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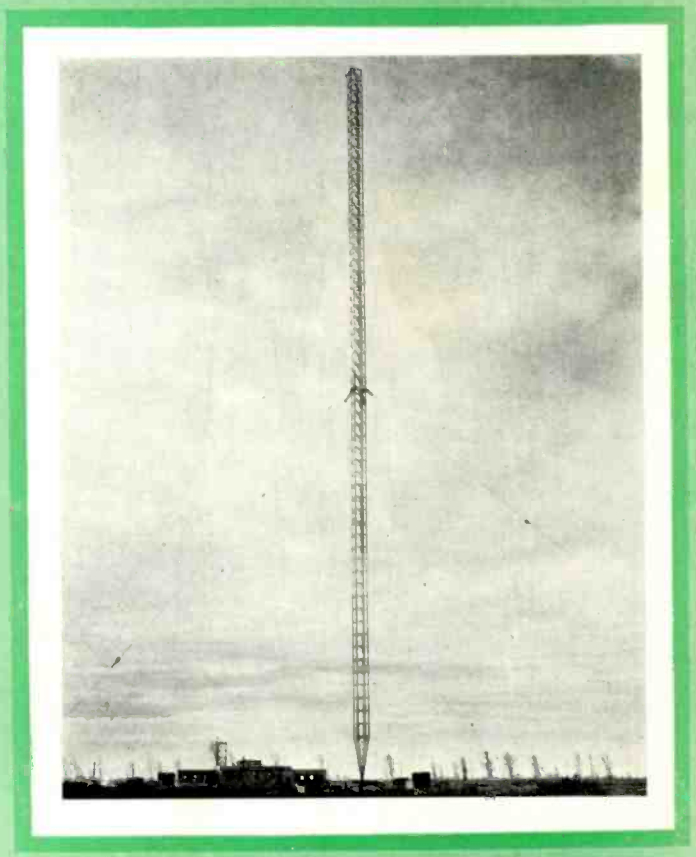

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THE JOURNAL OF WORLD COMMUNICATION

COMMUNICATION & BROADCAST ENGINEERING

M. L. MUHLEMAN
Editor

RAY D. RETTENMEYER
Associate Editor

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COVER ILLUSTRATION

THE 400-FOOT BLAW-KNOX VERTICAL RADIATOR OF RADIO STATION WWJ, DETROIT, MICHIGAN. NOTE THAT THE RADIATOR IS OF UNIFORM CROSS-SECTION.

FEATURES

DEPARTMENTS

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EDITORIAL

COMMITTEE ON INTERFERENCE

THE WAR against radio interference has at last started to take definite form. The development of standards for reducing man-made interference is one of the problems of a new American Standards Association committee. At a recent meeting called by the Radio Manufacturers Association the following officers were elected for this new sectional committee on Radio-Electrical Coordination: W. R. G. Baker, chairman; L. C. F. Horle, vice-chairman; and Virgil M. Graham, secretary.

In line with the policy of the ASA every group having an interest in a given project is invited to appoint representatives to serve on the committee which develops the standards. The following are among the groups which will be invited to send representatives to the Radio-Electrical Coordination Committee: RMA, AIEE, ARRL, American Transit Association, Association of American Railways, ASA Electric Light and Power Group, ASA Telephone Group, Department of Marine (Canada), FCC, IRE, IRSM, NAB, NEMA, Radio Club of America, RMA of Canada, Radio Wholesalers Association, SAE, and U. S. Department of Commerce—National Bureau of Standards. As the occasion arises, of course, representatives will be added from other interested groups.

Interference is one of the most important problems which the radio industry now faces, and the setting up of the proper standards should greatly help to clear the situation. Vice-Chairman L. C. F. Horle, in a very comprehensive article appearing in the November issue of *Industrial Standardization and Commercial Standards Monthly*, points out that the manufacturers, radio set owners and broadcasting stations (including television) will all benefit by the work of the new committee.

◆

NEW CHIEF ENGINEER FOR FCC

ON NOVEMBER 15, Dr. C. B. Jolliffe resigned as chief engineer of the Federal Communications Commission. Dr. Jolliffe was appointed chief engineer of the old Federal Radio Commission in 1930, and later to the same position with the Federal Communications Commission when the latter body succeeded the Federal Radio Commission. Dr. Jolliffe is to be commended on his excellent record of accomplishments with the Commissions.

Capable Lieutenant-Commander T. A. M. Craven was named as the new chief engineer of the FCC on November 20. Commander Craven, who has been associated with radio since 1913, comes to the Commission with an excellent record of contributions to the art of communications and it is felt that much may be expected of him.

◆

FREQUENCY MODULATION

THE FREQUENCY-MODULATION SYSTEM developed by Professor E. H. Armstrong, of Columbia University, has merited a great deal of interest and comment. In comparison with present systems of modulation frequency modulation offers, among other things, a considerable improvement in signal-to-noise ratio. A discussion of the subject will be found on following pages.

◆

HIGHWAY TRAFFIC INFORMATION

FOR A FEW special events and holidays, radio station WOR, in cooperation with the New Jersey State Police, has broadcast highway information to its listeners. This information is intended for motorists in the vicinity of Newark and New York City, and it provides data as to which routes are most congested and on which highways traffic is making the most rapid progress.

At the Princeton-Navy football game, for example, an announcement was made over the stadium p-a system to the effect that those desiring the latest information on traffic conditions expected in the metropolitan area should tune in on WOR on their way home. Then, after the game several brief announcements were made relative to existing traffic conditions on the various routes to the metropolitan area.

Such broadcasts serve two purposes. First, a valuable service is rendered to the motorists, and second, the number of WOR listeners is increased. Many motorists, who might otherwise tune to some other station, undoubtedly tune their auto-radio receivers to WOR and keep them tuned there in order not to miss the broadcast.

It seems that this type of service might well be extended. Weather information might also be provided along with the data on traffic conditions, since auto-radios are not equipped with a frequency band which enables reception of the Department of Commerce Weather Bureau Stations, and the broadcasts made at specified intervals during the day. This data would be of considerable value, and a sponsor for such a program should not be difficult to obtain. In any case, other radio stations in the heavier populated areas might do well to follow the example of WOR.

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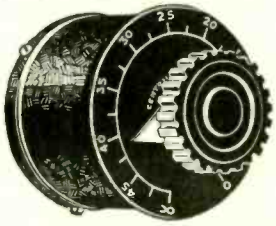

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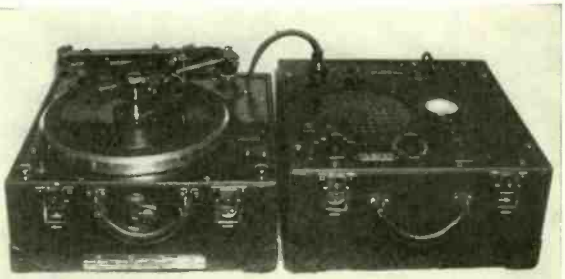

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COMMUNICATION & BROADCAST ENGINEERING

FOR DECEMBER, 1935

RECTIFIERS FOR TELEGRAPH SERVICE

By H. M. WARD and A. A. STEINMETZ

Engineers

WESTERN UNION TELEGRAPH COMPANY

WITH THE ADVENT of the many new types of mercury-vapor rectifier tubes Western Union engineers have done considerable pioneer work in the design of single- and poly-phase rectifiers for use where d-c supplies with excellent voltage regulation and a minimum of ripple are required.

Since the majority of telegraph circuits are operated by direct current, the problem of converting a-c power to d-c has long been an important one in the telegraph industry. Until a few years ago rectifiers of the Miller or aluminum-lead type and the lead-tantalum type were practically the only ones used for direct operation of telegraph circuits. Their use, however, was limited due to their poor regulation characteristics, bulkiness and low capacity. On the other hand, mercury-vapor rectifiers were at one time extensively used for battery charging. These were, however, displaced when the use of batteries was discontinued in favor of motor generators.

VOLTAGE REGULATION

Improvement of the gaseous-tube rectifiers to permit operation at higher voltages opened up a very wide field, and gave promise of the possibility of displacing the expensive motor-generator plant. The mercury-vapor type tube with filamentary cathode had a marked advantage not found in the earlier type of rectifying devices. This advantage was the practically constant voltage drop which existed across the rectifier tube, irrespective of the load. Thus was eliminated one of the principal causes of poor voltage regulation inherent in other rectifiers, since the reduction in voltage output with increase of load now depended only on trans-

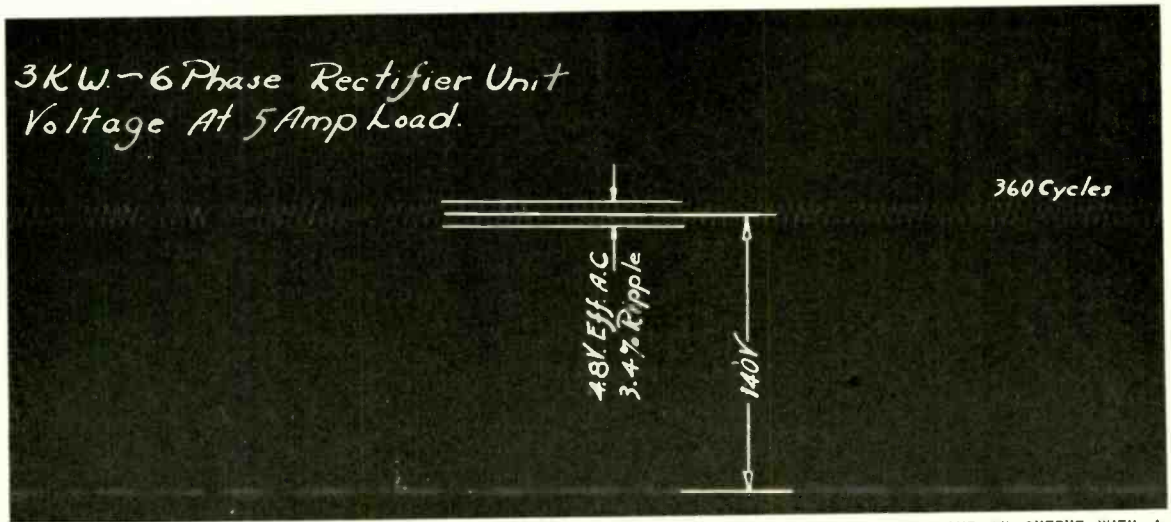


FIG. 3. A 3-PHASE, 60-CYCLE SUPPLY CHANGED TO 6-PHASE AND RECTIFIED WITH THREE FULL-WAVE TUBES GAVE AN OUTPUT WITH A 360-CYCLE RIPPLE OF APPROXIMATELY 4 PERCENT.

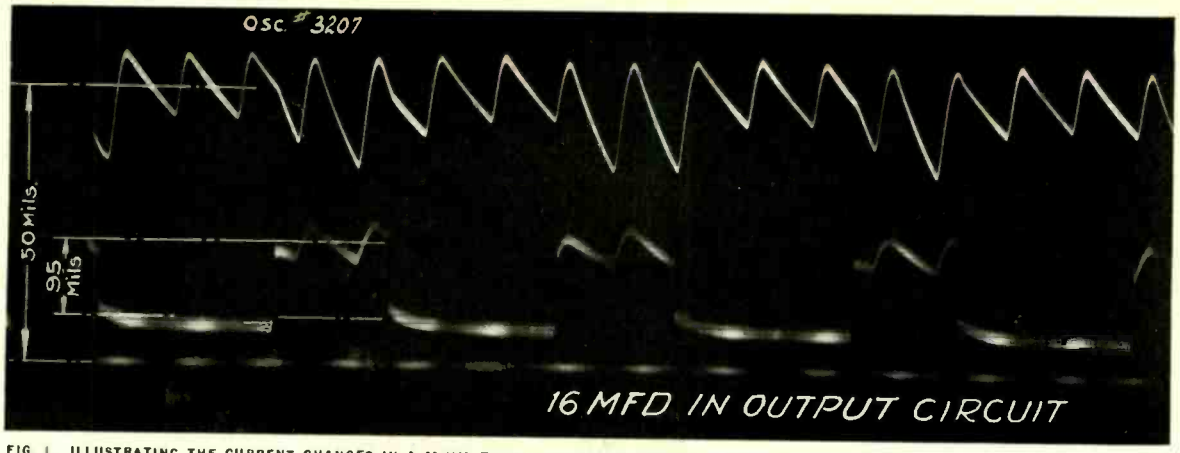


FIG. 1. ILLUSTRATING THE CURRENT CHANGES IN A 50-MIL TELEGRAPH CIRCUIT WHEN A PARALLEL CIRCUIT DRAWING 95 MILS FROM THE SAME SOURCE WAS ALTERNATELY THROWN ON AND OFF.

former regulation and the design of the filter circuit, both of which were under the control of the designer.

Several types of single-phase rectifiers with automatic-voltage-regulating features, developed by various manufacturers, were submitted for test but found unsatisfactory for telegraph use because of poor dynamic regulation. This was due to the instantaneous voltage change that occurred when the load on the rectifier was suddenly increased or decreased. It was in effect merely an inductive kick and did not appear on the average meter. It could, however, have a very bad effect on telegraph circuits operating from such a source, particularly if a portion of the load was of a fluctuating type. In order to avoid such a characteristic, single-phase mercury-vapor rectifiers were developed with a filter circuit consisting of only a 16-mfd condenser across the output of the tube. In theory at least this was not conducive to long tube life, but it did provide sufficient filtering at a minimum cost to permit operation of telegraph circuits, without introducing poor dynamic regulation.

THE "SWINGING CHOKE"

In order to provide a filter which would afford better tube protection and possible improvement in voltage regulation and filtering, experiments were made with the so-called "swinging-choke." This is simply an impedance with an iron core, in which the inductance tends to decrease rapidly as the current is increased. The choke is so designed that the inductance is at the minimum value which will provide good voltage regulation while at the same time it produces a much smaller inductive kick than a conventional choke. By inserting such a swinging-choke immediately ahead of the condenser, sufficient protection was afforded the rectifier tube to permit the use of a much larger condenser than would otherwise have been possible. The results obtained with single-phase full-wave rectifiers were very satisfactory as to voltage regulation, both static and dynamic.

The upper curve in Fig. 1 (16-mfd filter only) shows the current changes occurring in a 50-mil telegraph circuit when a parallel circuit drawing 95 mils from the same source, as shown in the lower curve, was alternately thrown on and off. The upper curve in Fig. 2 shows how regulation was improved by using a swinging choke and 75-mfd filter circuit on the same rectifier.

The maximum voltage drop for a rectifier of the former type, using an 83 tube, was 20 percent from no load to 100 mils load. The voltage drop for the latter type was only 2.4 percent.

Specifications for a typical swinging choke call for the following values of inductance with 64 volts, 120-cycle a-c and the following d-c currents applied:

1.6 henrys + or — 10% with .1 amp d-c.
0.4 henrys + or — 25% with .5 amp d-c.
0.2 henrys + or — 25% with 1.0 amp d-c.
0.115 henrys + or — 10% with 1.5 amp d-c.
0.075 henrys minimum with 2.0 amp d-c.

Resistance is specified not to exceed 1.25 ohms. The quality of regulation obtained may be improved by decreasing the inductor resistance, but this, of course, increases its size and cost.

