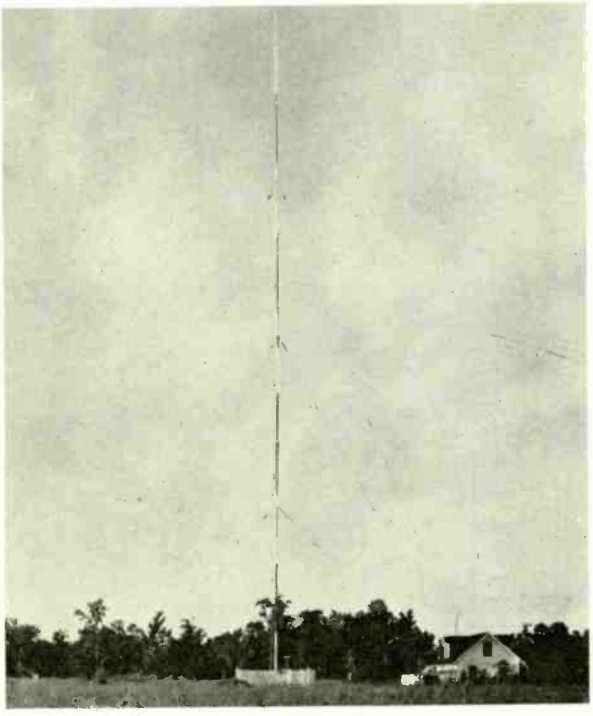
60 PERCENT COVERAGE INCREASE

From all indications we are led to believe, pending field strength measurements, that our coverage has been increased about sixty percent with the new radiator, this increase being highly desirable and at the same time, necessary owing to the nature of the Eastern Georgia territory assigned WTOC.

When we received the grant for an increase from 500 watts full time to 1,000 watts full time, it was decided to rebuild the whole existing installation so that the many new developments and improvements could be incorporated in a brand new transmitter that would be as near the ideal as the state of the art would permit.

MODERN PANEL ARRANGEMENT

Following up this thought it was decided to depart somewhat from the conventional arrangements of black bakelite panel fronts with everything mounted to them and follow some of the newer type arrangements of solid metal fronts, including grilled doors with interlocks for protection against accidental contacts with high voltage and also fooling with tuning controls by visitors; meters behind glass, tuning and other adjustments behind doors where they are not subject to accidental turning.



The quarter-wave vertical radiator at WTOC, which assists in providing a consistent daytime coverage of 100 miles.

FOOL-PROOF CONTROLS

A modern transmitter should be stable enough so that tuning controls should not have to be gotten to in a rush. In fact, it should not be necessary to do much, if any, adjusting of controls other than filament voltages. Therefore it should be feasible to have these where they are not in sight and not easily accessible, and, consequently, all controls except filament voltage adjustments and sequence switches are located behind plates which are accessible by unloosening two knurled nuts.

The result is a very pleasing transmitter front that is somewhat different from what one usually expects to see. The whole is done in a two-tone light grey and bordered in black. The transmitter room is done in a light color to match and the floor is covered with black and grey linoleum.

CIRCUIT ARRANGEMENTS

The circuit arrangements of the transmitter differ slightly from the conventional in that everything is located where short leads can be the watchword. Tuning controls are linked with their respective condensers and rheostats by flexible shafts. This allows parts to be placed where they belong in the circuit. Individual shielding is used for each stage and all stages, including the final 1 kw, are shielded. Tubes, of course, are located where air circulation is plentiful. Each stage is coupled to its succeeding stage by a short low-impedance transmission line. The lay-out is as follows:

TRANSMITTER LAYOUT

A 210 is used as a crystal oscillator with double temperature control, the crystal being in a separate inner oven and the oscillator tuning circuit being in the outer oven. The oscillator has a low plate voltage (150) which holds creeping to a minimum and which, with the double oven, enables us to maintain a frequency deviation of plus or minus 3 to 4 cycles for weeks at a time. In fact, the log shows that from a cold start at 7:00 a.m. until 12:00, midnight, the total deviation averages from 2 to 4 cycles.

The oscillator feeds an 865 buffer amplifier which is run at reduced voltage. This excites another 865 running at full voltage and exciting a pair of 203-A's in push-pull. This, then, furnishes plenty of excitation for the final modulated amplifier which uses four 204-A tubes in push-pull parallel. This stage is then modulated by two 849's in Class B push-pull. This Class B modulator is driven by two 845's in Class A push-pull which in turn are driven by two 843's in Class A push-pull.

AC FILAMENT SUPPLY

In this day of ac operation it is of course unthinkable to consider generators, so the filaments of all radio and audio stages are supplied from ac. With Scott-connected transformers, the hum level is kept far below the required minimum for the wide range levels encountered in symphony programs. Also with this arrangement it is convenient to have the individual plate meters for each side of the push-pull amplifiers, whether radio or audio, and thus proper balance maintained with the consequent harmonics of either radio or audio minimized.

The entire transmitter is contained in three units mounted side by side. One panel is the rectifier and filter assembly, containing all plate rectifiers, filters and control relays. Next is the exciter panel containing the crystal oscillator, buffers and 203-A push-pull stages. The last panel contains the final amplifier and modulator. These three units furnish a transmitter that is complete in itself.

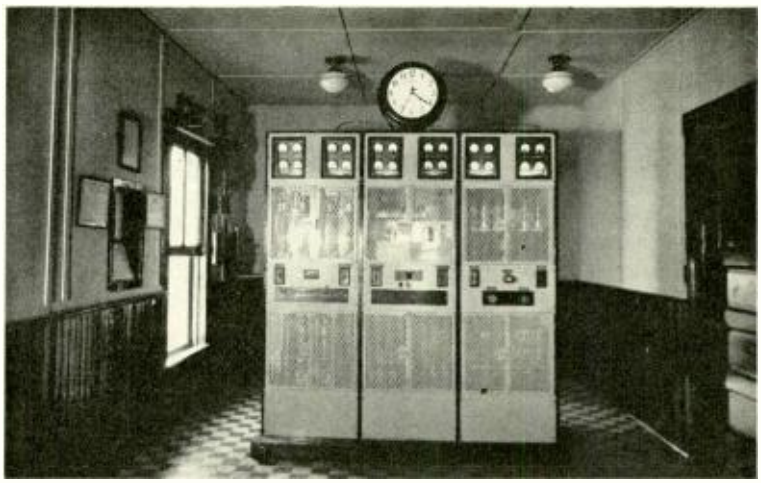
TRANSMITTER EFFICIENCY

The efficiency of this transmitter is immediately apparent by the fact that with the input necessary to get one kilowatt by the Commission's indirect method of rating, all tubes run stone cold, which is something that is seldom encountered. The wave shape as observed by regular checks with a cathode-ray oscilloscope with linear sweep and sine-wave input, leaves nothing to be desired.

The frequency response with reference level of zero db at 1,000 cycles, is 1.5 db down at 30 cycles, 0.5 db down at 60 cycles, 0 level at 80 cycles, at which level it stays clear to 8,000 cycles. At 10,000 cycles the level is 0.5 db down and at 12,000 cycles, it is 2 db down.

RELAY CONTROL SYSTEM

The control system is comprised of sequence relays ac-operated and interlocked with overload relays. No voltages can be applied until the proper time arrives and in case of an overload the relays drop out and in a few seconds come back in. In case of some intermediate overload relay opening from a momentary overload, everything ahead of this stage goes off and then comes back on in proper sequence. Manual control also can be had through the use of sequence stopping switches.



The new one-kilowatt transmitter at WTOC. The panels, from left to right, are: rectifier and filter; exciter, containing crystal oscillator, buffers and push-pull stages; final amplifier and modulator.

THE ANTENNA SYSTEM

After the 1,000-watt transmitter was put on the air, the next in line for improvement was the antenna system. The need of a new system has been felt for a long time, owing to the peculiar coverage job required of the station in Eastern Georgia. We had to have the best system for the least money and realizing a half-wave radiator was the ultimate, it was appreciated also that the designs of antenna systems have been undergoing change and steady improvement and that at some future date the half-wave radiator would doubtless be replaced by some system even more efficient.

VERTICAL PIPE RADIATOR

We decided to forego the expense of a half-wave job and install a good quarter-wave vertical radiator. A little calculation shows very quickly the improvement to be gained by the erection of a full ¼- or ⅜-wave system. Assuming a pure sine wave to be on an antenna, the amount of the wave actually on the antenna is a function of the physical length of the system. Thus, with a ⅛-wave radiator, there will be only ⅛ of a wave on the system regardless of what node it may be loaded to. Also, with a ⅜-wave system which is loaded with capacity to obtain resonance at ¼ wave, there will be a ⅜ wave on the radiator. Thus it was decided to approach ⅜ wave as near as possible and to decide on what shape it would take. The ideal radiator being a simple vertical wire and there being no convenient cloud to hang it on, we thought a vertical guyed pipe would come near enough to this to be acceptable. This should be even better than a tower with its greater excess metal and expense.

We contracted for the erection of a 206-foot guyed pipe, using a special Locke insulator at the base. The base section of the radiator is a seven-inch, double-thickness, steel pipe, each succeeding section a bit smaller until the mast tapers down to two inches. There are nine guys on the mast in groups of three, anchored to the ground at 120 degrees apart. The first set is at the 50-foot level, the second at the 100-foot level and the third, 150 feet, the last 56 feet of the mast being self-supporting. The guys are broken up in short lengths which are not a multiple of the working frequency. A heavy copper strip is welded to the pipe at short intervals all the way up.

TRANSMISSION LINE

The radiator is fed from a conventional two-wire transmission line of 615 ohms impedance terminating in a tuned tank at the antenna end, the tuning being done with two large fixed condensers in series. The center is grounded to furnish a low-reactance path to ground for harmonics. The tank was designed so as to have a circulating current in excess of ten times the line current for the sake of stability at that end. The radiator was resonated with fixed series condensers and a small variometer.

Meters are used at the radiator as well as at the transmitter for checking, and the external thermocouple for the meter at the transmitter was placed in the coupling house so that the antenna

(*Continued on page* 17)

TELEGRAPH INTERFERENCE

Part II of an article on the effect of low-frequency power induction on telegraph operation

(Based on a paper delivered at the Chicago Convention of the American Railway Association)

By L. M. JONES
& C. M. BROWN
Engineers
WESTERN UNION TELEGRAPH CO.

WE HAVE GIVEN illustrations of the effect of power induction on telegraph operation and have attempted to show wherein transmission efficiency may be limited by extraneous currents. We will now discuss some of the special methods of testing that are used in making detailed investigations to determine the magnitude of the extraneous currents and their effect on transmission.

Since the effect of distortion on hand-operated systems varies considerably with the operators, any measurement of the effect must involve this human element. Perhaps the best method of measurement is to determine the accuracy with which several operators can receive a message composed in an unfamiliar language over a circuit subjected to distortion. Then by weighing the accuracy of reception with the opinions of the operators relative to increased fatigue, the desirability of mitigative measures may be determined.

POWER INDUCTION TEST

The preliminary measurements of power induction should be of such a nature as to show the source of the disturbance, its approximate magnitude and any outstanding characteristics.

If, as is usually the case, other extraneous currents are present or if the power induction consists of two or more frequencies it may be desirable to utilize a tuned circuit and obtain readings at each frequency. It may also be desirable to make 24-hour measurements and thus determine the daily variation in the induction.

INDUCTION BREAKOVER TEST

The magnitude of the total interfering current may be determined by measuring the force exerted by the interference on the receiving relay armature, causing it to move from one contact to another, i.e., to breakover. Briefly, this measurement may be made quite simply by determining the amount of steady biasing current that is just sufficient to overcome the influence of the interference and hold the relay armature on either contact. One method of obtaining this information is described below:

(1) Terminate the line at both stations in a duplex set.

(2) Carefully center the armature of the main line relay at the testing station.

(3) Apply steady and like batteries to line at both stations.

(4) Increase the ohmic resistance of the artificial line (i.e., decrease the relay bias) at the testing station until the armature of the main line relay frequently breaks away from its contact.

(5) Gradually decrease this ohmic resistance (increase the bias) until the armature breaks away only momentarily and infrequently.

(6) The reading of the differential main line meter corresponding to this point is the induction breakover current.

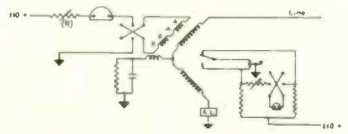


Fig. 10. Interference susceptibility characteristic test set.

INTERFERENCE SUSCEPTIBILITY TEST

Having fixed the magnitude of the interference, it only remains to determine how great a loss the circuit under test will experience due to this interference. For any magnitude of extraneous current, the amount of shifting, or change in length of a signal pulse may be obtained from the effective slope of the received current wave. Therefore, the effective slope characteristic is a measure of the susceptibility of a circuit to interference. It may be determined by the Interference Susceptibility Test Set diagrammed in Fig. 10.

TEST PROCEDURE AND THEORY OF TEST

The line to be measured is terminated, at each end, in a standard universal duplex set. At the sending end, alternate negative and positive impulses of equal length are applied to the line. At the receiving end, the Interference Susceptibility Characteristic Test Set is connected to the main line relay by means of an adapter. Fig. 11 illustrates graphically a representative line current wave, upon which is superposed the resultant current wave in the point circuit of the main line relay. The received impulse duration is indicated by the expression 1/2f, and the magnitude of the point circuit current by "I." An indicating meter connected in series

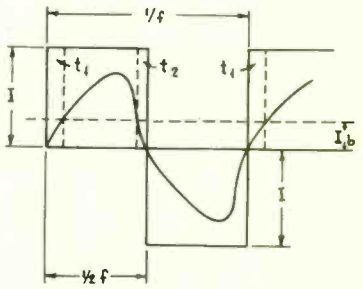


Fig. 11. Line and local current waves.

with one relay contact point would deflect to a point "1" providing continuous contact were maintained. If the relay armature is allowed to respond to the distant ac, the indicating meter will deflect to a point $\frac{1/2f}{1/f} \times I$, or, more simple, to I/2. This same deflection would be observed if another meter were connected in series with the opposite contact. In Fig. 10, one differential meter is used in series with both contact circuits in a manner such that the deflection I/2 is alternately reversed in effect upon the meter needle. The net deflection, under this condition, is zero, provided the received impulses are unbiased. If the receiving relay is biased an amount equal to $(-I_b)$, there will be, in effect, a resulting shift in the zero axis equal to I_b as shown by the dotted horizontal line in Fig. 11. The relay armature will now reverse contacts at the points which are

graphically spaced a distance t_1 and t_2 from the normal points of interception between the line-current wave and zero axis. The shortening of the relay contact duration will decrease the deflecting action of one meter coil an amount equal to $(t_1 + t_2)I$. The lengthening of the opposite contact duration will also equal this amount. This shortening or lengthening of a received impulse can be secured in units of time by applying the meter deflection to the following formula for various values of I_b:

$$t_1 + t_2 = i/2fI$$

Where: i is the meter deflection.
I is the maximum current in the point circuit.
f is the frequency of the received impulses.

