Communication and Broadcast Engineering

VOL. NO. 4

APRIL, 1935

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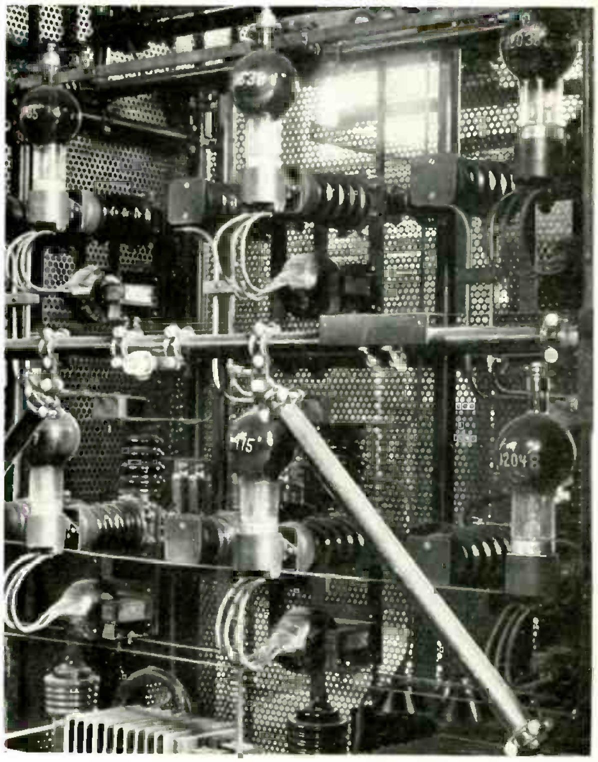

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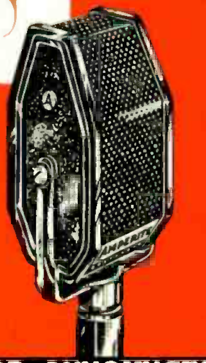

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FEATURES

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EDITORIAL

THE TREND IN HOUSING

FRANK LLOYD WRIGHT, the father of modern architecture, will have on display at the forthcoming Industrial Arts Exposition in Rockefeller Plaza, New York City, a model of a planned city; self-contained and self-supporting. The model is by no means the dream of an idealist—it is, as a matter of fact, a highly practical unit.

To begin with, the plan in its broader aspects, calls for the construction after modern lines, and of modern pre-fabricated materials, of engineered communities composed of residential and manufacturing units, located near a coal mine or an oil field. It is planned to have the cities completely powered by electricity. The power will be manufactured at the source of the fuel supply and fed to the planned cities by transmission lines.

Will such industrially-supported cities arise in the near future? We have said time and again that they will. We have it on good authority now that at least one such community is in the process of formation. There are to be some five hundred or a thousand pre-fabricated homes which, on the basis of three to a family, will form an engineered city with a population between 1,500 to 3,000 people.

A city of this type will undoubtedly lend itself to improved systems of communication. If such cities are to be self-contained and self-supporting, communication will be even more centralized than it is in present industrial communities. Moreover, the manner in which these communities are being planned would seem to indicate that the communications engineer will have the chance of spreading himself.

In so far as broadcasting is concerned, the trend has been for some time towards the establishment of regional transmitters. For the present such stations serve the larger trade-clearing cities and the cities of large population created through the setup of industrial enterprises. Conditions should be little different in the future, with the exception that instead of a few large industrial centers as we now have, there will be a greater number of smaller industrial communities grouped around a central fuel source or around a single manufacturing plant. Thus a single broadcast transmitter properly situated could readily serve a great number of separate industrial communities without departing from the conditions of regional coverage.

So much for planned cities. Of more immediate interest to the communication and broadcast field should be the activities of American Houses, Inc., in the east, and General Homes, Inc., in the middle west. Both concerns are in the business of manufacturing and selling direct to the customer, pre-fabricated houses that are the last word in sturdiness, convenience, adaptability and cheapness of upkeep. Both concerns have ample financial backing.

Pre-fabricated houses are by no means new. What is new and startling is the fact that houses with more conveniences than houses many times their cost, and which require but two weeks to erect, are to be offered the low-income man on a time-payment basis covering a period of 15 or 20 years. The costs are so low and the purchasing arrangements so simple that the project has all the earmarks of another "boom industry."

Undoubtedly there will be mass buying of pre-fabricated houses, and with such buying a large dispersion of population. The houses require land and with the acquisition of land by the home owner, new communities will spring up on the outskirts of our suburban cities, towns and villages. The result should be a thinning of the metropolitan populations and an increase in population density in the outlying areas. The distance a commuter is willing to travel is limited to approximately 30 miles, with the average closer to 20 miles. A shift of populations on this basis, then, would work no hardship on existing broadcast stations, but would call for a redistribution of communication lines and equipment.

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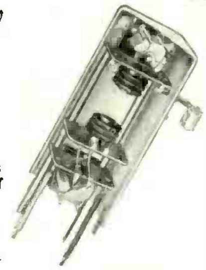

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FOR APRIL, 1935

Broadcasting Studio Acoustics

With Particular Regard to the Small Studio

By S. K. WOLF and C. C. POTWIN
ELECTRICAL RESEARCH PRODUCTS, INC.

THE ACOUSTIC DESIGN of broadcasting studios has become one of the more important phases of radio engineering. It is of fundamental importance that studios be designed to provide an acoustic transmission characteristic that will insure the fullest benefits from the many recent improvements in transmitting and receiving systems. For this reason, the traditional "dead" studio, which was so common in the early days of radio, is no longer suited to the present technique of broadcasting.

STUDIO LIMITATIONS

With the increase in the commercial activity of radio broadcasting, it has been necessary in many instances to confine the location of studios to densely populated areas, where the cost of rental is high and the availability of desirable space is limited. In the recent design of broadcasting centers, considerable attention has been given to the necessity of providing studios in a sufficient range of sizes to acoustically accommodate all types of programs, ranging from the small intimate groups to the large symphonies. Unfortunately, it is not always possible to obtain accommodations in buildings designed exclusively for broadcasting purposes and, consequently, many organizations have acquired space in existing buildings where ceiling heights are generally limited. As a result, groups of small studios have been built and utilized for wide varieties of programs, often with disregard to the acoustic limitations effected by the size of studio. It has been the experience of the authors that even with the handicaps imposed, more flexible and workable studios can be obtained from adherence to recent improved methods of acoustic design. We refer particularly to the smaller studio where it is difficult under the more common methods of treatment to create the setting or atmosphere which should be inherent in a particular type of program.

EFFECT ON LISTENER

From a comparison of size, it might appear to the layman that the broadcasting studio presents a less intricate acoustic problem than theatres or large auditoria. This might be true if the problem were only one of providing good acoustic conditions for binaural listening within the studio. It is quite well established, however, that the sound at the receiving end will not have exactly the same characteristics as that heard within the studio. Furthermore, for the present at least, we are not favored in radio broadcasting with the psychological effect produced on the individual by being able to see as well as hear the program. The sound energy received for a definite program should, therefore, have the accompanying acoustic quality or background necessary to create in the imagination of the listener a mental picture of the action taking place within the studio. This is in effect analogous to transporting the listener to the studio or vice versa.

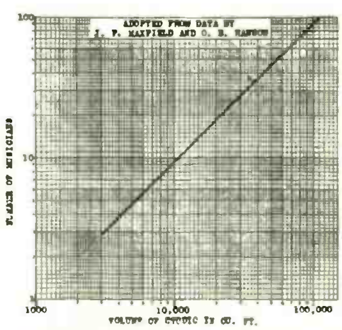

FIG. 1. THE CUBICAL CONTENT OF THE STUDIO LIMITS THE NUMBER OF MUSICIANS THAT MAY BE USED IN A GIVEN ORCHESTRA FOR THE BEST MUSICAL QUALITY.

Aside from the broadcasting theatre, recent developments in electrical transcription comprising improved methods of recording and reproducing of records have aided in bringing to the home large programs having all the characteristics of a stage performance. For psychological, as well as commercial reasons, the smaller program originating within the studio must today impart a similar reaction to the listener. The acoustic problem in studio design should, therefore, be one of providing the best room conditions for monaural pickup and of lending to each type of program the particular acoustic quality with which it would normally be associated.

DISTRIBUTION OF SOUND

The distribution of sound energy within the studio is largely affected by its proportions. It has been found that

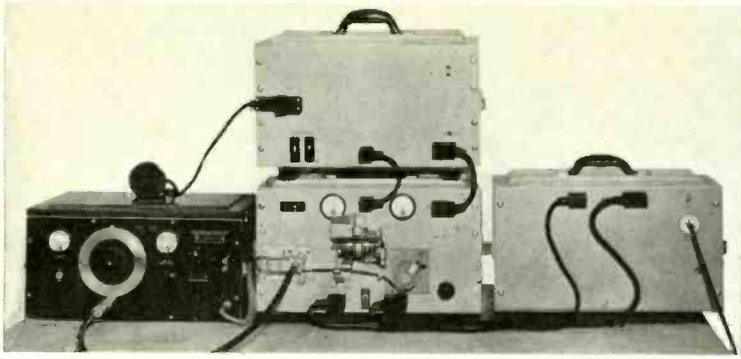

FIG. 2. HIGH-SPEED LEVEL RECORDER.

the best results are generally obtained in studios where the ratio of height to width to length is in the order of 2:3:5, respectively.

From an acoustic standpoint, the cubical content of the studio limits the number of musicians that may be used in a given orchestra for the best musical quality. Fig. 1, which is based on reliable data, shows what might be termed the commercial limits in this respect for good broadcasting practice in studios. The importance of maintaining these accepted limits in actual practice

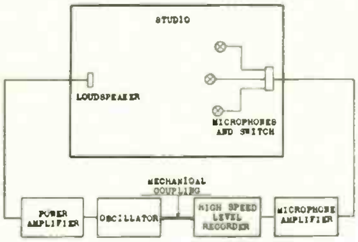

FIG. 3. SCHEMATIC DRAWING OF SETUP FOR STUDIO MEASUREMENT.

cannot be too strongly emphasized. The number of individuals other than performers, which may be present within the studio during presentation of the program, must be kept at a minimum.

REVERBERATION

One of the more common acoustic effects encountered in studios is reverberation caused by the repeated reflection of sound from surface to surface. This is desirable to a certain degree for music, since it lends depth and brilliance to the program. It is also desirable for speech, although to a more moderate degree than for music. It must not, however, be excessive in either case, and must meet the predetermined requirements of the given studio. Aside from reverberation, more complex problems, such as direct and multiple sound reflection as well as general room resonance at certain frequencies, are also encountered, particularly in small studios, and must be corrected for the best result.

It is possible to compute within reasonable limits of accuracy the amount of reverberation present in a given case and the quantity and quality of acoustic treatment required for its proper reduction. Since it is not always possible to completely analyze the more complex conditions by computational methods, it has been necessary to design acoustic instruments with which to measure variations in the decay of sound energy within enclosures.

LEVEL RECORDER

Perhaps the most recent development is the high-speed level recorder designed by the Bell Telephone Laboratories. As the name implies, this instrument is capable of measuring wide variations in sound intensity at a given point within a studio. Fig. 2 shows a photograph of the instrument and associated units. Fig. 3 shows a schematic drawing of the setup for studio measurement. Sound energy at selected frequencies is generated at a predetermined level by the loudspeaker within the studio and, to avoid standing-wave patterns, is varied within a small frequency band by a beat-frequency oscillator. This sound energy is picked up by a single microphone, or by a group of microphones controlled by a rotating switch, amplified and carried to the main unit of the instrument where the changes in intensity are recorded by means of a moving stylus on a waxed paper strip. The waxed paper, as it passes under the stylus, may be varied in three steps of speed ranging from 3/64" to 3" per second. The stylus may also be adjusted to follow changes in intensity varying from 45 to as much as 850 decibels per second.

DECAY RATE

The decay rate of the reverberant energy may be rapid or gradual, depending upon the type and amount of sound absorption present in the studio. Typical curves obtained with the level recorder are shown in Fig. 4. These two examples show the decay of the reverberant sound energy as measured at the same frequency in two different studios. Curve 1 is quite normal in rate of decay, indicating no unusual condition other than a moderate degree of reverberation at the particular frequency in this studio. In Curve 2, however, the irregularity is quite apparent, indicating the presence of multiple sound reflections and room resonance which tend to prolong the rate of decay in this latter studio. From an analysis of such curves taken at selected frequencies over a range from approximately 50 to 8000 cycles per second, it is possible to accurately determine the period of time it takes the sound to decay to the threshold of audibility at each frequency. If this period of decay or time of reverberation is comparatively long at certain frequencies due to reflection or resonant effects, it is borne out by the results with a far greater degree of accuracy than would be possible by computational methods. Typical reverberation characteristics for the full frequency range measured, are shown in Fig. 5.

PREDETERMINATION OF CONDITIONS

This instrument has not only been of inestimable value in the solution of the more complex problems, but has also helped to verify and improve the accuracy of reverberation analysis. A study of considerable measured data on various sizes and shapes of studios has made it possible to predetermine with greater accuracy the acoustic conditions and requirements of similar studios prior to completion of the final plans for design and construction.

In many cases where the older theories have been applied in determining the treatment requirements for studios, computations have been made at one frequency only (512 cps), with little or no consideration being given to the probable requirements at the lower and

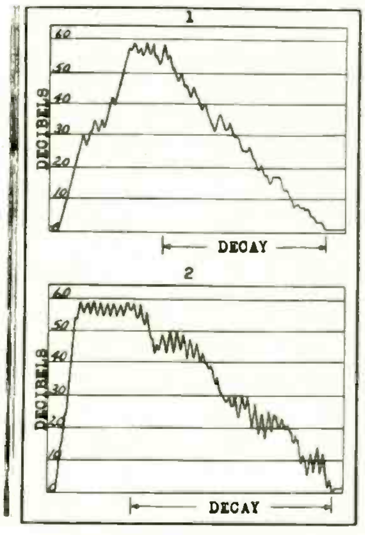

FIG. 4. TYPICAL CURVES OBTAINED WITH THE LEVEL RECORDER.

higher frequencies. On the basis of this inadequate analysis, absorbing materials have been selected and installed having efficiencies considerably in excess or below the requirements at the other frequencies.

ACOUSTIC MATERIALS

Acoustic materials used for sound absorption differ widely with respect to their efficiencies. These materials are principally dependent upon their plastic deformability and porosity for the absorption of sound waves. Plastic deformation affects the absorption of the low frequencies. The porosity of a material affects the absorption of the higher tones, or upper harmonics. Since these properties vary with different types of materials, it is usual for one material to absorb sound waves to a greater degree at one pitch or frequency than another type. This variation in absorption with frequency is a very important consideration in acoustic treatment and has a marked influence on the quality of sound originating within the studio. If, for example, the material used for treatment is particularly selective in absorption at the high frequencies and has little effect on the low frequencies, the bass tones will stand out relative to the higher overtones or harmonics and will produce a noticeable unbalanced effect, particularly for a musical program. This would also affect the quality of speech, producing a "boomy" condition with any increase in distance between the microphone position and the speaker. It is, therefore, of the utmost importance that the sound-absorbing material, or combination of materials, selected for treatment have acoustic efficiencies such as to produce the proper balance of absorption between the low and high frequencies in a given studio.

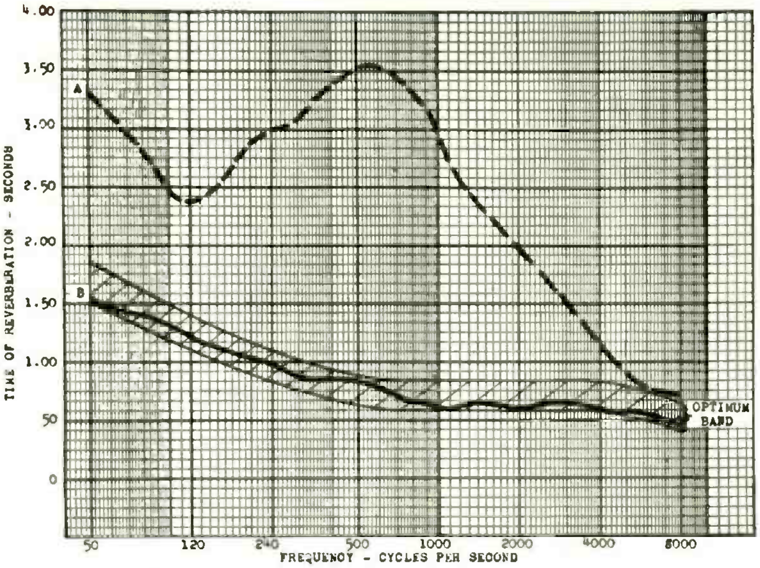

FIG. 5. TYPICAL STUDIO REVERBERATION CHARACTERISTICS.