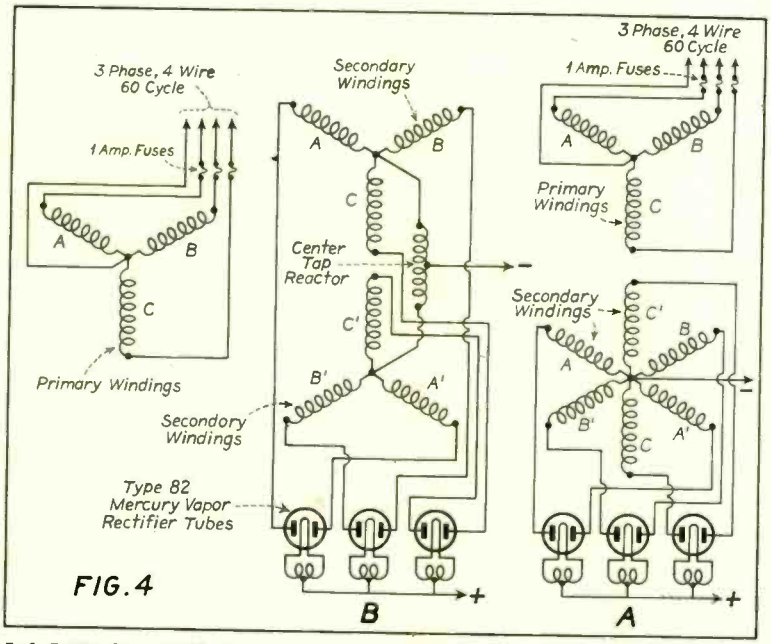


FIG. 4

TWO TYPES OF 6-PHASE RECTIFIERS. THE METHODS OF OBTAINING 6-PHASE POTENTIAL FROM A 3-PHASE SOURCE ARE ILLUSTRATED.

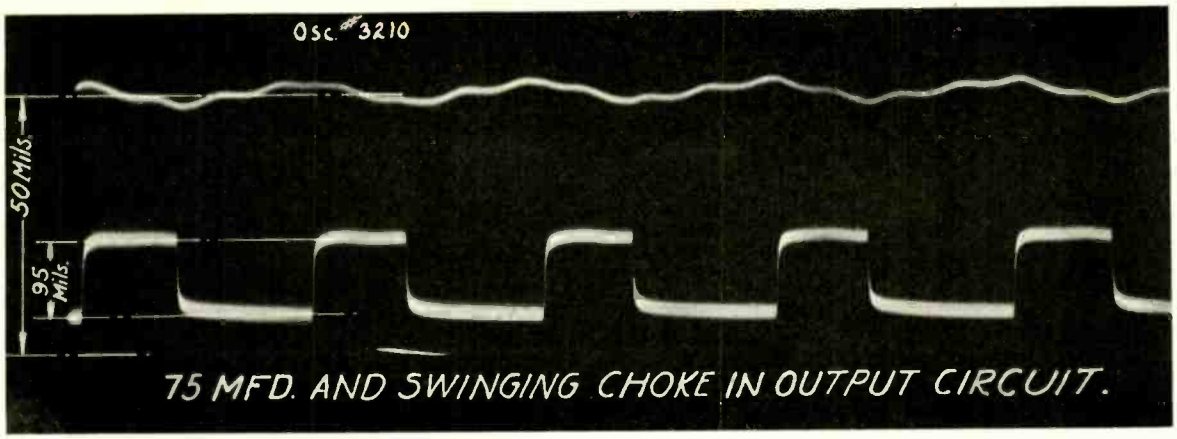


FIG. 2. ILLUSTRATING HOW REGULATION WAS IMPROVED BY USING A SWINGING CHOKE AND A 75-MFD FILTER CIRCUIT ON SAME RECTIFIER AS USED FOR FIG. 1.

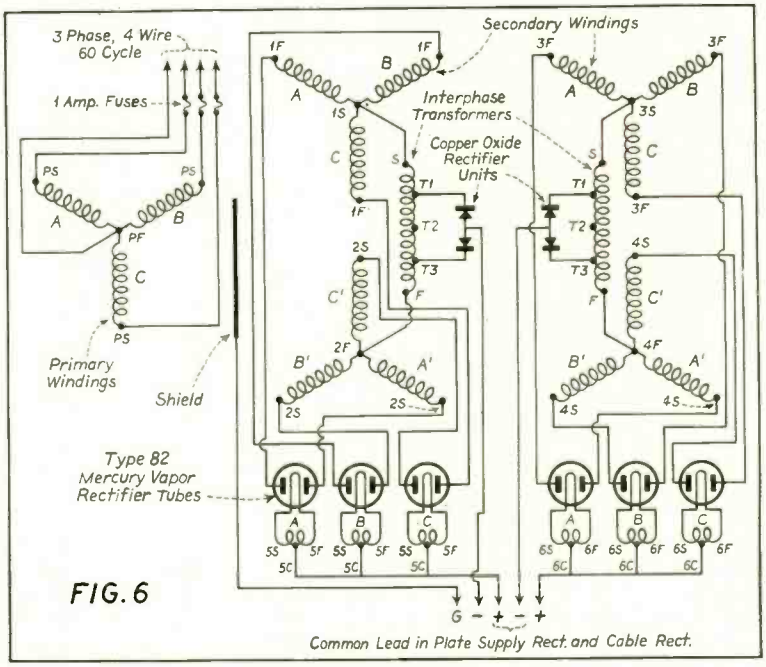
POLY-PHASE RECTIFIERS

In cases where greater capacity with better regulation is required than can be furnished with single-phase rectifiers, poly-phase rectifiers are used.

The theory of operation of the poly-phase rectifiers is based on the fact that the anode which is at the highest potential at any particular time passes current while the other anodes which are at any lower potential pass no current, even though they may be positive with respect to the cathode. In the ordinary single-phase full-wave rectifier the potential on one anode increases from 0 to its maximum value positive, and then decreases to 0 potential while the other anode is negative with respect to the cathode. Consequently, each anode in such a rectifier passes current alternately, the output potential of the rectifier increasing from 0 to its maximum and back to 0 at twice the supply-voltage frequency. With the poly-phase rectifier, due to the overlapping of phase voltages, the load is transferred from one anode to another before the voltage falls to 0. Consequently there results a ripple of much less amplitude and whose frequency is 3, 4, 6 or more times the supply frequency, depending on the number of phases. Thus, assuming a 3-phase, 60-cycle supply which is split by the secondary transformer winding connections to provide a 6-phase potential, we may, with three full-wave tubes, obtain a rectified output having a 360-cycle ripple of approximately 4 percent, expressed as the effective value of alternating-current voltage imposed on the d-c output voltage. A typical example is shown on Fig. 3. It may be seen that a ripple of such high frequency and relatively low amplitude would require a minimum amount of filtering.

Two types of six-phase rectifiers and a method of obtaining the six-phase potential from a three-phase source are shown on Fig. 4. Fig. 4-A indicates the simplest form of such a rectifier, the secondary winding consisting merely of a center-tapped winding on each phase, the center taps being connected together to form the negative pole of the rectifier. The outside terminals of these windings are connected, respectively, to the anodes of the three full-wave rectifier tubes. The center taps on the filament windings, which may be either separate secondary windings on each phase of the transformer, or an entirely separate filament transformer, are connected together to form the positive pole of the rectifier. It may be seen that the various anodes reach their maximum positive potentials at intervals of 60 electrical degrees.

The graph shown in Fig. 5 indicates the voltages applied to the anodes of the rectifier tubes and the upper portion of this curve, outlined by the points M, X, N, Y, O, etc., indicates the output voltage from a rectifier such as shown in Fig. 4-A. In such a rectifier, each anode and the transformer winding connected to it carries the entire output current in turn.



THE THEORETICAL CONNECTIONS OF A RECTIFIER EMPLOYING A RIPPLE-FREQUENCY MULTIPLYING ARRANGEMENT.

In order to reduce the peak currents carried by the tubes, and the inductive effect in the transformer windings resulting from the shifting of the entire output current from one winding to another, inter-phase transformers are generally used in poly-phase rectifiers in the manner shown in Fig. 4-B. In this type of rectifier, two separate secondary windings are provided on each phase and connected together in two groups of three with the inter-phase transformer or center-tapped reactor connecting the mid-taps of the two groups. The center tap of the inter-phase transformer then forms the negative pole of the rectifier.

The effect of the inter-phase transformer is merely to divide the load between the transformer winding and anode which is at the highest positive potential. For instance, assuming that the anode connected to transformer winding C prime is at the highest positive potential as indicated by point M on the graph, the output current of the rectifier flowing through half of the inter-phase transformer induces a voltage in the other half of the inter-phase transformer which tends to increase the voltage on windings A, B and C. Since winding A is at the next highest positive potential to winding C prime, the voltages between the anodes connected to these two windings are equalized and both carry current in parallel. The resultant output voltage of the rectifier is shown on the graph by A, X, B, Y, C.

Fig. 6 shows the theoretical connections of a rectifier employing a ripple-frequency multiplying arrangement*, which results in increasing the frequency of the output ripple and reducing its amplitude to approximately 25 percent of its original value. In this arrangement the inter-phase transformer is tapped at a point approximately 26.8 percent from each end and the positive terminals of two copper-oxide rectifier units are connected to these two taps. The negative terminals of these two copper-oxide rectifiers are connected together to form the negative pole of the main rectifier unit. The copper-oxide rectifier units serve to permit current to flow alternately through either end tap without short-circuiting the mid-section of the inter-phase transformer.

The current through the ordinary inter-phase transformer reverses at a frequency of 180 cycles and the voltage across it is approximately 50 percent of the anode potential. When the inter-phase transformer is center tapped the voltage of one group of anodes is increased by the same amount that the voltage on the other group is decreased. For example, by referring to the graph of Fig. 5 the point C is midway between points O and F, and all other points on the curve A, X, B, Y, C, which is the output voltage obtained from the rectifier with the center-tapped inter-phase transformer, are midway between the two transformer secondary voltages connected to the operating anodes. The inter-phase transformer used in the ripple-frequency multiplying arrangement is tapped so that the voltage on the higher potential anodes is decreased by approximately 26.8 percent and the voltage on the lower potential anodes is increased by approximately 73.2 percent of the total potential difference between them. This gives a resultant output voltage as shown by the curve Z, A prime, X prime, B prime, Y prime, etc. These tap positions on the inter-phase transformer were selected so that points A prime, B prime, C prime, would be at the same potential as points Z, X prime, Y prime, Z prime.

This arrangement not only increases the frequency of the ripple but materially reduces its amplitude in an ingenious manner by a very simple change in the inter-phase transformer and the addition of two relatively low-voltage, inexpensive copper-oxide rectifier units.

The oscillograms, Figs. 7 and 8, show the characteristics of a 2-kw motor-generator set as compared to a 2-kw six-phase rectifier when carrying a fluctuating load. In both of these oscillograms the top line shows the fluctuating load which was applied to the power source. The middle line shows the actual current flow through an independent circuit operating from the same source and carrying an average current of 50 mils. It may be seen that in the case of the motor-generator set, Fig. 7, application of the 6¾ ampere load caused the current through the separate 50-mil circuit to drop sharply and that when the 6¾ ampere load was removed, the current through the independent circuit suddenly returned to normal. Such distortion on a fast telegraph circuit might easily result in the introduction of errors. Although such extreme variations in load are rare in telegraph service, the example is given to show the unusual stability of the rectifier output.

Some experimental work relative to the use of copper-oxide and copper-sulphide rectifiers in poly-phase rectification has been done. The copper-sulphide element has a fairly definite breakdown voltage and low resistance so that its voltage drop under varying loads is somewhat similar to the mercury-vapor tube characteristics. However, this type of rectifier element is very definitely limited as to the maximum a-c voltage which it will withstand, regardless of the number of discs in a stack. The maximum voltage which may be applied is approximately 12 volts and, in order to use this type rectifier where higher secondary voltages are necessary, separate secondary windings of 12 volts each must be provided for connection to separate rectifier elements. The output of these separate rectifiers may then be connected in series to provide the desired output voltage. It may be seen that this would be impractical for ordinary telegraph line potential voltages but it is possible that this type rectifier will provide a satisfactory low-voltage source such as the 26 volts required for operation of telegraph simplex equipment.

The copper-oxide type rectifier does have a very important use outside the field of poly-phase rectification, where it is necessary to supply high-current, intermittent loads for short intervals, as for instance for automatic time stamp and clock-setting circuits.

In order to provide for such circuits in the past it was the practice to install motor generators of much larger capacity than would be required for the normal office load. Even with such large machines, the dip in voltage when time stamps or clock circuits operated, was frequently noticeable. The installation of these relatively inexpensive copper-oxide rectifiers not only eliminates this potential source of operating difficulty, but also permits the use of motor generators of smaller size, which will operate more efficiently at the normal office load. Due to the extremely low percentage of the time during which the load is actually on, the rectifier can be loaded very much more than would be safe with a steady load. Also the number of discs required in a stack for a given voltage can be reduced considerably. The rectifier stacks used are operated at five times normal current rating and twice normal voltage.

The use of rectifiers as compared to motor generators in telegraph service offers numerous advantages, the principal among which are lower first cost, the reduction in maintenance cost which may be effected by the elimination of rotating equipment, the improvement in operating efficiencies with resultant decrease in power costs, and reduction in amount of floor space required for power plant equipment.

Another advantage of the use of rectifiers is the quietness of operation. Considerable money is spent by the Western Union Telegraph Company in providing acoustical treatments for its operating rooms and the elimination of one source of disturbing noise may lessen the need for such treatments.

There are, of course, various limita-

*Patent applied for.

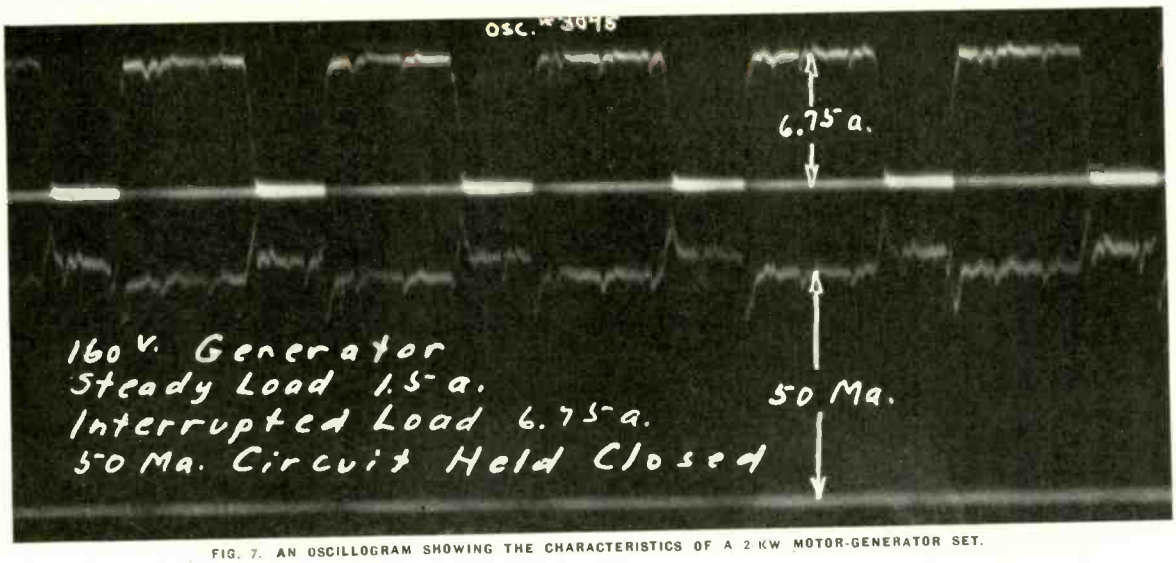
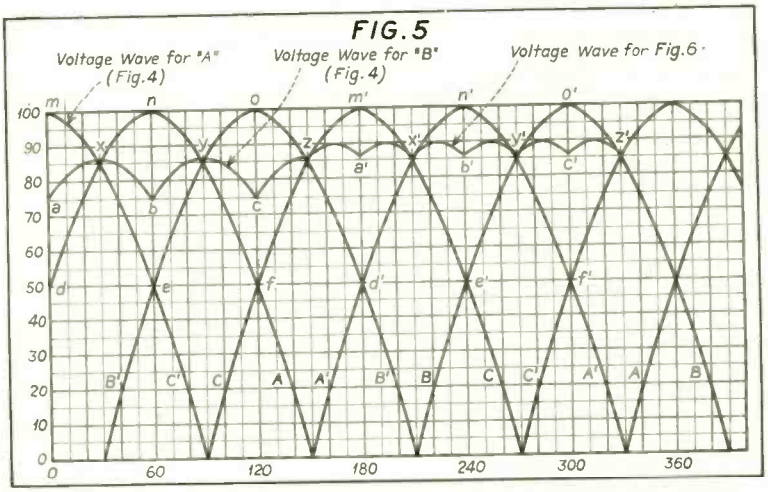


FIG. 7. AN OSCILLOGRAM SHOWING THE CHARACTERISTICS OF A 2 KW MOTOR-GENERATOR SET.

tions to the use of rectifiers, among which might be mentioned the limited variety of types of tubes available for the varied needs of the telegraph service. However, this situation is rapidly being eliminated by the manufacturers who are continually developing and placing new types upon the market.