In practice, readings of the indicating meter are obtained using both marking and spacing bias, and the level is applied in 5-mil steps. The average of the two readings is used for "i" in the formula.

I. S. C. CURVE

Now, we may plot the sum "$t_1 + t_2$" in milliseconds against "I_b" in mils bias, and obtain a curve which we will call the Interference Susceptibility Characteristic (I. S. C.) of the circuit. To this curve, we may apply our previously determined value of interference and obtain the time loss experienced. A typical I. S. C. is shown in Fig. 12.

By this method, we have been able to catalog circuits and thus estimate the losses to be expected from new power exposures, or the gains that may be derived from mitigative measures, without resorting to extensive field measurement.

TRANSMISSION TESTING MACHINE

A method that is very useful in determining the exact amount of loss experienced on a circuit involves the use of the Transmission Testing Machine. We will discuss briefly the essentials of this machine.

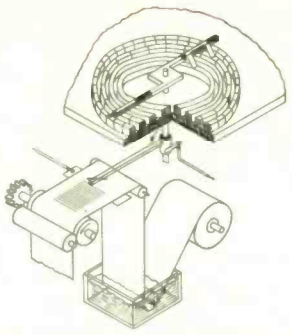


Fig. 13. Details of transmission testing machine.

A conception of the principle of the machine can most readily be formed if it be considered first as arranged for testing circuits both ends of which are available at a point, and if it be assumed that synchronism is maintained between the transmitting brush arm and the receiving indicator by connecting them both to the same shaft, as shown in Fig. 13. The signals are transmitted from the commutator shown in this figure which is very similar to the commutator of a multiplex set and are made to operate a relay at the receiving end of a circuit as shown in Fig. 14. The contacts of the relay are made to control a potential applied between the metallic needle 13 and the platen 12. The arm which carries the metallic needle passes over a saturated paper tape 15 in light contact with its surface. The solution with which the paper tape is saturated and the material of the metallic marking needle are such that when the proper potential is applied to the needle, a mark results from electrochemical action.

If, in response to a transmitted signal pulse, the receiving relay energizes the marking needle during the time of its transit across the paper, a mark is made continuously until the needle is again deenergized at the termination of that pulse. Thus if the transmission over the circuit under test be perfect, the revolving needle will draw a line on the paper tape which is a true projection of the length of the transmitted signal, the actual length being determined from the length of the segment and the ratio of the lengths of the needle arm and the brush arm.

Having ascertained the length of the perfect signal, the next step is to determine the portion of this signal that, during transmission, is rendered unreliable. This is accomplished by measuring the displacement of the received pulses from a vertical alignment. This displacement is in reality a shortening

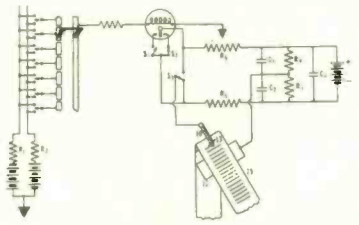


Fig. 14. Circuit diagram of the transmission testing machine shown in Fig. 13.

of the signal length and in percent signal loss =

$$\frac{\text{(displacement)}}{\text{(length of perfect signal)}} \times 100.$$

Since the mark for the signal may be of considerable length, it is often desirable to use in its place, a record of the travel time of the relay. Obviously, the displacement of the travel time mark from a vertical alignment will give the same indication as the displacement of the signal mark. The tapes shown hereafter will be of recorded travel time. The idea of transmission and reception being done on a common rotating member is, of course, no longer essential to a conception of the principle of this method of measuring. These two functions may manifestly be performed by separate rotating members so long as proper synchronism of rotation is maintained. It is by the latter modification that point-to-point testing is done.

TAPE RECORDS

Let us now look at a few Transmission Testing Machine Tape Records.

Fig. 15 illustrates three variations of transmission testing records, depicting the same line conditions. At the top of the figure is a record of an isolated signal pulse. Below this, the same

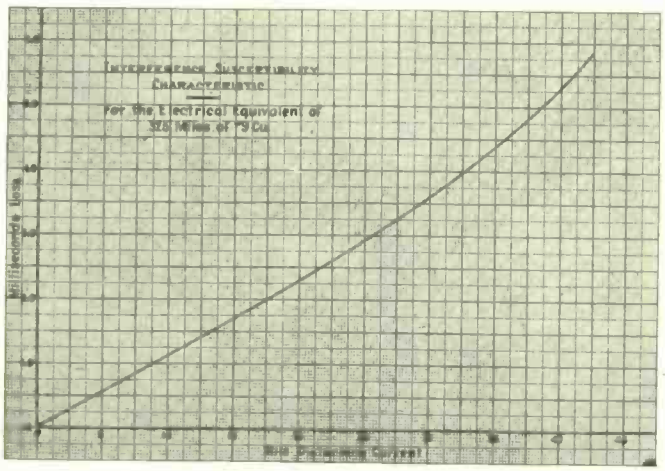


Fig. 12. Interference susceptibility characteristic curve.

pulse is shown in relation to the preceding and following pulses. At the bottom of the figure the record indicates the time that is required for the relay to pass from one contact to the other in conformity with a change in the polarity of the received signal. In this case, the signal length is represented by the blank space between the right and left travel time marks.

The distance "A" is proportional to the time interval between the departure of the receiving relay tongue from one contact, and its departure from the other contact at the next succeeding pulse of opposite polarity. The distance "B" is the length of the received solid signal. "C" is the difference between "A" and "B" and represents the time lost when the relay tongue travels from its marking to its spacing contact or vice versa. In this particular case, since there is no induction present, the beginning and ending of the signals are all in vertical alignment. However, if induction is present, the beginning and end of either the signal marks or the travel time marks will be irregular and an indication of the transmission loss due to induction may be obtained by measuring the maximum variation in the starting point of the signals.

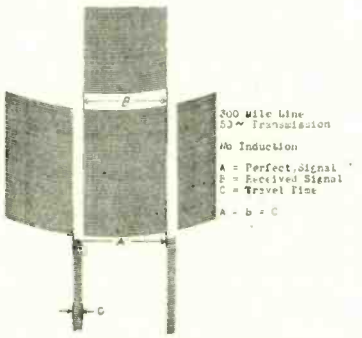


Fig. 15. Transmission testing machine tape records, showing three variations depicting the same line conditions. An explanatory legend is given above.

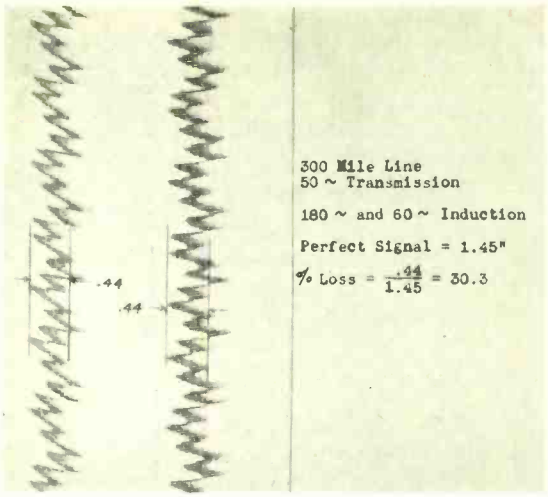


Fig. 16. A record of the signal shown in Fig. 15 when that signal is subjected to both 60- and 180-cycle interference.

Fig. 16 is a record of the signal shown on the preceding picture when that signal is subjected to both 60- and 180-cycle interference. In this case, the relay travel time is indicated by the short marks, and the actual length of the received signal is the distance between the termination of the travel time mark on one side of the record and the beginning of the corresponding travel time mark on the opposite side of the record. You will note in this figure that, in each case, the loss due to induction is represented by the distance between the beginnings of the earliest and latest signals. It is evident that a considerable portion of the signal is unreliable due to the induction and in this case the percent signal loss is, as indicated, 30.3 percent.

"INDUCTIVE COORDINATION"

On the preceding pages, we have indicated some of the detrimental effects of induced power currents. Thus it can be understood that the efficiency of telegraph operation may be jeopardized by uncoordinated power exposures. For this reason, extensive cooperative work with the power interests was initiated in an endeavor to devise means for permitting the two classes of utilities to operate satisfactorily in close proximity. These joint efforts have already led to a mutual understanding of the problem, and it is felt that future cases of inductive coordination will derive benefits from this cooperative work.

PLATON TEXIDO - Barcelona, Spain

ILLUSTRATION OF A recent exhibit of equipment handled by Platon Texido, Barcelona, Spain. This company is very active in the installation of transmitters of small power. Transmitters below one-kilowatt rating are assembled at the Barcelona plant from materials purchased principally in the United States. Recently installations have been made in Gerona, Lerida, Barcelona, and in Ceuta, North Africa. Transmitters of 8 kilowatts and higher are contemplated in some of the large cities of Spain. Platon Texido is becoming increasingly active in the development and use in Spain of 100-watt broadcast transmitters which will probably be operated as a complete chain similar to American practice.

POLICE-RADIO PRACTICE

The author offers suggestions for increasing effectiveness of police radio services and has included data on interference and code-signalling systems

PART II

By M. B. SLEEPER

INTERFERENCE—INDIVIDUAL VERSUS UNIFIED SYSTEMS

WHEN THE FIRST police radio transmitters went on the air, there was no interference problem. Now that radio has demonstrated its efficiency so definitely, and the public has come to demand that local police be provided with this new weapon, there are enough stations on the air to create at least the idea of interference. The Radio Commission, early in 1934, increased the number of channels available, although some have not been assigned yet.

Generally, the Commission has given the same frequency to several stations in one zone, and again to a zone in another part of the country. This refers to the 1,700 to 2,500-kc channels, customarily referred to as "convention police frequencies" to differentiate from the ultra-high frequencies.

This method has resulted in what police chiefs consider two types of interference. These are: 1. Interference from other stations in the same zone. 2. Occasional interference, particularly at night, from stations on the same frequency in another zone, when a car is in a particular spot or section where, by reason of shielding, reflection, or geological conditions, reception is better from a distant station than from the local station.

The former is a common complaint. The latter is only frequent enough to be serious as something that forms the subject of an objection.

In some zones, notably the 1,712-kc section around Boston, there may be some basis for the complaint that there are too many stations on one frequency. With the new Medford station added to that channel, there may be some justification for the feeling that the Federal Communications Commission is trying to apply pressure to the end that all the stations around Boston will be replaced by a single transmitter operating under a unified control.

Only the FCC is competent to explain its attitude. It may be that they have come to no conclusion as to the future policy in this matter. The Commission has, however, encouraged adjacent cities to combine in the use of a single transmitter, and has permitted the pooling of population to obtain higher power. That is, two cities, each of less than 100,000 population, could have separate transmitters of 50 watts output. But if their combined population exceeded 100,000, they could cooperate in the use of a single transmitter of 100 watts[1].

Regardless of the attitude of the Commission, there is a practical aspect to unified operation of police-radio transmitters. Police chiefs do not show enthusiasm over the idea. This was shown very definitely when, early in 1934, Massachusetts police chiefs very effectively killed proposed legislation directed toward unifying certain functions of the municipal police departments, although the bill had the backing of prominent state officers, including the Governor, and strong pressure was brought to bear by a well-organized citizens' committee, aroused to action at the time of the Millen-Faber case.

Right or wrong, the attitude of the chiefs prevails. Already, the result of operating combined transmitters can be seen. The value of radio has been demonstrated in these cases, but now that the chiefs see what radio can do, they want separate stations of their own!

There you have the theory and practice of unified police-radio systems. It is a serious matter for a Federal commission to undertake the enforcement of policies which are not acceptable to municipalities. It is much easier to find a way to permit them to function in a manner of their own choosing, and to help and guide them along lines which they believe best suited to their own needs.

WHAT IS MEANT BY "INTERFERENCE?"

When a police chief or his officers complain about interference, and there is much complaining done—greatly to the confusion of the engineers and the manufacturers selling police equipment—there is something wrong somewhere. It is no use to simply deny it, even though it is a fault existing merely by virtue of lack of understanding. And that is just about the case. That is:

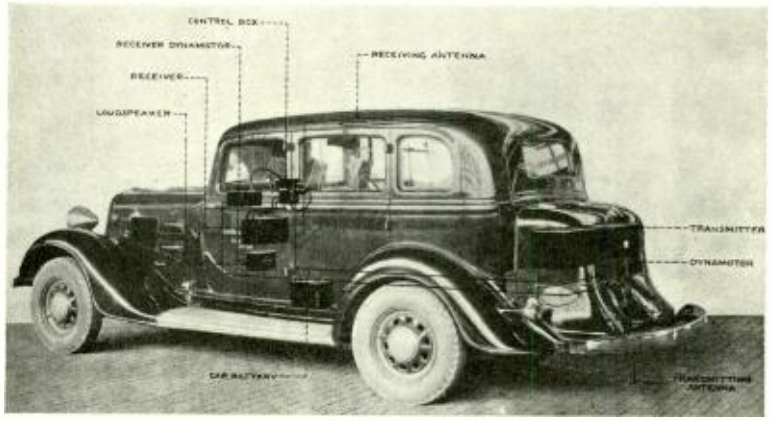
1. *To a novice at radio operating, any station heard other than his own is considered as interference.*

2. *Very little effort is made to avoid interfering by making sure, before transmitting, that no other station is transmitting on the same frequency.*

Police chiefs know radio communication conditions only from having listened on the broadcast band. They are not familiar with what are normal conditions on the other channels. They do

[1]Transmitting output is fixed by the Commission on a scale of population as follows:

Under 100,000	50 watts
100,000 to 200,000	100 watts
200,000 to 300,000	150 watts
300,000 to 400,000	200 watts
400,000 to 500,000	250 watts
500,000 to 600,000	300 watts
600,000 to 700,000	400 watts
700,000 and over	500 watts



(Photo courtesy General Electric Company)

Complete short-wave, two-way communication system installed in a police radio car. Note that the transmitter, dynamotor and transmitting antenna are installed in the rear of the car, while the receiver, speaker, receiving dynamotor and control box are installed near the dash, well away from the transmitter and at a point of lowest vibration. The receiving antenna is in the roof of the car.

(*Photo courtesy General Electric Company*)

Headquarters of W2XAT—dispatcher talking with "two-way" police cruiser car. Car receivers are tuned to the frequency of the headquarters transmitter frequency while each car transmitter is assigned a frequency of its own.

not understand that broadcast conditions are neither practical nor possible in the police band. The same ideas are shared by the operators and the crews of the cars. Occasionally a former ship operator is in charge of a police-radio station. Then, since his experience is imparted to his associates, a clearer appreciation of working conditions is found. Those cases are rare, unfortunately.

The point of view of chiefs who are contemplating the installation of radio must be considered also. The remark has been made to me in a number of instances: "Yes, I've been around to cities where they have radio, and I've been out in their cars. But that isn't what I want. Why, when I was out, I heard calls from half a dozen different cities! I'll wait until you fellows have this radio perfected."

Many engineers may think that such ignorance is unusual. Well, in the first place, it can't be sneered at as ignorance. Few engineers would make a creditable showing at police postal practice, for example. And in the second place, that isn't an unusual point of view. I heard several chiefs express themselves: "They didn't have radio when I pounded the pavements, and my men can get along without it, too!"