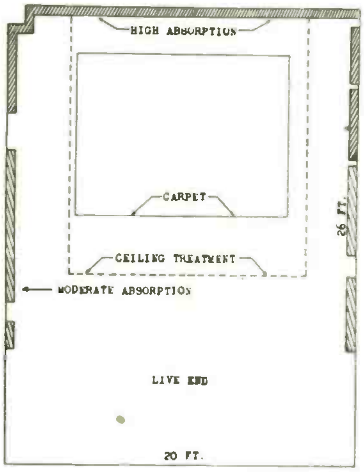

FIG. 6. DISTRIBUTION OF SOUND-ABSORBING MATERIAL IN SMALL STUDIO.

ACOUSTIC TREATMENT

Before selecting definite materials to fulfill the total absorption requirements, it is necessary to determine from an analysis of the shape of the studio and the relation of surfaces to the sound source and microphone, the proper distribution of acoustic treatment. This is important since, under the improved methods of treatment, certain surfaces within the studio will require sound-absorbing materials of high acoustic efficiency, whereas other surfaces will require only moderate absorbents. The efficiencies of these materials of different acoustic characteristics must, when combined, fulfill the total absorption requirements of the studio.

REFLECTING SURFACES

It is quite well established that sound-reflecting surfaces in close proximity to an orchestra or chorus lend depth, brilliance, and tone color to the music. The acoustic conditions under which one listens to direct musical presentation in concert halls or auditoria generally simulates those of live surroundings or reflective surfaces at the sound source and an area of relatively high absorption at the point of listening. The sound absorption at the listening area is contributed by the audience, carpet, seats and, in many cases, acoustic treatment on the surrounding surfaces. This relation between reflective and absorptive areas for direct listening has been accepted by music critics and engineers as approaching ideal conditions for the highest degree of fidelity and most pleasing quality of music. The listener who is accustomed to hearing direct sound under these conditions, will immediately distinguish, in any radio program, a certain lack of depth or acoustic perspective if the studio is not treated in the manner required to lend these characteristics to the program. We must, therefore, strive for quality of reception in broadcasting simulating that which an individual could expect to hear under direct listening conditions.

SURFACE TREATMENT

A careful arrangement of acoustic treatment is required to produce this effect in the limited space afforded by the small studio. The treatment should not be distributed at random over all surfaces, but should be placed mainly on the surfaces adjacent to, and in the immediate vicinity of, the microphone. The surfaces adjacent to the musicians or performers should not in general be treated but should remain sound reflective. The studio technique employed under this method of treatment might

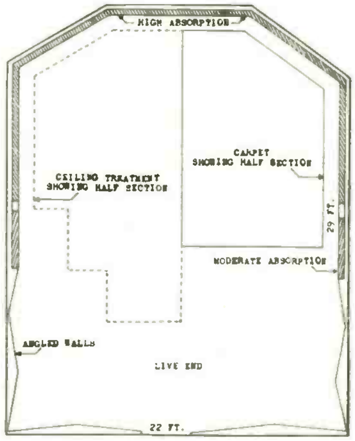

FIG. 7. ANOTHER EXAMPLE OF STUDIO TREATMENT.

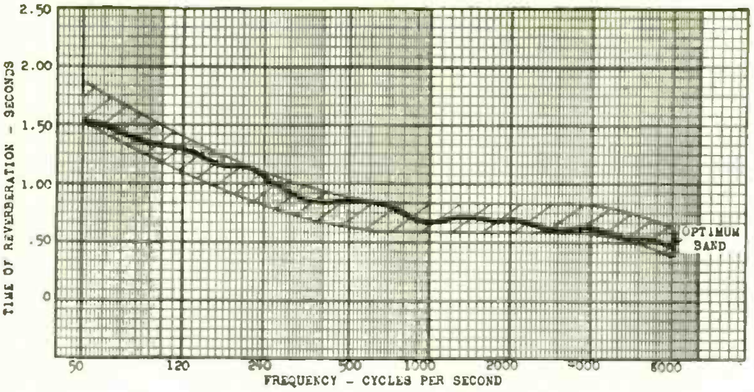

FIG. 8. CHARACTERISTICS OF STUDIO SHOWN IN FIG. 7.

suitably be termed "distant pickup." In other words, the microphone will be located in the treated end of the studio and the performers in the live or reflective end.

For reference, let us assume a rectangular studio with the microphone centered near one end. The other half-section will be considered the live end. The wall surfaces at the rear and rear sides of the microphone will be treated with a highly efficient acoustic material. The intermediate wall surfaces, including those midway between the extremities of the live and treated ends, may require material of moderate sound absorption. Carpet for the floor and acoustic material for the ceiling will be added in the treated end in an amount proportionate to the requirements of the given studio. The walls, ceiling and floor within the live end will generally remain hard smooth surfaces. Where possible, particularly in new construction and re-construction of studios, the walls in the live end should be angled or staggered to avoid multiplicity of sound reflection between opposite surfaces and to further aid in directing the reflected sound toward the treated end. This also applies to the ceiling surface in the extremities of the live end.

CONTROL ROOM LOCATION

The most suitable position for the control room from all standpoints, in a studio treated in this manner, would be at approximately the center point of either side wall, keeping the exposed glass area of the window at a minimum. The moderate sound absorbent generally required at this point would naturally be distributed above and below the window. The glass, generally consisting of two varied thicknesses with an air space between, should be tilted back as much as possible to aid in directing any sound energy reflected at this point, toward the ceiling treatment.

DISTANT PICKUP

The requirements for actual distance between the microphone and the position of the sound source in a studio treated in this manner will vary with the type of program presented. For orchestras of the average size and numbers used in the smaller studios, the musicians should generally be arranged well within the limits of the live end, and the microphone placed at a suitable position toward the extremities of the treated end. This so-called distant pickup should also be maintained, as far as practicable, for grouped vocalists of the usual numbers, as well as for individual instruments and soloists. Dramatic scenes can generally be worked with greater ease in this type of studio.

TWO EXAMPLES

The method of treatment advocated herein may be further clarified by a brief review of two interesting examples from a group of studios for which consulting service in acoustic design was recently rendered. These studios were constructed in an existing office building where space limitation was the predominating factor. In the first of these two examples, the inner walls, ceiling and floor of the studio, which were isolated and of soundproof construction, had been erected prior to consideration for acoustic treatment. Measurements were made in the untreated studio with the instrument previously described. The reverberation frequency characteristic obtained under these conditions is shown as Curve A in Fig. 5. The amounts of absorption required at the various frequencies to adjust this unfavorable characteristic to within accepted optimum limits for a studio of this size and shape were carefully determined. The sound-absorbing materials of various acoustic efficiencies were selected and distributed as shown on plan in Fig. 6. The studio was measured after treatment, and the resulting characteristic is shown as Curve B in Fig. 5. This is within the optimum band or best limits of reverberation time for the studio.

The second example is that of a studio which was acoustically planned prior to construction. All inner surfaces of this studio were also isolated and of soundproof construction. The manner in which treatment was distributed is shown on plan in Fig. 7. The walls and ceiling areas requiring sound-absorbing materials were constructed in such a manner that treatment would be flush with the remaining surfaces, thereby avoiding raised panel effects. As will be noted, the walls within the live end were of angular design. The reverberation frequency characteristic of this studio, as measured after construction and application of acoustic treatment is shown in Fig. 8. The characteristic is compared with the optimum band or best limits of reverberation time for this studio.

CONCLUSION

With careful consideration to the present, as well as probable future aspects of radio broadcasting, it is the authors' firm belief that the method of treatment described herein will more nearly fulfill all the acoustic requirements. Aside from heightening the acoustic perspective and improving sound quality and illusion, it is frequently possible with the proper positioning of the microphone for orchestra pickup, to produce the effect of a larger number of instruments than actually employed. This is often advantageous to certain types of programs. Musical selections are also rendered with greater ease and naturalness where this method of treatment is employed, thus largely overcoming the unfavorable reaction of many musicians and vocalists to the dead surroundings frequently encountered in studios.

Acoustics should be the primary consideration in the design or alteration of studios. Organizations should obtain competent and reliable advice on this phase of the problem, in order that their studios may be accurately designed to function as a definitely efficient part of the broadcasting system.

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TELEPHONE BROADCASTING

TELEPHONE BROADCASTING was introduced in Switzerland at the end of 1931 and the distribution is entirely in the hands of the Swiss Federal Telegraph and Telephone Administration, the telegraph and telephone services being public monopolies.

This type of transmission has been quite popular in Switzerland as the reception is very clear and free from static and atmospheric disturbances from which wireless radio particularly suffers, especially in the cities. The "wired" wireless, while not comparable in use with the regular radio, is increasing quite rapidly. The charge for this service is 36 francs a year, as compared with 15 francs for the regular radio. (*Electrical Division, Department of Commerce.*)

PROGRAM CIRCUIT EQUALIZERS

By N. J. OMAN
Audio Engineer
KENYON TRANSFORMER CO., INC.

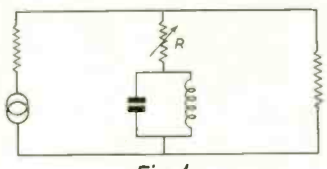


Fig. 1

EQUALIZATION BY MEANS OF A PARALLEL TUNED CIRCUIT.

THE PROBLEM OF program circuit equalization is one frequently confronting those who operate broadcast stations. Quite often little is known of the frequency characteristic it is desired to alter except that perhaps it is lacking in high or low frequencies.

FLEXIBILITY REQUIRED

For this reason it is desirable to have available equalizers that are extremely flexible so that they may be placed in the circuit and the character and amount of equalization changed easily and rapidly so that the results may be judged with some degree of accuracy by listening tests. The conventional manner by means of which equalization is effected is by bridging across the line a parallel tuned circuit whose resonance occurs in the frequency spectrum needing reinforcement. See Fig. 1.

The degree of equalization is controlled by a resistance, R, in series with one side of the line and the parallel tuned circuit. Generally both the inductance and the capacity of the tuned circuit are variable, making it possible to change both the point of resonance of the combination and the shape of the resonance curve. It has been found practical to add to this equalizer another parallel tuned circuit in series with the above-mentioned circuit elements for the low-frequency equalization, making it possible to reinforce both high and low frequencies simultaneously.

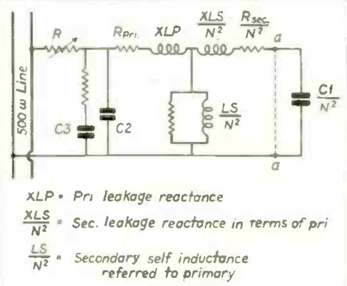


Fig. 2

FOR HIGH-FREQUENCY EQUALIZATION, SHORT CIRCUIT a..a; CONNECT C-2 ON PRI. OF A VALUE TO RESONATE WITH LEAKAGE REACTANCE AT 5 KC TO 8 KC. THIS GIVES THE SAME CIRCUIT AS FIG. 1. FOR LOW- AND HIGH-FREQUENCY EQUALIZATION, REMOVE SHORT CIRCUIT ON SECONDARY a..a C-1 IS OF A VALUE TO TUNE WITH SECONDARY SELF-INDUCTANCE TO THE DESIRED LOW FREQUENCY.

SPECIAL EQUALIZER

An interesting equalizer of this sort has been constructed using a transformer to furnish the inductance elements. The unit has two windings. One is of the desired inductance to work across the line to be equalized. The other winding is high in impedance. The equivalent diagram of the unit is illustrated in Fig. 2. All constants refer to line impedance.

At low frequencies, leakage may be neglected and the circuit is the familiar parallel tuned circuit. At high frequencies the performance is the same as for high-frequency equalization, for at those frequencies the impedance of C-1 approaches the short circuit of a......a used for high-frequency equalization only.

For low-frequency equalization, only the circuit is the same as for low- and high-frequency equalization, except that the condenser C-2 is replaced by a resistance and C-3, which should be of proper value to prevent the building up of any high-frequency resonance. The performance curves of a commercial unit of this type are shown in Fig. 3.

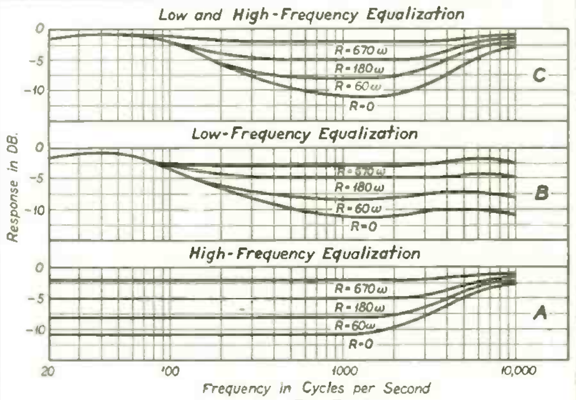


Fig. 3

PERFORMANCE CURVES OF A COMMERCIAL UNIT FOR EQUALIZATION.

PRECAUTIONS

In using such equalizers, it is necessary to exercise some caution to be certain that the variable impedance of the equalizers does not affect the response of associated equipment. For example, let us consider the effect of fluctuating impedance on the frequency response of a line-to-grid transformer. In order to get a flat response to a reasonably high frequency and at the same time develop maximum secondary impedance for the frequency range to be covered, it is necessary to resort to leakage-reactance tuning. Now, when the primary or source of impedance, multiplied by the impedance ratio of the transformer, is equal in magnitude at resonance to the impedance of the leakage reactance, as measured on the transformer secondary, and the sum of the tube and transformer capacity, there will be neither a peak nor a dip in the frequency response at this point. See Fig. 4.

As the three impedances are in series

(*Continued on page* 17)

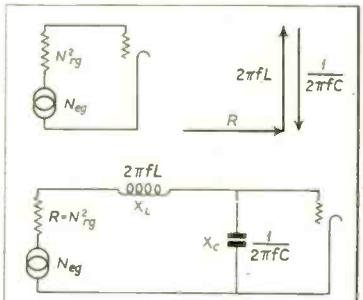
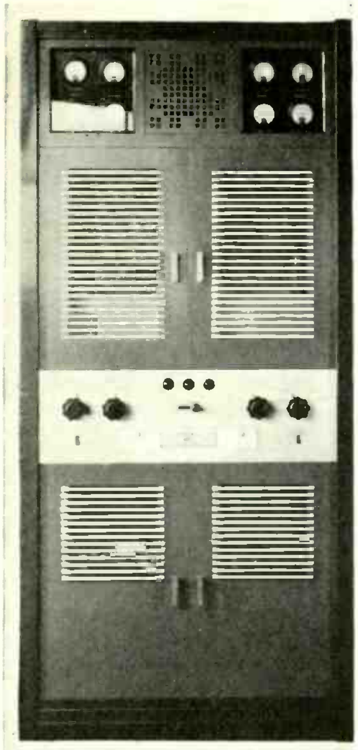


Fig. 4

REPRESENTATIVE CIRCUIT FUNCTIONS.



BROADCAST

By JOHN P. TAYLOR

THE 100-/250-WATT TRANSMITTER-EXCITER, THE FIRST OF A COMPLETE NEW LINE OF HIGH-FIDELITY TRANSMITTERS.

PART I: A UNIVERSAL LOW-POWER TRANSMITTER AND EXCITER UNIT

WITH THE RECENT announcement of a new five-kilowatt model—the third model of an eventually complete line—what may be aptly termed as a new generation of broadcast transmitters begins to take definite shape. Aside from their striking appearance and construction—in which the demarcation from old-style transmitters is most obvious—these new transmitters are of interest to engineers for several reasons, outstanding of which are: First, the attention given to specific high-fidelity requirements and, second, the integrated design idea which is emphasized throughout the four models of which this line is composed.

The first of these reasons has been widely noted and discussed, but the second, which is of at least equal importance, has not been fully appreciated—probably because the first three models were announced at different times and the relation between them only briefly indicated. As a matter of fact, all four models were planned simultaneously and designed not only so that they would match in appearance, but also so that the electrical circuits would be co-ordinated throughout. The exciter unit, for instance, is identical in all models—and, with very minor changes, also doubles as the low-power transmitter. The other units not only match the exciter in size and appearance, but also in circuit design so that in the higher-power transmitters—in which several units are combined—there is no waste of power and no duplication of equipment.