There are also certain limits beyond which rectifiers will not show higher efficiencies than are obtainable with motor-generator sets. This applies particularly to the larger size 110-volt installations where motor-generator efficiencies of 80 percent or above are possible. Because of the fixed voltage drop in rectifier tubes of from 8 to 12 volts, it is difficult to obtain higher efficiencies than 80 percent from rectifiers operating at such a relatively low-voltage output.

FIG. 5



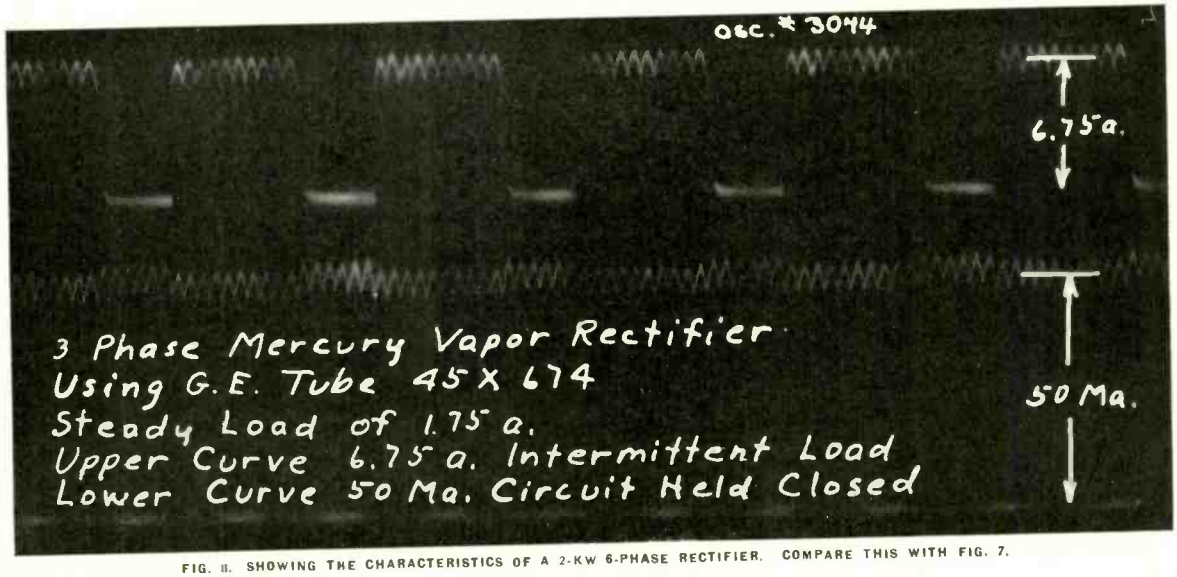


FIG. 8. SHOWING THE CHARACTERISTICS OF A 2-KW 6-PHASE RECTIFIER. COMPARE THIS WITH FIG. 7.

FREQUENCY MODULATION

PROFESSOR E. H. ARMSTRONG.

PROFESSOR E. H. ARMSTRONG, who holds the medal of the Institute of Radio Engineers for his invention of regeneration, and who rose to fame through the development of the superheterodyne and super-regenerative circuits, has made another, and equally promising, contribution to the science of radio. While the full significance of frequency modulation cannot as yet be fully appreciated, perhaps, the new system seems to offer considerable possibilities.

Professor Armstrong merits a great deal of commendation for his latest contribution to radio. The amount of time and effort spent in research on this system must have been enormous, for frequency modulation involves an almost completely new technique and some of the present conceptions of modulation as well as customary axioms must either be extended or discarded. Also, exhaustive tests, in conjunction with the National Broadcasting Co., have been carried on for more than a year.

Modulation can, of course, be accomplished by operating on any of three parameters of a wave, namely, amplitude, phase or frequency.[1] All three types of modulation have been analyzed by such scientists as J. R. Carson, Hans Roder, J. G. Chaffee, Balth van der Pol, and others.

The generalized expression for an alternating current is

$$I = A \cos (\omega t + \Theta)$$

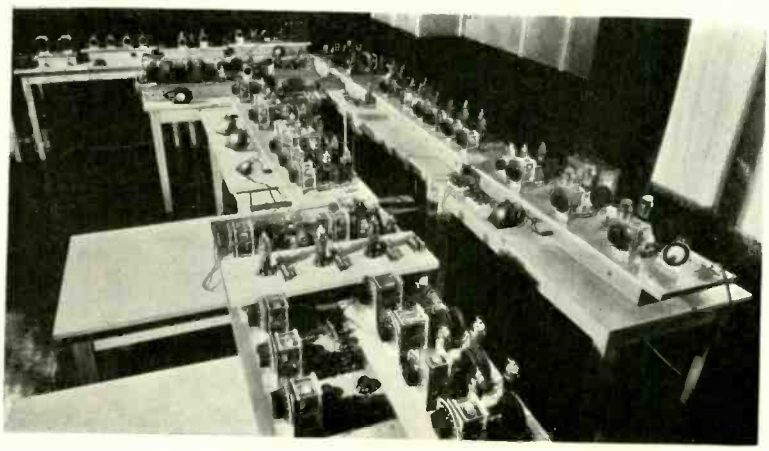
This current may be modulated by a process (called amplitude modulation) in which the signal controls the amplitude of the carrier wave while the carrier remains constant in phase and frequency. (It is assumed that the amplitude of the carrier is at all times proportional to the instantaneous amplitude of the signal wave.) In phase modulation the phase of the carrier is at all times proportional to the instantaneous amplitude of the carrier wave, while the amplitude and frequency of the carrier remain constant. In frequency modulation the instantaneous amplitude of the signal wave is employed to vary the apparent frequency of the carrier wave, the amplitude of which remains constant.

In Fig. 1 is shown a block diagram of the transmitting circuit. The essential elements consist of a master oscillator *E* followed by a carrier amplifier *F*. Carrier and audio signals are supplied to a balanced modulator *B*, the latter being supplied through a phase-correcting amplifier *A*. The balanced modulator suppresses the carrier and transmits two sidebands only to the phase-shifting network *C*, the latter shifting the phase by 90° so that no demodulation can occur with the original carrier. These sidebands are then combined with the carrier and fed to the frequency multipliers. A total frequency multiplication of 3000 was employed in the experimental setup at the Empire State Building transmitter.

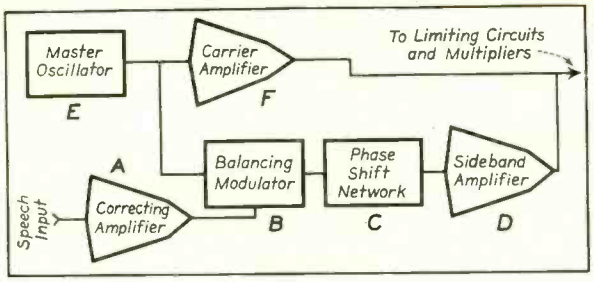
Fig. 2 shows, in a simplified form, the arrangement used in the receiver for converting frequency modulation to amplitude modulation, so that more or less customary methods of detection may be employed. This diagram is self-explanatory.

According to Major Armstrong, the chief advantage of his system lies in the improvement of signal-to-noise ratio; received noise is proportional to the received bandwidths only where the amplitude of the noise is greater than the carrier amplitude. Reference to Fig. 3 will show that as the band over

[1] Page 22, May, 1935, RADIO ENGINEERING. Page 18, June, 1935, COMMUNICATION AND BROADCAST ENGINEERING.



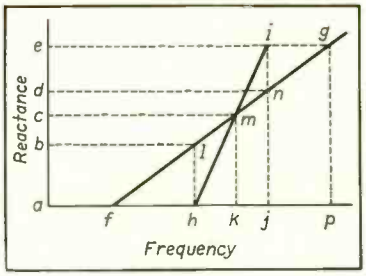
THE MULTIPLEXING APPARATUS IN THE EMPIRE STATE BUILDING.

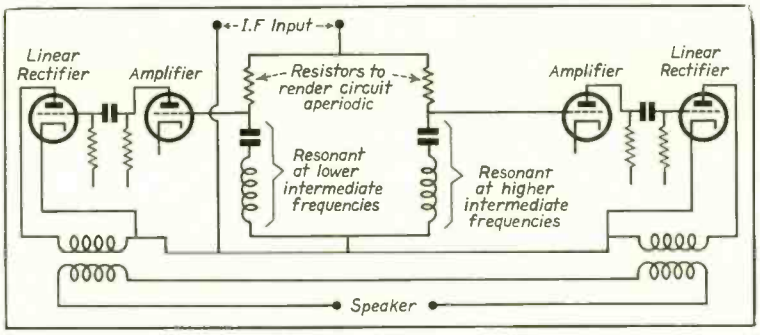


LEFT: FIG. 1. A BLOCK DIAGRAM OF THE TRANSMITTING CIRCUIT.

BELOW: FIG. 2. THE RECEIVER ARRANGEMENT FOR CONVERTING FREQUENCY MODULATION TO AMPLITUDE MODULATION.

RIGHT: FIG. 3. A DIAGRAM FOR ILLUSTRATING SIGNAL-TO-NOISE RATIO IMPROVEMENT.





which the system performs is widened the noise in relation to the signal decreases. For example, for a selective system having a slope *hi* the noise component of *h* will be *a* and the noise component of *j* will be proportional to *ae*. However, if the selective system has a slope of *fg* the noise components of *h* and *j* will be proportional to *ab* and *ad* respectively and the difference will be proportional to *bd*.

Major Armstrong has shown both analytically and experimentally that whereas in an amplitude-modulated wave an interfering voltage which is one percent of the carrier would spoil the program, an interfering voltage which is 50 percent of the carrier will be negligible in his frequency-modulated system. It appears that, in the ultra-high-frequency band in which Professor Armstrong proposes to use his system of modulation, ignition interference (the paramount interference problem of this band) presents the only real noise problem. Measurements made near Camden, N. J., on the 2-kw frequency-modulated transmitter located at the Empire State Building in New York City showed about a 30-db improvement in signal-to-noise ratio over an equivalent amplitude-modulated system. H. A. Wheeler, of the Hazeltine Service Corporation, working separately, has shown mathematically that about a 30-db improvement in signal-to-noise ratio might be expected.

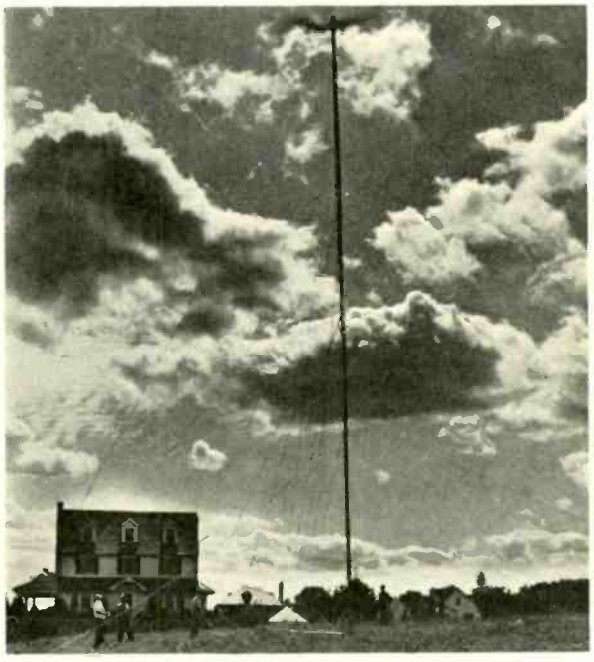
Although Armstrong's system appears to be somewhat complicated at the present time its constructional costs on a commercial scale should not by any means be prohibitive. As a matter of fact the system is still new and simplifications will undoubtedly be made.

While frequency modulation possesses many advantages for the 550-1500 kc broadcast band, such as, signal-to-noise improvement, adaptability for high-quality programs, elimination of adjacent-channel interference, and the like,

(*Continued on page* 18)

THE HALF-WAVE DIPOLE.

RIGHT: ERECTING ONE OF THE PRELIMINARY RECEIVING ANTENNAS AT HADDONFIELD, N. J. THIS MAST AND ANTENNA WERE LATER REPLACED BY A HALF-WAVE DIPOLE.



THE LAKE FOREST, ILLINOIS, TWO-WAY RADIO-EQUIPPED PATROL FLEET.

TRAIL-BLAZING IN TWO-WAY POLICE-RADIO COMMUNICATION

By D. L. ELAM
Consulting Engineer
CARTER MOTOR COMPANY

DUE TO the wide-spread interest in two-way police radio and due to the fact that many new installations are being made (often by engineers who are without experience in this field), much money is spent in experimenting, and quite often in junking costly equipment and replacing it at still greater expense before satisfactory service is obtained. It is hoped that a review of the actual experience of one of the first such systems in use will be valuable to those who contemplate the installation of this type of service.

This review concerns the city of Lake Forest, Illinois, which was one of the first in the field. Their equipment was installed on October 1, 1933, more than two years ago. Chief of Police Tiffany of Lake Forest has been enthusiastic in making available his experience. This article describes the equipment used, together with a record of the various problems encountered and an explanation of how each obstacle was overcome.

EQUIPMENT

The equipment consists of one fixed and four mobile stations. The fixed station is located in the building housing the city police department, while each of the four mobile units is mounted in a squad car. All equipment is tuned to the same frequency and the controls are locked securely in place.

The mobile units were mounted in trunks attached to the rear bumpers of the four cars. These trunks proved to be subject to violent vibration which broke soldered connections, shook loose the locking devices which held the tuning controls, and broke the Pyrex stand-off insulators which were used to mount the antennas. The use of Pyrex stand-off insulators was abandoned on the first cars and wax-impregnated wood, which resisted the vibration, was substituted. The Pyrex mountings were reinstalled, however, when new cars with built-in trunks were purchased. These trunks, being a part of the car body, are much less subject to vibration than the separately mounted trunks.

POWER SUPPLIES FOR MOBILE UNITS

The power-supply requirements for the mobile units are 175 milliamperes at 250 to 300 volts, for the transmitters, and 50 milliamperes at 250 volts, for the receivers . . . and, of course, heater current for all tube filaments. The choice of 6.3-volt tubes allowed the use of the car's storage battery to heat the filaments. However, the choice of a source for supplying the necessary high-voltage current for the plates presented a real problem. B batteries were too expensive and fan-belt driven generators were rejected because there was no satisfactory way to keep the voltage from varying with the engine speeds. There were available at this time small double-commutator genemotors taking 6 volts at one commutator and delivering 135 to 275 volts from the other. As the car battery can supply considerable power at a fairly constant voltage, these were chosen to supply the necessary high-voltage plate current.

The genemotors available at that time were designed only for intermittent use on auto-radio receivers and sound-truck installations, while the police service required them to run continuously night and day. (Although after two years of constant service, the original machines are still in use.) The older types of genemotors require periodic oiling and commutator cleaning. The more recently developed continuous-duty machines require no oiling and are conse-

quently free from commutator film which accumulates on the older types due to the oil working out of the bearings.

Genemotors available at the time of this installation were not large enough to supply all the power for these units, so two were used in each mobile station. One runs continuously and supplies 50 mils at 250 volts to the receiver and is switched to supply the oscillator plate current when transmitting. The other genemotor runs only when transmitting and supplies 125 mils at 275 volts to the speech amplifier, modulator, and modulated radio-frequency power amplifier.