To find out just how serious the interference conditions are in the much-discussed Boston zone, I made a time check, to determine the average number of minutes per hour the 1712-kc channel was in use. Transmission from Providence was not considered, because that station was too weak to be counted. The result was quite surprising. This channel was used on an average of 15 minutes in each hour. Subsequently, Medford went on the air in this channel, so that this figure must be increased slightly. Yet with three minutes blank out of every four, police chiefs complain that interference is very serious.

INTERFERENCE A MATTER OF POINT OF VIEW

Certainly the situation isn't very bad in Boston when considered from the standpoint of time used and not used. Yet the complaints from chiefs in cities to which less-used channels will be assigned are severe sales resistance to radio manufacturers.

Some one, or some agency, must undertake to educate police officials, to make them understand the essential limitations of radio communications, so that they will not require the impossible, nor feel they must await some further development which will limit car reception to signals from its own headquarters.

Such an effort, however, must recognize the point of view of the chiefs. Many of them object strongly to having orders to their cars heard in other cities. Why? I have never heard a chief explain. The answer is generally: "Because I don't want it." We may hope that this attitude will change. Meanwhile, it must be recognized and accepted.

TRANSMISSION TIME CAN BE REDUCED

Practically no effort has been made to reduce to minimum the time required to transmit messages. No standard procedure has been worked out to the end that the time used can be cut down. New operators in new stations hear other operators, and adopt their technique. Possibly the Communications Commission can make a useful contribution in this matter. It would seem that the Commission is the logical source for a standard of calling and message procedure.

There is an existing rule that an operator must listen in before transmitting, but from my own observation I have never known the rule to be obeyed. If I were a chief, I would require my operators to maintain a constant watch, not only to make sure they did not interfere with other stations on the same frequency, but to pick up messages which might, for example, tell of criminals escaping in the direction of my city.

Police-radio stations are equipped with receivers, of course, but generally they are not on. Perhaps it is too much trouble to cut out the receiver during transmission. It may not have occurred to the operators that the input to the set can be shorted by a simple relay. Such an arrangement should be in use at every police station.

Another thing that calls for study is the manner of transmitting messages. The voice is not an entirely satisfactory means of communicating intelligence.

On the other hand, musical notes, ranging from perhaps 250 to 2,500 cycles, can be heard distinctly under conditions which render the voice totally indistinct.

For example, it is a common practice to whistle code signals into the telephone when there is a great deal of interfering noise at either end of the line. Any radio operator has whistled into his microphone when his speech was reported as too faint to be understood.

From my observation of police-radio signalling, and of fire-alarm signalling, I should urge strongly the use of numbers transmitted by a simple, automatic device, using an adaptation of the Continental Code numerals. That is, rather than use the fire alarm method, I should transmit the numbers in this way:

1	. —	6	— .
2	. . —	7	— — .
3	. . . —	8	— — — .
4	. . . . —	9	— — — — .
5	. . . . .	0	— — — — —

Instead of using station call letters, I should assign a characteristic signal, using a chime note, to each station on a given channel. That is, five stations on one channel might be assigned signals in this way:

City No. 1, signal . .
City No. 2, signal . . .
City No. 3, signal . . . .
City No. 4, signal . . .
City No. 5, signal . . . . .

Here is a typical call, according to present procedure: "This is station WXXX, the Newman Police Department, calling cruiser number 29. Calling cruiser number 29. Calling cruiser number 29. Call your station. Call your station. Call your station. This is station WXXX, signing off at 10:32. That is all."

With the code transmission suggested, the operator at City No. 2, for example, would transmit the same message thus:

Attention	Station	Calling	Car No.	Calling	Car No.
Signal	identification	2	9	2	9

Attention	Call Your	Station	Time is Now
Signal	Station	Identification	3 2

The average police operator will require 30 seconds, at least, to get off the message in words. The same message can be transmitted in 12 seconds, less than half the time required for words.

The code message above starts with an attention signal. This is important for any kind of transmission, and most stations now use a buzzer for this purpose. Then comes the station call repeated twice. Manchester, N. H., uses a chime for an attention call. If you have heard that station, you will understand why a chime note is suggested for the station call.

As for the number code, some readers may object to this feature, but suppose you are in Car 29. When you hear a car number transmitted, you naturally listen for the numeral 2. If the first numeral is anything else, you can reject the message, as not intended for you.

Following the car number, there is a long dash. Then three or four symbols can be used for oft-repeated messages, such as ——— . . ——— to mean: "Call your station." Next comes the station call again, and the number 32, to give the time. The hour can be taken for granted, and need not be transmitted.

Many cities are using code numbers for street addresses. The idea is good, but the numbers are easily misunderstood. It has been established over years of experience, that numbers can be received with far greater certainty by code. If you are interested in finding out for yourself, go out in a police car, and have the operator signal to you with his attention buzzer. Pick spots along street car lines, or other noisy sections. Try listening while you drive through a dead spot, or past any kind of electrical or mechanical noise.

The buzzer signal will come through clearly and with unmistakable certainty. Then try voice reception under the same conditions.

ORIGINAL THINKING NEEDED

Perhaps the suggestion just made to reduce transmission time and increase intelligibility are subject to further refinements. The purpose to be served here is to suggest the application of original thinking to the problems of police communication. Right now, transmission practice has just grown up like Topsy, without direction, and without cooperation between the engineers and the police officials.

A glowing example of things that can be done wrong because there is no perfected, standard practice came to my attention a few months ago. I stopped to make a call from a phone booth in an ice-cream parlor, right near a police radio station. A radio set was turned on in the place, receiving baseball scores.

Just as I hung up the telephone, the police transmitter came on the air, blanketing the broadcast reception. I listened to the message, out of curiosity, and to my amazement I heard the operator call a car and say: "Stand by at the First National Bank. They are going to move a lot of money, and they want some extra protection." Imagine giving out such information on the air!

I don't know what happened to that operator. Perhaps the chief didn't hear about it. But I do know of several cases where operators have been put back on the pavement because of the injudicious use of the names of well-known citizens or public officials on the air.

EXCHANGE OF IDEAS ESSENTIAL TO PROGRESS

Radio manufacturers are not likely to contribute much toward the progress of police radio for two reasons. First, because there is quite often no profit in this class of business. Research and development are expensive, and no money can be put into such work when every sale shows a loss. Second, the equipment is being sold chiefly through jobber organizations, so that the engineers who do the actual design work have little contact with the police departments. Consequently, they have no opportunity to gain an intimate knowledge of police problems.

The Communications Commission will probably continue to move with caution in this field, choosing to encourage the use of police radio without attempting to direct or even to indicate the proper avenues of advancement.

The police chiefs themselves, however, can do much along this line by encouraging original thinking and the exchange of ideas on the part of their operators. These men are rapidly collecting a fund of practical experience which is bound to supply the ground work on which future progress will be based.

There are many matters which call for discussion which have not been mentioned in this paper, such as the pros and cons of conventional and ultra-frequency transmission, super-regenerative *vs* superheterodyne reception at ultra-frequencies, the application of two-way radio, and stop-start *vs* duplex systems for two-way communication. Looking toward the future, there is the subject of radio reception for foot patrolmen, and matters of cooperation with fire departments.

All these and other subjects must be discussed sooner or later and ideas exchanged concerning them. If the chiefs will encourage it and permit technical comment and criticisms from their operators, police radio will be benefited tremendously.

WTOC—SAVANNAH

(*Continued from page* 11)

current could be read on the transmitter panel. Protection against static discharges at the base of the antenna was provided with the aid of a ball gap and static leak.

COVERAGE

In operating, this system showed more than a 60-percent increase in our service area. All in all this radiator does the work as well, if not better, than a tower of the same height, and we wondered why the type was not used elsewhere. Before we completed construction, we learned of another station of large power installing one for use as a reflector in a directive system.

Daily reports from listeners indicate this new 1-kw job is covering better than half the state of Georgia and Georgia is 300 miles across.

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BROADCASTING NUMBER OF THE LONDON TIMES

THE ISSUE OF THE London *Times* for August 14, 1934, is accompanied by a supplementary "Broadcasting Number" which consists of twenty-eight pages of full newspaper size. The general field of British broadcasting is covered in a considerable number of articles, most of which are necessarily brief. There is a brief historical account of the development of the B. B. C. including the special local organizations for handling the particular problems of Scotland, Wales, and Northern Ireland, and a discussion of the development of Empire broadcasting. An article on B. B. C. foreign relations includes a discussion of program exchanges with C. B. S. and N. B. C. Notwithstanding repeated demands, Wales does not have its own regional station because no channel is available. There is a small map show-

(*Continued on page* 24)

REMOTE BROADCAST PICKUP

Portable ultra-short-wave transmitters for broadcast pickup service

By EARNEST H. ROY
Short-Wave Technician
WBEN-W8XH

THE USE OF portable ultra-short-wave transmitters for broadcast pickup service, where land wires are not available, is generally being adapted by many broadcast stations.

The Engineering Department of WBEN, Buffalo, N. Y., realizing the importance of "on the spot" broadcasts, recently completed several ultra-short-wave transmitters for this broadcast service. During the past months these transmitters have made it possible to broadcast many local events such as "street parades," "golf matches," and airplane races.

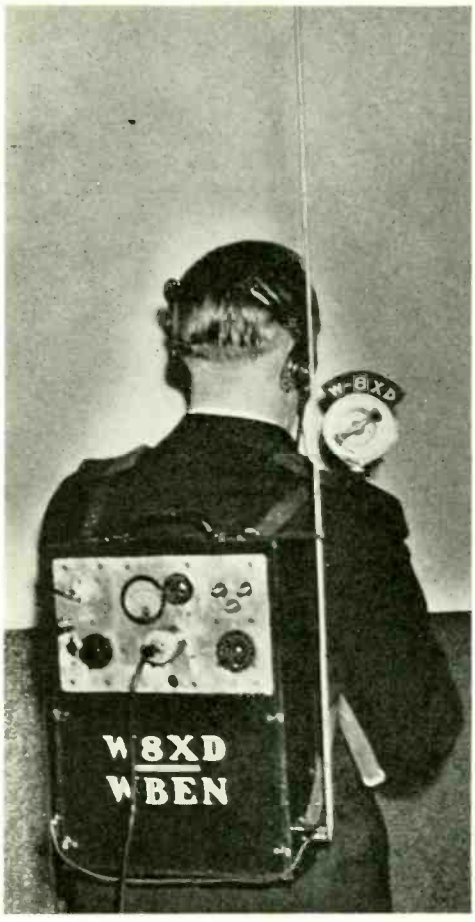


Fig. 1. Pack transmitter of W8XD which is operated on 7.9 meters.

RELAY TRANSMITTER

In a recent issue of COMMUNICATION AND BROADCAST ENGINEERING, Mr. R. J. Kingsley, Chief Technician of WBEN, presented facts covering the W8XH, 7.3-meter, broadcast station operated by WBEN. This W8XH station is used during the "on the spot" broadcasts as a base transmitter. This provides a reliable means to pass along instructions, general information and starting cues to the portable ultra-short-wave pickup position.

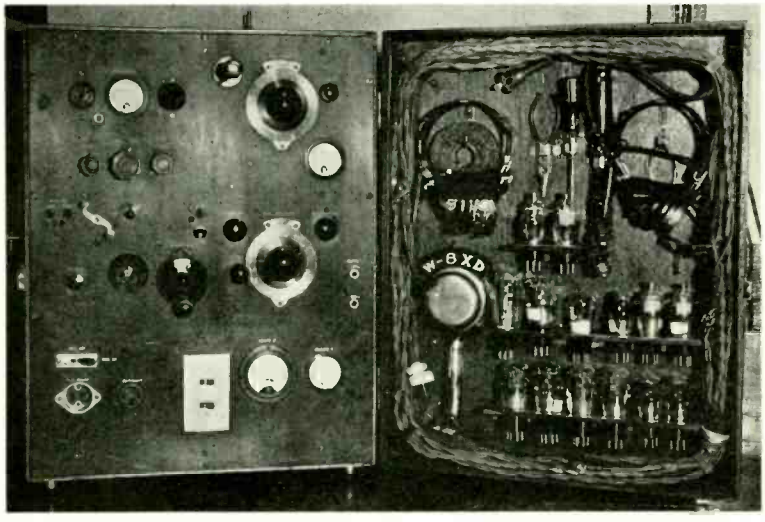


Fig. 2. The larger type of ultra-short-wave transmitter used by W8XD.

PACK TRANSMITTER

For a "short haul" broadcast a small pack type transmitter is used. This transmitter is battery operated and weighs approximately thirty-eight pounds.

A typical pack transmitter broadcast set-up is shown in Fig. 1. The lower compartment contains both the 135-volt plate supply as well as the two-volt filament storage battery. The transmitter can be operated continuously for a period of four hours. The top portion houses both the transmitter unit and a simple one-tube super-regenerative receiver. The one-tube receiver offers headphone volume on the signals of the base transmitter. A standard double-button carbon microphone is used. The transmitter unit includes a type 30 speech amplifier working into the grid of a 33 modulator. This modulates effectively a type 30 oscillator working on 7.9 meters. All necessary controls have been mounted on the front panel. A plate meter shows the total drain on

(*Continued on page* 21)

XEAW—

Reynosa, Tamaulipas, Mexico

"The Voice of International Service," XEAW, formerly XED, the first of the Mexican border stations

By VINCENT S. BARKER
ENGINEER, XEAW, 1932-1933

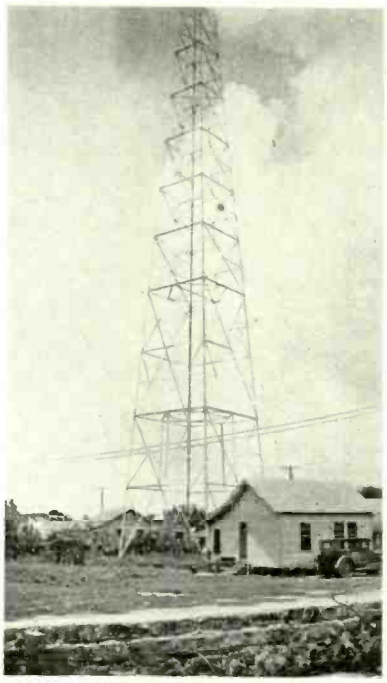
XEAW, "The Voice of International Service," of Reynosa, Tamaulipas, Mexico, first came on the air in 1930 with the call of XED and was the first of the much discussed "Mexican border stations." Located a few hundred yards from the Mexican bank of the Rio Grande in the quaint old city of Reynosa, across from Hidalgo, Texas, XEAW has a buying public from Texas to Alaska—orders for Rio Grande valley citrus fruit having actually been received from Alaska and Nova Scotia in response to a series of fruit advertisements from that station. With an antenna power of only 10 kw, XEAW is now one of the lowest powered of the border stations, but due to the good location, her coverage compares favorably with the others, considering their enormously increased power of from 75 to 200 kw in the antenna.