In the description which follows these units are considered both separately and with relation to each other—particularly with reference to the effect of this integrated design on the attainment of high fidelity. However, before this description, a word about the economics of this "planned production."

COST CONSIDERATIONS

Broadcast transmitters of standard manufacture usually seem high-priced; or at least they do to broadcasters not familiar with the production problem involved. To those acquainted with the situation, the reason for this has always been fairly evident; namely, the small quantities in which such transmitters have perforce been manufactured. Thus, in recent years the number of transmitters produced of any one design has seldom exceeded twenty, and the average number per design has been about fifteen. Most transmitters are, of course, custom built, and probably will continue to be so regardless of quantity, so that no important saving in material and labor costs would be occasioned by increased production.

However, the situation with regard to development and design costs is distinctly different. Such costs are practically fixed; that is, they are independent of the number of units produced. Hence, the per-unit share of these fixed costs decreases rapidly as the total number of units produced is increased. When it is considered that, for small quantities, these fixed costs may be as much as fifty percent of the total, it is obvious that overall transmitter costs can be decreased considerably by even moderate increase in quantity.

It is precisely at this point that one of the important advantages of unit construction becomes evident, for, since these units are employed in several different transmitter models, the number of them produced is considerably greater than would be the case if each transmitter model were entirely different in design.

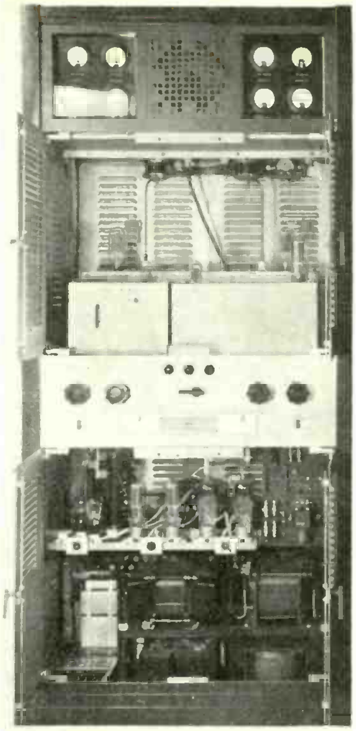
This is particularly true of the exciter unit of which there must, of course, be as many as the total number of transmitters of all models. In the case of the transmitters described here, the saving effected by this increase in quantities has been sufficient not only to offset increased manufacturing costs and added costs occasioned by the necessity of meeting high-fidelity requirements, but also, in the case of most of the models, to actually effect price reductions in the face of influences which would otherwise have almost certainly necessitated increases.

THE 100-/250-WATT TRANSMITTER-EXCITER

One of the most immediate, as well as one of the most interesting, results of the integrated design of these new transmitters is to be seen in the low-power, or the 100-/250-watt model. Since, requirements such as frequency stability are independent of power, smaller transmitters have always been disproportionately costly. Thus, transmitter costs have generally been about proportional to the square root of the power. Since transmitter effectiveness is also generally considered about proportional to the square root of the power, this ratio of transmitter costs seemed in a sense justifiable. Unfortunately, however, this has usually operated to the detriment of low-power stations because manufacturers—realizing that low-powered transmitters were sold on a price, rather

TRANSMITTERS

UP-TO-DATE



FRONT VIEW OF THE TRANSMITTER-EXCITER UNIT WITH THE DOORS OPEN SHOWING THE INDIVIDUALLY-SHIELDED, RADIO-FREQUENCY STAGES, THE CUSHIONED MOUNTING OF THE AUDIO STAGES AND OTHER CONSTRUCTIONAL DETAILS.

than a quality, basis—were forced to skimp on quality in order to meet competitive prices.

In the case of the low-power transmitter described here it was absolutely necessary that quality and fidelity be of the highest order, inasmuch as this same unit was also to be used as the exciter of higher-power transmitters designed for stations in which the highest quality was an absolute prerequisite. As a result of these multiple requirements, low-power stations benefit by having made available for their use a transmitter which assures that a power increase in the future will not require junking of the already installed equipment.

MECHANICAL CONSTRUCTION

Two views of the 100-/250-watt transmitter-exciter, the first unit of this new line of transmitters, are shown. As will be noted, the equipment is completely contained in what might be styled a locker-type cabinet. The cabinet in this instance is 84 inches high, 37½ inches wide and 26½ inches deep. Other units (which will be described later) have the same front dimensions, although the high-power units are of necessity of greater depth.

It is interesting to note that this new type of construction represents the fourth major type in the evolution of transmitter construction. The first, of course, was the original bread-board design. The second was what might be called the composite design in which components were variously mounted in a more or less open pipe framework. The third was the recently used, but now obsolete, construction of angular frames and flat panels. In the fourth, as typified by the transmitter described here, the self-contained idea is carried one step further.

However, it will be noted that in the latter case greater compactness has been obtained without further sacrifice of accessibility. In fact, the accessibility of all parts which for any reason may have to be serviced is very much greater than in the previous design type. This follows partly from the greater attention given to the more sensible arrangement of components and partly from the large doors which open the whole back and almost the whole front of the transmitter. And, incidentally, these doors are secured with instantly released catches.

The details of the construction of this unit are well shown in the views and need hardly be repeated. However, one feature, namely, the concentration of all controls on a single relatively small panel, is worthy of added note. In older-type transmitters, condensers and other variable tuning elements had to be rigidly coupled to controls on the panel. The mechanical limitations thus imposed often necessitated these tuning elements being placed at positions other than those most desirable from a standpoint of efficiency in the radio-frequency circuit. In the 100-/250-watt transmitter shown here, as well as in the other transmitters of this line, this has been overcome by utilizing flexible "dental cable" as a means of coupling. This novel arrangement makes it possible to mount all variable condensers and inductors in position allowing the shortest possible connections, and to group all tuning controls on a single small panel. This panel is inset and the recess provided with a cover plate. After initial adjustment the cover plate may be placed in position, thus removing the tuning controls from view and eliminating all possibility of the transmitter being inadvertently detuned.

A word might also be said with regard to the appearance, since every engineer is, or should be, concerned with having his station present the most pleasing and business-like appearance possible. And it might be noted here that in a show business, such as broadcasting definitely is, the commercial importance of a good appearance can hardly be over-stated. In the transmitter shown the modern note has been emphasized. The general design, following suggestions by a noted artist, conforms throughout to the best concepts of dynamic symmetry. The meters, like the tuning controls, are grouped on inset panels and all of these panels, together with the doors, are carefully proportioned. The transmitter cabinet is finished in shades of black and gray while the control panel is of white metal.

ELECTRICAL DESIGN

In electrical design this transmitter is perhaps more noteworthy for perfection of detail and flexibility than for any particular innovation. However, such distinctly up-to-date features as Class B modulation, V-cut crystals, and ac operation are, of course, incorporated.

The general layout of circuits is indicated in Fig. 1. Carrier frequency is generated by an 843 utilized in an improved crystal-oscillator circuit. Features of this circuit are the provision of a vernier condenser for minute adjustments of frequency and the use of a V-cut crystal. The latter, which has a temperature coefficient only a fraction of that of the X- and Y-cut crystals formerly used, is a very recent development. It makes possible closer frequency control with less complicated temperature-control circuits. The crystal-oscillator circuits are provided in duplicate (only one is shown in the schematic diagram) and are mounted as a single unit with a selector switch so that either circuit may be used without changing any connections—or occasioning any loss of time necessary for interchanging units.

The oscillator is followed by a buffer amplifier utilizing an 865, and this by an intermediate amplifier employing a single 203-A which in turn drives the power amplifier. The latter consists of a pair of 203-A's in push-pull when the unit is used as a 100-watt transmitter or as an exciter, and of four 203-A's in multiple push-pull when used as a 250-watt or 100-/250-watt transmitter.

All of these radio-frequency stages are operated Class C and are self-biased (current-limiting devices being provided). Each stage is separately shielded and all controls, including neutralizing, are brought out to the control panel. This is an arrangement which simplifies adjustments and improves stability.

The audio circuits are operated push-pull in order to minimize hum introduction. The input stage employs four 843's in push-pull parallel, Class A. These are operated Class A to insure the good regulation necessary to correctly drive the modulated stage. The latter consists of two 203-A's in push-pull, Class B, transformer-coupled to the plate circuit of the last radio-frequency stage. For 100-watt operation only two 843's are used in the first audio stage and the modulator is changed to two 845's operated Class A. The arrangement used when the unit is employed as an exciter will be described later.

The flexibility of these circuits is well worthy of note. As has been indicated, the power amplifier as well as the two audio stages provide of alternative tube complements. In each instance the maximum number of required sockets are provided and wired. Only minor changes in voltages are required in converting from one type of operation to another. At the most the unnecessary equipment consists of four sockets and in no case is there any power waste or circuit inefficiency.

AC OPERATION

The 100-/250-watt transmitter, as well as the other transmitters of this line, are completely ac operated. Plate voltages for all the tubes in this unit are furnished by a rectifier employing two 872's in a single-phase, full-wave circuit. A 250-volt dry-rectifier furnishes plate voltage for the oscillator and bias voltage for the modulators, while all other stages are self-biased.

Advantages of all ac operation will appeal to nearly all engineers. There are no generators, no batteries, no starter, or other auxiliaries. Another direct advantage is that all voltages may be adjusted by a single front-of-the-panel control.

Starting controls include two switches, one for filament and bias (and oscillator plate), the other for amplifier plate voltages. A time-delay relay prevents the latter being applied until the filaments have been properly warmed. When the plate-voltage switch is left in

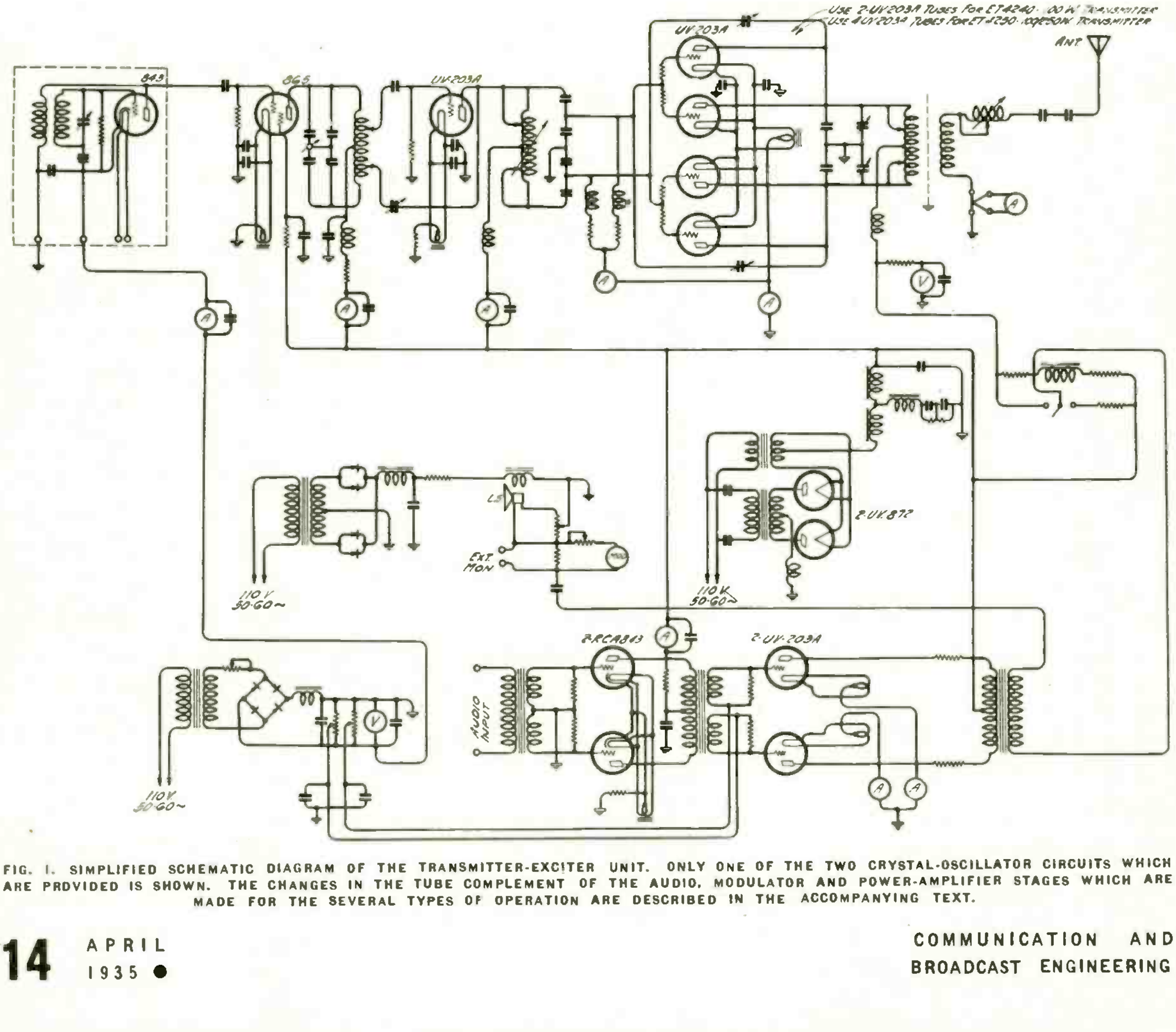


FIG. 1. SIMPLIFIED SCHEMATIC DIAGRAM OF THE TRANSMITTER-EXCITER UNIT. ONLY ONE OF THE TWO CRYSTAL-OSCILLATOR CIRCUITS WHICH ARE PROVIDED IS SHOWN. THE CHANGES IN THE TUBE COMPLEMENT OF THE AUDIO, MODULATOR AND POWER-AMPLIFIER STAGES WHICH ARE MADE FOR THE SEVERAL TYPES OF OPERATION ARE DESCRIBED IN THE ACCOMPANYING TEXT.

the "on" position, single-button automatic starting is provided.

Metering facilities include eight separate meters grouped on two tilted indirectly-illuminated panels. Two of these meters may be switched into any one of four positions in the circuit so that, in all, a total of fourteen metering positions are provided. All plate currents and plate voltages may be read, as well as line voltage, tank current, antenna current, and percentage modulation.

"HIGH FIDELITY"

The recent introduction of high-fidelity receivers has emphasized the desirability of greater fidelity in broadcast transmitters. Unfortunately the phrase "high fidelity" has been much abused and often incorrectly applied to equipment in which but one or two of the factors affecting fidelity have been given adequate consideration. True fidelity is obtained only when reproduction is possible which neither subtracts from nor adds to the original, and when the usable volume range is equal to the full dynamic range of the original. This requires, first, a uniform frequency characteristic—so that nothing will be lost from the original; second, negligible distortion—so that nothing will be added to the original; and third, a low background and hum level—so that a reasonable range (equal to average requirements) can be accommodated between minimum and maximum usable levels. The specific performance characteristics necessary to insure reasonable accomplishment of this have been analyzed* and standards for "high-fidelity" set up.

The complete line of transmitters referred to here have been designed with special regard to these standards and special development and test work carried out to insure that they would exceed the minimum requirements by a margin sufficient to guarantee high-fidelity operation even under conditions falling somewhat short of optimum adjustment. The specifications of the 100-/250-watt transmitter-exciter described here include: (a), a frequency characteristic flat within 2 db over the range of 30 to 10,000 cycles; (b), a background noise level 60 db below 100 percent modulation level, and (c), audio harmonic content less than 4 percent with all harmonics arithmetically added at any modulation level up to 95 percent. Actual measurements show that the distortion, under the least favorable operating conditions, is considerably less than 4 percent and that the distortion of the unit when operated as an exciter is less than 2 percent. This latter is particularly important as all high-fidelity requirements must, of course, be overall requirements and hence the characteristics of each unit of a high-power transmitter consisting of several units in tandem must be considerably better than the overall requirements, since factors such as distortion are additive.

*"The Specific Transmitter Performance Required for High Fidelity," by L. F. Jones, *Broadcast News*, February, 1935.

BOOK REVIEW

TELEVISION: TO-DAY AND TO-MORROW, by Sydney A. Moseley and H. J. Barton Chapple, published by Sir Isaac Pitman and Sons, Ltd., London, England (U. S. Representative, Pitman Publishing Corp., 2 West 45 Street, New York, N. Y.), fourth edition. 205 pages, cloth covers, price $2.50.

Probably the most satisfactory way to begin a review of *Television: To-day and To-morrow* is to quote from its introduction by Sydney A. Moseley:

"To many wireless experts some of the points included here may appear elementary, but I am providing for the reader whose knowledge of the technical side of television is limited.