The small amount of commutator ripple was removed from these motors by the use of a small filter choke and condenser arrangement in the output leads, these filters being similar to the ones used in the plate supplies of broadcast receivers. Freedom from high-frequency hash and brush noises was assured by placing the two genemotors and their filters in a heavy metal box and inserting properly by-passed radio-frequency chokes in all leads coming from this box.

THE MOBILE TRANSMITTER

The mobile transmitters are housed in their own completely-enclosed metal boxes, as are the receivers and plate-supply units. The tube line-up is as follows: A 42 tube as oscillator; another 42 as a modulated radio-frequency amplifier, coupled to the antenna. The speech equipment starts with a single-button hand microphone with a switch located in the handle. This switch actuates the relays for switching the smaller genemotor from the receiver to the oscillator, starting the large genemotor, and switching the antenna from the receiver to the transmitter. Since these switches, as well as the speed pickup of the genemotors, are almost instantaneous, very rapid two-way conversation can be carried on between the fixed and mobile stations, or between two mobile stations.

The microphone excites the grid of a 6C6 tube which, in turn, drives the grid of a 42 tube to modulate the plate current of the r-f amplifier.

The original mobile transmitter units are still in use and are reasonably satisfactory.

THE MOBILE RECEIVER

The first receivers tried were of the super-regenerative type with the detector coupled to the antenna. These, while satisfactory from the standpoints of sensitivity and ruggedness, were soon discarded for two reasons: First, their radiation was troublesome, while two or more stations were in the same vicinity; and, second, it was hoped that the superheterodyne receivers, with which they were replaced, would be quieter in operation when no transmission was taking place.

The new superheterodyne receivers are a success in that they do not cause radiation interference, but are not as quiet as was hoped, since they do not discriminate against ignition noises as do the super-regenerative units. The automatic volume control, which is attempted in practically all commercial purpose, ultra-high-frequency superheterodynes, was not fast enough in its action to shut off ignition noises. Therefore, it was necessary to look in other directions for ways to reduce background noises. The Lake Forest engineers are at present taking a logical step in overcoming this noise, a step which we shall discuss later in this article.

The car operators have been getting some relief from the annoyance of background noises by using volume controls placed across the voice coils of the speakers, these controls being located where they may be conveniently reached. By cutting down the volume to a very low level, the background becomes less objectionable. When a call is coming in, the volume is easily adjusted for satisfactory reception and is reduced again when the transmission is over.

The transmitters, receivers, and plate-supply units are all fastened rigidly to a board which is secured to the bottom of the trunk by four vibration-reducing mountings, made by embedding two bolt heads in a ball of live rubber, the bodies of the bolts extending in opposite directions. One bolt is secured to the mounting board supporting the equipment, and the other to the bottom of the trunk.

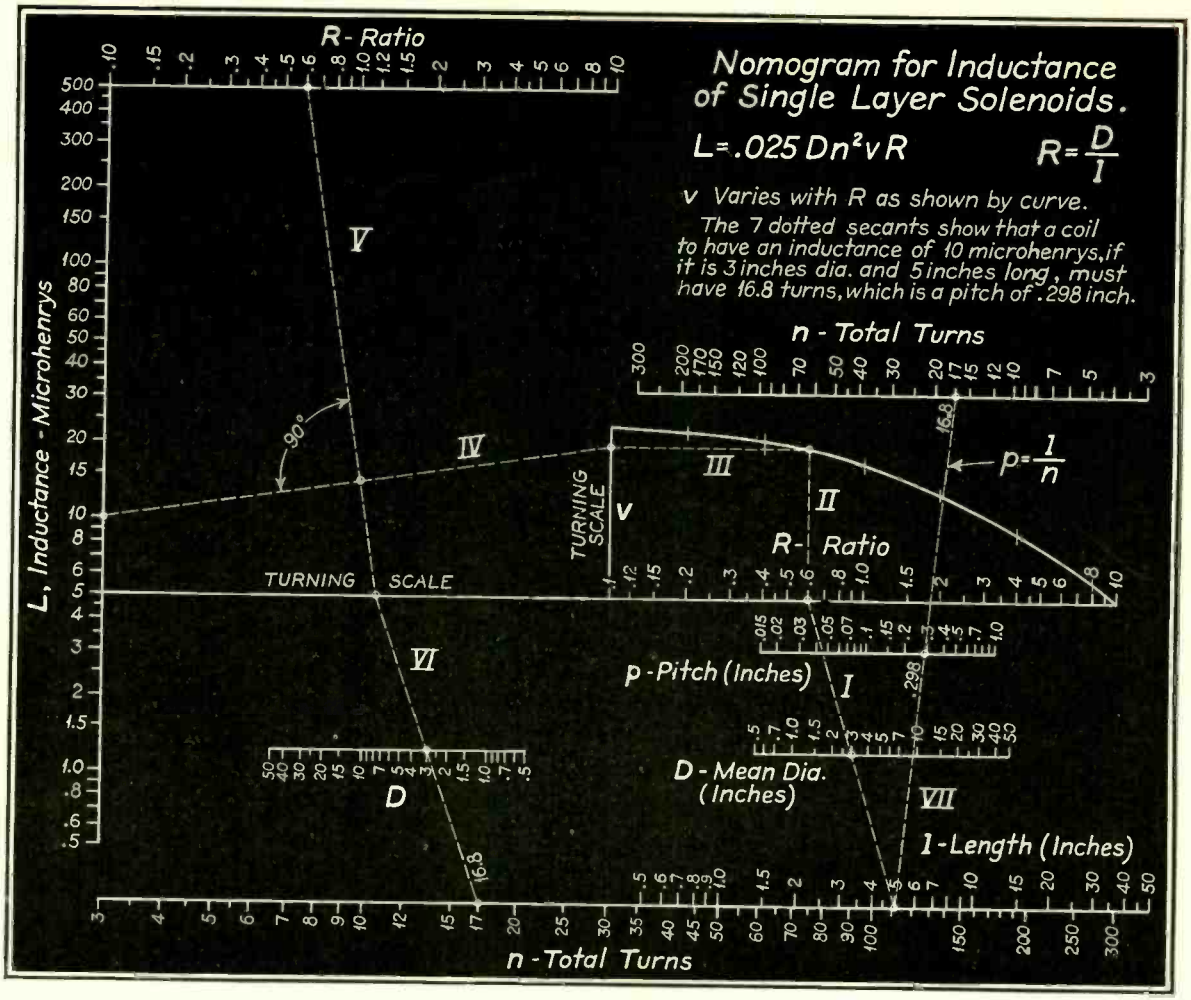
THE MOBILE ANTENNAS

The first tests made were with half-wave antennas stretched between two masts mounted one on each end of the car. These were abandoned almost at once because of their bulk and unsightliness. They were replaced by vertical quarter-wave rods mounted at the right side of the trunk. Power is fed into the quarter-wave rod by connecting a pick-up coil beween its base and the car body which serves as the ground. The antenna is brought to resonance by a small compression-type variable condenser connected between the base of the rod and the pickup coil. The antenna is switched from transmitter to receiver by the same relay which controls the genemotors.

An ingenious device is incorporated in these antennas which allows them to buckle freely in any direction and then right themselves, in case the car should run under any obstruction low enough to strike them. The antennas are made in two sections and are equipped with three-inch flanges where they are joined together. The flange of the top section rests upon the flange of the lower section, and is held in place by a stretched coiled spring secured in the tube which

(*Continued on page* 18)

CHIEF TIFFANY DEMONSTRATING ONE OF THE ORIGINAL MOBILE STATIONS.



NOMOGRAM FOR SINGLE-LAYER SOLENOIDS

By CARL P. NACHOD

Vice-President

NACHOD & U. S. SIGNAL CO., INC.

THE INDUCTANCE of a single-layer solenoid or helix may be computed by the well-known Nagaoka formula $L = 0.025\ D\ n^2\ v\ R$, as shown on the nomogram. In the Nagaoka formula, L is the inductance in microhenrys, D is the mean diameter of the coil in inches, l is the coil length in inches. $D/l = R$ is the ratio of the diameter to the length, and n is the total number of turns. In this formula, also, v is a function of R. A table of assumed values of R and the corresponding values of v is given in the U. S. Bureau of Standards Circular 74, page 252. This circular is now out of print, but it may be consulted at most public libraries.

By drawing six lines or secants, as shown, the inductance L may be computed from the nomogram, if D, l and n are given; or n may be found, if L, D and l are given. The secants are numbered to show their consecutive order for the computation of n, secant VII determining the pitch p, or $p = 1/n$. The curve is plotted from the above mentioned tabular relationship between R and v, for which no equation is given. Secants II and III are the coordinates of a point in this curve.

The scales for n and l, at the bottom, overlap at their inner ends. However, graduations are above for l and below for n, so there should be no confusion.

The square nomogram at the upper left is best solved by drawing a pair of right-angle lines on transparent paper. These lines are manipulated so that three of the arms pass through the desired points causing the fourth arm to pass through the value to be found. Each line of the cross must pass through *opposite* sides. The left side for L has been extended to give a larger range, and the intersection may be made outside the square.

All scales are logarithmic. The modulus of the scale n is 2m, while the modulus of the p and the two D scales is m/2. For all other scales the modulus is m.

IRE ROCHESTER FALL MEETING

SPECIAL DISTRICT MEETINGS of the Institute of Radio Engineers have been held in Rochester, New York, for a sufficient number of years that they are now known as the Rochester Fall Meetings. The 1935 Fall Meeting was held on November 18, 19 and 20 at the Hotel Sagamore.

The attendance at the meeting set an all-time record. It was outstanding as well in the large number of localities represented and the enthusiasm displayed on every hand. In addition to the technical sessions the talks at the banquet dealt with the probable effects of the new trade agreement between United States and Canada, the outlook of the radio industry in view of recent political developments as well as a comparison of the European radio industry with that in this country. It was evident that the industry as a whole is far from discouraged.

The advent of all-wave receivers placed in the foreground the problems of oscillator tracking and oscillator stability. Methods of meeting these problems and the degree of performance attained were discussed by W. A. Harris. Another problem which has come to the fore, namely, the losses in tubes and dielectrics at high frequencies, were dealt with by C. J. Franks. R. M. Wise considered the problems encountered in the manufacture of metal tubes and the technique developed to meet them.

Dr. V. K. Zworykin discussed at some length the multi-stage electron multiplier tubes which were previously revealed at a recent meeting of the New York Section of the IRE. These tubes, which function on the principle of secondary emission caused by impinging primary electrons, have the advantage of unusually high gain per tube, as well as a much lower noise level than conventional amplifier tubes. Heretofore, secondary emission has been considered a serious handicap, which it still is in conventional tubes. Dr. Zworykin has, however, turned this handicap into a device which promises to be of considerable importance, particularly in high-gain low-frequency amplifiers. Tubes with as many as 10 stages and gains of about 200 db have been constructed.

The pros and cons of standardization in the radio and allied fields were presented by L. C. F. Horle and P. G. Agnew. Some of the points raised indicated the absurd tolerances and almost but not quite identical requirements placed on component parts. It was effectively pointed out that a considerable saving would accrue if engineers would show some inclination to use more standard components. It was also pointed out that the Gas Industry had adopted the first fittings standards of the SAE some years ago to effect a considerable economy for both industries. The necessary machinery for close cooperation on standards is now set up by the ASA for coordination of the standards of the various industries. During the extended discussion it was brought out that some of the difficulties in the way of standardization in the radio field were:

1. Rivalry between manufacturers.
2. Complicated patent situations.
3. Rapid development.
4. Frequent changes in practice.
5. Rapid changes in materials utilized.
6. Rugged individuality employed in this field which is still in its pioneering stage.
7. The large number of companies involved.
8. Rapid changes in personnel.
9. Two standardization bodies, IRE which is scientific, RMA which is industrial in nature.
10. Unbalance due to seasonal nature of the product.
11. Commercial necessity of gadgets.
12. Secrecy because the industry feels the need of immediate rather than ultimate profits.

In spite of these difficulties, a good case was made for closer cooperation and more standardization. It was obvious that those participating in the discussions felt there was a distinct need for honesty in the rating of products and that general standardization was nor only desirable but also possible.

Dr. Jolliffe covered in considerable detail the frequency assignments since 1927. He pointed out that the spectrum below 30 mc is likely to remain as it is for some years but that definite assignments can be expected shortly at frequencies above 30 mc.

Mr. Otto Schade described and demonstrated an oscillograph which will reproduce a family of curves, such as the characteristics of a vacuum tube, on a cathode-ray tube screen. This apparatus is capable of continuous calibration and can be put to a wide variety of uses.

The influence of tube and circuit properties on random electron noise was discussed at some length by W. A. Barbour. Mr. Barbour showed that the ratio of signal-to-thermal-agitation noise does not increase as fast as signal step-up with increase in the Q of the first tuned circuit.

Major E. H. Armstrong's discussion of frequency modulation supplemented his earlier paper before the New York Section. The Major gave credit to such early workers in the field as Poulsen, Carson and others, and pointed out the reasons for dropping frequency modulation in 1925 when Carson showed mathematically that at least as great a band was required for frequency modulation as for amplitude modulation. Another hurdle was the difficulty of holding the no-signal carrier frequency fixed in the spectrum.

H. A. Wheeler described a new all-wave antenna system with several novel features. In general automobile-ignition noise and other man-made static generated near the ground appear to radiate more energy in the vertical fields. For this reason doublet antennas have come into general favor for all-wave reception.

All in all, the Rochester Fall Meeting of the Institute of Radio Engineers was a very pronounced success. A general feeling of optimism seemed to prevail, and talks with engineers and personnel of the different organizations brought to light the fact that most of the companies have a full production schedule ahead of them.

TWO-WAY POLICE RADIO

(*Continued from page* 15)

forms the top section, and fastened to an eye screw located in the center of the bottom flange. On striking an obstruction, the antenna buckles at this flanged joint, stretching the coil spring which pulls the top antenna section back into place when the car has passed from under the obstruction.

In the first experiments, one of the mobile transmitters was used at the fixed station, but its use was intended to be only temporary until a more substantial, alternating-current powered transmitter could be built. The line-up of the fixed station is as follows: A 42 tube as an oscillator, another 42 tube as a buffer amplifier, and two 841 tubes as a modulated final amplifier. A double-button microphone is used in the fixed station. The speech amplifier has a two-stage microphone amplifier, using two type 37 tubes in cascade, a 210 driver tube and an 845 as a modulator. Two plate-current supplies are provided. One delivers 300 volts for the speech amplifier, oscillator, and buffer amplifier; the other supplies 1,000 volts to the modulator and, through suitable dropping resistors, to the 210 driver and to the two 841's in the modulated power amplifier.

The output power claimed for this transmitter is 15 watts of modulated carrier. This lays down a good signal all over the patrolled area, even though it includes deep ravines and the beach below the high bluff along Lake Michigan. The area covered by the police of this city lies within a radius of slightly more than six miles from the fixed station.

Even though the signals from this station have been consistently good, an addition, employing two 150-watt tubes, is now in process of construction. This is expected to step up the carrier power from the present 15 watts to about 100 watts. It is hoped that this will boost the signal level in the policed area to well above the ignition noises which are so annoying on the ultra-high frequencies. This high ratio of signal-to-noise will allow the mobile receivers to be operated at a much lower sensitivity level, and the background noises will be reduced to such an extent that they will be inaudible. This is the improvement referred to in the discussion of receivers, and will probably be adopted by many other installations.

The receiver used at the fixed station is the same as those used in the mobile installations. A new one is in construction which will make use of a tuned-radio-frequency amplifier stage ahead of the first detector. This receiver should give more sensitivity than those now in use.

A calibrated battery-operated combination frequency meter and monitor is used to keep all transmitters tuned to the same frequency. Periodic checks are made on both transmitters and receivers, and after adjustments are completed, all dials are locked in place.

A half-wave antenna of the "Zep" type located on the roof of the police building was first used. The one now in use is a vertical half-wave antenna placed on top of a tall smokestack some 250 feet southeast of the police building. This is approximately 100 feet from the ground and is fed by a single wire attached to one side of the center, similar to a "voltage-fed Hertz."