THE CONTROL PANELS

After a varied career under different managements and engineers, XEAW today differs considerably from the original installation of XED, the addition and enlarging of the control room and other audio equipment, and a complete re-design of the final power amplifier constituting the main changes. As may be seen from the photographs, the transmitter is contained on nine panels, the center one holding the crystal equipment, the first and second buffer stage, and the modulated amplifier. The frequency of 965 kc is controlled by one of two crystals, each being kept at a constant temperature in its own electrically-heated oven, and either one switched into the grid circuit of the 210 crystal oscillator. This oscillator drives a buffer stage using an 860 run at a low plate voltage, which in turn drives another buffer stage of one 860 with a much higher plate and bias voltage than the former.

TUBE COOLING SYSTEM

The output of this second 860 excites the modulated amplifier, a 203-A, Class C, and the modulated energy from this stage is supplied to the grid circuit of three 204-A's operated in parallel as a Class B amplifier. This stage provides the excitation for the final amplifier, a stage of two 207's in parallel, Class B. The cooling system for the 207's consists of the usual coils of rubber hose, a pump, and two cooling radiators, one outside the building with a large fan, and the other inside the power room with a device for running cool water



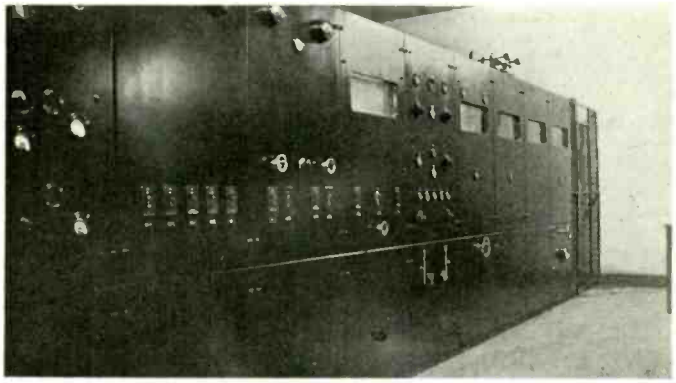
One of the 180-foot towers at XEAW, Reynosa, Mexico.

over the outer surface of the radiator in the summer months when the temperature in the power room gets to about 110 F. The water for the water jackets is river water, distilled by a gasoline still at the station, and the pure distilled water being the water coming into contact with the tubes. The whole cooling system is interlocked in the usual manner so that in the event that the water pressure falls below, or rises above, a previously determined value, the filament and plate voltages are removed from the 207's. The 104 amps at 22 volts, required for the filaments of these two tubes is obtained from a 3-kw generator.

A transmission line, conductively coupled to the tank of the power amplifier at the one end, and the antenna loading coil at the other, carries the radio-frequency energy to a fan antenna, suspended between two 180-foot steel towers some 150 feet away from the station building.

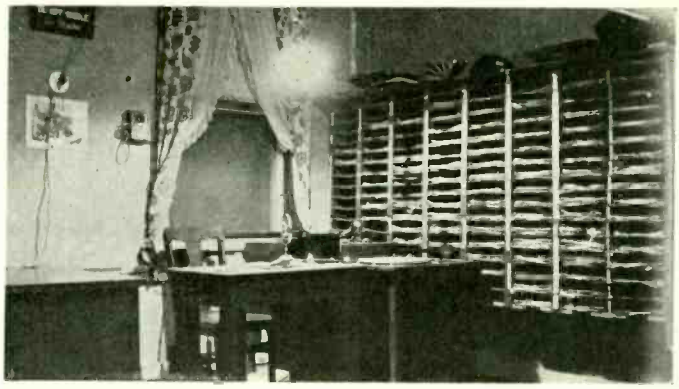
THE STATION STUDIOS

Two studios are used in Reynosa, one in the same building as the transmitter, and one in the town of McAllen, Texas,



The transmitter panel at XEAW.

about seven miles north of the river. The larger of the Reynosa studios will accommodate an orchestra of 40 pieces, while the smaller one is used for trios, solo work, etc. This small studio also contains a truly remarkable collection of phonograph records, some two thousand being stacked in racks on two sides of the studio. The two microphone positions in each studio, the turntable equipment and a program line from the Texas studio, feed into the control room which contains a six-channel mixer, a W.E. 6C amplifier with its attendant volume indicator panel, a monitoring amplifier and loudspeaker, telephones from the McAllen studios and interphones from the transmitting room, office, and Reynosa studios.



Corner of small studio showing phonograph record rack holding 2,000 discs.

PROGRAM CENSORSHIP

The programs that originate in the McAllen studios are sent to Reynosa over a circuit rented from the local telephone company; the line having to pass through the local Mexican post office before arriving at the station. The reason for this is, that, armed with a double-pole, single-throw switch, a pair of headphones and a jack patched across the line, the "gerente" in charge may open the line, by the simple process of pulling the switch, in the event that anything of a political or religious nature should be broadcast. In addition to the program circuit from McAllen, a monitoring circuit between the announcer's booth in that studio and the control room in Reynosa is also in use; all signals for the changing of programs from the Texas to the Reynosa studios are conducted over this circuit. W. E. carbon microphones, and The International Broadcasting Equipment Co.'s condenser microphones, are in use at both points.

The output of the control room feeds into a 500-ohm line which matches the impedance of the primary of the line-to-tube transformer over in the transmitting room. This transformer couples the line to the grid of a 203-A Class A audio amplifier, which is situated at the extreme left-hand side of the main transmitter panel. This stage is resistance coupled to the grid of the modulator, an 849, which modulates the 203-A Class C amplifier as shown in the block diagram.

POWER SOURCE

The power for the station comes from the Texas side and, after passing through the local power company in Reynosa—for the purpose of their charging what they wish for the power, and to whom XEAW pays the power bill—is delivered at the sub-station, at 4600 volts, three phase. This is stepped down to 220 volts three phase, and 110 volts single phase, and is supplied to the various units of the station.

The plate voltages for all stages, with the exception of the last power amplifier, is obtained from a 3000-volt rectifier using six 872's—full-wave, three-phase—the individual voltages being obtained from dropping resistors in the plate and screen leads. The plate supply for the audio amplifier in the control room is a 360-volt rectifier, the filament power for the 203-A audio amplifier in addition to the control room filaments being obtained from one of two banks of A batteries. The 11,000 volts required for the plates of the 207's comes from a mercury-arc rectifier consisting of three Cooper-Hewitt mercury-arc rectifier bulbs, submerged in an oil bath six feet long and three feet deep, and so connected as to give a three-phase, full-wave output waveform. The ac voltage supplied to the rectifier bulbs is stepped up through three single-phase, G.E. 15 kva transformers. The "keep alive" is started manually and may be cut off during rectification if a current of one amp or more is pulled from the arcs. A smaller amount of current consumption requires that the "keep alive" be kept running all the time.

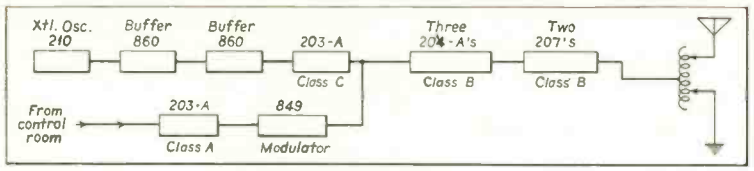
MEXICAN TECHNICAL STAFF

The Mexican technical staff of XEAW consists of one licensed transmitter operator, two control room operators assisted by a "day helper," and a night watchman; the remainder of the station staff being two announcers, one Mexican and one "foreign" (i. e., any nationality other than Mexican), both bi-lingual, and one foreign engineer. The licensed operator on duty is responsible to the Mexican government for the observance of frequency and other Mexican radio regulations, as is the operator on duty in this country responsible to the U. S. Government (or FCC), while the engineer is responsible to the broadcasting company for all technical details.

IMMIGRATION REQUIREMENTS

The immigration requirements for foreigners to work in Mexico are severe and are strictly adhered to, it being necessary—in the writer's case—to produce a contract for one year between the broadcasting company and the engineer, one bond of 500 pesos to be refunded when the holder of the passport checks out of the country, six passport photographs (later on, another six for local town hall registration), 22 pesos for the revenue stamps that are stuck on the passport (later on, a further 12 pesos

The main building of the station, then XED (November, 1933).



Block diagram of the layout at XEAW.

for stamps that are stuck on the registration cards) and, when all this has been forwarded to Mexico City and the issuance of the passport has been duly authorized, one more contract must be drawn up; this time between the engineer and the responsible Mexican operator, stating that the engineer will teach the operator the art of radio engineering—the idea being, presumably, that at the expiration of the passport, if the operator is capable of assuming the duties of the applicant for renewal, the renewal will not be forthcoming.

When all of the above, plus some proof of the applicant's ability to hold the job for which the passport is issued, is approved, a passport is issued for a period of either two or six months, at the end of which more pesos and photographs must be submitted with the application for renewal. The passport is good for the one job only; i. e., to quote mine: "Radio Ingeniero Tecnico de Difusora, XEAW, Reynosa."

The Mexican personnel of the station was exceptionally fine, all men being willing and eager to work and to learn.

OPERATING DIFFICULTIES

XEAW operated under difficulties during the fall of 1933. The heaviest hurricane in years struck the lower Rio Grande valley on the eve of Labor Day, and after power interruptions having knocked that station off the air for twelve times in one hour, it finally went off and stayed off for five days. During the night and the next day much damage was done to the valley, power lines and telephone lines were down for miles and it was five days before power was restored to the station and longer than that before the program circuit was in operation from McAllen again.

The actual damage to the station was slight, one strand of the fan antenna was down, the transmission line from station to antenna base was down, about ten of the cross-sections on each of the towers has been loosened by vibration and were on the ground, and some damage was done to furniture and carpets by rain having entered through smashed windows.

As an aftermath of the storm, which finally spent itself in the mountains around Monterey, the river began to rise about ten days after the storm hit Reynosa, and was soon over its banks. Again the station was without power, due to the fact that the high lines were carried across the river by the span of the bridge from Hidalgo, Texas, to Reynosa, and rather than risk the danger of having the 4600 volts loose on the bridge, should the water carry it away, the power company decided to cut it off till all danger was passed. During this time driving from McAllen to the station was impossible, the journey being made by driving, rowing and walking.

"OLD MAN RIVER . . . "

No sooner had the roads, etc., been repaired from the effects of flood No. 1, than the river again started to rise, flooded the spillways and repeated the performance. This time the water got to within six inches of the back door of the transmitting room, and again the station was without power for several days.

Feeling that the station had had its share of bad luck, normal operations were resumed as soon as was possible with no expectations of further disaster until one bright Saturday the first week in November, the International Bridge across the Rio Grande broke off at the Texas side—a result of the undermining of the foundations by the floods—and again power was taken off the station—this time for three weeks.

"MANIFESTOS"

Since that time I understand that the Mexican government has ordered all "psychology" programs, fortune telling, etc., off the air, and also has ordered the discontinuance of the maintenance of broadcasting studios in the U. S. by Mexican radio stations, no more medical talks with the special permission of the Mexican department of health, and that all programs shall first be broadcast in Spanish.

If a few more such orders are issued, and enforced, it is problematical whether XEAW can continue to be "La Voz a Servicio International."

REMOTE BROADCAST PICK-UP

(*Continued from page* 18)

the entire unit and also indicates when the antenna system is tuned to proper resonance.

RADIATING SYSTEMS

Two radiating systems can be used on this transmitter; a short vertical rod, such as shown in the illustration of Fig. 1, or a half-wave, di-pole vertical antenna. The half-wave antenna is mounted on a portable mast and is carried by means of a flag belt. Twisted feeders carry the r-f current from the transmitter to the center of the half-wave antenna system. On broadcasts where the half-wave antenna system is used the short vertical rod becomes a receiving antenna for the one-tube receiver.

LARGER TRANSMITTER

In order to cover greater distances, a more powerful unit was constructed. This unit is shown in the illustration of Fig. 2. Many unique features have been incorporated in this unit. Arranged on the transmitter cover are spare tubes for each socket, tools, soldering iron and various other items necessary for convenient portable operation. The entire set-up requires thirteen tubes for full operation.

The entire transmitter unit operates on 300 volts "B" potential at 230 milliamperes total plate current. A type 83 rectifier provides this rather high plate current. The transmitter operates from a 60-cycle ac line and requires 150 watts. Where no ac power is available a portable ac motor-generator is used. This generator operates from two six-volt storage batteries.

Two type 56 tubes serve as a speech amplifier working into the grids of two type 2A5 tubes in a parallel circuit. This stage in turn modulates a type 53 oscillator.

TWO RECEIVERS USED

A midget broadcast receiver as well as an ultra-high-frequency receiver have been included. This provides a means for contacting the base transmitter and also a means for monitoring the regular WBEN, 900-kc frequency for starting cues.

The entire set-up has been so designed that in case of an emergency broadcast the transmitter can be picked up by WBEN technicians, rushed to the spot of broadcast and be placed into immediate operation. In many cases further instructions can be passed on to the portable transmitter while it is on its way to the broadcast.

TELECOMMUNICATION

PANORAMA OF PROGRESS IN THE FIELDS OF COMMUNICATION AND BROADCASTING

BYRD EXPEDITION

The explanations of many little-understood atmospheric and solar conditions which affect radio communication and radio broadcasting generally, are among the more important scientific findings expected of the Byrd Expedition in Little America.

The expedition has been supplied with high-powered radiotelegraph equipment by the Mackay Radio and Telegraph Company with which Admiral Byrd and his men are maintaining constant contact with civilization throughout their two years stay at the bottom of the world. This communication is maintained through any of Mackay Radio's seven coastal radio stations on the Atlantic and Pacific Coasts, but principally through the famous stations at Sayville, L. I., and at Palo Alto, California. The operations with Admiral Byrd are being directed by A. Y. Tuel, Mackay Radio vice-president and general manager.

PROPAGATION STUDIES

The radio research experts of the Expedition are working closely with the Mackay Radio technical department in New York which is headed by Haraden Pratt, vice-president and chief engineer. According to Mr. Pratt, "This is a rare opportunity indeed to study the very special and peculiar propagation phenomenon of radio short-waves in the Antarctic regions. The daily radio communication should result in observations of unusual interest and, probably, of definite value leading to the further development of radio communication over vast distances."

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RADIO BEAM INDICATOR

A VISUAL INDICATION of the direction of the radio waves from the new KYW Station in Philadelphia will be available at all times as a result of a new development by Westinghouse engineers. In addition to indicating direction, small push-buttons permit the operator to accurately adjust the radio beam from the Station Control Room. The device is called a "graphic meter panel" and is set into the station wall along with seven others panels for controlling the radio transmitter.

A cathode-ray tube is mounted on the panel near the center so that its fluorescent screen comes flush with the panel. On this screen, patterns are reproduced which indicate the radio beam direction. The signals that produce the patterns come directly from the bases of the four 245-foot vertical antenna masts used at the new station. They are conducted back to the graphic meter panel through special underground circuits. At the base of each antenna, there is a motor-operated tuning equipment which is controlled from the push-buttons on the graphic meter panel in the Control Room. By operating these push-buttons, the operator adjusts the phase relationship of the current being delivered by the transmitter to each of the antennas, and determines the direction of the radio beam.