"I ought to add that I started out to write a piquant history of television as I knew it first hand, but the subject has grown out of hand.

"I found history was being made even as I wrote.

"On the top of this came the publication of certain books on television (1930), written by Americans and published by English houses who were not, apparently, aware of the incomplete nature of their knowledge of the subject.

"It was also very evident from these works that only the American side of television was stressed, and an altogether insufficient tribute was given to the man who had done more for television than any of his contemporaries. It is only meet, therefore, that we should balance matters by telling the story of the progress of Baird television, and give in the simplest language possible an explanation of 'how the thing is done.' "

Chapter I covers the history of television from the time of its fundamental invention, namely, Nipkow's scanning method that made use of the spiral disc, up to and including the use of the cathode-ray tube and ultra-high frequencies.

Chapter II, entitled "The General Details," begins with a definition of television. Next comes a consideration of the relationship existing between aural broadcasting and transmission and reception of television. The rest of this chapter is broken up into the following divisions: Conveying Complete Intelligence, The Work of the Photoelectric Cell, a Process of Conversion, Forming a Picture, The Picture Canvas, Creating Form from Strips of Light, and The Co-operation of Amateurs Needed.

The next two chapters are entitled The Baird Television Transmitters and "Televisor" Receivers, respectively. Each of these chapters covers about 20 pages.

Synchronization, one of the most important phases of television, is considered next. Two methods are discussed. The first system makes use of a part of the picture signal which is, most naturally, the scanning frequency. The second method is known as the "Magnetic Toothed Wheel System." According to the authors the latter method is by far the better of the two and is, also, much simpler.

Chapter VI deals with the photoelectric cell and neon tube from the standpoint of their use in television.

The subject of television receivers is the next to receive attention. This is followed by Tele-Cinema and Tele-Talkies in Chapter VIII. Chapter IX covers the work done by Baird in utilizing ultra-violet and infra-red rays in television apparatus, the subject being labeled as Noctovision.

Daylight Television and Phonovision, Color and Stereoscopic Television, Screen Television, and Ultra-Short Waves and Cathode-Ray Tubes are the titles of Chapters X, XI, XII, and XIII, respectively; while the last chapter is devoted to a review of television in other countries.

Television: To-day and To-morrow is a well-illustrated book, there being some 56 figures and 73 plates, and has been found to be quite readable. For the purpose for which it is intended it is to be recommended.

MAINTAINING AND MEASURING TRANSMITTER FREQUENCY

Part II--Frequency Maintenance

By VICTOR J. ANDREW, Ph.D.
Chief Engineer,
DOOLITTLE & FALKNOR, INC.

IN PART I we described several circuit elements involved in frequency control. They are oscillator, amplifier, buffer amplifier, mixer (detector), frequency multiplier, and frequency divider. We will now examine some complete radio systems in terms of these elements.

In the more complicated systems, numerous amplifiers and buffer amplifiers are omitted, since we are primarily interested in the various frequency changers.

In Fig. 3 we have a typical circuit of a broadcast transmitter, where no frequency changes are involved. The frequency generated in the oscillator passes successively through the buffer amplifier and amplifiers (1) and (2), then to the antenna. Along each line joining successive elements is shown the frequency which passes between the adjacent elements.

FREQUENCY DOUBLING

A circuit commonly used in amateur transmitters is shown in Fig. 4. The frequency is doubled twice in frequency multipliers (1) and (2) between the oscillator and the final amplifier. Straight amplification is not used because it would require an oscillator at the operating frequency of the transmitter, which would use a crystal so thin that it would lack sufficient strength to withstand vibration without breaking. Doubling, tripling, and various combinations of these are used in high-frequency transmitters. Multiplication by more than three is not common because the higher harmonics are so much weaker that too great amplification would be required.

CONTROLLED OSCILLATORS

The circuit in Fig. 5 uses a controlled oscillator for the purpose of obtaining very large power gain with a limited number of tubes. No frequency changes are involved. A piezoelectric oscillator generating one watt is operated through a buffer into a controlled oscillator which generates 1,000 watts, but which has its frequency controlled by the one-watt oscillator.

Another use for the controlled oscillator is shown in Fig. 6. Here a large power gain is needed because the controlling signal is a high harmonic and consequently has very small amplitude. The piezoelectric oscillator has an output of 3 watts at its fundamental. The frequency multiplier produces in the order of 0.0001 watt in its 20th harmonic, but this is sufficient to control the frequency of an oscillator generating 2 watts.

These circuits using controlled oscillators require somewhat different adjustment procedures than the usual nonregenerative amplifiers, and will continue to deliver a signal off frequency under circumstances which would cause an amplified signal to diminish or disappear. For these reasons controlled oscillators are not desirable for certain services.

SYNCHRONIZED TRANSMISSIONS

When two or more transmitters at different locations are synchronized to operate on exactly the same frequency, the controlling circuits become quite complicated. Fig. 7 shows one method which is used for this purpose. A 4,000-cycle standard frequency is ob-

TYPICAL TRANSMITTER CIRCUITS

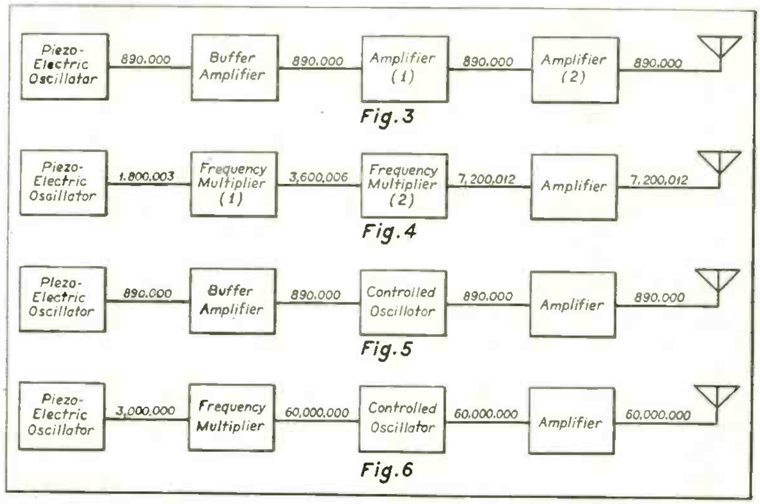
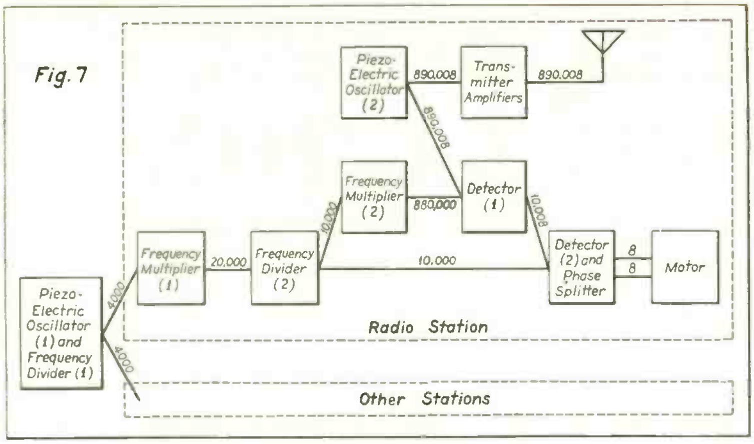


FIG. 3. TYPICAL BROADCAST TRANSMITTER CIRCUIT. FIG. 4. TYPICAL AMATEUR TRANSMITTER CIRCUIT. FIG. 5. USE OF CONTROLLED OSCILLATOR FOR LARGE POWER GAIN. FIG. 6. USE OF CONTROLLED OSCILLATOR IN FREQUENCY MULTIPLICATION.



SYNCHRONIZATION OF SEVERAL TRANSMITTERS ON ONE FREQUENCY.

tained from a precision laboratory. The frequency-producing equipment, not shown in detail, consists of a piezoelectric oscillator (1) and frequency dividers (1) to produce 4,000 cycles. This frequency is chosen to transmit from the laboratory to the stations because it is as high as can be satisfactorily sent over ordinary telephone circuits.

When the 4,000 cycles arrives in each radio station, it is converted into 10,000 cycles by multiplying (1) by 5 and by dividing (2) by 2. The 10,000 cycles is then multiplied (2) by 88 to obtain a frequency 10,000 cycles below the assigned frequency of the transmitter. Next, a beat between the 880,000-cycle standard frequency and the transmitter oscillator (2) is obtained in detector (1). This beat is exactly 10,000 cycles if the transmitter is on its assigned frequency, or is 10,008 when the transmitter is 8 cycles above its assigned frequency. By beating the 10,008 cycles against the standard 10,000 cycles in detector (2), an 8-cycle signal is obtained. This is produced as a two-phase circuit by suitable circuits, and is used to drive a synchronous motor. The two phases are necessary in order to distinguish whether the transmitter is above or below its assigned frequency. The motor which is driven by the 8-cycle beat turns a variable condenser in the transmitter oscillator (2). When the transmitter frequency has been changed by 8 cycles, the frequency to the motor falls to zero and the motor stops, leaving the transmitter exactly on frequency.

ADVANTAGE OF SYSTEM

While it would be simpler to obtain the transmitter frequency from the standard signal and amplify it in the transmitter, this method would allow the transmitter to stop if the standard signal were interrupted. In the method shown, the transmitter remains at its previous frequency as precisely as possible with a piezoelectric oscillator (2). While lengthy interruptions of the standard are not frequent, momentary disturbances, even single clicks, would have a disastrous effect in the simpler method mentioned.

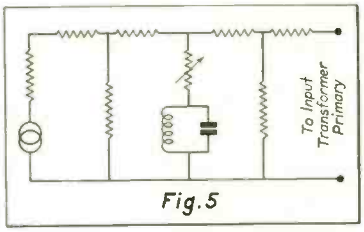
The deviation of 8 cycles used as an illustration is many times greater than actually occurs with this system.

(To be continued)

CIRCUIT EQUALIZERS

(*Continued from page* 11)

and equal in magnitude, equal voltages appear across each, and the voltage across the capacity, or the voltage between grid and cathode, is the same as



THE USE OF PADS IN AN EQUALIZER CIRCUIT.

would exist at some lower frequency where leakage and capacity might be neglected.

USE OF PAD

Now let it be assumed that the primary is fed by some impedance lower than the value intended. The resultant transformer frequency characteristic will be peaked at the high-frequency resonance point. This condition would exist with low-frequency equalization. The result would be high- and low-frequency equalization whether it were desired or not. To remove this difficulty, a pad should be placed between the equalizer and the input transformer to isolate the impedance fluctuations of the equalizer from the transformer primary. A pad should also be used before the equalizer to prevent distortion caused by working the tubes of the preceding equipment into a plate load lower than that which is optimum for maximum power output with minimum distortion. See Fig. 5.

This type of distortion is most noticeable with high-frequency equalizers which present a low impedance to the source of power at low frequencies where the voltage amplitudes of the signal are greatest.

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TRANSATLANTIC RADIO TELEPHONE IMPROVED

HOW AN ANTENNA can be aimed into a beam of radio waves and made to select a single component was described by Messrs. E. Bruce and A. C. Beck, engineers of the Bell Telephone Laboratories, at a meeting of the Institute of Radio Engineers, April 3, 1935, at the Engineering Building, New York. In their passage over long distances short radio waves are separated into several beams which often interfere with each other and cause fading. These separate beams result from the many reflections between the earth and the electrified layers of the upper atmosphere, which the radio wave experiences as it is being transmitted from the sending to the receiving station. This splits the original wave into a number of separate components which arrive at the receiving station at slightly different times and from somewhat different directions. If only one of the several components is picked up fading can be very much reduced. Experiments which Messrs. Bruce and Beck have made show that by using an adjustable antenna it is possible to segregate one of the beams from the rest and thus improve the clarity of reception. The antenna used consisted of single strands of wire connected in the form of a diamond 600 feet on a side. The method is not applicable to home radio because a very large antenna is required, but it will improve transatlantic radio-telephone reception and be of benefit to the radio enthusiast who listens to programs which are rebroadcast by local stations after having been received by a steerable antenna from some over-sea station.

CONTROLLING OVER-MODULATION

By P. S. GATES
Chief Engineer
GATES RADIO & SUPPLY CO.

● A SYSTEM OF AUTOMATIC CONTROL FOR PREVENTION OF OVER-MODULATION, USING CLASS B AMPLIFIER AND RELAYS

THE DESIRE TO prevent over-modulation is, of course, one of foremost prominence in modern radio broadcasting. Every broadcast engineer knows that distortion, broadness and sideband disturbances result from over-modulation, and as a result, nearly every engineer keeps the average program level at a point between 75 and 80 percent modulation, so that crescendos and sudden peaks will not exceed 100 percent modulation at any time.

The broadcast engineer of today is to be complimented on the fact that in very few cases has over-modulation prevailed knowingly. He has insisted on cathode-ray equipment or meters to make sure of this point.

MODULATION AND AVC

In radio receivers, we have automatic volume controls to act primarily as a medium against fading. In broadcasting we have, however, the old and fairly reliable manually-operated gain control. Needless to say, the extreme problems in constant level do not exist in broadcasting that do in a radio receiver, but at the same time it does seem that some automatic method should prevail in the modern broadcast plant to prevent a sudden increase in the program level in causing over-modulation before the engineer can reach the gain control. In the larger stations, where the program is monitored both at the studio and the transmitter, the danger of not observing an increase in program level is slight, but even the most accurate monitoring is subject to error. The smaller station, usually having only one operator on duty, will appreciate some device that would operate automatically to positively prevent over-modulation, not by a visual indicator, but by a method of reducing the gain of the amplifier to a point of 100 percent modulation or less, automatically.

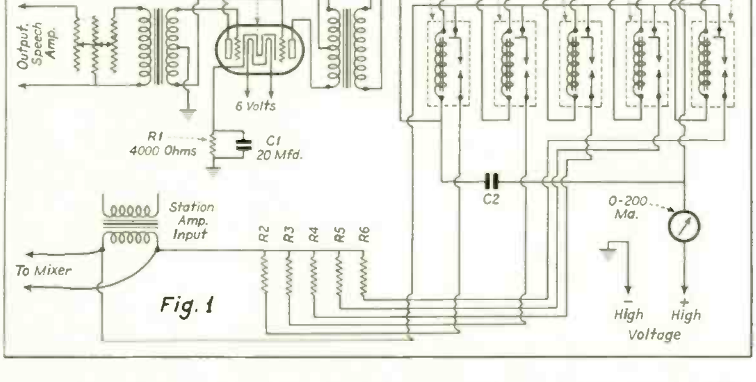

DIAGRAM OF AUTOMATIC OVER-MODULATION CONTROL. THE VALUES OF R-2 TO R-6 ARE DEPENDENT ON THE AMPLIFIER INPUT IMPEDANCE.

OVER-MODULATION

Many times the control operator has switched to a remote point where a husky announcer was yelling at the top of his voice about a fifty-yard run around left end, and sending all meters on the transmitter to the peg. Yes, and many an operator today is wearing a wig because some soprano, with a plus 200-db voice, tried to force the microphone half-way up the antenna lead-in. In both cases there was tremendous over-modulation, which may have awakened the baby in Mrs. Jones' home or jarred the voice coil loose on Mr. Listener's new radio.

All of these things border slightly on the ridiculous, but it must be realized that at least 50 percent of the automatic volume controls in receivers are there in name only, especially in off-brand sets, and there are lots of them. Moreover, avc, or no avc, over-modulation ruins program quality. So the broadcaster should do something to prevent these sudden bursts of volume or excessive audio peaks from leaving the station. It is agreed that the human hand is not quick enough to get to the gain control in time to prevent them, especially if the operator is busy typing his log, etc.

MEANS OF PREVENTION

In broadcasting we must have a more positive method of automatic volume control than in receiving. The idea of a relay closing with a given amount of current passing through it is well known and relays are already in use as circuit breakers in general electrical applications, everywhere.

Since the advent of the photoelectric cell, relay manufacturers have devoted a great deal of time and research to the perfection of relays which will close at a low current with minimum chatter, which makes their application ideal for the automatic volume control or "prevention of over-modulation."

The circuit diagram of Fig. 1 illustrates the principle of the automatic control. The actual method of construction is optional and several combinations can be used as far as tube complement is concerned. The 6A6 tube has been shown because most stations have either 6 volts ac or dc to light tube filaments, but a 19, a pair of 12A's, or any similar low-current Class B tube may be used. The plate supply, like that for all Class B service, must be such that the voltage will be constant within 5 percent between minimum and maximum plate load of the tube (Fig. 2).