In an attempt to decrease background noises, a receiving antenna was placed vertically on a tall brick tower on top of a building located 250 feet to the southwest of the police building. A transposed two-wire feed line connects this antenna to the receivers.

Considerable money and time spent in experimenting could be saved on new installations, if the experiences of the older ones were more readily available. The experience at Lake Forest has brought out the following facts:

Vibration is a major cause of trouble in mobile radio equipment and every precaution should be taken to prevent it. The most satisfactory plate-power source for low-power mobile transmitters is the storage-battery driven genemotor, developed especially for this purpose. Low-powered transmitters, delivering five watts or so, can be used, but more powerful transmitters are desirable.

Radiating receivers are not satisfactory inasmuch as they cause interference. Superheterodyne receivers, even with automatic volume control, are liable to let through more ignition noise than the super-regenerative types. Quarter-wave vertical antennas are most suitable for mobile use. Half-wave antennas placed vertically so as to be non-directional are best for the fixed station when it is centrally located. If the fixed station is not centrally located, some form of directional antenna would work better. Both transmitting and receiving antennas at the fixed station should be erected as high as practical in order to give good coverage. The lead-in from the fixed receiving antenna should be of such construction that only the energy picked up by the antenna proper is fed into the receiver, since the energy picked up by the lead-in is likely to contain considerable background noise.

Some method of frequency checking must be provided and checks made regularly to keep all units tuned to the same frequency.

FREQUENCY MODULATION

(*Continued from page* 13)

there are several factors tending to prohibit its use at these frequencies. For one thing, special receivers would have to be built to receive frequency-modulated signals. Also, the wide band of frequencies required for this system makes its use impractical in this band. There is some question as to whether comparable results might not be obtained with amplitude-modulated equipment employing a volume-compressing system at the transmitter with or without an expanding system at the receiver. A cursory investigation of frequency-modulated signals as proposed by Armstrong would indicate that if volume compression of the audio signals were employed before application to the transmitter, a narrower bandwidth might be required for equivalent results. At any rate, there appears to be no good reason for supposing that volume compression could not be applied to a frequency-modulated system to effect equivalent improvements to those accruing from its application to amplitude-modulated signals. If this is true it would appear that a frequency-modulated system employing volume compression might result in a sufficiently narrow band to permit of its use at lower frequencies. However, wide bandwidths are intimately associated with signal-to-noise ratio in frequency-modulated systems, and consequently it would appear that while volume compression can be made to compensate to some extent for the loss in signal-to-noise ratio at reduced bandwidths, the resultant bandwidth must exceed twice the audible range if any appreciable advantage is to result from frequency modulation.

As has been pointed out, however, Armstrong proposes to use his system at the ultra-high frequencies where bandwidths of the required order are not at such a premium. And it is at these higher frequencies that we may expect its future development—especially in connection with facsimile, television, and possible future high-quality binaural transmissions.

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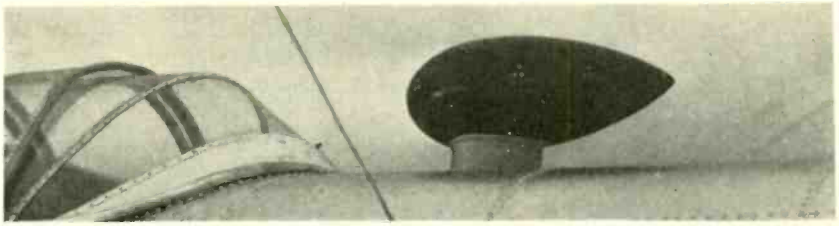
CORRECTION

ON PAGE 18 of the November, 1935, issue of COMMUNICATION AND BROADCAST ENGINEERING, the first equation in the article *Parallel Resonant Circuit Having Impedance Independent of Frequency* should read as follows:

$$Z = \frac{(R_2 + J\omega L)\left(R_1 - \frac{j}{\omega C}\right)}{(R_1 + R_2) + J\left(\omega L - \frac{1}{\omega C}\right)}$$

A STREAMLINED RADIO-COMPASS



Photographs courtesy Rudy Arnold

THE UNITED STATES Coast Guard Radio Division, working in conjunction with the Air Division, has just developed a new streamline housing for radio direction-finding loop antennas, to replace the old type double- and single-loop antennas.

The old type antenna had the disadvantage of having a wind drag of 57 pounds, being situated directly in the air stream, and resulting in a loss in speed. This, in the small, compact fast patrol boats, was a distinct disadvantage.

The streamline housing is a hollow "tear drop" or pear-shaped object made of bakelite, is about 10 inches in diameter, and 18 inches long. The housing is made in two sections, which are riveted together, the loop antenna fitting inside, and the whole object being attached to the fuselage of the plane. Thus, the wind drag is reduced to less than a pound, and the speed of the plane is increased by five miles an hour.

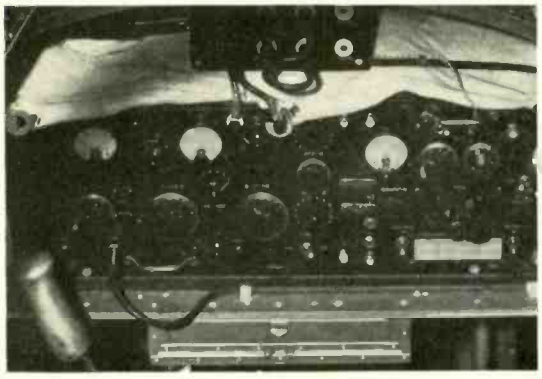
It was claimed in tests made several years ago that use of such a housing would reduce direction-finding value, but this is not now the case, for in some ways direction-finding value is even increased.

The direction finder for which the loop and housing work is the transmitter-receiver direction-finder, a radio-equipment which is combined in one unit. This equipment combines telegraph and voice (cw and mcw) emission over the frequency ranges of 275 to 600 kilocycles, and 2600 to 4000 kilocycles; reception, 200 to 6000 kilocycles; and radio direction finding 200 to 750 kilocycles.

The transmitter delivers 10 watts when using normal power-supply which is derived from a dynamotor operated from the plane's 12-volt electrical system, and 5 watts when operated as emergency equipment from a storage battery and B batteries. The telephone emission is 100 percent modulated. When operating from dynamotor power supply, the transmitter uses type 210 vacuum tubes, and operating from emergency power, type 112A tubes. The latter arrangement provides for operation in case the plane is forced down, or in case of failure of the electrical storage plant.

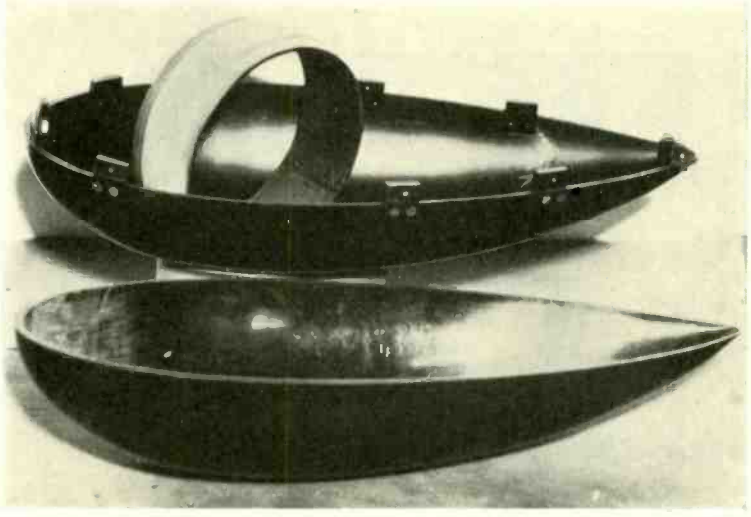
The receiver (for both voice and code) has a range of 250-500 miles with a fixed antenna, and 500-1000 miles with a trailing antenna. The direction-finder equipment enables the plane to be navigated by radio, and also provides homing and radio-contact facilities.

By means of this radio equipment, the Coast Guard aircraft of the Grumman type are able to utilize the facilities heretofore reserved only for much larger planes of the patrol type.



ABOVE: THE U.S.C.G. STREAMLINED COMPASS MOUNTED ON A GRUMMAN TYPE PLANE. LEFT: THE TRANSMITTER-RECEIVER DIRECTION-FINDER EQUIPMENT.

BELOW: SHOWING THE CONSTRUCTION OF THE BAKELITE HOUSING FOR THE LOOP.



TELECOMMUNICATION

PANORAMA OF PROGRESS IN THE FIELDS OF COMMUNICATION AND BROADCASTING

PRE-RECORDING OSCILLOGRAPH

ELECTRICAL ENGINEERS have a device which makes it possible to obtain an actual photographic record of a phenomenon which has already occurred, Dr. A. W. Hull of the General Electric Research Laboratory announced in his talk on "An Oscillograph with a Memory" at the autumn meeting of the National Academy of Science, at the University of Virginia, November 18. "As quick as lightning" is no idle saying, for a flash of lightning requires very few millionths of a second; and yet laboratory workers can obtain a record not only of the lightning stroke itself but of the conditions immediately preceding the stroke—and obtain the record with the lightning stroke as the impulse to cause the photographing of the time even before it existed as a stroke.

Dr. Hull stated that "In recent years engineers have succeeded in developing lightning recorders with a reaction-time of less than a millionth of a second. Even this is scarcely short enough, however. The ideal would be a negative reaction time—a device which should have a premonition of when the lightning is going to strike, and begin recording ahead of time. Such a device would be able to report the whole story of events before, during, and after the stroke.

"The new electric detective, the pre-recording oscillograph, may be depended upon to be on the job and ready with pencil and paper a twenty-fifth of a second before the lightning strikes. As its name indicates, it uses memory as a substitute for foreknowledge. One makes sure that it does not miss the event by the simple ruse of putting it on the job long enough ahead of time—hours or months—with instructions to record continuously on its tiny slate, and erasing as fast as it writes, except for the last few lines. When at length the important event occurs, another electric servant, this time a Thyratron tube with a magnet as an assistant, opens a camera shutter and takes a picture of the slate. The Thyratron tube does not have to hurry; a fiftieth of a second after the event is soon enough to open the camera. The lines written just before the event and not yet erased are photographed, and the camera is left open long enough to record also what is written during and after the event.

"The pre-recording oscillograph is a very simple device. The robot which writes the record is a cathode-ray tube; its pencil a beam of cathode rays; its slate a glass plate covered with a thin coating of willemite, a phosphorescent mineral which glows with a brilliant green light when the cathode rays fall on it, and which continues to glow for about a twenty-fifth of a second. That is the memory."

The device described by Dr. Hull at the Academy meeting is being used at Schenectady in studying the life of power rectifiers, Thyratron and other electronic tubes.

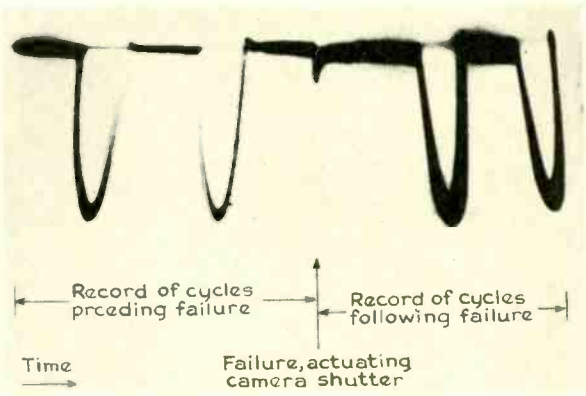
NEW WEATHER MAPS

NEW WEATHER MAPS give a much broader foundation for daily forecasts than the old. Recent advances in meteorology and availability of modern rapid communication systems, mainly airway radio and teletype, have made the new maps possible, says the Weather Bureau. Besides observations taken at the earth's surface—all that formerly appeared—upper-air observations are now charted.

To tell the country what sort of weather is in store, the official forecaster at each of the six districts and ten airway forecast centers of the Weather Bureau studies a map that pictures conditions at a given instant over a certain area. He then deduces what may be expected to happen next. These maps are charted early every morning, except Sundays and holidays, from observations flashed to the map rooms by telephone, telegraph, radio and teletype, from about 400 field and airway stations of the Weather Bureau, from about 300 cooperating agencies, from foreign meteorological services, and from ships at sea. Until October 1935 they consisted essentially of isobars (lines of equal pressure, reduced to sea level), isotherms (lines of equal atmospheric temperature near the earth's surface), and symbols for cloudiness, wind direction, wind velocity, and other pertinent weather facts.

Forecasters realized that, although some weather changes are "home made"

DR. HULL WITH THE PRE-RECORDING OSCILLOGRAPH.



AN OSCILLOGRAM OF THE OPERATION OF A HALF-WAVE RECTIFIER. NOTE THE FAILURE.

by local cooling or heating—most of the changes are caused chiefly by the replacement, at a given locality, of air in one condition by air in another condition and by the interaction of these different masses. Weather Bureau officials felt that maps showing the state and location of air masses from day to day would be valuable, but they hesitated to change a reasonably successful system until existing methods of air mass analysis had been perfected.

From observations taken by airplanes sent up to 17,000 feet each day at 25 stations, supplemented by the rest of the data available to them, a small group of specially trained meteorologists track air masses as they move —sometimes fast, sometimes slow— over the earth. Past and present performance of air masses is a valuable clue to their future performance, which, in turn, determines largely what the weather will be in the next 12, 24 or 36 hours.

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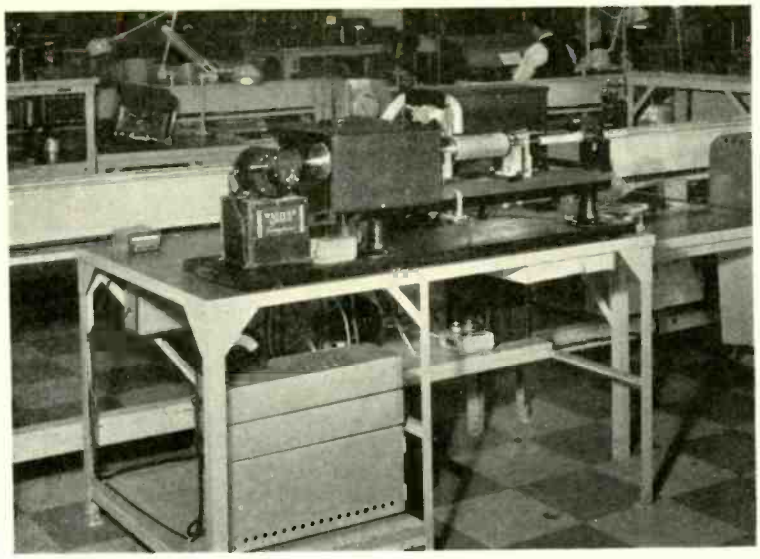

THE HIGH-SPEED FACSIMILE-TELEGRAPH EQUIPMENT DEVELOPED BY THE WESTERN UNION TELEGRAPH COMPANY.

WLW'S PORTABLE PACK TRANSMITTER

JOSEPH CLARK, Clerk of the Cincinnati Board of Elections and nationally-known authority on the proportional representation method of ballot, is caught by the candid camera as he explained this intricate voting system to Announcer Joe Ries and the 500,000-watt WLW audience, as the count began election night. Only five cities in the United States use this method of voting.

The picture gives an excellent view of WLW's new portable short-wave "pack" transmitter. By means of this equipment broadcasts may be picked up anywhere, flashed to a nearby receiving set and thence by wire to WLW's transmitter at Mason, Ohio. The equipment was designed and built by Robert Booth, Jr., of the WLW engineering staff. Booth is seen with the transmitter strapped on his back.

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BUFFALO-NEW YORK FACSIMILE TELEGRAPH CIRCUIT

FACSIMILE TELEGRAPHY service was established on November 14 when the Western Union Telegraph Company opened its first regular commercial facsimile circuit between Buffalo and New York.

Inauguration of the facsimile system was announced by R. B. White, president of the telegraph company, as a development of much interest in the communications field. From 30% to 75% faster than previous methods of facsimile telegraphy, the new system is capable of "scanning" fourteen square inches of space a minute.