The panel also contains four radio-frequency ammeters that indicate the radiating current present in each of the four antennas. In addition, two recording meters at the top of the panel continuously record on a moving tape the voltage delivered to the radio station from the power lines and the power consumed by the output amplifier of the transmitter.

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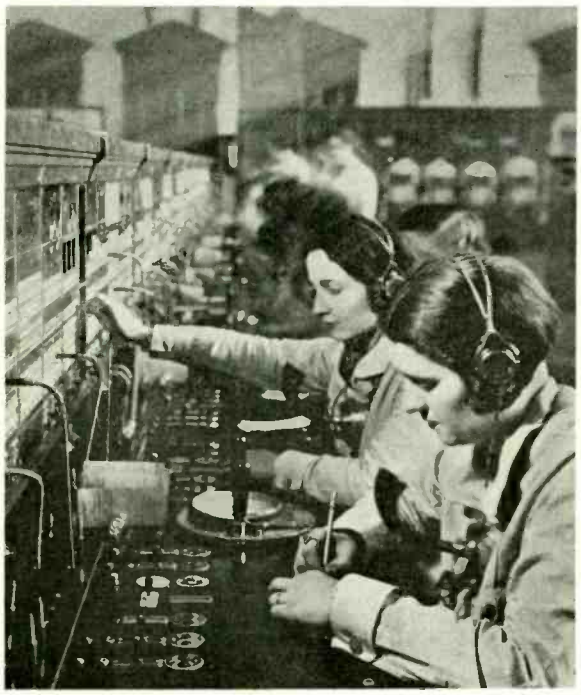
WTMJ DEMONSTRATES FASCIMILE BROADCASTING

Facsimile transmission was demonstrated for the first time outside of New York, Wednesday, October 10, in the studios of WTMJ, the Milwaukee Journal Station. The showing was made privately for members of the Wisconsin Radio, Refrigeration and Electrical Appliances Association and representatives of trade papers, and was the forerunner of the first public demonstration of the equipment to be given at the three Schuster department stores from October 15 to 27, inclusively.

For the last several months, WTMJ engineers have been experimenting with facsimile transmission and have worked several improvements since the New York showing last spring, before members of the then Federal Radio Commission. Many difficulties were found in broadcasting, but with the aid of John V. L. Hogan, WTMJ's consulting engineer, WTMJ engineers have been able to perfect transmission to a point where it is now possible to send pictures from W9XAG, the transmitter on the roof of the Schroeder Hotel, to various parts of the city.



Toll operators in central office of the Rumanian Telephone Company, in Bucharest . . . one of the world-communication units of the International Telephone and Telegraph Corporation.

Transmitting station of the Mackay Radio & Telegraph Co., at Palo Alto, California. This station operates the Mackay Radio service between the United States and points in the Far East and in the Island Possessions and is also one of the principal stations in the Mackay Radio national radio-telegraph network which interconnects 12 principal cities in this country. It is this station which is maintaining the nightly contact between Admiral Byrd's expedition in Little America and civilization.

PRECISION RECEIVERS

SIX NEW DEVICES to be used in policing radio broadcast stations have just been delivered to the Federal Communications Commission by the Westinghouse Company. Each consists of a highly stabilized quartz crystal oscillator, a harmonic generator, and a radio receiver. The equipments are suitable for installation on special trucks of the Commission which travel around the country picking up the signals of the various radio stations. The signals received from the stations are mixed with the local signal generated by the quartz crystal oscillator. By a special device having a linear scale, the frequencies of the various stations are checked. These sets are checked regularly for accuracy against the primary standards of the Government.

DESCRIPTION OF DEVICE

Each set is mounted in a padded wooden box about 5 feet long with leads and filters extending from the rear. Complete operation is obtained from batteries. The new equipments are the result of intensive development and valuable help from engineers of the Commission since the development started. Without sacrificing quality and accuracy of the measurement, it is possible to take readings on a given station in an extremely short time. A special condenser with micrometer drive was designed and manufactured for each equipment for use in the heterodyne oscillator so that a linear scale could be obtained without the use of correction curves in making readings.

Although the accuracy of these standards is not as high as that of the primary reference standards operated by the Communications Commission at Grand Island, Nebraska, they are quite accurate so far as ordinary things in our lives are concerned. For example, in a series of measurements taken in the laboratory, engineers have reported an average error of only 3 parts in a million. In ordinary terms, this is equivalent to 1 inch in 5.26 miles.

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W. U. TELEREGISTER OPERATIONS

The Teleregister service, provided by the Teleregister Corporation, a Western Union subsidiary, is constantly being expanded to additional cities and brokerage offices, it is said. Teleregister boards are now in service in New York City, Chicago, Philadelphia, Newark, Boston, Detroit, Pittsburgh, Cleveland, Washington, Providence and Buffalo.

The Teleregister is a centrally operated quotation board, installed in large brokerage offices, on which the previous close, today's opening, high, low, and last prices of stock appear under the names of companies whose securities are dealt in on the New York Stock Exchange. Through W. U. wire lines, these quotations are flashed to 200 Teleregister Boards in eleven large cities.

One of the interesting developments of Teleregister is a Dial Service. Subscribers to this service have a little display unit in their offices, and on their desks a special dial. When the subscriber wishes to learn the quotations for a stock he refers to a list and dials the proper number.

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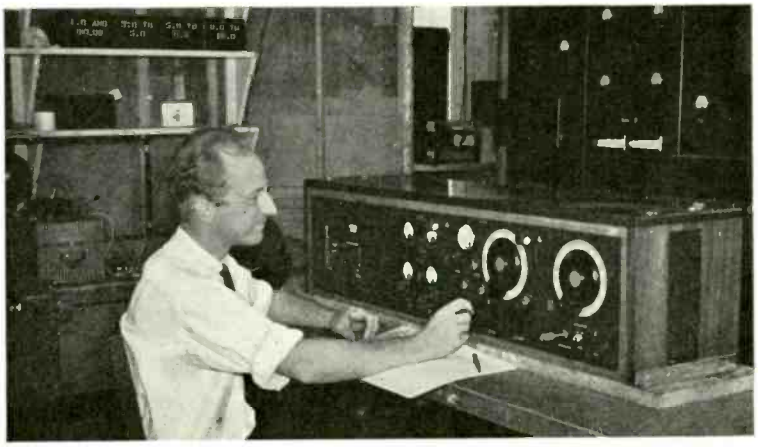
TALKING LIGHT

WHEN THE NEW Union Pacific six-car streamlined passenger train visited Schenectady on November 7 it had a headlight that talked. On the platform of the station stood a handtruck, on which was a tripod-mounted concave mirror, and in back of that a loudspeaker system. The train rounded a curve in approaching the station and, in full daylight, the orange-red beam of a headlight could be seen. The operator on the train aimed the beam of his projector at the mirror; and then, while the train pulled into the station and stopped, persons aboard the train were able to talk, over the beam of light, to those on the platform.

Engineers of the General Electric Company, which supplied the electric equipment of the train, had installed the special headlight while the train was in Albany the previous night.

Aboard the train the voices were converted by the microphones into electrical energy. This was used to modify the light of the neon lamp in the "headlight." At the focus of the concave mirror of the receiving equipment was a photoelectric tube which converted the modulated light into electric energy. This was fed to an amplifier and then to the loudspeaker system.

It was the first time that "talking light" had been used on a railroad.



Special Westinghouse reception unit developed for the FCC and used for policing radio broadcast stations.

BOOK REVIEWS

SIGNALS AND SPEECH IN ELECTRICAL COMMUNICATIONS, *by John Mills, published by Harcourt Brace & Co., New York, 281 pages, cloth covers, list price $2.00.*

The author of this book is well known to most readers for such recent works as "Within the Atom" and "The Realities of Modern Science." To the older generation, however, he will always be associated with his earlier work, "Radio Communication." While his best known works are of a strictly non-technical nature, albeit dealing with highly technical subjects, his original work was of a highly technical nature and appeared at a time when literature on radio subjects was anything but plentiful. Few indeed of the older men in the radio fraternity have not read and re-read his original work. The author states that he intends to avoid the usual pitfall of technical writers who fail to keep their readers clearly in mind because they write with one eye cocked over their shoulders at what their colleagues may think and so fail to cut loose for the general audience. Although Mr. Mills boldly states that in writing this book he has turned his eyes from his colleagues, he is too old a student of communications and has too long been involved in the thick of the art to stray from the solid facts of physics and engineering. In spite of this, his latest work is highly readable and interesting both for the material and for the author's inimitable style.

The book is divided into 16 chapters dealing with such interesting material as: Vivisection of Speech; Communication with Electrical Beams; Electrical Extension of the Senses; The First War with Attenuations; Transcontinental Echoes; The Modern Jim; Television; etc. This treatise should have considerable appeal for the non-technical reader who likes to take his dose of technical information with a coating of sugar. While there may be no royal road to a knowledge of communications, the author has at least eased the bumps and jolts along the way by the use of homely illustrations drawn from every-day life, as well as by his point of attack. The author keeps the reader sufficiently removed from the details so that he can see the forest rather than the trees and with the author's intimate knowledge both of the physical facts and of the struggle to increase them, the reader is eventually acquainted with the present status of the art as well as with some of its more interesting history.

This book is well and interestingly written and should prove of interest not only to the non-technical reader, but to the technician as well.

ELECTRICAL COMMUNICATION, *by Arthur L. Albert, published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 448 pages, price $5.00.*

There has been no lack of text and reference books dealing with practically every phase of the communication and electronic art. Books dealing with the theory, design, or application of vacuum tubes or communication networks, with the art of acoustics, telephony, telegraphy, television and radio are generally available and widely used. Practically all of the texts which have come to this reviewer's attention, however, have been concerned with the theory or application of some specific phase of the communication art, rather than with the subject as a whole.

The author of this book has addressed himself to the task of presenting the various phases of electrical transmission of intelligence as they contribute to the provision of the public with an adequate and economical communication service. It is the avowed intention of the author to present a discussion of the entire communication art and industry for the engineer engaged in the broader aspects of communication as well as to provide the engineering student with a basic text around which a thorough knowledge of the subject can be built. This book should appeal particularly to those readers who prefer a word description to a mathematical analysis. Derivations and proofs of the few formulas used are dispensed with almost entirely, although the book is replete with references from which such information may be gained.

The book is divided into fifteen chapters which include such important topics as sound, the history of electrical communication, speech and hearing, electrical fundamentals of communication, exchange and toll telephone systems, telegraph systems, telephone transmission theory, electric wave filters, inductive interference, electron tube theory, and wireless communication.

In addition to its use as a text book for engineering students, *Electrical Communication* should find a ready field among those people in the communication industry engaged in administrative, supervisory or similar non-technical activities, who desire a better understanding of the plant and engineering features of the industry. In spite of the wide field covered in this book, the author has not simply cataloged the high spots, but has included a fairly complete and detailed discussion of each topic. This book is replete with references, a bibliography of some 330 citations being given. As a matter of fact the bibliography is one of the outstanding features of the book.

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LONDON TIMES REVIEW

(*Continued from page 17*)

ing the location of broadcasting stations in Great Britain, and the number of inter-station program wire channels available.

Raymond Braillard has an article on the work of the European International Broadcasting Union, "Lucerne and After." E. V. Appleton has articles on short-wave broadcasting and television broadcasting. Col. Moore-Brabazon, President of the British R. M. A., has an article on receivers, and S. R. Mullard on twelve years' progress in values.

The general arrangement of the B. B. C. "Broadcasting House" is presented in some detail. There is a table of broadcasting stations of the world, including short-wave broadcasting stations. British censorship restrictions are discussed.

Some of the legal problems of broadcasting are considered, including those due to the holding of British courts that an author of a copyright work can prevent the unauthorized broadcasting of his work, and the decision that copyright is infringed when copyright material is publicly reproduced, as on a loudspeaker in a hotel lobby, for which the copyright owner had licensed B. B. C. only for reception for private and domestic use.

There is an article on the legal property rights which a broadcaster has in the material which he transmits, a *droit d'émission*, including control of rebroadcasting, and garbling and distortion in reproduction.

Sir John Reith considers national broadcasting policies, mentioning the Russian and German policies as one extreme, and U. S. policies as the other extreme, and says:

"At the other end of the scale, the many American stations—humorously called "Ego Stations"—that were created for the purpose of publicizing the particular opinions or wares of their proprietors, find themselves less and less able to do so, since the criterion by which they are judged under the Radio Act is whether they serve public interest, convenience or necessity." . . . "In practice, therefore, broadcasting systems, whether their form and organization be commercial, chartered, or state, look upon the satisfaction of a public need as their *raison d'être*."

R. S. Ould

FEDERAL COMMUNICATIONS COMMISSION REPORTS

RULING ON 100-WATT STATIONS

THE BROADCAST DIVISION on October 10th gave consideration to that part of Section 307 (b) of the Communications Act of 1934, which relates to additional 100-watt stations and reads as follows:

"Provided further, That the Commission may also grant applications for additional licenses for stations not exceeding one hundred watts of power if the Commission finds that such stations will serve the public convenience, interest, or necessity, and that their operation will not interfere with the fair and efficient radio service of stations licensed under the provisions of this section."

The Division decided that these stations will be assigned only to the channels designated in Rule 121 as local channels in the Rules and Regulations of the Commission, namely: 1200, 1210, 1310, 1370, 1420 and 1500 kc. In determining interference that may be caused by these stations, the present power-frequency mileage separation tables of the Engineering Department will be followed and the technical requirements for the installation and operation will be the same as for all other broadcast stations.

New broadcast stations will be licensed under this section only after a full showing has been made that the station will be operated in public interest. This showing must include full facts concerning the applicant's financial and technical ability to operate the station requested. It must be shown that program material is available such that programs can be built that will be of service and interest to the listeners. Proof must be submitted that sufficient possibilities are available that the applicant can provide adequate talent, personnel and properly maintained equipment.

A review of existing stations in small centers of population reveals that a majority of these stations are having great difficulty in operating with adequate programs, maintenance and personnel.

Past records show that in many cases applicants hope to obtain a limited facility and expect at a later date to materially increase that facility. The present allocation does not permit such later increases and accordingly the Commission must have proof that the assignment, as requested, has a reasonable promise of success.

POWER AND TIME QUOTAS

On October 10th, the Broadcast Division revised rules 109, 110, 111 and 120 which made a fundamental change in its broadcast quota system as promulgated to comply with Section 307 (b) of the Communications Act of 1934.

"Interference caused by stations at night is different from that caused at day. Consequently, the broadcast quota due, the limit of which is interference, has been separated into two parts, 'night quota' and 'day quota'. The quota charge for a station operating both day and night has been divided into two parts, the power and time of operation between 6:00 a. m. and 6:00 p. m. being charged to 'day quota' and the power and time of operation between 6:00 p. m. and 12:00 midnight being charged to 'night quota'. A day station, the operation of which is entirely between 6:00 a. m. and 6:00 p. m. is charged only to 'day quota'.

"The 'night quota' due and 'day quota' due are entirely separate and wholly independent of each other. Applications will be considered in two parts if night and day operation is requested, and the proper quota due considered in connection with each part.