PRINCIPLE OF OPERATION

The principle simply is that as the volume increases in the station amplifier, the current drain increases in the Class B stage, as the Class B stage is bridged across the output of the station amplifier: and, of course, when the current drain reaches a certain point in the Class B stage. Relay No. 1 will close.

Now the static current of the 6A6 tube is about 17 ma per plate, or 34 ma for the tube. The pad across the input of the Class B stage should be adjusted so that at the normal program volume of the station amplifier, the plate current of the 6A6 tube will not exceed the static amount, or in other words, there will be no plate swing. Now Relay No. 1 is designed to close at 40 ma; Relay No. 2 at 45 ma; Relay No. 3 at 50 ma; Relay No. 4 at 55 ma: and Relay No. 5 at 60 ma.

Now to each of these relays is connected a resistor, the exact value depending, of course, on the input impedance of the station amplifier. We can even have a sixth relay which, when closed, will create a direct shunt across the input. Obviously, this relay would close at about 80 ma. As an example, we will say the input impedance is 200 ohms. Let us then fasten to Relay No. 1 a 150-ohm resistor; to No. 2 a 125-ohm resistor, and so on down, in 25-ohm steps, to a direct short if Relay No. 6 is added. These resistor values are merely examples and do not represent the true values, as they would again depend on the position of the master gain control on the station amplifier for normal program level.

Each of the resistors is so arranged, as shown in the circuit diagram, that they parallel the input line of the station amplifier when the relay closes.

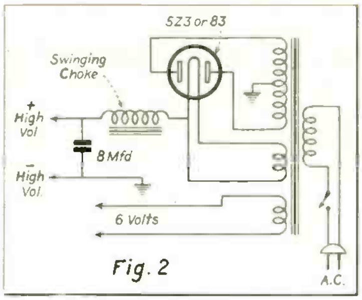

DIAGRAM OF SUITABLE POWER-SUPPLY FOR THE AUTOMATIC OVER-MODULATION CONTROL.

OPERATING PROCEDURE

Now with the pad at the input of the Class B amplifier adjusted so that there is no plate swing in the 6A6 tube at average program level, let us say that Madam Screecho is introduced. She opens up her solo quite conservatively and Mr. Operator proceeds to type his log or take meter readings, unaware that Madam Screecho will soon develop an unlooked-for crescendo, when all at once she opens up and with a rush to the mike, attempts high "C." Well, as far as high "C" is concerned, most of it stays in the studio, or at least her extra efforts for volume are wasted, as perhaps Relays 1, 2 and 3 have closed, pulling the program down to normal volume; or, if our soprano loses all control of herself, she may have closed Relay 6 for a moment which, all in all, prevented over-modulation, allowed Mrs. Jones' baby to keep sleeping, cheated the service man out of a repair job on Mr. Listener's loudspeaker and, best of all, saved the operator's hair.

The addition of the automatic control will not affect the operation of the transmitter in any way. When the program level is normal, the automatic control is not in operation, and not until the level goes dangerously high will it automatically go into action.

It may be thought that an instrument of this kind would prevent crescendos and destroy the created shadings in musical renditions, which is not the case, as it should be remembered that the automatic control "input pad" is adjusted not to allow plate swing in the Class B stage until 100 percent modulation is reached.

If desired, constant-impedance networks may be used instead of single resistors to float across the input when the relays close, but as they close as a rule only for a short instant, this will not be necessary, as the automatic control is only a protection and not the master gain control.

The entire unit can be built on a 10" by 19" panel. The relays should be mounted on a celotex base to prevent excessive noise.

THE RELAYS

Of major consideration are the relays. These, of course, carry the brunt of the work. In the first place, the relay designed to close at 45 ma must be able to carry the current of the relay closing at 65 ma. Also, the windings should have as low a dc resistance as is possible for good operation without chatter, and show good accuracy. The relays should be in dust-proof containers so that the action will remain good and the contacts clean.

The one point to consider is the action of the relay when the plate swing is just to the current point where the relay closes, or when the current swings rapidly below and above the critical point, caused, we will say, by vibrato in a single musical instrument. In this case, the relay will close just the same as for any other reason. However, the resistance controlled by Relay No. 1 is usually designed to effect about a 3-db attenuation, so that the drop will not be great at the first step. In this case, an instrument with vibrato which might cause the relay to chatter, so to speak, would not cause a noticeable change in volume, but *would* prevent over-modulation.

By using the automatic control, we have no change in the standard speech equipment whatsoever. If the gain of the station amplifier is too high, the control operator pulls it down the same as always.

The purpose of the automatic control is purely in the nature of a partial circuit-shunting device to go into action when the gain of the amplifier exceeds the safety point for 100 percent modulation.

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INTERFERENCE IN FRANCE

SEVERAL MONTHS ago the French High Commissioner appointed a commission to study the causes of local static and ways of eliminating it. This commission, composed of the French Adviser to the Lebanon Department of Posts and Telegraphs, the French Director of Economic Affairs at the High Commissariat, the French Manager of Radio Orient (subsidiary of "Compagnie Generale de Telegraphes sans Fil"), and a few French and Lebanese radio amateurs, investigated and suggested to the High Commissioner that he issue a decree compelling all persons using electric motors in any city to equip them with special condensers so as to eliminate local static. The High Commissioner is said to have promised to issue the necessary decree. (*Electrical Division, Department of Commerce.*)

TELECOMMUNICATION

PANORAMA OF PROGRESS IN THE FIELDS OF COMMUNICATION AND BROADCASTING

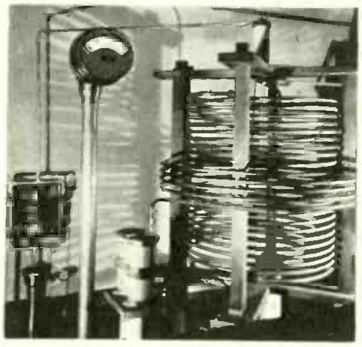
NATIONAL PRIMARY STANDARD OF RADIO FREQUENCY

THE NATIONAL primary standard of radio frequency, described in the February number of the *Journal of Research* (RP59), consists of two independent groups of piezo oscillators using specially prepared quartz plates operating under controlled conditions as regards temperature, pressure, humidity, and voltage. The first group, known as section 1, was a commercial development and consists of four piezo oscillators with frequencies of 100 kc. Section II, which was constructed at the Bureau, consists of two piezo oscillators, one having a fundamental frequency of 100 kc and the other 200 kc. An output of 100 kc is obtained by means of a submultiple generator. A separate voltage-supply system is provided for each section. Rectifiers furnish filament and plate voltages, which are filtered and held constant by an automatically adjusted battery-charging system.

The absolute frequency of one of the units of each section is checked daily against the Arlington time signals by a synchronous-motor clock driven by the one hundredth submultiple of the frequency of the controlling unit. The daily measurements provide a check on the frequency variations of the standard over an extended period. Frequency variations over short intervals are shown by an automatic recorder of the frequency difference between one of the units of section I and each of the other five units.

Submultiple frequencies from the primary standard are used in several laboratories of the Bureau. A standard frequency of 5,000 kc is transmitted four hours a week and is extensively used by radio manufacturers, radio-transmitting stations, and testing laboratories throughout the United States in the calibration of standards of frequency. These transmissions are maintained in agreement with the primary standard.

Curves presented for the two units, measured in terms of the Arlington time signals, do show a small increase in frequency with time. The unit with the smaller change showed a frequency drift of about one part in 10 million per month. (*Technical News Bulletin, February,* 1935.)



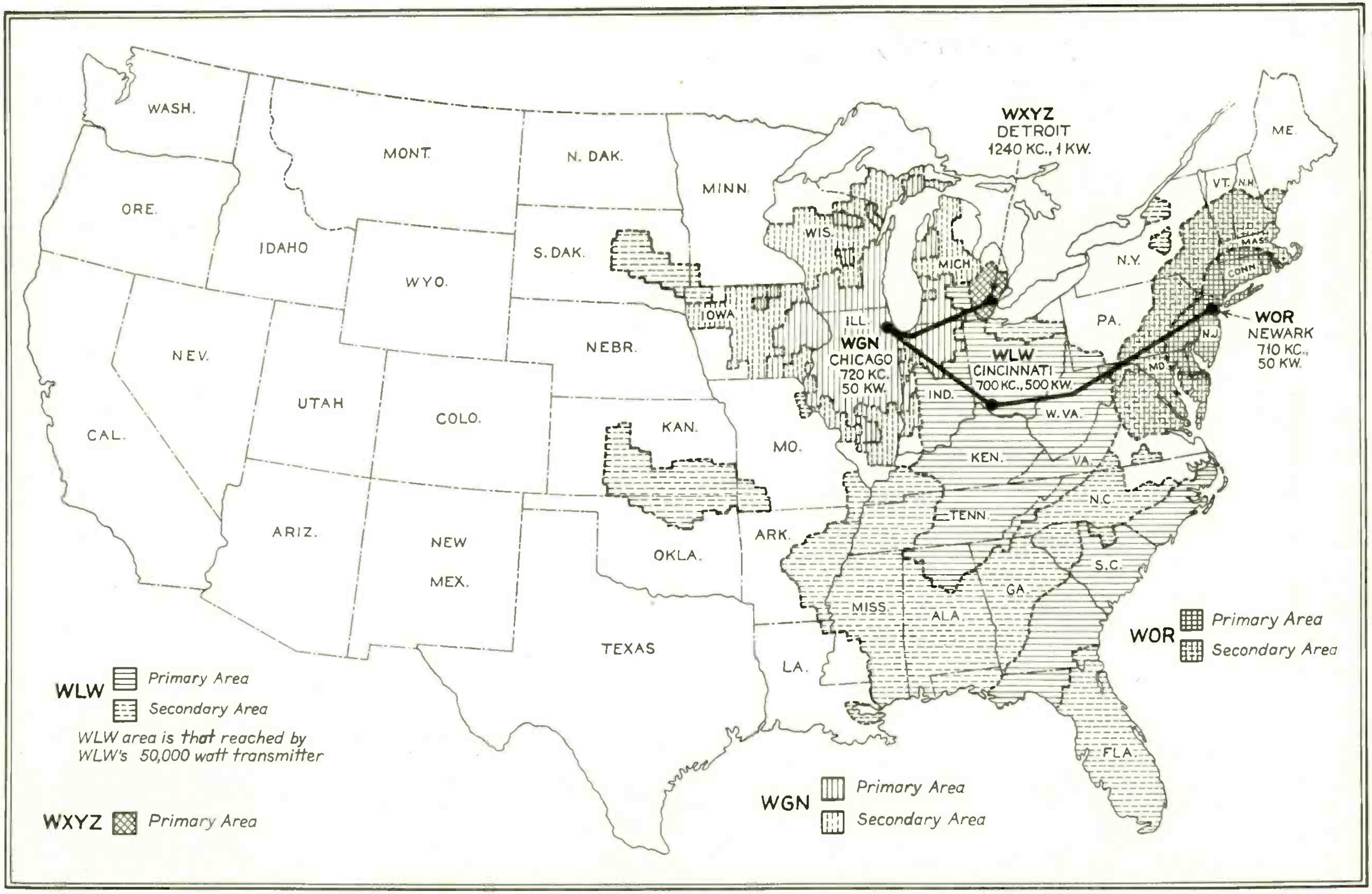
MAIN COUPLING EQUIPMENT OF WOR'S NEW 50-KILOWATT TRANSMITTER AT CARTERET, N. J. AT THE LOWER LEFT CAN BE SEEN THE BEGINNING OF THE NITROGEN-FILLED TUBE THROUGH WHICH THE CONCENTRIC TRANSMISSION LINE RUNS UNDERGROUND FOR 600 FEET TO THE ANTENNA SYSTEM. A SPECIALLY MOUNTED WESTON HIGH-FREQUENCY AMMETER, READING UP TO 40 AMPERES, PROVIDES A FINAL CHECK ON THE STATION'S HIGH OUTPUT AS IT LEAVES THE TRANSMITTER BUILDING.

WMAZ GOES 1000 WATTS . . . TO THE RIGHT, A VIEW OF THE NEW TRANSMITTER BUILDING, AND BELOW, G. P. RANKIN, JR., CHIEF ENGINEER, DESIGNER AND BUILDER OF THE CLASS B TRANSMITTER OF THE SOUTHEASTERN BROADCASTING CO., MACON, GA.

CANADA EXTENDS RADIO FACILITIES

IT HAS BEEN ANNOUNCED in the press that the Canadian Radio Commission contemplates a construction program involving an expenditure of approximately one million dollars to give more complete radio coverage throughout the Dominion and to eliminate those dead spots which exist in some sections of Canada at which radio reception is very difficult, and in some instances without effect. The execution of the contemplated plans would eradicate the numerous complaints which are received from the various sections of Canada complaining of poor reception, or none at all, according to *Electrical Foreign Trade Notes* of March 15, 1935.

Modern stations of reasonable power would be erected in various sections where coverage has been inadequate. The surveys by the Commission show that these areas exist particularly in the Maritime Provinces, a section of Quebec, part of Ontario, Saskatchewan, part of Alberta, and a great part of British Columbia.—(*H. M. Bankhead, Commercial Attache, Ottawa.*)



MAP No. 5 - - Mutual Broadcasting System Network

COVERAGE SHOWN FOR WOR IS BASED ON THE NEW 50-KW TRANSMITTER . . . WLW COVERAGE ON 50-KW TRANSMITTER.

Federal Communications Commission Reports

TICKER SERVICE

ON FEBRUARY 6, the Telegraph Division granted special permission to the Western Union Telegraph Co., to establish rates for Chicago Mercantile Exchange ticker service at St. Louis, Mo., effective on one day's notice. Special permission was also granted this organization to establish rates for New York Stock Exchange stock ticker service at Mansfield, Ohio, and to establish New York-New Orleans Cotton Miscellaneous ticker service at Terrell, Texas, both being effective on one day's notice. This Division, further, granted the following special permissions to the Western Union Telegraph Company to establish rates: For New Orleans Cotton Miscellaneous ticker service at El Reno and Yukon, Okla.; Grain-Cotton-Bond combination ticker service at Albuquerque, New Mexico, and Bisbee, Arizona; New York Stock ticker service at Lake Charles, La., and Clearwater, Fla.; and Chicago Board of Trade ticker service at El Reno and Yukon, Okla. All of these are effective on one day's notice.

NEW WORKING FREQUENCY FOR AIRCRAFT

ON MARCH 1, 1935, the Commission modified its Rules and Regulations to establish a working frequency for itinerant aircraft, in addition to 3,105 kilocycles now authorized. The modification of the rules and regulations is as follows:

"(1) Change the list in Rule 229 opposite 3,120 kilocycles (Page 73) to read 'Aircraft, Ship Telegraph and Coast Telegraph.'

"(2) Add to Rule 262a (A) 3,120 kilocycles; national working frequency for all itinerant aircraft, this frequency to be used in lieu of 3,105 kilocycles for working purposes on itinerant aircraft equipped for transmission on two frequencies; it shall not, however, be mandatory for aircraft not having a rapid means of frequency changing from 3,105 kilocycle to 3,120 kilocycles."

ORDER OF ORGANIZATION

AT A SPECIAL MEETING of the Commission en banc, on March 9, attended by Commissioners Sykes, Prall, Case, Walker and Stewart, the following Order of Organization was adopted, effective March 11, 1935:

Commissioner Prall, as Chairman of the Federal Communications Commission, was assigned to each Division as a member, replacing Commissioner Sykes on the Telegraph and Telephone Divisions.

Commissioner Sykes was assigned to the Broadcast Division.

The action of the Broadcast Division in delegating to Commissioner Brown the task of holding hearings in Texas and California, was approved by the Commission.

The new order of meetings of the Federal Communications Commission is as follows:

1. The Broadcast Division meeting will be held each Tuesday, at 10:00 a. m.
2. The Telegraph Division meeting will be held each Tuesday, at 2:30 p. m.
3. The Telephone Division meeting will be held each Wednesday, at 10:00 a. m.
4. The Commission en banc meeting will be held each Wednesday, at 2:30 p. m.

The Chairman of the Commission delegated Commissioner Case, in the absence of Commissioner Payne, to continue to sit in on the Telegraph Division hearing.

Additional Changes

The Commission also announced the following additional changes in the organization of its three divisions:

Commissioner Norman S. Case was assigned to the Broadcast Division and Commissioner Thad H. Brown was assigned to the Telephone Division.