Telegrams to be transmitted by facsimile are mounted upon a cylinder which, revolving on a horizontal axis, rapidly passes under an electrical scanning device. As the characters comprising the message pass under this instrument they are transmitted telegraphically to a similar machine at the other end of the line where a receiving paper revolves upon a like cylinder. In passing from the sending to the receiving end between Buffalo and New York the signals used are amplified in power over ten billion times.

The Western Union process involves the use of an entirely dry paper. It requires no processing and is ready for delivery as soon as it comes from the receiving machine. The sending and receiving machines are "phased" to get proper framing of the received record and run at precisely the same speed. Synchronous motors are used to provide this very critical speed matching.

Much effort and money has been spent in developing facsimile methods in recent years. A transatlantic facsimile service was begun in 1924, and the telephone company started a "telephoto" service in 1925. This latter method of sending pictures, suitably adapted, is now being used by the Associated Press in a wire service by which news photos are transmitted to certain of its newspaper members.

A year and a half ago Western Union engineers, under the stimulus and encouragement of President White, began to develop a facsimile method of transmission which would be fast enough and simple enough for regular commercial telegraph use. The facsimile system which now has been placed in regular operation between Buffalo and New York City is the outcome of their work.

No announcement was made as to how rapidly the new system of telegraphy will be extended to other cities, nor as to when the facsimile transmission of drawings, designs, tabulations, manuscripts, etc., will be available. It is understood, however, that the latter is largely a matter of determining rates and conditions of service, since the system is equally well adapted to such functioning.

FEDERAL COMMUNICATIONS COMMISSION REPORTS

RULE 139 AMENDED

THE COMMISSION, Broadcast Division, at a regular meeting held on October 29, 1935, amended Rule 139 to read as follows:

Rule 139 (a) A licensee of a broadcast station will not be authorized to operate a transmitter unless it is capable of delivering satisfactorily the authorized power with a modulation of at least 85 percent. When the transmitter is operated with 85-percent modulation, not over 10 percent combined audio-frequency harmonics shall be generated by the transmitter.

(b) All broadcast stations shall, on and after November 1, 1936, have in operation a modulation monitor approved by the Commission.

(c) The operating percentage of modulation of all stations shall be maintained as high as possible consistent with good quality of transmission and good broadcast practice and in no case less than 85 percent on peaks of frequent recurrence during any selection which normally is transmitted at the highest level of the program under consideration.

(d) The Commission will, from time to time, publish the specifications, requirements for approval, and a list of approved modulation monitors.

MODULATION MONITORS FOR BROADCAST STATIONS

RULE 139, as amended, section (b) (above), requires all broadcast stations to have in operation on and after November 1, 1936, a modulation monitor approved by the Commission. The modulation monitors will be approved by type after tests at the Bureau of Standards in the same manner that frequency monitors, as required by Rule 145, are approved. Any manufacturer desiring to submit a monitor for approval should supply the Commission with full details and if the specifications appear to meet the requirements, the Commission will request the Bureau of Standards to issue shipping instructions. Below are given the specifications that the modulation monitor must meet to be tested at the Bureau of Standards before it will be approved by the Commission. Approval will be given based on the test data taken at the Bureau, but the Bureau of Standards does not approve and disapprove the monitor as this is entirely in the hands of the Commission.

The specifications pursuant to Rule 139, section (d), are as follows:

1. A d-c meter for setting the average rectified carrier at a specific value and to indicate changes in carrier intensity during modulation.

2. A peak-indicating light or similar device that can be set at any predetermined value from 50 to 120 percent modulation to indicate on positive peaks, and/or from 50 to 100 percent negative modulation.

3. A semi-peak indicator with a meter having the characteristics given below shall be used with a circuit such that peaks of modulation of duration between 40 and 90 milliseconds are indicated to 90 percent of full value and the discharge rate adjusted so that the pointer returns from full reading to 10 percent of zero within 500 to 800 milliseconds. A switch shall be provided so that this meter will read either positive or negative modulation and, if desired, in the center position it may read both in a full-wave circuit.

The characteristics of the indicating meter are as follows: Speed—The time for one complete oscillation of the pointer shall be 290 to 350 milliseconds. The damping factor shall be between 16 and 200. The useful scale length shall be at least 2.3 inches. The meter shall be calibrated for modulation from 0 to 110 percent and in decibels below 100 percent with 100 percent being 0 db. The accuracy of the reading on percentage of modulation shall be ± 2 percent for 100-percent modulation, and ± 4 percent of full-scale reading at any other percentage of modulation.

4. The frequency characteristic curve shall not depart from a straight line more than ± 0.5 db from 30 to 10,000 cycles. The amplitude distortion or generation of audio harmonics shall be kept to a minimum.

5. The modulation meter shall be equipped with appropriate terminals so that an external peak counter can be readily connected.

6. Modulation will be tested at 115 volts ± 5 percent and 60 cycles, and the above accuracies shall be applicable under these conditions.

7. All specifications not already covered above, and the general design, construction, and operation of these units must be in accordance with good engineering practice.

RESOLUTION

THE COMMISSION en banc, on October 23, adopted the following resolution, proposed by Commissioner Payne:

"I move that the Commission obtain the facts as far as they relate to the American communications companies under regulation of this commission, as to the alleged cancellation of a broadcast to this country from Geneva by Delegate Baron Pompeo Aloisi, on October 10, 1935."

A. T. & T. APPLICATION REOPENED

AT A GENERAL SESSION of the Federal Communications Commission it was decided to reopen the application of the American Telephone and Telegraph Company for permission to construct an experimental coaxial cable from New York to Philadelphia for broad-band transmission.

This action followed a petition of the American Telephone and Telegraph Company asking permission for "reargument" of the recent order of the Commission granting permission for the construction of the cable under certain conditions.

The Commission not only granted the request of the applicant but decided to permit a re-hearing of the case before the entire Commission at the earliest practical date open on the Commission's docket, which is November 25, 1935, beginning at 10 A. M., at the Commission's offices, Washington, D. C.

EXPANSION OF TELETYPEWRITER EXCHANGE SERVICE

THE FOLLOWING figures, which are compiled from the tariffs filed with the commission by companies offering teletypewriter exchange service, show the number of exchanges at which this service is available:

State	No. of Exchanges 8/1/34	9/30/35	Additional
Alabama	12	15	3
Arizona	3	6	3
Arkansas	9	12	3
California	92	121	29
Colorado	14	20	6
Connecticut	33	41	8
Delaware	2	2	0
District of Columbia	1	1	0
Florida	17	21	4
Georgia	20	25	5
Idaho	5	7	2
Illinois	66	79	13
Indiana	43	50	7
Iowa	9	12	3
Kansas	16	20	4
Kentucky	13	15	2
Louisiana	15	19	4
Maine	32	36	4
Maryland	5	11	6
Massachusetts	97	118	21
Michigan	31	39	8
Minnesota	10	13	3
Mississippi	5	11	6
Missouri	16	18	2
Montana	6	7	1
Nebraska	5	8	3
Nevada	2	2	0
New Hampshire	14	21	7
New Jersey	46	54	8
New Mexico	3	5	2
New York	82	95	13
North Carolina	20	25	5
North Dakota	3	5	2
Ohio	23	30	7
Oklahoma	12	14	2
Oregon	17	24	7
Pennsylvania	59	79	20
Rhode Island	17	23	6
South Carolina	12	16	4
South Dakota	4	6	2
Tennessee	11	15	4
Texas	30	51	21
Utah	10	10	0
Vermont	9	13	4
Virginia	15	15	0
Washington	25	41	16
West Virginia	15	17	2
Wisconsin	30	38	8
Wyoming	2	2	0
Total	1038	1328	290

CLEAR CHANNELS—CHAIN STATIONS

AT A MEETING of the Commission en banc the following motion by Commissioner Stewart was referred to the Broadcast Division for consideration and report to the Commission:

"I move that the Broadcast Division be directed to report to the Commission (a) whether in its opinion the Commission should adopt special regulations under section 303 (i) of the Communications Act for the regulation of chain broadcasting and (b) in the event that the adoption of such special regulations is believed by that Division to be desirable, the proposed text of such regulations.

"In support of the motion I wish to call attention to the following:

1. At the time it provided for clear channels (General Order No. 40, August 30, 1928) the Federal Radio Commission said: '* * * 40 channels will be assigned to stations with minimum power of 5000 watts and a maximum to be determined by the Commission and announced with the allocation. On these forty channels only one

station will be permitted to operate at any time during night hours, thus insuring clear reception of the station's program, up to the extreme limit of its service range.'

2. The following statement was made by the Federal Radio Commission on July 2, 1930: 'As amended, it (General Order No. 40) provides for a certain number of high-power stations on interference-free channels to serve rural and sparsely settled areas over long distances under favorable conditions.'

3. The population and area of the United States dependent for broadcasting service at night on the secondary coverage of clear-channel stations is shown in the following table:

Zone	*Percentage of population within secondary coverage*	*Percentage of area within secondary coverage*
First	24.00	57.30
Second	27.60	60.40
Third	56.30	70.40
Fourth	33.60	70.00
Fifth	35.40	90.38
United States	35.80	76.70

These figures are as of December, 1933, but there has been little change in the situation since they were compiled.

4. The programs available at night to this 35.8 percent of the population of the United States who reside in 76.7 percent of its area are therefore those offered by clear-channel stations; and their program selection is largely limited to those carried by such stations.

5. The present situation of clear channels (night-time) with respect to chain programs is:

Clear Channels	40
NBC Network Stations	26[ab]
CBS Network Stations	12[b]
MBS Network Stations	3[a]
Non-Chain Stations	1

6. Duplication of programs on clear-channel stations reduces the value of clear channels to persons dependent on secondary service (for whom the channels were set apart) and tends to defeat the announced purpose to the establishment of clear channels."

RULE 132

THE COMMISSION, Broadcast Division, at a regular meeting held on November 12, 1935, adopted the following rule:

Rule 132—(a) The transmitter proper and associated transmitting equipment of each broadcast station shall be designed, constructed and operated in accordance with good engineering practice in all phases not otherwise specifically included in these regulations.

(b) The transmitter shall be wired and shielded in accordance with good engineering practice and shall be provided with safety features in accordance with the specifications of Article 37 of the current National Electrical Code as approved by the American Standards Association.

(c) The station equipment shall be so operated, tuned, and adjusted that emissions are not radiated outside the authorized band which cause or are capable of causing interference to the communications of other stations. The spurious emissions, including radio-frequency harmonics and audio-frequency harmonics, shall be maintained at as low a level as required by good engineering practice. The program distortion, audio-frequency range, carrier hum, noise level, and other essential phases of the operations which control the external effects shall at all times conform to the requirements of good engineering practice.

(d) Whenever, in this rule, the term "good engineering practice" is used, the specifications deemed necessary to meet the requirements of good engineering practice will be published from time to time.

(e) This rule shall be effective upon its adoption provided, however, that existing broadcast stations shall be allowed one year in which to meet the requirements herein.

a. One station included on both NBC and Mutual.
b. One channel has both CBS and NBC stations.

APPOINTMENTS

AT A GENERAL SESSION of the Commission, November 6, the following action was taken:

Lt. E. K. Jett was designated Acting Chief Engineer to succeed Dr. C. B. Jolliffe, who has resigned, effective November 12, 1935.

Lt. Jett has been identified with communications for 20 years, having served in the Navy 18 years and with the former Radio Commission and this Commission for the past 7 years. He has been serving as Assistant Chief Engineer since September, 1931, having charge of radio services other than broadcasting. Since the creation of the Communications Commission, wire-telegraph services, including submarine cables have been added to his duties.

W. J. Norfleet who has been Acting Chief Accountant since June 7, 1935, was named Chief Accountant. He will head the Accounting, Statistical and Tariff Department.

Mr. Norfleet came to this Commission from the Bureau of Valuation of the Interstate Commerce Commission where he was employed for many years.

APPLICATIONS GRANTED FOR NEW STATIONS

Broadcast Division

October 22, 1935.

PACIFIC ACCEPTANCE CORP., San Diego, California, granted construction permit, 1200 kc, 100 watts, daytime.

NASHVILLE BROADCASTING CORP., Nashville, Tennessee, granted construction permit, 1370 kc, 100 watts, unlimited time.

EVANSVILLE ON THE AIR, Inc., Evansville, Indiana, granted construction permit, 1370 kc, 100 watts, unlimited time.

October 29, 1935.

DON LEE BROADCASTING SYSTEM, San Francisco, California, granted construction permit, portable-mobile, 31,100, 34,600, 37,600, 40,600 kc, 100 watts.

WCBD, Inc., Waukegan, Illinois, granted construction permit, portable-mobile, general experimental, 31,100, 34,600, 37,600, 40,100 kc, 5 watts.

SCRANTON BROADCASTERS, Inc., Scranton, Pennsylvania, granted construction permit, portable, general experimental, 31,100, 34,600, 37,600, 40,800 kc, 100 watts.

RCA MANUFACTURING CO., Inc., Camden, New Jersey, granted license to cover construction permit, visual broadcasting service, 42,000-56,000, 60,000-86,000 kc, 30 kw.

November 12, 1935

PHILCO RADIO AND TELEVISION CORP., Philadelphia, Pennsylvania, granted construction permit, special experimental, 42,000-56,000, 60,000-86,000 kc, 250 watts.

DON LEE BROADCASTING SYSTEM, San Francisco, California, granted construction permit, portable-mobile, general experimental, 31,100, 34,600, 37,600, 40,600 kc, 100 watts.

Telegraph Division

October 29, 1935

STEPHEN J. PATTERSON. NC-14031, granted license, itinerant aircraft, 3105 kc, 7 watts.

CITY OF KOKOMO, Indiana, granted construction permit (2 applications), mobile, general experimental, 33,100 kc, 7.5 watts.

CITY OF OLYMPIA, Washington, Police Headquarters, granted construction permit, police service, 2414 kc, 50 watts.

VILLAGE OF RIVER FOREST, Illinois, granted construction permit (4 applications), mobile general experimental, 30,100, 33,100 , 37,100, 40,100 kc, 25 watts.

ROGER WOLFE KAHN, NC-780-W, granted license, itinerant aircraft, 3105 kc, 7 watts.

STATE OF IOWA, Fairfield, granted construction permit, state police service, 1682 kc, 500 watts.

STATE OF IOWA, Atlantic, granted construction permit, state police service, 1682 kc, 500 watts.

PAN AMERICAN AIRWAYS, Inc., New York City, New York, granted aircraft license, NC-14715, for period of 30 days, pending action on application.

AMERICAN AIRLINES, Inc., Washington, D. C., granted aircraft license, NC-8485, for period of 30 days, pending action on application.

BRANIFF AIRWAYS, Inc., Washington, D. C., granted aircraft license, NC-8495, for period of 30 days, pending action on application.

RICHARD ARCHBOLD, NC-777, granted license, itinerant aircraft, 3105, 3120 kc, 20 watts.

A. FELIX DUPONT, Jr., NC-5003, granted license, itinerant aircraft, 3105 kc, 7 watts.

November 5, 1935

CITY OF CHARLOTTESVILLE, Virginia, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

CITY OF ROCKY MOUNT, North Carolina, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

CITY OF CORBIN, Kentucky, Police Department, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

CITY OF CHICKASHA, Oklahoma, granted construction permit, police service, 2450 kc, 50 watts.

STATE OF WASHINGTON, Highway and Patrol Department, granted construction permit (2 applications), portable-mobile, police service, 2490 kc, 10 watts.

TERRITORY OF ALASKA, Kenai, granted construction permit, fixed public point-to-point telephone and telegraph service, 2616, 2986 kc, 40 watts.

November 12, 1935

CITY OF HUNTINGTON, Indiana, Police Department, granted construction permit, general experimental, 2490 kc, 50 watts.

TERRITORY OF ALASKA, Hydaburg, granted authority to erect and operate point-to-point telegraph and telephone station pending receipt and consideration of formal application for construction permit, 3265, 2616 kc, 40 watts. Same for Angoon, Alaska, except 3092.5, 2616 kc. Same for Jack Wade, Alaska, except 2616, 2994 kc.