"The 'night quota' due and assigned does not differ materially from the night portion of the present system. The 'daytime quota' due each zone and state within each zone has been increased so that the quota already assigned no longer becomes the limiting factor in many cases to an increase in daytime power of local and regional stations and day and limited time stations on clear channels."

Rule 120 was modified so that the maximum daytime power on the regional channels listed in the rule was increased to 5,000 watts. No other change was made in the maximum power of other classes of stations.

In increasing the daytime quota due the several states, it is not the intention of the Commission to license additional new daytime stations unless a full showing has been made that public interest will be served in making such a grant. The applicant must definitely establish the need for the additional service, the financial and technical ability to operate such a station in accordance with the Rules and Regulations, and that the station can exist on the basis of the grant requested.

A survey of the stations in small cities or communities indicates that it is extremely difficult for such stations to operate even though they have full time. The possibility of a daytime station under similar circumstances becoming a success is greatly decreased.

APPLICATIONS GRANTED FOR NEW STATIONS

Telegraph Division

October 10, 1934.

DUPAGE COUNTY, SHERIFF'S OFFICE, County Building, Wheaton, Ill., was granted a construction permit for experimental service to operate as a municipal police station in emergency service. The frequency is 37,100 kc and the power 35 watts.

PAUL D. LANGRICK, doing business as Langrick Radio Engineering Service, Los Angeles, Calif., was granted a construction permit for portable equipment to be used for general experimental service. The frequencies are 1614; 3492.5, 6425; 17,310; 31,600; 35,600; 38,600; 41,000; 86,000-400,000 kc. The power to be used is 750 watts.

ARTHUR MEIER, Anchorage, Alaska, was granted a construction permit for general experimental service using frequencies of 31,600; 35,600; 38,600 and 41,000 kc at 10 watts.

AERONAUTICAL RADIO, INC., Baltimore, Md., and Camden, N. J., was granted two construction permits (aviation) for equipment to be used at frequencies of 2922; 2986; 4122.5, and 5652.5 kc at 15 watts power.

October 17, 1934.

AERONAUTICAL RADIO, INC., Wenatchee, Wash., was granted construction permit, the frequencies being 3005; 2854; 5377.5 (day only) kc and the power 50 watts.

C. W. CROSS, L. B. BRITAIN, JAY LEE CROSS, doing business as Geoelectric Survey Co., were granted construction permit for portable equipment to be used for Geophysical purposes. The 10-watt equipment is to be used at frequencies of 1602; 1628; 1652; 1676; and 1700 kc.

RADIOPHONE CORP. OF AMERICA, Los Angeles, Calif., were granted construction permit for portable-mobile equipment to be used at frequencies of 1614; 2398; 3492.5; 4797.5; 6425; 8655; 12,862.5; 17,310; 23,100; 31,600 34,600; 35,600; 37,100; 40,600; 41,000; 86,000-400,000 kc and 100 watts. Emission: A3.

CITY OF HARRISBURG, Pa., was granted construction permit, the power being 25 watts. The frequencies are 30,100; 33,100; 37,100 and 40,100 kc. The same applicant was also granted construction permit (5 applications) for portable-mobile equipment to be used within the city limits. The power is 9 watts and the frequencies the same as listed above. Emission: A3.

VICTOR HENRY TONJES, Berkeley, Calif., was granted construction permit for portable-mobile equipment to be used for special purposes. The power is 50 watts and the frequencies are 31,600; 35,600; 38,600 and 41,000 kc.

SUFFOLK (VA.) POLICE DEPARTMENT was granted construction permit for using frequencies of 30,100; 33,100; 37,100 and 40,100 kc at 25 watts. Emission: A3.

CITY OF ZANESVILLE, Ohio, was granted construction permit for 50-watt equipment to be used at the frequency of 2430 kc. Emission: A3.

CITY OF EVERETT, Washington, was granted construction permit for 50-watt equipment to be used at a frequency of 2414 kc. Emission: A3.

CITY OF JACKSON, Michigan, was granted construction permit for 50-watt equipment to be used at a frequency of 2466 kc. Emission: A3.

JACK T. JEFFORD, NC-901-W, was granted license for 20-watt equipment to be used at 3105 kc. Emission: A1.

October 24, 1934.

INTERNATIONAL BUSINESS MACHINE CORP., New York, N. Y., was granted a construction permit for general experimental portable station to be operated at frequencies of 3492.5 and 6425 kc, and at a power of 200 watts.

D. REGINALD TIBBETTS, Berkeley, Calif., was granted construction permit (2 applications) for portable-mobile equipment to be operated at frequencies of 31,600; 35,600; 38,600, and 41,000 kc. The power is 25 watts.

ATLANTA (GA.) DEPARTMENT OF POLICE, was granted a construction permit for a general experimental station of 20 watts power to be operated at a frequency of 37,100 kc.

RCA VICTOR CO., INC., (New York) was granted construction permit (10 applications) and licenses covering portable-mobile equipment to be used for general experimental service at a power of 25 watts. The frequencies are 30,100; 31,600; 33,100; 35,600; 37,100; 38,600; 40,100; 41,000, and 86,000-100,000 kc.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGonigle, Secretary, 112 Willoughby Avenue, Brooklyn, N. Y.

V. H. C. EBERLIN

Introducing—the "Chancellor of the Exchequer"—our own Viggo Henry Conradt-Eberlin 2nd, Association Treasurer.

Upon leaving High School, Mr. Eberlin attended and subsequently graduated from electrical trade school where he completed a course in Applied Electrical Engineering in 1920. Radio beckoned—and the lure of the sea creating a desire in him to perpetuate the maritime accomplishments of his Danish forbears prompted him to study Radio Operating at the East Side Y.M.C.A. under Nilson and Horning. Completed the course in six months and obtained a First Class Commercial Operator's License.

S O S CLUB MEMBER

Mr. Eberlin's first assignment was a freighter on which he visited many European ports. Uneventful.

Not so the second assignment. The SS. *Arizonian* bound from New York to West Coast ports. While enroute from Seattle to Vancouver, B. C., fog settled over Puget Sound . . . ship lost in the fog . . . ran aground on stone reef off San Juan Island . . . VHC sent his first SOS . . . ship was later maneuvered into Esquinalt Harbor, the stern under water, where it was beached. Later raised and towed to drydock where it was found that nine plates had been torn from hull . . . ship temporarily patched and towed to Tacoma, Wash., for proper repairs.

Upon completion of repairs, journey was resumed, with first stop at Portland, Oregon, where ship collided with another, resulting in stove-in bow. Necessary repairs made . . . trip down West Coast without incident until off the Mexican Coast when the ship's propeller took its leave. Ship towed to New York.

Continued taking sea assignments until 1924 when he went ashore for a year as a member of the Telephone Company's "Flying Squadron"—then to sea again for another year, after which he joined the Tropical Radio Telegraph Company, sailing on various ships of the United Fruit Company.

In 1929 he was promoted to position of Assistant Radio Inspector with the Tropical Company and stationed at New York. The economic readjustment brought about his return to the sea in 1934 when, for the first time, he enjoyed the privileges of a three-man watch. He sailed several trips as Chief Radio Officer. At present Mr. Eberlin occupies the position of "Technician" at Tropical Radio Central, Miami, Florida.

Mr. Eberlin has kept abreast of the developments in modern radio. He recently completed a course in Radio Engineering at the Capitol Radio Engineering Institute. He is always in the forefront in endeavors to achieve better conditions for radio personnel afloat and ashore . . . holds rank of Ensign in United States Naval Reserve, in line for advancement to Lieutenant, J. G., now connected with Seventh Naval District. Sea career consists of 108 voyages

V. H. C. EBERLIN, II
Treasurer, V.W.O.A.

to all parts of the world. Taking flying lessons at present and intends to adopt that as a hobby. An energetic and willing worker in Association activities—and last but not least, an excellent "Tin Box" tender.

ITALY AWARDS

Under date of August 30th, 1934, the New York *Times* printed a list of 99 Americans who received decorations from the Italian Government for their assistance in the Balbo massed flight from Rome to Chicago and return in July, 1933. Included in this list were the following communications men, several of whom are members of the Association: Mr. Ellery W. Stone, Vice President, Mackay Radio; decorated with the Order of Grand Officer of the Royal Crown of Italy. Mr. T. E. Nivison, General Superintendent, Mackay Radio; decorated with the Order of Cavalier of the Royal Crown of Italy. Mr. W. O. Lee, Manager of the Sayville station of Mackay Radio, and Mr. J. A. Bossen, Superintendent of Marine Shore Stations for Mackay Radio and formerly Association Vice-President; both received the decoration of Cavalier of the Royal Crown of Italy.

BANQUET AND CRUISE

Plans are being formulated . . . committees will soon be appointed . . . the date will be decided upon . . . a hotel will be selected . . . an entertainment program will be developed and talent engaged . . . the nature of the cruise worked out . . . highlights arranged . . . tickets printed and circulated among our membership . . . for the Tenth Annual "Night of Knights" Banquet and Cruise of our Association to be held sometime during the month of February, 1935. Suggestions concerning this are in order—they will be appreciated. Let us know what you desire on this occasion.

IN RETROSPECT

(SECRETARY'S NOTE:—This is the first of a series of "trips down memory lane" with the veteran radio men who, in their day, saw many strange sights and experienced thrilling adventures. Every man who went to sea has interesting memories. Help us to keep alive those memories by passing along yours. Send a paragraph along now to the Secretary.)

"Bill" Fitzpatrick is the Charter contributor. Memories of his days as a ship radio operator follow: Before the time of any radio laws and but one operator on a ship. . . . That famous general order No. 28, signed by the superintendent, Henry J. Hughes, and countersigned by the general manager, C. C. Galbraith, which was supposed to put an end to unofficial conversation. But didn't. . . . The next outstanding order which gave but a few weeks to change from Morse to Continental. . . . J. C. Murphy on the Ward Line just wasn't going to change. . . . The Tropical Radio men in the Gulf and Central America who kept on with Morse. . . . Chapman and Ed Hartley at Miami who used Morse long after in an effort to prevent piracy of private press to Nassau. . . . What pirates we were! . . . The original "DF" in the swamp at Manhattan Beach. R. H. Marriett in charge with Frank Hart as assistant. . . . *"You may go where you please, from Cape Race to Belize, but you can't get away from DF."* . . . Later, that station back to Coney Island, in Dreamland Park, with E. F. Brodhead as manager. . . . E. E. Bucher as operator at "P" atop the Plaza Hotel, New York. Later an inspector. "I'm collecting data on static: did you have any this trip?" Mr. Bucher later started a school at 42 Broadway, New York, so that the operators might obtain sufficient knowledge to pass the Government examination for "certificate of skill." The price of fifty cents a lesson—which went to the wireless company. Fred Smith, Bob Jones, "Pop" Allington and yours truly the first pupils. Twenty-five years later, with uninterrupted service, that school is now the RCA Institutes.

PERSONALS

Arthur F. Wallis, Mackay Marine Superintendent, forwards a comprehensive report on a recent West Coast disaster in which the radio operator creditably distinguished himself; for action by the Awards committee. . . . Steve Kovacs, recently of the radio staff of the *Leviathan*, is Instructor in Radio Engineering and Operating at the Keystone Radio Institute in Pittsburgh. . . . V. P. Villandre, formerly Association Treasurer, continues his good work in behalf of the Association at the Radiomarine offices at Varick Street. . . . E. H. Rietzke, President of the Capitol Radio Engineering Institute, rates congratulations on the increasingly interesting material in his monthly Bulletin. . . . H. H. Parker and Thomas Licari report changes of address. . . . J. V. L. Hogan's picture on the cover of the August issue of *Radio News* inspecting his latest television development. Mr. Hogan is Chairman of the Committee on Television of the Institute of Radio Engineers. Veteran member V. W. O. A. . . .

OVER THE TAPE...

NEWS OF THE RADIO, TELEGRAPH AND TELEPHONE INDUSTRIES

"THE DUNCO LINE"

"The Dunco Line" is the title of a 4-page bulletin recently released by Struthers Dunn, Inc., 139 N. Juniper Street, Philadelphia. The bulletin covers the Dunco Line which includes the following: Aquastats; Electric Counters; Fish Spine Beads; Flashers, automatic; Ladles, electrically heated; Limit Switches; Pots, electrically heated; Relays, power transfer, remote control and signal; Rheostats, adjustable; Thermal Links; Thermostats; and Time Delays.

Included in this bulletin is a business reply card for literature on the above items.

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SCHOOLS USE BRUSH MIKES

Announcers at WLB, at the University of Minnesota, where Brush microphones are installed, find, it is stated, that they can use them with the utmost freedom. Besides general broadcasting on this station, announcers use the 4S6P to advantage in reporting sports events, including football games and basketball games.

However, the field of sport at Minnesota University is not the only one taking advantage of Brush microphones. At Northrop Memorial Auditorium, a lapel 2S2P picks up lectures for the public-address system. Numerous junior high schools in the middle west are also using brush mikes it is reported.

The Brush Development Company, manufacturers of Brush Microphones, are located on Perkins Ave., at E. 40 St., Cleveland, Ohio.

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FRANCIS D. BARTOW ELECTED TO G. E. BOARD

At a meeting of the board of directors of the General Electric Company on October 26, 1934, in the offices of the company at 570 Lexington Avenue, New York City, Francis D. Bartow was elected a member of the board.

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RCA SHOWS GAIN

David Sarnoff, President of the Radio Corporation of America, has made public the statement of income and surplus of the Radio Corporation of America and subsidiaries for the third quarter of the year 1934 and for the first nine months of the year.

The total gross income from all sources for the quarter ended September 30, 1934, was $16,810,790.17, as compared with $14,225,112.28 for the same period of 1933. The surplus at the beginning of this 1934 quarter was $11,040,671.44 and at the end $11,446,861.41, comparing with $8,582,972.50 and $8,057,813.63, respectively, for the 1933 period.

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RECTIFILTERS

The Raytheon Manufacturing Company, Electrical Equipment Division of 190 Willow Street, Waltham, Massachusetts, announce that they have acquired from the Square D Company of Detroit, Michigan, their "RectiFilteR" business. These units will henceforth be manufactured and shipped from Waltham, Massachusetts, and will continue to be known as RectiFilteRs.

RectiFilteRs are devices for changing ac to dc the conversion being effected with no moving parts. They consist of transformers, rectifying elements, choke coils, and condensers. In some cases meters, relays, switches, and other control equipment is included. RectiFilteRs are designed for operation from any ac power circuit and by appropriate design of the transformers and rectifying elements can be made to deliver dc at almost any combination of voltage and current. The residual ac component remaining in the dc output can be reduced to any desired degree by the proper selection of the choke coils and condensers which comprise the filter circuit. The entire assembly is mounted in a suitable code steel box and marked as a unit. Both copper oxide and bulb rectifiers are employed depending upon the rating.

The Raytheon line includes standardized RectiFilteRs for broadcasting, theatre, fire alarm, signal, telephone, and battery charging service. Among the various sizes are low voltage units rated at a few milliamperes to over 20 amperes and others delivering as much as 12,000 volts at 2 amperes. Special units can be manufactured to order to meet customers' specifications.