Effective March 11, 1935, Commissioner Case will act temporarily for Commissioner Brown in the Telephone Division.

Division Meetings

At a Special Meeting of the Broadcast Division, Commissioner E. O. Sykes was named Chairman and Commissioner Norman S. Case was named Vice-Chairman.

At a Special Meeting of the Telephone Division, Commissioner Thad H. Brown was named Vice-Chairman.

Anning S. Prall, Chairman of the full Commission, will serve on each division. The divisions and personnel follow:

Division No. 1—Broadcasting

Commissioner E. O. Sykes, Chairman.
Commissioner Norman S. Case, Vice-Chairman.
Commissioner Anning S. Prall.

Division No. 2—Telegraph

Commissioner Irvin Stewart, Chairman.
Commissioner George Henry Payne, Vice-Chairman.
Commissioner Anning S. Prall.

Division No. 3—Telephone

Commissioner Paul A. Walker, Chairman.
Commissioner Thad H. Brown, Vice-Chairman.
Commissioner Anning S. Prall.

NATIONAL CONFERENCE CALLED BY BROADCAST DIVISION

THE COMMUNICATIONS COMMISSION, in its report to Congress, as required by Section 307 (c) of the Communications Act, under the caption "Proposed Action" stated, among other things, the following:

"The Commission proposes to hold a national conference at an early date in Washington, at which time plans for mutual cooperation between broadcasters and non-profit organizations can be made, to the end of combining the educational experience of the educators with the program technique of the broadcasters, thereby better to serve the public interest. The conference should also consider such specific complaints as might be made by non-profit groups against the actions of commercial broadcasters in order that remedial measures may be taken if necessary.

"The Commission intends also actively to encourage the best minds among broadcasters and educators alike in order to develop a satisfactory technique for presenting educational programs in an attractive manner to the radio listener. Cooperation with the United States Commissioner of Education and other governmental agencies already established to assist in building helpful radio programs will be sought to an even greater degree than it now exists. The results of the broadcast survey, which is now being conducted by the Commission to determine the amount and quality of secondary service of large metropolitan broadcasting stations in remote sections of the United States as well as by broadcast stations generally, will be studied with the thought in mind of providing the best possible service to every American radio listener and to provide him with a well-balanced selection of non-profit and public-interest programs. The results of a direct questionnaire survey now under way will be studied with the same thought definitely in mind.

"The Commission feels, in particular, that broadcasting has much more important part in the educational program of the country than has yet been found for it. We expect actively to assist in the determination of the rightful place of broadcasting in education and to see that it is used in that place.

"There have been protests, particularly by persons interested in the preservation of the broadcasting facilties of educational institutions, against the procedure under which licensees are required to defend their assignments in hearings upon applications of other parties. The Commission now proposes that provisions be made to conduct informal, preliminary hearings on applications that appear from examination to be antagonistic to established stations, or likely adversely to affect the interests of any established station, to determine whether the application violates any provision of the Communications Act or the Rules and Regulations of the Commission, or whether or not the applicant is legally, financially and technically qualified to contest the use of a radio facility with an existing station. Under such a provision, application found inconsistent with law or regulations and applications of those found not qualified to operate stations will be refused without requiring the presence of licensees of existing stations at hearings.

"It is the earnest belief of the Commission that the action planned by it will accomplish results which will prove of lasting benefit to the broadcast structure as well as to the American radio public. The Commission seeks to accomplish the purposes for which the non-profit interests and the broadcasters are earnestly working without the necessity of any radical reallocation, which would precipitate dissatisfaction and chaos and which would tend only to complicate and impede true progress in the broadcast public service.

"In making this report, the Commission is not unmindful of the sincerity with which the well-considered arguments were presented by the non-profit organizations supporting the proposal of a statutory allocation as well as by the broadcasters generally. The fine spirit and cooperation were most helpful. The Commission does not wish to seem to disregard the requests of the non-profit organizations. It is to effectuate these requests and to accomplish the greatest and widest good that the Commission will undertake the action outlined in this report. It is our firm intention to assist the non-profit organizations to obtain the fullest opportunities for expression. Every sound, sensible and practical plan for the betterment of the broadcast structure will be speedily effected."

The Commission en banc has delegated to the Broadcast Division the power and duty of calling and holding this conference. Pursuant thereto, the Broadcast Division called a national conference of all broadcast licensees of the Commission, the National Association of Broadcasters, all chain broadcasting companies, all educational, religious and non-profit eleemosynary institutions and all persons, groups and associations of every character interested in the subject to be present and participate in this conference. The cooperation and participation of all governmental agencies, particularly the United States Commissioner of Education, are especially requested by the Broadcast Division. It is also hoped that, at this hearing, definite plans may be presented for consideration and study.

The conference will be held in the offices of the Commission in the New Post Office Building, in Washington, D. C., beginning at ten o'clock Wednesday, May 15.

The Commission would like for those who desire to participate to inform it of this fact not later than April 24, so that an agenda may be prepared by the Division.

APPLICATIONS GRANTED FOR NEW STATIONS

Telephone Division

March 7, 1935.

ATLANTIC COMMUNICATIONS CORP., granted construction permit, experimental service, portable-mobile (points along the Schuylkill and Delaware Rivers), 30,100, 31,100, 31,600, 33,100, 34,600, 35,600, 37,100, 37,600, 38,600, 40,100, 40,600, 41,000 kc, 1.5 watts; same except 30 watts power.

March 27, 1935.

MUTUAL TELEPHONE CO., Ulupalakua, T. H., granted construction permit, general experimental, 220,000 kc, 100 watts; also authority to communicate as a point-to-point telephone station in fixed public service on an experimental basis only under the exceptions of Rule 320. Same, with the exception of a frequency of 230,000 kc, was granted for Kaunakakai, T. H.

Broadcast Division

February 19, 1935.

JACK W. HAWKINS AND BARNEY N. HUBBS, Pecos, Texas, granted construction permit, 1,420 kc, 100 watts, unlimited time.

W. B. GREENWALD, Hutchinson, Kansas, granted construction permit, 1,420 kc, 100 watts, unlimited time.

February 26, 1935.

THE ARDMOREITE PUBLISHING CO., Inc., Ardmore, Oklahoma, granted construction permit, 1,210 kc, 100 watts, daytime.

GARDEN CITY BROADCASTING CO. (Homer A. Ellison and Frank D. Conrad), Garden City, Kansas, granted construction permit, 1,210 kc, 100 watts, unlimited time.

March 5, 1935.

SOUTHERN MINNESOTA BROADCASTING CO., Rochester, Minn., granted construction permit, 1,310 kc, 100 watts, unlimited time.

March 19, 1935.

LOUIS WASMER, Inc., Spokane, Washington, granted two construction permits, general experimental station, mobile, 31,100, 34,600, 37,600, 40,600 kc, 2 watts.

FLORIDA CAPITOL BROADCASTERS, Inc., Tallahassee, Florida, granted construction permit, 1,310 kc, 100 watts, unlimited time.

SOUTHERN MINN. BROADCASTING CO., Rochester, Minn., granted special temporary authorization to operate a portable transmitter on 1,310 kc, to conduct field-strength measurements and tests in and around Rochester, between the hours of 12 midnight and 6 a. m., cst, in order to determine transmitter site.

March 26, 1935.

THE MONOCACY BROADCASTING CO., Frederick, Md., granted construction permit, 900 kc, 500 watts, daytime only.

BENSON POLYTECHNIC SCHOOL, Portland, Ore., granted construction permit, general experimental, portable-mobile, 31,100, 34,600, 37,600, 40,600, 86,000-400,000 kc, 25 watts; also authority to communicate as broadcast pickup station in temporary service and on an experimental basis only.

Telegraph Division

February 20, 1935.

AERONAUTICAL RADIO, Inc., Cincinnati, Ohio, granted construction permit, 2,906, 3,072.5, 3,088, 4,937.5, 4,952.5, 4,967.5, 5,672.5, 5,692.5, 3,062.5 kc, 75 watts.

WARDS COVE PACKING CO., Alaska, granted construction permit, public coastal - coastal harbor, 2,538 kc, 50 watts.

CITY OF WICHITA, Kansas, granted construction permit, 24 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 4.5 watts. Granted authority to communicate as municipal police station in emergency service on an experimental basis only under exceptions of Rule 320.

C. F. TOLMAN AND H. F. LYNN, Robinson Mine, Calif., granted construction permit, 2,726, 3,190 kc, 25 watts, to be used only for emergency communication involving safety of life during periods when no other means of communication are available; same at Grass Valley, Calif.

February 27, 1935.

PACIFIC ALASKA AIRWAYS, Inc., Skagway, Alaska, granted construction permit, aviation-aeronautical and aeronautical point-to-point, 3,082.5, 5,692.5, 8,220; 2,648, 3,082.5, 4,125, 8,015 kc unlimited, 6,570 kc day only, 20 watts.

AERONAUTICAL RADIO, Inc., Bakersfield and Sacramento, Calif., granted construction permits, aviation-airport, 278 kc, 15 watts.

SUPERIOR OIL PRODUCING CO., N C-13744, granted license, aviation-airport, 3,105, 5,602.5, 3,232.5, 2,922, 4,122.5, 3,072.5, 4,937.5, 3,088, 4,967.5, 5,122.5, 3,147.5, 5,662.5, 3,322.5, 5,572.5, 3,162.5 kc, 50 watts.

HUDSON COUNTY BOULEVARD COMMISSION, Jersey City, N. J., granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 25 watts.

CITY OF OIL CITY, Pa., granted construction permit, police service, 2,482 kc, 50 watts.

FLORIDA POWER CORP., St. Petersburg, Florida, granted construction permit, portable-mobile, special emergency service, 2,726 kc, 50 watts.

ALASKA JUNEAU GOLD MINING CO., Juneau, Alaska, granted construction permit and license, special emergency service, 2,726 kc, 25 watts; Taku Inlet, Alaska, construction permit and license, 2,726 kc, 25 watts.

March 6, 1935.

CITY OF FRESNO, Calif., granted construction permit, general experimental, portable-mobile, 37,100, 40,100 kc, 5 watts.

TAMPA NEW ORLEANS TAMPICO AIR LINES, Inc., NC-11729, NC-11730, NC-11732, granted aviation-aircraft license, 1,638 kc for direction finding, 3,105 kc for communication with any ground station, 5,515 kc for communication with ship and coastal stations when in flight over sea, 15 watts. NC-11731, granted aviation-aircraft license, 1,638 kc for direction finding, 3,105 kc for communication with any ground station, 500 kc international calling distress frequency, 4,140, 5,515, 6,210 kc for communication with ship and coastal stations when in flight over sea; two transmitters, one 15 watts, one 25 watts.

March 12, 1935.

CITY OF AKRON, Ohio, Municipal Airport, granted construction permit, 278 kc, 15 watts.

PIONEER SEA FOODS CO., Eyak River, Alaska, granted construction permit, public coastal - coastal harbor service, 2,538 kc, 50 watts.

GENEVA POLICE DEPARTMENT, Geneva, N. Y., granted construction permit, general experimental service, 30,100, 33,100, 37,100, 40,100 kc, 50 watts.

CITY OF SAN GABRIAL, Calif., granted construction permit, 30,100, 33,100, 37,100, 40,100 kc, 50 watts. Three applications were also granted for similar mobile equipment.

METRO-GOLDWYN-MAYER CORP., granted construction permit, portable-mobile (ships), 2 applications, 31,600, 35,000, 38,600, 41,000 kc, 5 watts. Authority was also granted to communicate as a motion-picture station in temporary service and on an experimental basis only, for the purpose of determining the usefulness of ultra-high-frequencies for synchronization of ships and cameramen during actual filming of a motion picture while at sea, for period ending November 1, 1935.

CITY OF RADIO CITY, South Dakota, granted construction permit, police service, 2,450 kc, 50 watts.

PIONEER SEA FOODS CO., Eyak River, Alaska, granted construction permit, fixed public point-to-point telephone service, 3,092.5 kc, 50 watts.

PAN AMERICAN AIRWAYS, Inc., Alameda, Calif., granted construction permit, aviation-aeronautical and aeronautical point-to-point, frequencies: (a) 2,870, 8,220, 12,330, 16,440 kc, (b) 2,648, 16,240 kc, power 350 watts. Points of communication on (a) to be primarily with aircraft stations in Trans-Pacific Service, and (b) with aeronautical point-to-point stations on the Trans-Pacific Route. Experimental authority was granted for period of tests covered by Rules 217 and 218 covering the following frequencies: (a) primarily for communication with aircraft stations in Trans-Pacific Service, 5,035 and 5,165 kc, unlimited hours; (b) for communication with aeronautical point-to-point stations on Trans-Pacific Route: 2,986, 5,035 and 5,165 kc, unlimited hours, and 6,570, 6,580, 8,220, 12,330 kc subject to condition that no interference is caused to international mobile service. The Pan American Airways, Inc., was also granted the same for Glen Dale, Calif.

CITY OF EVANSVILLE, Indiana, granted construction permit, 2 applications, mobile, general experimental service, 30,100 kc, 5 watts.

March 19, 1935.

WALKER P. INMAN, NC-3138, granted aviation-airport license, frequencies: (a) 3,105; (b) 2,922, 4,122.5; (c) 4,967.5, 3,088, 4,937.5, 3,072.5; (d) 5,592.5, 3,182.5, 5,122.5, 3,147.5, 5,662.5, 3,322.5, 5,572.5, 3,162.5 kc. Power 50 watts (a) with any ground station, (b) with Green Chain stations, (c) with Blue Chain stations, (d) with Red Chain stations.

BAMBERGER BROADCASTING SERVICE, Inc., Carteret, N. J., granted construction permit, 339.2 kc, 30 watts.

RCA MANUFACTURING CO., Inc., Camden, N. J., granted construction permit, 2,398, 3,492.5, 4,797.5, 6,425 kc, 1,500 watts.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

CRUISE REPORT

NOW THAT SOME of the excitement attendant upon the simultaneous Dinner Cruises of the New York, San Francisco, Chicago and Boston Chapters of the V. W. O. A. has subsided and a comprehensive report has been rendered, we should like to submit some of the highlights of the Tenth Anniversary celebration of our founding.

A telephone conference hook-up was arranged between the four dinners and the Chairman of each Chapter addressed each of the other Chapters. V. Ford Greaves, of the Federal Communications Commission, addressed us as the Chairman of the San Francisco Chapter. Dwight M. Williams then greeted the assembled audiences from the Chicago Dinner followed by Charles Kolster acting in the capacity of Boston Chapter Chairman. George Clark, our President, and Fred Muller, Junior Past President, each greeted the newly formed Chapters from the New York Dinner Cruise.

Many thanks are due Fred Dewey, Manager of the Metropolitan District in San Francisco for the Mackay Radio and Telegraph Company; Ray Meyers and Thomas Stevens of Radiomarine; and V. Ford Greaves of the Federal Communications Commission, for their splendid work in making possible the first Dinner Cruise of the V. W. O. A. on the West Coast.

Likewise Dwight M. Williams of the RCA Institutes; George Martin of Radiomarine in Chicago; Guy R. Entwistle of the Massachusetts Radio and Telegraph School; Charles Kolster; and Harry Chetham, Chief Radio Operator of the Somerville Police Radio Department, are hereby tendered our heartfelt thanks for their untiring efforts in conjunction with the inaugural Dinner Cruises of the V.W.O.A. in Chicago and Boston.

MARCONI TELEGRAM

London, February 9, 1935.—Veteran Wireless Operators Association (received February 11th) Hotel Montclair. New York City:—CORDIAL GREETINGS TO MY FELLOW VETERAN WIRELESS OPERATORS ASSEMBLED IN NEW YORK FOR 1935 ANNUAL DINNER STOP EVERY YEAR THE DIVERSITY AND EXTENT OF WIRELESS COMMUNICATIONS GROWS BUT THE FINE PIONEERING SPIRIT OF THE SERVICE MEETS EACH NEW DEMAND WITH ZEAL ABILITY AND ASSURANCE OF SUCCESS STOP LONG MAY IT CONTINUE SO WITH HEARTY VETERANS TO LEAD THE YOUNGER GENERATION TO NEW SPACE TRIUMPHS STOP PERSONAL REGARDS TO PRESIDENT CLARK MR SARNOFF AND MY MANY OTHER FRIENDS WITH YOU TONIGHT (SIGNED) MARCONI

SOUTH POLE GREETINGS

THANK YOU FOR YOUR MESSAGE STOP THE MEMBERS OF THE EXPEDITION JOIN ME IN HEARTILY RECIPROCATING YOUR GREETINGS. (SIGNED) R. E. BYRD.