RICHARD ARCHBOLD, granted construction permit, aeronautical, 3105, 4140, 6210 kc, 20 watts.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

11TH ANNUAL

THE ELEVENTH ANNUAL Dinner-Cruise of the Veteran Wireless Operators Association will take place on the evening of Tuesday, February 11, 1936. At 8 p. m. on that evening most of the old-time operators residing in and near New York City will journey to the Hotel Montclair at Forty-ninth Street and Lexington Avenue (opposite the Waldorf-Astoria) to reminisce with their cronies of old and to drink toasts to their adventurous past at the modernistic bar in the Cafe Chantant, among the facilities engaged by our committee for our exclusive use.

A delicious full-course dinner will be served during which we will be entertained by the music of a popular radio broadcasting orchestra. George Clark, our president, has already agreed to write a skit, the like of which no one else can hope to compose, and he tells us that it will be participated in by himself and others of the cast of his previous productions—all VWOA amateurs!

Tentative arrangements have been made for connecting the various chapter dinners with the New York affair but at present we cannot disclose the probable circuits to be used. It will, however, be conducted via radio. This feature, we believe, will be one of the highlights of the evening. We hope to have some ultra-modern equipment not only on display but in actual operation in the banquet room.

The Annual Awards of the Veteran Wireless Operators Association will be made at the Dinner-Cruise. This feature has always been of great interest to those participating in our affairs. A broadcast of this feature is probable. Some of the recipients of awards will be present to receive personally their commendation for outstanding performance in the line of duty.

At the December meeting, which was held on Wednesday the fourth at Bonat's Cafe on 31st Street opposite the Post Office, President Clark appointed the following committees for the forthcoming Dinner-Cruise. Entertainment: Joseph A. Hopfenberg and Pierre Boucheron; Reception: W. S. Fitzpatrick and R. H. Frey; Year Book: Wm. J. McGonigle and C. S. Anderson; Press and Publicity: Fred Meinholtz and Fred Ehlert; Tickets: Each and everyone of us.

And the best news of all in connection with the Dinner-Cruise is the fact that despite steadily mounting prices of all commodities we are happy to be able to again price the tickets at $3.00 for an individual and $5.00 for a Lady and Gentleman. Tickets may be obtained from the Secretary at the above address; at Mackay Radio from A. F. Wallis, marine superintendent; Maurice Schatt at the Capitol Radio Engineering office at 29 Broadway; Eddie Kaminsky at Radiomarine offices at 75 Varick Street; and from any member of the Association.

SEASON'S GREETINGS

The Officers and Directors of the Veteran Wireless Operators Association take this opportunity of wishing our members and friends a Very Merry Christmas and the Happiest of New Years.

NOMINATIONS

At a Board of Directors meeting held on the fourteenth of November 1935, the following names were placed in nomination for officers and directors and they were announced at the December general meeting:

For President—George H. Clark and G. W. Johnstone; Vice-President—C. W. Horn and W. C. Simon; Secretary—William J. McGonigle; Treasurer—Paul K. Trautwein.

For Directors—Fred Muller, A. A. Isbell, C. D. Guthrie, Fred Klingenschmitt, A. J. Costigan, W. S. Fitzpatrick, J. A. Bossen, Maurice Schatt, H. H. Parker, Wm. J. McGonigle, H. H. Hayden, Arthur Lynch, Charles E. Pearce, Harvey Butt, A. F. Wallis, Wm. F. Aufenanger, H. F. Coulter, H. P. Westman, Chas. E. Maps, Paul K. Trautwein.

SOUTH POLE

It is, indeed, a pleasure to pass this information along to our membership and the general public. Carl O. Petersen, Lieutenant USNR, a Veteran Member of our Association and Radio Operator on the First Byrd Antarctic Expedition, for which work he subsequently received a Testimonial Scroll from our Association and a member of the Second Byrd Expedition as cameraman for Paramount Film Company. Being a radio operator and since the cameraman accompanied all of the flights. Carl had opportunities few ever have to witness nature in the raw in the far wastes of the Antarctic. He was a member of the party which made the tractor journey to the Edsel Ford Mountain range in the Marie Byrd Land.

In all, Lieutenant Petersen has spent six years in polar exploration on four different expeditions and he is well equipped to discuss the work of polar exploration. He has recently assembled a group of the best films taken on the Second Byrd Expedition and his services may be engaged to show the film and his lecture which precedes the film, the comments which accompany the showing of the film and the discussion which follows should prove extremely interesting coming as it does from a veteran of the polar regions.

The film takes about an hour and a quarter to run. Lieut. Petersen has complete equipment and since the film is safety film it may be shown in any type auditorium. We highly recommend this film and suggest that persons interested contact Lieut. Petersen at his home 66 South Bay Avenue, Freeport, L. I., N. Y. The charges are very reasonable. We have already arranged to have Lieut. Petersen show this film before the radio and camera clubs of the Telephone Company.

BOSTON CHAPTER

Harry Chetham, Secretary of the Boston Chapter has been showing a great deal of enthusiasm in organizing the Boston Chapter and from present appearances the Dinner-Cruise in Boston this year will be bigger and better than last year's affair. Some of the applications that Harry has sent in recently follows: Mark L. Mac Adam, Henri Jappe, Alfred Pote, G. R. Entwistle, Arthur E. Erisson, Lloyd C. Greene, T. R. McElroy, Arthur Stockellburg, Robert J. Hartshorn, Charles C. Kolster, Frank D. Pitts, Arthur H. Vickerson, Raymond F. Trop, and Bart Mac Carthy.

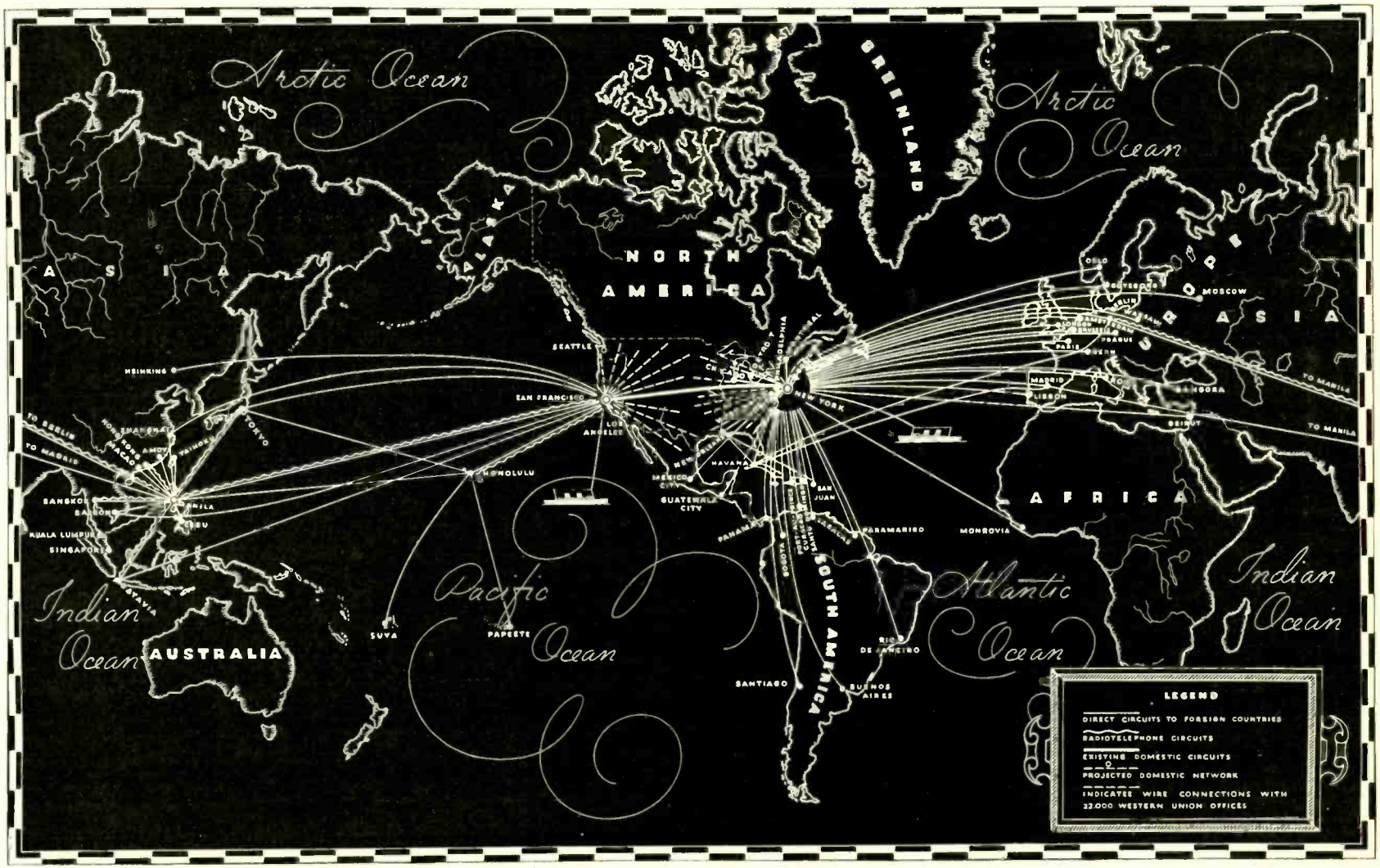
At a recent meeting of the Boston Chapter the following officers were elected: Charles C. Kolster, Chairman; G. R. Entwistle, Vice-chairman; Harry Chetham, Secretary; Raymond F. Trop, Treasurer.

Many thanks HC for your excellent work in organizing the Boston group and welcome to the 35-year group. Yes, Harry Chetham began his radio career thirty-five years ago. Get everything in readiness up there HC so that we may greet you on the eleventh of February via radio. More of that in a Bulletin to appear shortly.

PERSONALS

Sincere thanks to W. A. Winterbottom, vice-president and general manager of RCA Communications and Arthur A. Isbell, manager, commercial department of RCA Communications for their splendid support and encouragement in the Year Book activity. For years past they have been the Charter advertisers. . . . Glad to see Fred McDermott of the A. T. & T. Radio Program group at the December meeting. . . . And after a long absence Pierre Boucheron was there, too. . . . Joseph A. Hopfenberg was present to accept the chairmanship of the Entertainment committee. . . . W. R. Schwalm, always an enthusiastic supporter of VWOA activities, was with us and re-affirmed his support of our future activities. . . . Arthur A. Isbell has been at all of our recent meetings. His hearty handshake for all present is known to most of us. . . . S. Young White of Loftin-White renown was there at the suggestion of H. H. Hayden of Ward Leonard. Glad to receive Mr. White's application HH. . . . "Bob" Grey supervisor of the Bull Lines Radio Department enjoyed the proceedings with his inseparable companion Maurice Schatt, New York representative of the Capitol Radio Engineering Institute. . . . Always glad to see Richard Davies, Jr. He seems to enjoy the proceedings so much. . . . Frank Orth journeyed in from Flushing, L. I., N. Y. . . . Fred Meinholtz, communications supervisor of the New York Times was with us too. . . . All in all a very fine meeting.

TUESDAY EVENING, FEBRUARY 11TH, 1936, HOTEL MONTCLAIR, NEW YORK CITY. (LINCOLN'S BIRTHDAY EVE).



MAP No. 13--The RCA World-Wide Radio-Telegraph System.

OVER THE TAPE...

NEWS OF THE RADIO, TELEGRAPH AND TELEPHONE INDUSTRIES

E. W. RICE, JR.

Edwin Wilbur Rice, Jr., 73, honorary chairman of the board of directors of the General Electric Company, died at his home in Schenectady, N. Y., November 25, after a long illness. He was one of the pioneers of electrical development in the United States, and in association with the late Charles A. Coffin played a conspicuous part in the building of General Electric. Mr. Rice was largely instrumental in adding to the company's technical staff the late Charles P. Steinmetz; he encouraged the investigation by the company of the Curtis steam turbine and gave it a fair trial through a period of uncertainty until it became the foundation of a vast electric power system development; and he was chiefly responsible for the establishment of the famous General Electric research laboratory, having recommended that step to the directors in 1900.

•

J. J. SALLY RECEIVES APPOINTMENT

The Crowe Name Plate and Manufacturing Co., have announced that their Philadelphia territory is now being actively covered by Mr. J. J. Sally, who will give particular attention to the radio trade.

Mr. Sally, formerly connected with sales force of the above organization in Chicago, has established his offices on the seventh floor of the Terminal Commerce Building, 401 North Broad Street, Philadelphia, Pa. His telephone number is Lombard 7839.

•

FREQUENCY-MEASURING SERVICE

The Bliley Electric Company, Erie, Pennsylvania, designers and manufacturers of quartz crystals for general and special radio-frequency applications, announce that they are in a position to furnish accurate frequency measurement for commercial broadcast stations. All measurements can be made within an accuracy of one part in 5,000,000, which is equal to 0.3 cycles on a 1500 kc frequency.

For this monitoring service a General Radio Company Primary Standard of Frequency and associated measuring equipment is used. Any type of notification desired can be utilized.

Further information and descriptive literature can be obtained by writing Frequency Monitoring Division of the Bliley Electric Company, Erie, Pa.

•

"TRANSCOTE"

Transcote will be the new trade name for transcription material produced in Hollywood by the Radio Transcription Company of America, which maintains branches in New York and Chicago.

The new substance is the flexible variety and, though slightly higher in cost than the old-style laminated material, is said to be more durable and practically indestructible.

The organization produces eight transcription programs each week for 39 weeks of the year. C. C. Pyle heads the firm. Headquarters are in Hollywood.

TIME

The United Fruit Tropical Radio Company have installed aboard all their ships a clock system which can be synchronized with a telegraph key, for observing the three-minute silent periods, from 15 to 18 minutes, and from 45 to 48 minutes, after the hour for SOS and general calls, as required by the International Radio Conference at Madrid, according to the Self-Winding Clock Company.

United Fruit are using WOR's time signal for setting these clocks as this is the only signal they can receive at any hour of the day. Ward Line will install the same system in the near future.

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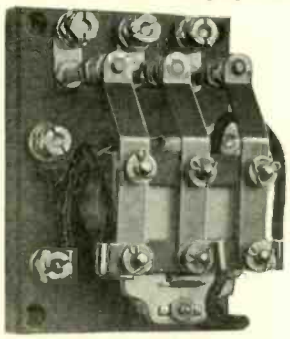
TIME OVER THE TELEPHONE

Struthers Dunn, Inc., relay specialists of Philadelphia, have recently furnished relays for a novel advertising scheme. It makes use of the fact that people have a



habit of asking the telephone operator for the correct time. When a certain number is called on the telephone, this equipment automatically answers with the time and an advertising message.

This equipment consists of a bank of telephones, a light unit, a photo-electric cell, two drums wrapped with the sound track of motion-picture film, a sound amplifier and a number of relays. The operation of this equipment is as follows: An incoming telephone call actuates a telephone relay, whose contacts energize the coil of a front contact relay. Closing the contacts of this relay starts a motor which raises the telephone receiver by means of a cam and excites the light unit which throws a beam of light on one of the drums. The drum reflects the light back to the photoelectric cell and the amplifier provides sufficient volume for the message to be heard. The light unit travels forward on one drum and back on the other receiving a message from each. When the light unit has returned to its initial position, the telephone receiver is dropped and the equipment is ready for the next call. Relays are also used to lock out incoming calls while the equipment is in operation and to transfer to a spare amplifier in case of a tube burn out or other casualty.

Complete information on relays for this and many other applications may be obtained by writing to the above company who specialize in building relays for special applications.

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BELL SCIENTIST HONORED

On October 23 Dr. Edward C. Wente of the Bell Telephone Laboratories received the first award of the Progress Medal of the Society of Motion Picture Engineers. The award was made to Dr. Wente for his fundamental contributions and outstanding inventions in motion-picture technology.