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NEW WESTERN ELECTRIC BULLETINS

The Western Electric Company, Inc., have recently made available a number of interesting bulletins on their equipment. These bulletins are titled as follows: Station Speech Input Equipment, No. 15A; Studio Speech Input Equipment for Radio Telephone Broadcasting; No. 82A Amplifier; Low Level Amplifier, No. 81A; Plate Voltage Rectifier, No. 8A; Volume Indicator, No. 700A; Speech Input Equipment for Radio Broadcasting; Dynamic Microphone; Recessed Panel Construction for Radio Broadcasting Systems; and Plate Current Meter, No. 262A Panel.

These bulletins are well illustrated and give complete technical specifications on all the equipment covered.

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SMITH NAMED WESTINGHOUSE INTERNATIONAL V. P.

Harold Smith has been elected Vice-President of the Westinghouse Electric International Company, according to a recent announcement by G. H. Bucher, President of that organization.

Mr. Smith joined the personnel of Westinghouse in 1919 as a member of the legal department of the Westinghouse Electric and Manufacturing Company. In 1926 he was appointed General Solicitor and in 1929 Vice-President.

Prior to his connections with Westinghouse, Mr. Smith was engaged in the practice of law in Chicago as a member of the firm of Glennon, Cary and Walker. He is a graduate of Northwestern University (LLB. in 1905) and of Yale (LLM. in 1906). He has also pursued studies at the University of Chicago and is a member of the bars of the states of New York and Illinois.

Mr. Smith's new duties will be in addition to those of his position as Vice-President of the Westinghouse Electric and Manufacturing Company. His headquarters are at 30 Rockefeller Plaza, New York City.

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INCREASE IN G. E. SALES

Sales billed by General Electric Company during the first nine months of 1934 amounted to $121,735,122.98, compared with $97,426,146.39 during the corresponding period last year, an increase of 25 per cent, President Gerard Swope has announced.

Profit available for common stock for the first nine months of this year was $11,714,247.20, compared with $6,886,600.45 for the first nine months of last year. This profit is equivalent to 41 cents a share for the first nine months of 1934 and 24 cents a share for the first nine months of 1933, on 28,845,927 shares outstanding in both periods. Dividends declared for nine months of this year amount to 45 cents a share, compared with 30 cents a share for the corresponding period last year.

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POWER TUBES AT REDUCED PRICES

The products of the Duovac Tube Radio Corporation have always enjoyed an excellent reputation, being used in almost every theatre and in broadcast stations, it is said. Their recent failure, which was caused by patent difficulties, removed them from the field.

By a special arrangement the entire stock of more than three thousand transmitting tubes was taken over by the Harrison Radio Company, 142 Liberty Street, New York City, for liquidation. It is said that although every tube had previously passed the manufacturer's tests they were put through a retest, with the result that every tube carries a guarantee.

This company is well-known in the broadcast and amateur field where for more than eight years they have been regarded as one of the leading supply houses.

Advance notice of this sale has aroused considerable interest and the volume of orders and reorders already received indicates an early sell-out, it is said.

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NEW HAMMARLUND TWELVE-PAGE CATALOG

A new special 1935 edition of the catalog of The Hammarlund Manufacturing Co., Inc., 424 West 33rd Street, New York City, containing complete details and prices on the hundred odd items now being produced, has just been issued.

Among the many units listed and described are the popular transmitting condensers, single and dual; midget receiving and transmitting condensers; padding and trimming condensers of the air. and mica tuned type, Isolantite radio-frequency chokes for high and low power work, etc.

The well known Comet Pro is also described. This receiver is now being used by such leading broadcasters as the Columbia Broadcast System, National Broadcasting System, WINS, WOR, WOWO, etc., for reception of high frequency signals for rebroadcast work.

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATION AND BROADCAST FIELDS

NEW DISTORTION METER

In order to meet the need for a practical instrument for the measurement of the audio harmonic content present in the output of broadcast transmitters, the Radio Research Co., Inc., 9th and Kearny Sts., N. E., Washington, D. C., announces its type 235 Distortion Meter. This instrument, illustrated here, combines in one compact, direct-reading, rack-mounted unit everything necessary to measure the audio

harmonic content of the transmitter output, it is stated. Provision is also made for checking the distortion present at any point in the audio system, thus making possible the isolation and correction of the cause of distortion.

A built-in source of pure tone is provided for exciting the transmitter. The percentage ratio of the effective value of the combined harmonics to the fundamental is read directly on a meter, graduated 0-10% with a multiplier provided to change the range to 0-30%. The meter can be read at values as low as 0.5%.

The operation of the instrument is simple and rapid. It is entirely ac operated and self-contained, no external equipment of any kind being necessary for its operation. Every effort has been made to make this equipment thoroughly practical for regular use in the broadcast station or in the laboratory where a quick, accurate means of measuring distortion is needed.

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NEW KENYON CLASS A-B AMPLIFIER KIT

The Kenyon Transformer Co., Inc., 840 Barry St., New York City, has introduced a unit designed to act as a public-address amplifier capable of delivering either 18 or 36 watts power output. This output is achieved by using either push-pull Class A-B 45s or push-pull parallel Class A-B 45s in the output stage. By unique type of chassis construction, using one chassis for the audio channel and one chassis for the power channel, it is possible to change this amplifier from an 18-watt amplifier to a 36-watt amplifier by merely installing two tubes, two transformers, and a filter reactor. The mechanical construction of the chassis also permits the operation of the amplifier as a rack and panel unit, or as a table mount unit. In the past on rack mount amplifiers built on a chassis, it was necessary to remove the amplifier chassis from the panel before the amplifier wiring became accessible. With the new units it is only necessary to remove four 10-24 screws to remove the panel. When the panel is removed, the chassis is held in place to the rack by an additional four screws which have no connection whatsoever with the panel. Thus, when the panel is removed, all wiring is exposed.

A common voltage amplifier is used for either the 18- or 36-watt condition. This amplifier consists of a pair of 77 pentodes operating push-pull impedance coupled to a pair of push-pull 76 tubes. The overall gain is said to be 80 db. Despite the high gain of the voltage amplifier, it is said the hum level has been kept down to 50 db with respect to full power output. Microphonic noises which might otherwise be transmitted through the amplifier by the 77 or 76 tubes have been eliminated by mounting these voltage amplifier tubes in a phosphor bronze spring suspension.

Broadcast studios have applied this amplifier for sound effects.

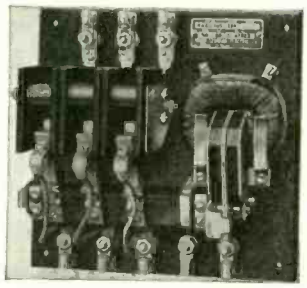
•

WARD LEONARD CONTACTORS

Ward Leonard Electric Company, Mount Vernon, N. Y., announces a line of dc. and ac. contactors that for several years have been used in their control assemblies and are now available as separate units.

They can be used as control contactors for motors, for disconnect purposes in conjunction with suitable auxiliary switches, for electric ovens, various other electric control applications and for special control panels.

High contact pressure with low operating and holding currents in the coils are



among the features claimed for these contactors.

Auxiliary silver-to-silver contacts are furnished as standard equipment for maintaining the coil circuit when momentary push-button control is used.

Additional normally open or normally closed auxiliary contacts can be furnished when required.

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NEW REMLER P-A AND REMOTE AMPLIFIERS

The unification of remote broadcasting and public-address amplification, made possible by the newly designed Remler High-Fidelity PAR-19 combination, shown in the accompanying illustration, is a convenience which measurably improves the quality of both p-a and broadcast performances, it is said.

The Remler PAR-19 consists of a public-address power amplifier and a remote amplifier housed in a single portable case designed to supply local public-address and remote broadcasts from the same microphone input. Three input channels are provided with main gain controls on both the p-a and the remote.

The public-address amplifier is a four-stage, push-pull resistance-coupled amplifier, using three type 6A6 tubes, two type 2A3 tubes, and one type 82 rectifier. The

remote amplifier consists of a three-stage, push-pull amplifier using type 6A6 tubes.

The new Remler PAR-19 weighs only 85 lbs. The unit is manufactured by the Remler Co., Ltd., 2101 Bryant St., San Francisco, Calif.

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PRESTO UNIVERSAL RECORDER

The Presto Universal Recorder, manufactured by the Presto Recording Corporation, 139 West 19th Street, New York, N. Y., is a portable unit designed for recording sounds of nearly any type. This new instrument is the result of painstaking research and application by recording engineers with years of acoustical experience in the design and manufacture of all types of recording instruments, it is stated.

Two cases comprise the Presto Universal Recorder; one case contains the turntable and motor, feed mechanism, and electro-magnetic pickup, while the other case contains the amplifier, controls, loudspeaker and volume indicator. The turntable will accommodate records up to 12" in diameter and runs at 78 rpm or 33⅓ rpm. Two cutting heads and two feed screws are supplied. One feed screw feeds from the inside out, while the other feeds from the outside in. One cutting head and feed screw are for use on aluminum or any other metallic disc. For cutting celluloid, gelatin, or the Presto Recording Disc the other cutting head is used. Interchangeability is extremely simple, only a few seconds being required to change from one head to the other, it is said.

IMPROVED CATHODE-RAY OSCILLOSCOPE

A linear-sweep model cathode-ray oscilloscope, shown in the accompanying illustration and designed for use by broadcast stations, advanced amateurs, physics laboratories, and the like, has been announced by Kaltman and Romander, 62 Court St., Newark, N. J.

This oscilloscope features the following: Controlled linear sweep 0-150,000 cycles per second; controlled external sweep; frequency-locking device for sweep frequency; picture-centering adjustments, wide-range focus adjustments; and com-

plete component shielding. In addition the unit is self-contained and includes batteries and 110-volt, 60-cycle power supply. The tubes used are RCA 906, 885, 234, 281, and 280.

A request to the above company will bring further information.

•

NEW MIKE STANDS

The Eastern Coil Co. of 56 Christopher Ave., Brooklyn, N. Y., manufacturers of microphone stands and quartz crystal holders, announces the following new items of interest to broadcast stations.

Three section telescopic stands ideal for juvenile broadcasts. Allows microphone to be brought down to the level of the child performer. Available in varying weights of from 8 to 18 pounds.

A heavy floor stand with a ½-inch pipe thread especially designed for the new velocity and dynamic microphones. Base weight 23 pounds and total weight 32 pounds.

A simplified mounting for the 618 and 618A dynamic microphones which allows the mike to be coupled to the regular type of microphone stand having the movable rod threaded for ⅝"-27 thread.

A microphone coupling device, ideal for remote control equipment, allows the microphone to be readily dismounted from the stand without the necessity of disconnecting any wires or the use of any tools.

Catalogued sheets upon request.

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BRUSH CRYSTAL TWEETER

The Brush Development Company, East 40th Street and Perkins Ave., Cleveland, Ohio, have developed two types of Piezo-electric High-Frequency Speakers particularly adaptable to high-fidelity receivers and special public-address use.

The primary use of the Type T-51 unit is in radio receivers, where it is intended to be connected across the primary of the low-frequency dynamic speaker transformer. Its reproduction begins at the point where the response of the dynamic speaker starts to fall off, it is said, and continues to 8,000 cycles.

As the speaker has a negative or capacitative reactance, no filter is required when used in combination with an inductive reproducer of the usual moving coil type. It is said that aside from supplying the desired upper register, thus permitting the dynamic speaker to be designed for maximum efficiency over a limited range, but also by its tendency to correct the power factor of the dynamic speaker gives a more efficient loading of the tube and circuit than would otherwise be obtained.

The Type T-51 has a face diameter of 4 15/16" and is 1 23/32" deep. No field excitation is required.

The Type T-51P is designed for public-address use and may be obtained with suitable transformer for 4, 8, 15 and 500-ohm input.

A special bulletin on these new crystal speakers may be obtained from the Brush Development Company.

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THE MAGNETIC MONOPHONE

A new type of telephone instrument which operates without batteries or any other external source of electric current is now being produced by Automatic Electric Company, Chicago, manufacturers of automatic and manual telephone systems for public and private exchange service.

This new telephone, known as the Magnetic Monophone, is essentially a modern idealization and perfection of Alexander Graham Bell's electromagnetic telephone which he invented in 1876. The magnetic unit is a receiver and transmitter requiring no battery supply whatever.

In fundamental design the magnetic telephone unit, shown here, is similar to the type of magnetic loudspeaker unit in which

an armature vibrates between the poles of a permanent magnet and actuates a diaphragm to which the armature is attached by a sturdy but light connecting link.

When used as a microphone the sound waves vibrate the diaphragm and, in turn, the armature. This vibration sets up variations in the magnetic flux thereby inducing currents in the coils which form a part of the magnetic system.

When two units are combined to form a handset, they may be connected in series or in multiple, depending upon conditions encountered and the results desired. Several units may be connected to one line; and each handset is designed to accommodate a cut-out switch to disconnect those not in use. The unit is powerful enough to permit several receivers to be connected to one line.

•

RCA VICTOR INDUCTOR MICROPHONE

The new RCA Victor Inductor Microphone is a high-quality unit specially designed for remote pick-ups, indoors or outdoors. This is a pressure-type unit differing, however, from previously designed pressure-operated microphones in that the faults common to this type of microphone have been reduced (in so far as remote pick-up requirements are concerned) to negligible proportions, it is stated. This results in the following qualities being claimed for the Type 50-A microphone: Insensitive to wind and mechanical vibration; unaffected by temperature and humidity; requires no external excitation or power supply; requires no closely-linked amplifier; is well suited for close talking; and is small, light, convenient, rugged and inexpensive.

The response characteristic of the Type 50-A unit is fairly uniform throughout its range of 60 to 9,000 cycles, the largest variation being 4 db.

The Inductor Microphone has been designed to have an output 8 to 10 db higher than that of the usual velocity microphone. This difference is sufficient to approximately balance the loss in mixers and therefore to offset the rise in background noise which would otherwise be caused by low-level mixing. The sensitivity is such that, for a sound pressure of 10 dynes, the output level across a 250-ohm line is —67 db, as compared to a zero level of 12.5 milliwatts.

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ONAN ELECTRIC LIGHTING PLANTS

D. W. Onan and Sons, 43-51 Royalston Ave., Minneapolis, Minn., have announced their 1935 Onan Electric Lighting Plants which provide 110-volt, 60-cycle alternating current that will operate any standard appliance that would be used on city line service up to the capacity of the machine. These plants have capacities of 300, 500, 1000 and 2000 watts.

The engines are four-cycle, air-cooled, using 6-volt ignition, float-feed carburetor, mechanical governor, 6-volt starting motor and storage battery with remote control for self-starting. All parts are standard to the automotive and electrical field and available from any source where parts of this kind are supplied.

Direct-current models in companion sizes, also larger plants up to 50,000 watts capacity, gasoline and oil driven are available.

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AC PRE-AMPLIFIER

The Bruno Laboratories, 20 W. 22nd St., New York City, announces an ac-, dc-operated pre-amplifier having the same standards of quality and performance adhered to in their velocity microphones.