Also from the S/S. *Jacob Ruppert* at the South Pole the following message was received at the Tenth Anniversary Cruise:

FROM THE ANARCTIC ICE-FILLED SEAS WE SEND OUR HEARTIEST GREETINGS AND BEST WISHES FOR A GRAND BANQUET STOP WE WILL TAKE AN EXTRA GOOD LOOK AT ALL THE SURROUNDING ICEBERGS AND THINK OF YOU ALL WHO HAVE SOMETHING ELSE TO ADD TO YOUR ICE. (SIGNED) C. O. PETERSEN AND C. BAILEY.

GOLD MEDAL AWARD

The Annual Gold Medal of the Veteran Wireless Operators Association, for the outstanding performance in the line of duty on the part of radiomen during 1934, was awarded at the Tenth Anniversary Cruise to George W. Rogers, former Chief Radio Officer of the T. E. L. *Morro Castle*. Dr. Donohue, Mayor of the City of Bayonne, Mr. Roger's home town, presented the City of Bayonne Gold Medal to Mr. Rogers simultaneous with the V. W. O. A. presentation.

WHO WAS THERE?

E. Jay Quinby, of the RCA Manufacturing Company Advertising Staff, led a large delegation from the Camden headquarters. E. Jay performed superbly as the District Attorney in our "Home Talent" skit. Included in his party were H. P. Kasner, J. L. O'Connell and Mr. Beal, as well as several other members of the RCA group in Camden. . . . Fred Muller had his brother JC, also a veteran radioman and V.W.O.A. member, and the Mrs. Muller and their friends. . . . A. F. Wallis, Mackay Marine Superintendent saw to it that a large delegation attended from the Mackay organization, included among whom were A. Y. Tuel, Mackay Vice-President; T. E. Nivison, Mackay General Superintendent; J. A. Bossen, Marine Commercial Manager: C. D. Guthrie of the Marine Department; and others from the Mackay organization too numerous to mention. . . . W. C. Simon. Tropical Radio Company Inspector and R. Pheysey of the Commercial Department of the Tropical Company, were accompanied by a large delegation of friends. . . . A. J. Costigan, Radiomarine Traffic Superintendent: A. A. Isbell, RCA Communications Commercial Department Manager; H. F. Coulter, of Radiomarine; W. S. Fitzpatrick; C. S. Anderson; and W. Aufenanger of RCA Institutes, attended with their friends. . . . H. T. Hayden brought a delegation from the Ward Leonard Company in Mount Vernon. . . . Ye Secretary had a delegation from the Telephone Company. . . . J. W. Swanson, Vice-President of the Southern Radio Corporation had a table for his friends . . . . J. V. L. Hogan brought along his television co-workers. . . . And not to forget our lady members—Mrs. Hughes, and of course the beloved "Daddy", and Miss Michelson seemed to enjoy themselves greatly. . . . Our Treasurer, P. K. Trautwein had difficulty finding a seat at his own table. . . . Maurice Schatt of Capitol Radio Engineering Institute and R. H. Frey of the Bull Lines were hearty participants. . . . George W. Rogers, Gold Medal recipient was accompanied by a group of friends from Bayonne. . . . Ernest Cole, Second Radio Officer of the ill-fated S/S. *Mohawk* was there to receive his Testimonial Scroll. . . . Our resident agent W. S. Wilson came up for the Dinner from Wilmington, Delaware. . . . George Street, accompanied by Mrs. Street, appeared to enjoy the program. Ben Titow of RCA Communications was responsible for the presence of many guests from his company. . . . Mr. Swannecamp and M. O. Smith of the engineering department of the National Broadcasting Company attended with a group of their fellow engineers. . . . Of course, our President, George Clark was there, with his friends. "Don Jorge" was the skipper in the "skit" as well as master of ceremonies during the evening—not to mention his fine performance as narrator for the "Television in 1950" demonstration. . . . Sergent Pearce, our printer, a truly veteran radioman, and F. R. Bristow, formerly of RCA Institutes, were there enjoying every minute of it. . . . Lee L. Manley a former Director left his office at the H. H. Eby plant in Philadelphia in time to participate in the festivities. . . . A. C. Tambourino and Sam Schneider, former Treasurer, arrived early and helped with the preparations. . . . T. D. Haubner and his friends had a table. A highlight of the evening was the presentation by TDH of the pair of telephone receivers he used at the time he sent the first S O S to H. J. Hughes who was then his superior in the United Wireless Company. TDH paid tribute to the fine character and amiable spirit of the justly titled "Daddy of the Veterans"—Henry J. Hughes. . . . Then, too, there was Jim Baskerville of the RCA Photophone Company and C. A. Hahne another real old timer. . . . Arthur H. Lynch, Frank Kurz, J. A. Hopfenberger, R. S. Egolf, J. W. Graham, Charles E. Maps, George E. McEwen, Peter Podell and many many others were with us on this gala evening. . . . Telegrams of regrets were received from Fred Meinholtz, F. P. Guthrie, George Lewis, W. Kirchhoff and Paul Sexson in behalf of our Honorary President.

LET US KNOW!

Have you paid your dues and have not received a 1935 Membership card? Have you asked us a question in a letter and received no answer? Have you changed your address and are we still sending your mail to your former address? Did we fail to send you a Membership pin or Year Book you requested? Did we promise to get some information for you, and didn't, or if we did, failed to advise you? If we have neglected to perform one of the above functions for you or one not mentioned. our Complaint Department is now open. We have just dug ourselves out from under the Year Book Advertising and preparation, Banquet details, collecting membership dues, answering queries concerning

(*Continued on page 25*)

OVER THE TAPE . . .

NEWS OF THE RADIO, TELEGRAPH AND TELEPHONE INDUSTRIES

VISUAL SOUND PRODUCTS DEPARTMENT CREATED BY RCA

Mr. G. K. Throckmorton, Executive Vice-President of the RCA Manufacturing Company, announced the creation of a new Visual Sound Products Department, headed by John K. West, as Manager, to handle the sales activities in connection with 16-millimeter sound-on-film amateur motion-picture cameras, 16-millimeter sound projectors, for school, home and industrial use, slide-film mechanisms, and sound-advertising trucks.

At the same time, announcement was made of the establishment of branch district offices for the promotion and sale of visual sound products in New York, Chicago and Hollywood. Mr. E. F. Kerns is in charge of the New York district, with headquarters at 411 Fifth Avenue; Mr. C. S. Kernaghan is in charge of the Chicago district, with headquarters at 111 North Canal St., and Mr. Mark Smith is in charge of West Coast activities in this field.

WEBSTER CATALOG

The Webster Company, 3825 West Lake Street, Chicago, now have available copies of their latest catalog, No. S-35, which describes a complete line of public-address equipment, starting in with the microphone, and ending with the loudspeaker.

An effort has been made to make this catalog one that will assist in selecting the proper type of co-ordinated equipment for public-address installation work. The equipment listed has been designed and selected to centralize the responsibility in one manufacturer for the results that will be obtained in installation work with properly made installations, it is stated.

While this catalog does not include the entire Webster line, it is more complete than anything they have offered up to this time. Of course, supplementary bulletins will be issued from time to time describing other Webster products.

LAMPKIN LABS. MOVE OFFICE

The Lampkin Laboratories announce the new location of their main office and shop at Bradenton, Florida, where the manufacture of specialized equipment of original design will be continued. All technical inquiries, orders, etc., should be addressed to the main office.

A sales office will be maintained at the old address, 146 West McMillan Street, Cincinnati, Ohio.

It was also announced that prepaid shipment will be made on all orders accompanied by the full purchase price . . . this in lieu of cash discount.

WESTINGHOUSE HOLDS POLICE-RADIO SCHOOL

An intensive three weeks' radio training school for a special field force of police signal-system engineers is being conducted at Westinghouse's Radio Works, Chicopee Falls, Mass., by J. G. Beard, Commercial Radio Engineer. The course of study covers the fundamentals of radio, lectures and comprehensive analysis of police-radio methods and latest engineering developments. Each "student" is a recognized police signal-system engineer of the Gamewell Company, the oldest manufacturers of police signal systems.

In conceiving and organizing these classes, W. C. Evans, Manager of the Radio Division of the Westinghouse Electric and Manufacturing Company, and V. C. Stanley, President of the Gamewell Company, recognized that police organizations are not necessarily qualified to cope with the technical aspects of radio. Radio being a new adjunct to police signal work it is most natural that the police look to experts in police signal systems having a specialized knowledge of police requirements to furnish this modern weapon for combating crime.

PREMIER CRYSTAL LABS. BULLETIN

The Premier Crystal Laboratories, Inc., 53-63 Park Row, New York, N. Y., have recently issued their Bulletin No. 103. This 8-page bulletin covers constant-frequency control equipment, featuring crystals, numerous types of crystal holders, and high-frequency inductances and mounting bases.

Each item is well-illustrated and technical data is also given for each item.

This bulletin may be had on request.

MCRAE JOINS EASTERN AIR LINES

One of the most experienced radio engineers in aviation, Don C. McRae, who assisted in developing the first point-to-point communication for a commercial airline in 1926, has joined Eastern Air Lines as Chief Communications Engineer, it is announced by Capt. E. V. Rickenbacker, General Manager.

Mr. McRae has just completed building a new transmitter that is combined with a new receiver in a compact plane installation for TWA that is said to save 25 pounds in weight, to increase range and to reduce static. The transmitter has an output of 80 watts and eight frequency channels automatically selected. The installation includes a Department of Commerce long-way receiver and an auxiliary combined radio-range beacon and two-way voice receiver operated from dry cells.

Another one of Mr. McRae's achievements was the de-icing antenna for the Douglas beacon receiver. The device was designed to eliminate static and "dead" conditions encountered during icing and sleet.

HYGRADE SYLVANIA ANNUAL REPORT

Nineteen hundred and thirty-four marked the 20th consecutive year of profitable operation for Hygrade Sylvania Corporation and its predecessor companies, according to the annual statement as of December 31, 1934, which was issued February 13.

Net income for the year after all charges and taxes amounted to $874,416.54 equal to 6.21 times the $6.50 a share preferred dividend requirement for 1934 and equal to $3.81 a share on the 192,684 shares of common stock after deducting the preferred dividend of $6.50 a share. This compares with 1933 earnings of $655,072.86 or $2.67 a share on the common stock.

The Company's balance sheet showed current assets of $4,221,876.66, or 7.9 times current liabilities. This compared with $3,694,625.04 on December 31, 1933.

Cash, plus U. S. Government obligations, municipal and other marketable securities at December 31 market values, amounted to $2,070,294.69. Similar assets were $1,541,703.84 at the end of 1933. Year end inventories of finished products represent less than three months' sales.

The report notes that Hygrade Sylvania's position as second largest producer of radio receiving tubes was continued with substantial sales increases both in domestic and foreign sales, the company now having accredited representation in 86 foreign countries.

Lamp sales during 1934 maintained the high standard of 1933.

The Company's position as an employer of labor places it high in its own industry with an average number of employees of 3,099 in 1934 as compared to 2,888 in 1933, and with total employee earnings in 1934 of $3,069,000. as compared to $2,870,000. in 1933.

Maintaining its reputation as a "management owned" company, Directors and Employees own 68 percent of the total common stock outstanding, according to the report.

ACHESON COLLOIDS BULLETIN

The Acheson Colloids Corporation of Port Huron, Michigan, has available for distribution Technical Bulletin No. R191, dealing with "Colloidal Graphite—An Ideal Ray-Focusing Anode Material for Cathode-Ray Tubes". Copies will be furnished free to those interested.

V. W. O. A. NEWS

(Continued from page 24)

the Cruise, and many other details of organization. We request those of you who have not paid 1935 dues to do so promptly so that we may plan for the coming year. We will try to answer queries more promptly now that the major activity of the year is past.

IN MEMORIAM

We learn with deep regret of the recent decease of Cyril DeWitte Reinhard in New York City.

"Doc", as he was familiarly known, was engaged in radio since 1905. He was Chief Engineer for E. J. Simon during the war and later Staff Supervisor for E. R. P. I. At the time of his death he was an Engineer in the New York Sanitation Department.

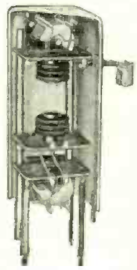
On behalf of our membership we extend our heartfelt sympathies to C. D. Guthrie, one of the truly fine radiomen, who recently lost his wife.

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATION AND BROADCAST FIELDS

NEW HAMMARLUND I-F TRANSFORMERS

The Hammarlund Manufacturing Company, Inc., 424-438 West 33 Street, New York City, have recently announced their new variable-coupling, air-tuned, intermediate-frequency transformers. These new Hammarlund transformers are designed to permit continuous variation of the mutual inductance between primary and secondary through a wide range of values and without otherwise affecting circuit constants. The approximate range of variation is said to be from one-third critical coupling to over three times critical coupling. Continuous variation between these limits may



be controlled from the receiver panel by means of suitable mechanical arrangements, or, where continuous variation is not necessary, the coupling may be adjusted to the desired value and locked at that point by means of a collar and set-screw provided for that purpose.

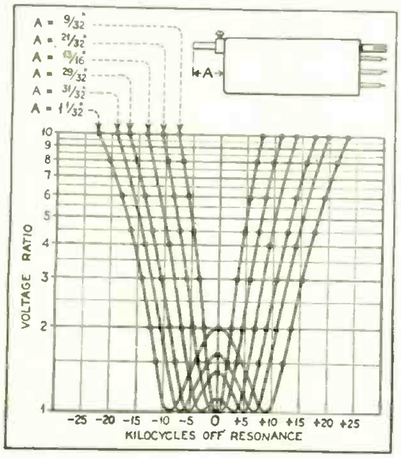
The transformers lend themselves to many types of mechanical actuating devices for securing continuous coupling variation by means of a panel control.

The effect of various coupling values on the transmission characteristics of a single transformer is shown in the accompanying graph. In a one-stage i-f amplifier, two transformers are used; so in this case, the overall selectivity curve is calculated by squaring the ordinates of the graph. Thus the voltage ratio marked 10 becomes 100, 5 would become 25, etc. Similarly in a two-stage i-f amplifier, three transformers would be used and the 10 ratio would become 1000 and so on.

For panel control of selectivity several transformers can be mounted in line and their coupling varied simultaneously. However, widening out the transmitted band increases the depth of the notch in the center of the curve. With several transformers in cascade this notch may seriously affect tuning and fidelity. For this reason, where wide-band or high-fidelity reception is desired, it is advisable to use three transformers . . . one fixed and two variable. The coupling of the fixed transformer may be adjusted to substantially level off the notch when the two variable units are close coupled. Where a wide flat top is required, and where extreme adjacent-channel selectivity is necessary, the above precautions do not apply and almost any number of transformers may be ganged together. When this is done a stop should be provided to limit the panel control so that coupling cannot increase to a point where the effect of the notch becomes objectionable.

These transformers are not available in center-tapped types. Where it is desired to couple the last transformer into a diode. Type AAT-CT transformers may be used.

Impregnated coils and low-loss air-dielectric condensers are said to result in a highly stable unit regardless of conditions of temperature or humidity. The transformers may be used with any screen-grid tubes normally used as i-f amplifiers. Both tuning adjustments are on one side of the aluminum shield.



THIS GRAPH SHOWS THE EFFECT OF VARIOUS COUPLING VALUES ON THE TRANSMISSION CHARACTERISTICS OF A SINGLE TRANSFORMER.

AMERICAN ELECTROSTATIC MIKE

The American Microphone Co., 1915 South Western Avenue, Los Angeles, Calif., announces an improved type of microphone, known as the American Electrostatic Microphone.

The Electrostatic is said to have no inherent noise, to be immune to temperature changes and unaffected by atmospheric moisture and barometric pressure changes. It has no cavity resonance and is free from structural resonance peaks, it is further stated. This mike is of high impedance and can be connected directly into the grid without a matching transformer.

Another advantage of this mike is said to lie in the fact that it can be operated as far as 200 feet from an amplifier without the necessity of an intervening pre-amplifier.

This microphone has been in development in the Los Angeles laboratories of the American Microphone Co., for over a year. It is available in two models, Model "GA", for stand mounting, and Model "GB", a hand microphone.

WEBSTER NO. A-30 AMPLIFIER

The Webster A-30 Amplifier, shown, is a Class A unit designed to develop a high output and at the same time provide good tone quality and appearance. It is recommended for large indoor installations.

The tubes used in the A-30 are: Two 57's, two 56's, four 2A3's, one 83, and one 80. It is a three-stage amplifier with a power output at 5 percent distortion of 30

watts. The input impedance is for carbon microphone, 200 ohms, and phono pickup, 8,000 ohms; while the output impedances are 4-8-16-500 ohms. The overall dimensions are 18" x 10" x 9½", and the weight is 45 pounds. This unit may be obtained for 110- or 220-volt, 50-60 cycle operation.

Further information may be obtained from The Webster Company, 3825 West Lake Street, Chicago.

BURGESS ANNOUNCES NEW TWIN-SIX

The Burgess Battery Company announces a new 3-volt telephone battery to be known at the Burgess Twin-Six. This battery is designed to replace two No. 6 dry cells.

It is a compact, square battery in a water-proof, heat-welded jacket. It is said to weigh 40 percent less than two No. 6's and take up 30 percent less space on shelves or in linemen's cars or trucks. Linemen carry only one Twin-Six instead of two No. 6's into a residence to make a replacement and make only two connections instead of four.

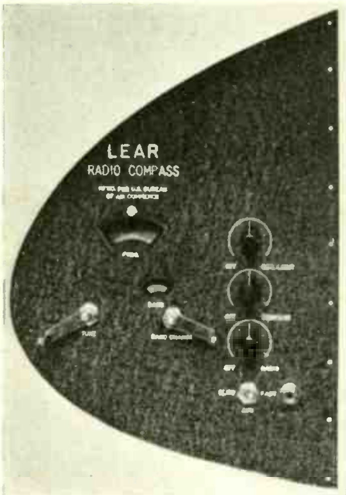
The new Twin-Six will be distributed by Max F. Hosea, President of the Inland Equipment Company, Indianapolis, Indiana. Mr. Hosea is a well-known operator of independent telephone exchanges.

LEAR RADIO COMPASS

The Lear Radio Compass, recently announced by Lear Developments, Inc., 125 West 17 Street, New York City, is said to feature, among other things, the following: Perfect aural reception while using the compass as a homing device, and the compass loop can be placed any distance from the receiver up to 30 feet. This compass is really a new type of radio direction finder for use on both aircraft and ships, and by means of which it is possible to use any standard broadcast station as a directing beam.

The instrument consists primarily of a three-band receiver which tunes from 200 to 400 kc, 550 to 1500 kc, and 3000 to 6200 kc in conjunction with a balanced modulator and audio oscillator. In addition to this there is a special loop antenna and a small vertical antenna. The sense of direction is shown on a zero-center, right-left visual indicator meter.

The Servicio Aero Colombiquo of Colombia, South America, are reported to have adopted the Lear Compass as official equipment in their fleet of 16 planes.



The panel illustrated is a reproduction of a special control panel installed in Amelia Earhart's Lockheed-Vega.

NEW WESTERN ELECTRIC TRANSMITTER

In consonance with the Federal Communications Commission's policy of authorizing increased power for certain broadcasting stations, seven such stations have within the past two months ordered from the Western Electric Company the recently developed 5-kilowatt broadcast transmitter. This transmitter has been designed by Bell Telephone Laboratories.

The stations are KFRC, San Francisco; KHJ, Los Angeles; WSPD, Toledo; WJAS, Pittsburgh; KLZ, Denver; WOW, Omaha, and WTCN, Minneapolis. In addition, station KMBC, Kansas City, has arranged for the installation of amplifying and control units from the same type of transmitter.

The transmitter is designed to deliver 5 kilowatts of unmodulated carrier to the antenna and to effect 100 percent modulation of the carrier corresponding to peak power outputs of 20 kilowatts. The purity of signal is said to be unaffected by the process of modulation and amplification.

The weighted noise level due to residual components introduced by the rectifiers and filament supplies is better than 80 decibels below the signal at 100 percent modulation. The audio-frequency characteristic is linear within plus or minus one decibel from 30 to 10,000 cycles per second. Distortion is less than 5 percent at 100 percent modulation and under 2 percent at average program levels.

The harmonic radiation on any multiple of the carrier frequency is at least 70 decibels below the carrier. The carrier-frequency stability is maintained within 50 cycles per second of the assigned frequency by means of quartz-crystal control.

The general circuit scheme is as follows: A quartz-crystal controlled oscillator operates into a buffer amplifier, followed by a parallel stage which drives a modulating amplifier consisting of two tubes in push-pull. Following this are two amplifiers in cascade, each a push-pull combination.

The grid and plate voltages are obtained from mercury-filled rectifiers. The high-voltage rectifier employs six tubes in a bridge circuit, each tube being equipped with individual protective relays with associated signal lamps.

GENERAL RADIO TRANSMISSION MONITOR

The General Radio complete Class 730-A Transmission Monitoring Assembly is comprised of a Type 731-A Modulation Monitor, a Type 732-A Distortion and Noise Meter and a Type 733-A Oscillator. The assembly occupies 22¾ inches of relay-rack space. All of the units operate separately and are electrically and mechanically self-contained. The only extras required to place all of the assembly in operation are a 115-volt, 60-cycle ac outlet and a simple receiving antenna or pickup coil and condenser. All necessary connecting cords are supplied.

The General Radio Type 731-A Modulation Monitor gives continuous indication of percentage modulation on either positive or negative peaks and also positive visual indication of over-modulation peaks in excess of any pre-determined modulation level. The decibel scale on the percentage modulation indicator can be used for measurements of the fidelity characteristics of the transmitter. The modulation meter requires no balancing adjustment.

The modulation indicator is a Weston Model 301 high-speed meter, which follows accurately the modulated signal. The use of two tubes in the associated voltmeter circuit makes it independent of the tubes within about 0.1 percent. Two tubes have been found essential for getting a true measure of the difference between the positive and negative peaks. On badly distorted waves a single-tube circuit has material error of 5 to 10 percent.

The over-modulation lamp will flash at the instant the modulation exceeds the value to which the "Nominal Modulation Peaks" dial has been set, and will remain lighted as long as over-modulation continues. The flashing circuit is entirely automatic, is independent of line voltage and carrier amplitude, and requires no initial balance.

The percentage modulation measurements can be relied upon, for modulation frequencies from 30 to 10,000 cycles, to an accuracy of better than 2 percent at 100 percent and 0 percent levels, it is said. The possible error increases to a maximum of 4 percent at 50 percent modulation levels. The readings are most accurate at high modulation percentages where greatest accuracy is required.

A control is provided on this monitor for adjusting the amplitude of the carrier. A switch is used to select either the positive or negative peaks for measurement. A "Nominal Modulation Peaks" dial, calibrated, and continuously variable from 0 to 100 percent, is provided. An On-Off switch with pilot lamp controls the power input.

The General Radio Type 732-A Distortion and Noise Meter is designed for measurements of total harmonic distortion and noise and hum levels present in the output of a broadcast transmitter. Distortion measurements in the audio-frequency system alone may be made. Both percent distortion and noise level are read on a large meter and a multiplier dial giving full scale multiples of X1, X3, X10, and X30. The input to the distortion and noise-measuring circuit is accessible for line testing through one of the two double jacks on the panel. The modulation envelope is available at the other double jack.

A Weston Model 643 meter, calibrated directly in percent distortion and decibels noise level, is provided. Zero adjustment of the meter is made by a knob projecting from the front of the meter. Full-scale meter values of 1, 3, 10, and 30 percent distortion are provided and selected by a switch, while the noise or hum range is 30 decibels to 70 decibels below the value of the modulated carrier, or 65 decibels below an audio-frequency signal of zero level.

The frequency range is 380 to 420 cycles for distortion measurements; 30 to 10,000 cycles for noise and hum measurements. The overall accuracy of measurements is better than ± 5 percent of the indicated value on any range.

The General Radio Type 733-A Oscillator has an output power of 30 milliwatts. The frequency is 400 cycles within ± 2 percent. The frequency of the oscillator does not change by more than 1 percent because of heat dissipation in the unit or changes in the ambient temperature.

The internal output impedance is 50, 500, and 5000 ohms. This is obtained by changing a connection between the output terminals and the filter. These values enable a wide range of impedances to be connected to the oscillator without large mismatch loss.

Complete information on this assembly or on the separate units may be obtained by writing to the General Radio Company, 30 State Street, Cambridge, Mass.

MICA TRANSMITTING CONDENSERS FOR STACKING

Departing from the conventional pointed-end design, Aerovox mica transmitting condensers permit stacking while at the same time offering any combination of electrical connections. These bakelite molded units have flat tops and bottoms, permitting perfect stacking in minimum space, it is said. Mounting holes are to one side of main body, thoroughly insulated and independent of condenser terminals. Thus each unit may be mounted anywhere, even on a metal chassis, without involving the electrical connections. When stacked, the mounting screws or rods are slipped through aligned mounting holes, leaving terminal lugs free for any individual or group wiring. Terminals are of new design for soldered, permanent connections, without transferring harmful heat to the imbedded condenser section. Manufactured by the Aerovox Corporation of Brooklyn, N. Y., these mica transmitting condensers are available in a wide range of capacities from .00005 to .04 mfd, and in 1000, 2500 and 5000-volt ratings.

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"The Market Place"

Manufacturers are requested to send data on their new products for use in the communications and broadcasting field, promptly, for inclusion in "The Market Place" section.

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AURAL MONITOR FOR BROADCAST STATIONS

The Eastern Radio Specialty Company, 1845 Broadway, New York City, have announced a new Police and Broadcast Linear Detection Monitor, known as the Peak B-2.

This monitor employs a tuned diode circuit which feeds a triode audio-frequency amplifier through a potentiometer-type volume-level control. The tube used is the type 85 which has a diode and a triode combined in one envelope.

A power-supply unit is contained in the monitor case, thus making the unit completely ac operated. A type 84 full-wave

rectifier tube is used and its dc output is filtered by a 150-henry choke and a dual 8-mfd electrolytic condenser. The power transformer has an electrostatic shield between primary and secondary windings.

The monitor components are completely contained in a steel cabinet 8½" high by 6" wide by 10" deep, offering thorough shielding of the unit. The panel and chassis are copper plated. The cabinet, panel and top of chassis are finished in black ripple.

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HIGH-FIDELITY SOUND SYSTEM

The Turner Company, Cedar Rapids, Iowa, have recently announced their combination High-Fidelity Sound System which is said to have a flat frequency response within plus or minus one and one-half db from 40 to 10,000 cycles, full 25-watt output, hum-free operation and four stages of high-gain amplification incorporated in the main amplifier. This combination consists of their 4-SC Dia-Cell Microphone, MC-50 Amplifier, and the Turner Pre-amplifier.

The Turner Company will be pleased to supply any further information that may be desired.

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HIGH-FIDELITY TRANSMITTER

Doolittle and Falknor, Inc., 1306 West 74th Street, Chicago, Ill., have recently announced their new Type 250-B Radio Broadcast Transmitter. This is a Class B shunt-feed, high-level, 100 percent modulated transmitter that may be operated with either 100-watt or 250-watt output by throwing one switch.

The 250-B is entirely ac operated from a 115-volt, 60-cycle, single-phase power supply, with the exception of the modulator bias which is obtained from a small 45-volt B battery.

The overall efficiency is approximately 16 percent for 250-watt operation, 100 percent modulated.

Dual crystals and temperature-control circuits are provided, either crystal being selected by means of the Crystal Selector Switch. The frequency-control equipment has a stability of plus or minus 20 cycles per second.

The overall frequency-response characteristic at 100 percent modulation is said to have a variation of less than 2 db from 50 to 8000 cycles for 250 watts output and less than 3 db variation from 50 to 8000 cycles for 100 watts output.

The power change from 250 to 100 watts is made by means of a single switch which corrects the speech-input level at the same time it changes the power output.

The transmitter frame consists of two special racks for subpanel mounting, such that all tubes are mounted on the panel front but are behind perforated doors which enclose the front of the transmitter. Where necessary the individual panels are enclosed with can covers. The entire rear of the transmitter is enclosed with perforated screens. All meters, with the exception of the oscillator plate meter and the speech-amplifier plate meter, are located on panels behind glass at the top of each rack. All power switches and power-changing switches are located on the doors.

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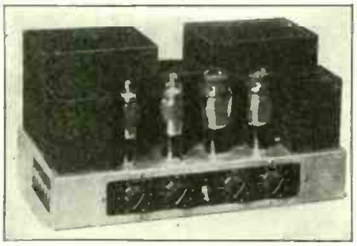
NEW AC-DC AMPLIFIER

An interesting new amplifier has just been announced by the Morlen Electric Company of 100 Fifth Ave., New York City. This amplifier is a dual-service unit, it being possible to operate it from either a six-volt dc power source, such as an automobile storage battery, or from standard 110-volt, 60-cycle ac lines. The amplifier, shown in the accompanying illustra-



tion, is completely self-contained, there being no external power packs of any kind.

The tube lineup is a 6C6 feeding an 89 driver Class A connected, which feeds a pair of 6A6 tubes in a Class B output stage. The power output is 20 watts and the quality is said to be excellent for all classes of p-a work even at the maximum power output.

This new amplifier is also available as a portable case unit, in addition to the standard Morlen chassis type. For all classes of truck and sound-car work and for traveling shows requiring both indoor and outdoor ballyhoo this new amplifier will render excellent service, it is stated.

A bulletin describing this unit is available.

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NEW TRANSMITTER-RECEIVER UNITS

The Harvey Radio Laboratories, 12 Boylston Street, Brookline, Mass., have recently announced their Type RTM (mobile) and Type RTF (fixed) transmitter-receiver units. Both types are designed for two-way ultra-high-frequency communication on the general experimental frequencies; and both types are said to feature the following: Low initial cost and upkeep, low power consumption, good operating efficiency, easy installation, built-in dynamic speaker, and no interfering radiation.

The Type RTM has a carrier output of 4 watts, with 16 watts on modulation peaks. This unit is designed for fixed-frequency use and may be preset at any point between 30 and 60 mc. Two 71A's are used as self-excited oscillators in a TNT circuit. A 79 is used as a Class B modulator, an 89 as Class A driver, a 76 as speech amplifier, and a 37 as detector, the modulator and speech amplifier acting as audio amplifier when receiving. The power supply is from an external dynamotor delivering 225 volts at 120 ma. Input 6 volts dc to both filaments and to dynamotor. The total battery drain is 8 amperes receiving and 10 amperes transmitting.

The Type RTF has a carrier output of 10 watts, with 40 watts modulation on peaks. This unit, like the RTM, is designed for fixed-frequency use and may be preset at any point between 30 and 60 mc. The receiver may be tuned, however. Two 45's are used as self-excited oscillators in TNT circuit, a 53 as Class B modulator, a 53 as Class A driver, a 56 as speech amplifier, a 56 as detector, and an 83V as rectifier. The power supply is an integral part of this unit delivering 300 volts at 150 ma for both receiver and transmitter.

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NEW PRESTO NEEDLES

The Presto Recording Corp., 139 West 19 Street, New York City, have just informed us that for a long time there has been considerable difficulty in obtaining steel cutting stylii for cutting celluloid discs as well as their special coated discs. These stylii were imported from Europe, but were very unsatisfactory because of the poor workmanship and the material used. At that time there was no manufacturer in the United States that could make these cutting stylii. However, these stylii are now being manufactured exclusively for Presto and under their own specifications, it is stated. These needles are now in production and deliveries are being made. The reports of the trade are said to be very enthusiastic.

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SEMI-AUTOMATIC TRANSMITTER TUNING

In changing transmitter tuning from one wavelength to another it is desirable and necessary to effect the change in the shortest possible time. This is especially true in airway communications where a ground station may be transmitting weather reports on one wavelength, a direction beam on another and talking with pilots aloft on the third. It is also essential that the transmitter be returned to identically the same wavelength each time the same information is again being broadcast to make it easier for the pilots to tune their receivers. To accomplish semi-automatic tuning of the transmitter the following equipment is used:

A six-position selector switch, mounted on the control panel, provides for selection of any one of five circuits and an off position. Selection of any one circuit may be made from any previous position of the switch without closing any other circuit. A relay is used to connect the transmitter for the desired wavelength. It consists of five independently-operated relays mounted side by side, each one having three normally open poles. The contacts short circuit various sections of the tuning coils and are located as close to the coils as possible to reduce capacity effects and prevent inductive coupling.

Struthers Dunn, Inc., Philadelphia, Pa., are in a position to supply this equipment, and also the solution of most other problems involving relays. Similar equipment may also be had for transport companies, and other radio stations working on several wavelengths. Complete data will be sent on request to the above company.

INDEX TO ADVERTISERS

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