The pre-amplifier consists of a single unit employing two 77's and one 25Z5 tube, and is mounted in an iron case 7" x 12" x 5" finished in crystalline black.

The "Bruno" Pre-Amplifier is adapted for remote pickup and when used with Model RV-3 is capable of loading a telephone line with full gain on, it is stated. A switch regulates its output to a lower level if desired.

This Pre-Amplifier can be supplied for standard rack mounting or for portable use, both types being capable of operation from 115 volts, 60 cycles ac or from 115 volts dc.

TINY RESISTORS FOR HEAVY WORK

Although hardly larger than carbon resistors of low wattages, the tiny Pyrohm Junior wire-wound vitreous enamel resistors, developed by Aerovox engineers, are now available in 10, 15 and 20 watt ratings, and 100-30,000, 250-70,000, and 1000-100,000 ohms.

The units are wound on a porcelain tube with a high-grade resistance wire, the ends of which are brazed to copper bands, while the pigtail leads are soldered to the terminal bands. The entire unit is completely coated with a vitreous porcelain enamel, protecting the winding against moisture and mechanical injury. Proper design and conservative ratings insure adequate dissipation of heat. The units are being produced by the Aerovox Corporation, Brooklyn, N. Y.

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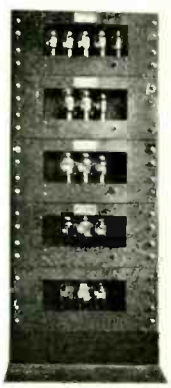
NEW HIGH-FIDELITY AMPLIFIERS

Sound Systems, Inc., Cleveland, Ohio, announces a new line of high-fidelity general-purpose amplifiers which are supplied with panels for rack mounting or without panels for other purposes.

The new Series S Amplifiers are constructed in a heavy sheet-steel, one-piece case, with tubes mounted in a single row and completely protected. All audio- and power-transformer chokes and retards are sealed in heavy individual steel cases. These cases are mounted within the main amplifier case. Input and output terminals are conveniently located inside of the base of the amplifier with a removable cover mounted in the back of the amplifier, giving easy access to these terminals; and knockouts are provided in the end of the amplifier to accommodate input and output lines. All metal parts are rustproof and have a black crystalline finish.

The Series S voltage amplifier is provided with a master gain control. Input impedances of all Series S amplifiers are



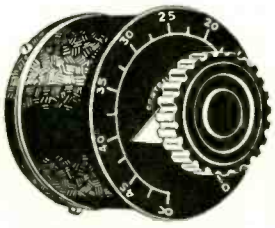
as follows: 500 and 200 ohms center tapped; 300, 235 and 50 ohms are also available. Output impedances: 500-ohm tapped at 250, 168, 125, 100 and 84 ohms, permitting the use of from one to six 500-ohm lines. There is also a separate 15-ohm monitor line. The PA-100 and all combinations of the PA-100 and PA-101 give the desired output ratings, such as 4½, 10. 15, 39, 45, 60, 75 and 90 watts. The PA-100 is rated as a 4½-watt voltage amplifier and is also recommended as a driver or pre-amplifier by connecting its output to from one to six PA-101 output stages to obtain power outputs up to 90 watts. The hum level of the PA-100 is said to be approximately 60 db below signal level.

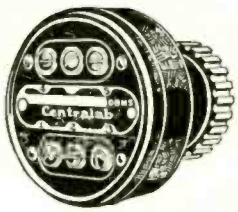
NEW "T" PAD ATTENUATOR

A new "T" Pad Attenuator, recommended for use in all input systems where it is necessary to maintain a constant impedance to both input and output, has recently been announced by the Central Radio Laboratories, 900 E. Keefe Ave., Milwaukee, Wis.

The resistance sections in this unit are made of a special graphite, contact being made by a patented non-rubbing band which insures a low noise level and requires no adjustment or cleaning. A black crackle finish steel cover provides an electrostatic and electromagnetic shield. This also acts as a double dust shield, the resistance elements being entirely enclosed in bakelite.

The attenuation is straight line for 95% of the rotation, a maximum of 95 db and then smoothly to infinity, it is stated. No appreciable attenuation of frequency is present until 16,000 cycles is reached, and no insertion loss.





The rating of this "T" Pad Attenuator is one watt. It is recommended that this control be used in the circuit at a level of not more than plus 22 db above the standard zero level.

The "T" Pad with dial plate is shown in one of the accompanying illustrations. The dial is 3 inches in diameter with black background and silver numerals.

The terminals, as shown in the other illustration, are screw-type mounted in a bakelite strip at the rear of the control.

A new booklet, "Series II Sound Projection Controls", covers a complete line of constant impedance "T" Pad Attenuators, "T" Pad Faders, "L" Pad Attenuators, Gain Controls, and Straight Faders. This booklet is free on request to the Central Radio Laboratories.

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OIL-FILLED TRANSMITTING CONDENSERS

Designed for performance rather than price, a new line of oil-filled, oil-impregnated transmitting condensers is announced by the Aerovox Corporation, Brooklyn, N. Y.

The units are available in round and rectangular metal cans, in either case with high-tension insulator post terminals; and are wound with pure linen paper instead of kraft or cheaper grades, thereby guarding against deterioration even at high operating temperatures, it is stated. Linen paper dielectric also provides the necessary strength for a tightly-wound section. Finished sections are thoroughly impregnated in high-grade oil, placed in the can

and surrounded by a protective oil bath not only for a higher insulation value and a long life, but also for the proper expansion-contraction properties whereby an oil circulation is set up through the section for cooling purposes. Containers are hermetically sealed for complete protection against moisture and leakage.

The round can type includes special reinforcement in winding process, relieving undue strain. The rectangular seamed can type has a clamped section for constant pressure in order to avoid plate fluttering . . . a frequent cause of breakdown when clamps are not used. Units are available in popular working voltages and capacities.

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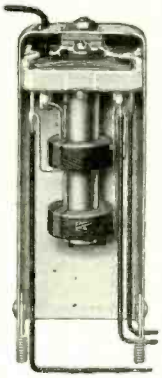
HAMMARLUND MIDGET I-F TRANSFORMERS

The small midget i-f transformer shown has just been developed in the Hammarlund Manufacturing Company laboratories at 424 West 33rd Street, New York City.

These transformers are useful as original equipment, in standby receivers, etc., used in broadcast and radio telegraph stations, or anywhere where the saving of space is an important factor.

Except for its diminutiveness, the units are mechanically and electrically identical to the two-inch round Hammarlund type i-f transformers. They are of the tuned-grid, tuned-plate type, with lattice-wound coils impregnated to prevent moisture effects. The tuning condensers are the mica



compression type, mounted on isolantite bases and adjustable from the top of the can. The leads are R. M. A. color coded, and tagged for easy installation. Transformers with secondaries for standard screen-grid tubes, or center tapped for tubes requiring split input circuits, are available.

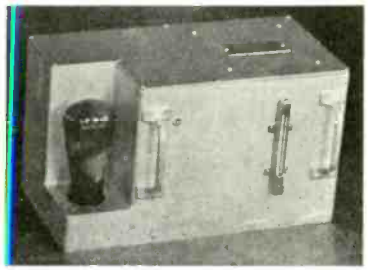
The aluminum shield can measures 3½" high by 1-7/16" square. The threaded mounting studs are of a 1-5/16" center.

The transformers are made in the 465 and 175 kc style.

CRYSTAL OSCILLATOR

A new crystal oscillator unit, shown in the accompanying illustration, has been developed by the Westinghouse Company at Chicopee Falls, Massachusetts, and is being offered for sale to municipal and police radio installations. Features of the new oscillator include high frequency stability, compactness and accessibility, it is stated.

The complete unit measures overall approximately 12" x 7" x 6" and consists essentially of an aluminum casting into which the crystal oven, oscillator circuit and oscillator tube are placed. The front of the oscillator contains two handles, a thermometer, a frequency adjustment and a



type 10 oscillator tube. The tube is set into a depression in the casting and does not project beyond the surfaces of the oscillator unit.

The right end of the unit contains the crystal oven which is insulated with balsa wood and capable of maintaining a temperature on the crystal that does not vary more than approximately .08° Centigrade from the normal temperature. The crystal is contained in a heavy metal holder, the electrodes of which are spaced with quartz. The left section of the casting contains the oscillating circuits, including coils, condensers, and resistors. Some of the parts are contained in a hollow section of the chassis under the tube. The frequency adjustments provided on the front of the oscillator consist of a miniature variable condenser connected in the oscillating circuit and arranged to give only a few cycles plus or minus from the base frequency of the crystal.

The casting is closed on the top and bottom by aluminum plates which effectively shield the parts. The unit contains a row of 8 terminals in the rear so that the unit may be placed on the shelf and plugged into the circuit into which it is to be used.

The output of the oscillator is connected through a filter circuit which prevents change of the oscillator frequency when load conditions on the output change.

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IMPROVED MODULATION METER

A modulation meter embodying many new features has just been introduced by the Radio Research Co., Inc., 9th and Kearny Sts., N. E., Washington, D. C. This instrument, shown in the accompanying illustration, is intended to be used for continuous monitoring of the program of a broadcast station.

A new type of meter having an exceptionally fast movement is used to indicate the modulation percentage and it is claimed that this new modulation meter is more practical than a cathode-ray oscillograph for the purpose of program monitoring.

The scale of the modulation percentage

indicator is graduated 0-110% modulation and also is graduated in decibels with 100% modulation as the reference point. This additional scale is particularly useful to the station engineer in making frequency and amplitude characteristic runs on the transmitter and in setting up the audio levels to be maintained at the studio.

Another meter on the panel indicates carrier amplitude and carrier shift. This instrument is entirely self-contained and ac operated. Both positive and negative peaks can be read. The radio-frequency input required is so low that the load will not upset the adjustment of the modulated amplifier in a transmitter employing low-level modulation. This modulation meter is available also with peak indicator and peak counter.

•

G-E PYRANOL CAPACITORS

A complete line of G-E Pyranol transmitter capacitors is now available through established dealers in radio equipment.

These capacitors are treated and filled with Pyranol, a non-flammable, non-explosive liquid dielectric developed and patented by the General Electric Company, which is widely used in G-E capacitors for power-factor correction and for many special applications. Through the use of Pyranol and carefully controlled manufacturing processes, their characteristics are given exceptional permanency, it is said.

INDEX TO ADVERTISERS

Yes!

Subscribers may date back their subscriptions to include the first number (October) of Communication and Broadcast Engineering.

A limited number of extra copies have been printed so that files may be kept complete.

The subscription rate is $3.00 yearly. Foreign and Canada $4.00 yearly.

Bryan Davis Publishing Co., Inc.

19 East 47th Street

New York City

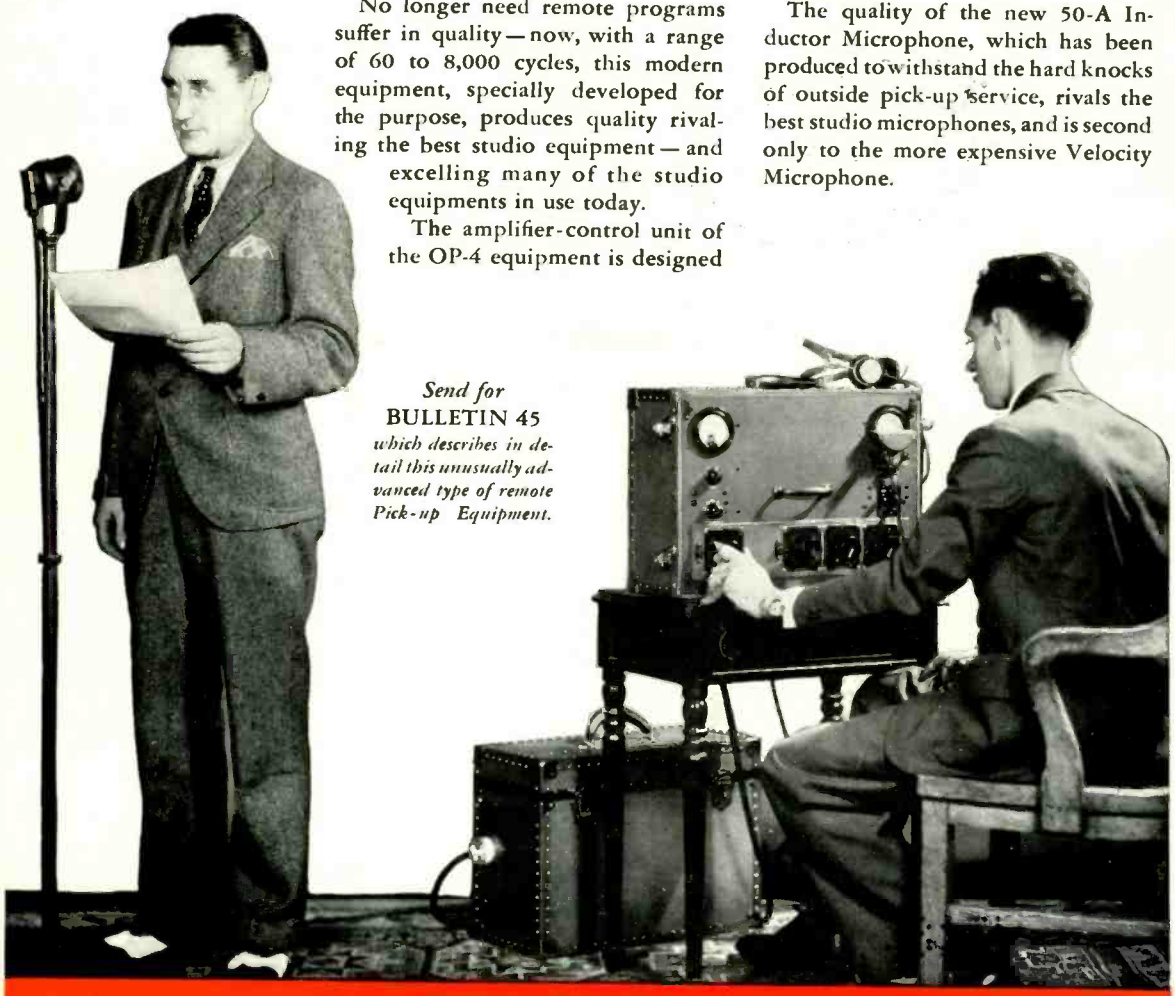
AT LAST! *high quality for outside pick-ups*

THE new *OP-4 Remote Pick-up Equipment,* complete in two conveniently portable carrying cases—with the new *50-A Inductor Microphone*—specially designed to produce studio quality for outside pick-ups.

No longer need remote programs suffer in quality—now, with a range of 60 to 8,000 cycles, this modern equipment, specially developed for the purpose, produces quality rivaling the best studio equipment—and excelling many of the studio equipments in use today.

The amplifier-control unit of the OP-4 equipment is designed with all controls conveniently arranged—even to the illuminated volume indicator. The battery carrying case has convenient space provided for the flexible cords, microphones, and headphones.

The quality of the new 50-A Inductor Microphone, which has been produced to withstand the hard knocks of outside pick-up service, rivals the best studio microphones, and is second only to the more expensive Velocity Microphone.



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