•

WOW'S NEW STUDIOS

Radio station WOW, owned and operated by the Woodmen of the World Life Insurance Association, opened their new studios in the New Insurance Building, 17th and Farnum, Omaha, Nebraska, on December 7, 1935. WOW's 5000-watt transmitter is located at 56th and Kansas Avenue.

•

"LARGE BROADCASTERS FOR TELEVISION"

Major progress in the development of television will come from large-scale broadcasters, according to Harry R. Lubcke, director of television for the Don Lee Broadcasting System.

After reviewing the past and present status of the art for members of the Chaparral Club attending a dinner at the Los Angeles Tennis Club recently, Mr. Lubcke said: "We can expect the large broadcasters to lead the television parade. The expense of television-broadcasting facilities is considerable. The qualifications required of the Broadcasters by the Federal Communications Commission are high, even for permission to engage in the present experimental work. It is certain that the Commission will require high standards when television becomes a commercial medium."

The Chaparral Club comprises alumni of both Stanford and University of California and a representative group of Los Angeles business men.

•

U. S. E. CATHODE-RAY TEST EQUIPMENT

United Sound Engineering Co,. 2233 University Ave., St, Paul, Minn., has issued three technical sheets on the latest U. S. E. equipment.

The sheets cover the Type CR-3 Cathode-Ray Oscillograph, the Type CR-4 Beat-Frequency Audio Oscillator and the Type CR-5 Frequency-Modulated R-F Oscillator.

•

BAKELITE SILVER ANNIVERSARY REVIEW

The Silver Anniversary issue of the Bakelite Review will be found particularly interesting. This issue covers the history of the Bakelite Corporation and many other interesting features, including data on the application of Bakelite materials in industry, and new developments in the molding fields.

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATION AND BROADCAST FIELDS

AMPHENOL MICROPHONE CONNECTOR

A recent development for the sound-equipment field, a microphone plug embody-

ing the latest developments of the Amphenol contacts and molded bakelite, has been announced by the American Phenolic Corporation, 500 South Throop Street, Chicago.

The heavy brass outer shell of this unit is finished in black enamel and chrome, giving the connector a rich, modern appearance. This shell is locked together by a threaded brass collar that holds the male and female sections tight and prevents embarrassing disconnection, so often encountered in outdoor pickups. The heavy shell may be safely walked on while in use without danger of breakage or noise. Snow, rain and slush will not interrupt programs going through Amphenol microphone connectors, it is stated.

The gasket cap at each end of the connector contains a para rubber ring which expands against the cable when the cap is tightened and seals the plug against the entrance of moisture and dirt, around the cable.

The third contact (most widely spaced from the two remaining) is grounded to the brass shell of the connector with a flush screw, automatically grounding it and the microphone ring and stand. In connecting the cable, care should be used to see that the shield (in two-wire circuits) and the grounded neutral wire (in three-wire circuits) is always connected to this contact.

For further information write to the American Phenolic Corporation.

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NEW HIGH-GAIN AMPLIFIER

Public Ad Inc., 2015 East 65 Street, Cleveland, Ohio, announces the Type 103-A Public Ad high-gain amplifier with bridged T type attenuator. This unit is intended for broadcast-studio, recording-studio, public-address, remote-pickup, and amateur-phone applications.

In order to keep hum and noise levels to the lowest possible values the 103-A has been designed around the metal tubes. These units are said to feature flexibility, compactness, and portability; and they have been especially designed for use in conjunction with the Brush sound-cell microphones.

Combination of two or more Public-Ad Amplifiers makes possible an efficient mixer unit, it is stated. Levels can be independently controlled on each channel without affecting other channels. Pilot light on each unit indicates operation of respective channels. Each Type 103-A unit permits connection of one sound-cell microphone by means of specially designed metal locking-type plug and receptacle.

•

FERRIS MICROVOLTER

The Ferris Instrument Corporation, of Boonton, N. J., announces a new Microvolter, for laboratory use. This new instrument, designated as Model 17B, is a "big brother" of their well-known Model 10B Instrument.

It includes a rotating coil system, somewhat similar to that used in the 10B, but with 10 coils to cover 100 to 30,000 kilocycles, and with improvements in construction to make possible greater permanence of calibration.

A worm-drive condenser, with a total scale length of approximately ten feet, makes possible very close frequency settings, for selectivity measurements and other purposes.

An unusual feature of the Model 17B is that the power unit (not shown in the

illustration) is separate from the Microvolter, and is connected to it by a plug and cable. Very complete r-f filters are of course included in the instrument to prevent leakage. With this construction, the instrument can normally be used on the a-c line, but when special conditions, such as unusually severe hum tests, or operation away from a power source make it desirable to operate from batteries, this can be done without any change in the instrument.

Another feature of this construction is that it keeps the heat of the power unit away from the Microvolter proper, contributing to the stability of frequency calibration.

A direct-reading system of modulation measurement, which can be used with either the self-contained 400-cycle oscillator, or with an external audio source, is included in the 17B.

An illustrated circular describing the instrument in detail can be obtained from the Ferris Instrument Corporation, Boonton, N. J.

•

WALL-MOUNTING MONOPHONE

The new Type 35A5 Wall-Mounting Monophone, shown in the accompanying illustration, has been recently announced by the American Automatic Sales Company, 1033 West Van Buren Street, Chicago. This unit may be mounted at any desired height, and the user may be comfortably seated or standing, as he desires. The Monophone handset makes it easy for the user to talk directly into the transmitter mouthpiece, while permitting him to move about at will, within a cord's length of the wall box.

All working parts of the new Monophone are mounted on the molded bakelite base, the cover carrying no equipment or wiring. The sound openings in the cover are lined with radio grill cloth, to exclude dust and insects, and the wiring is constructed to meet the most trying climatic conditions. Instrument mounting holes are molded with a thin film closure, which may be "knocked out" as needed. Holes are located to permit mounting on a standard electrical outlet box, if desired, so either conduit or open wiring may be used. Dimensions of the instrument are: height, 9½ inches; width, 5¾ inches; depth, 5 inches. The Monophone handset is 9 inches long, over all.

The Type 35A5 Wall-Mounting Monophone may be provided for either automatic or manual central-battery service. The manual model is fitted with a neat cover plate, easily replaced by the dial when desired. The dial is mounted above the handset cradle, which is so shaped that the handset is removed by pulling forward instead of lifting, thus avoiding interference with the dial.

This new telephone is equipped with standard polarized ringer for individual line or code-ringing service, or with harmonic ringer of any standard frequency. Ringer is arranged for bridged or grounded ringing, as ordered. The telephone can be furnished with the exclusive Autelco anti-sidetone circuit with three-winding induction coil, or with the induction-coil-receiver circuit. All handsets are fitted with the new Type 35A7 "all positions" Monophone transmitter.

THE Group Subscription Plan for COMMUNICATION AND BROADCAST ENGINEERING enables a group of engineers or department heads to subscribe at two-thirds the usual yearly rate.

The regular individual rate is $3.00 a year. In groups of 4 or more, the subscription rate is $2.00 a year. (In Canada and foreign countries, $3.00.)

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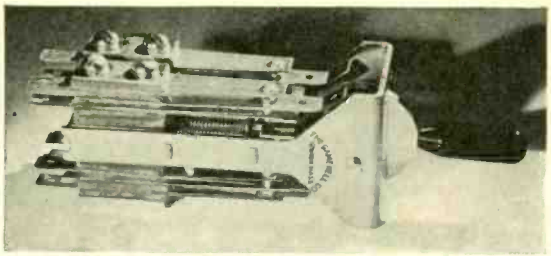

THE CAM LEVER SWITCH.

CAM LEVER SWITCH

The cam lever switch shown in the accompanying illustration has been designed for use in circuits where the break-down requirements do not exceed 25,000 volts. The contacts are rated at 1 ampere, 110 volts, d-c, non-inductive load. The overall dimensions are: 2½ inches wide, 5½ inches long from handle to end of contacts and 1¼ inches thick.

The switch is made for mounting on a face plate, ⅛ inch thick by means of four ¼-inch screws with a 4-40 thread.

A positive stop is provided in the center position so that when the handle is returned to this position from an operated position the contacts on the opposite side of the switch are not affected. There is approximately 1/16 inch between the rollers and the operating springs when the switch is on the center position.

For complete information write to The Gamewell Company, Newton, Mass.

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UNITED TYPE 304-A TUBE

The United Electronics Company, 42 Spring Street, Newark, N. J., have announced that their air-cooled broadcast tube type 304-A is now available. This tube, which has been approved for use in broadcast stations by the Federal Communications Commission, is interchangeable with the type 204-A.

The type 304-A may be used as a Class C oscillator and r-f amplifier, or in Class B as an r-f power amplifier.

Typical characteristics are as follows:

Class B—R-F Power Amplifier

Max. Operating D. C. Plate Volts.....2,500
Max. Unmodulated D. C. Plate Amps.....0.225
Max. Plate Dissipation.....250 Watts
Max. R. F. Grid Current.....10 Amp.
Typical Operation:
Ep = 2,000, Eg = —70, Ef = 11 A. C.
Unmod. D. C. Plate Current.....0.160 Amp.
Peak Output .....400 Watts
Carrier Output (Mod. Factor 1).....100 Watts

Class C—OSC. and R-F Amplifier

Max. Operating Plate Voltage:
Modulated D. C.....2,000
Unmodulated D. C.....2,500
Max. D. C. Plate Current.....0.275 Amp.
Max. D. C. Grid Current.....0.080 Amp.
Max. Plate Dissipation.....250 Watts
Max. R. F. Grid Current.....10 Amp.
Typical Operation:
Ep = 2,000, Eg = —175, Ef = 11 A. C.
Output .....350 Watts

The improved construction in the 304-A embraces an element assembly completely mounted on two channel members. This unit assembly is said to permit perfect spacing and alignment of grid, plate and filament, because these channel members support all elements as well as the top and bottom glass stems. This assures constant maintenance of the electrical characteristics.

The United processed graphite anode is used in this tube as well as in all other of their three filament types.

•

HIGH-VOLTAGE CONDENSERS

The popularization of the cathode-ray oscillograph for radio servicing and experimenting, since more rugged and economical tubes for the purpose have become available, has led to the increased use of high-voltage condensers.

Normally, since the current drain by the cathode-ray tube is very small, a 1-mfd condenser is sufficient for filtration. Dykanol oil-filled and impregnated Type TD condensers are suggested where space is at a premium, according to Cornell-Dubilier Corporation, 4377 Bronx Boulevard, New York. The physical size of these capacitors is about one-sixth that of paper-wax type units.

The different cathode-ray tubes require different B voltages, to enable the tubes to be worked up to their safe operating characteristics. The most popular type tube, No. 906, takes 1,200 volts maximum, but is commonly worked at 1,000 volts. Therefore ordinary condensers can not be used in filtering the maximum B feed, since the condensers' working voltage is too low. The d-c working-voltage rating is given by the manufacturer, and the actual d-c voltage present should never exceed specification.

This type of condenser is fully described in the Cornell-Dubilier Catalog No. 128.

•

NEW COLLINS TRANSMITTER

The 45A is the newest small-sized transmitter of the Collins Radio Company, whose engineers have been working steadily to increase the power, improve the efficiency and afford more reliable performance in a low-cost transmitter.

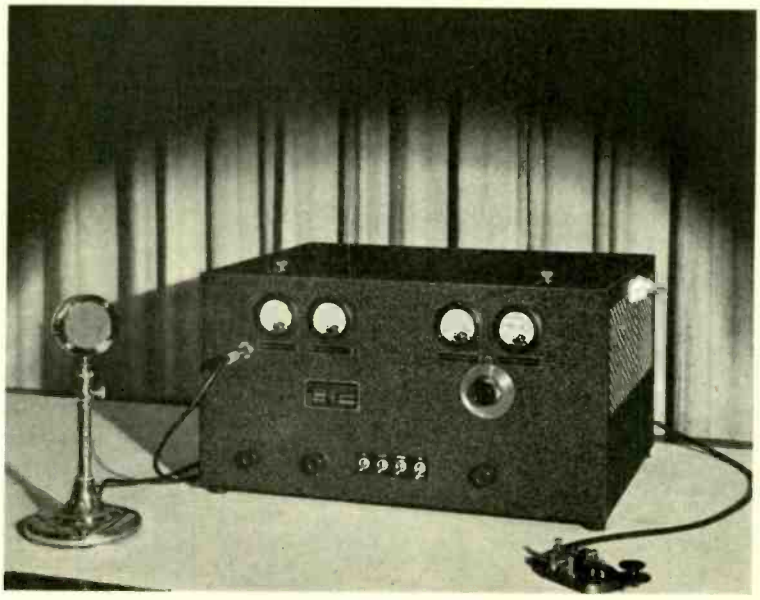
The rated output of the 45A is 40 watts telephone, 125 watts telegraph. On tests, these sets are said to show actual outputs of 50 watts telephone, 160 watts telegraph, with excellent overall efficiencies. The type of modulation employed permits the full tube and power-supply capacity to be used effectively on both telegraph and telephone, it is stated.

One of the interesting features of the 45A is the new unit-type frequency shift which allows the set to be operated instantly on any predetermined frequency up to 30 megacycles. The frequency-shift unit consists of a small aluminum case containing not only the pre-tuned excitation tank circuits but also the crystal for each frequency on which it is desired to operate. This unit and the output tank coil are plugged into the transmitter through the hinged top, one frequency-shift unit and one output tank coil being used for each frequency. The only tuning controls on the panel are the grid and plate condensers in the final amplifier, and their calibrated positions are shown on a card attached to the top of the frequency-shift unit.

A new Collins' development, low-loss inductive neutralization is employed in the 45A transmitter. The inductive neutralization is said to eliminate the additional circuit elements necessary with ordinary types of neutralization and to allow a triode amplifier to be operated with the same circuit efficiency and convenience as a shield grid amplifier.

In addition to a full complement of instruments, the 45A is equipped with a modulator indicator calibrated both in percent modulation and in decibels. This instrument gives a constant indication of the average level of modulation during transmission. The meter is arranged to show the actual audio-frequency variation in the r-f output.

Two separate power supplies furnish the necessary d-c voltages to the various tubes in the 45A. The low-voltage power supply delivers 300 ma at 350 volts to the speech-amplifier and excitation tubes, and provides the telegraph and telephone bias voltages for the final amplifier. The high-voltage power supply delivers a maximum current of 250 ma at 1250 volts to the output tube.



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★ ★ ★ COLLINS broadcast equipment has established a unique reputation for faithful transmission. The frequency response of the 20C is uniform within plus or minus 1.5 decibels from 30 to 10,000 c. p. s. Total r. m. s. harmonic content is less than 5 per cent of the fundamental at 95 per cent modulation. Carrier noise is held 60 decibels (90 decibels weighted value) below program level by generous circuit design and without resorting to "hum bucking."

All components are over-sized and adequately protected by overload devices. The use of the very best materials and the most skillful mechanical design gives a fine appearance inside and out.

Every type of transmitting apparatus is manufactured by the Collins Radio Company. Microphones — Series 12 Speech Input Systems — Studio Accessories — Concentric Transmission Lines — Tower Impedance Matching Units — every component from microphone to antenna is co-ordinated for best performance. ★ ★ ★

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CEDAR RAPIDS, IOWA ★ NEW YORK, 11 West Forty-Second Street

HIGH FIDELITY on 100 watts at LOW Cost

Completely self-contained and A-Coperated for low installation and operating costs.

Here is an RCA Broadcast Transmitter that solves very simply and easily the usually difficult problem of reconciling the necessity for economy with the need for quality. RCA 100-E supplies 100 watts power, is low in first cost and in operating cost, yet provides a High Fidelity signal on the air.

Economy has been achieved by RCA engineers in this transmitter by introducing certain desirable simplifications, using inexpensive tubes, adopting new engineering developments, and designing a mechanical assembly honestly proportional to 100-watt needs.

Thus a transmitter was created that is startlingly simplified. Yet it yields not an inch, in convenience, reliability and performance, to the finest high-powered transmitters. It thus has everything the 100-watt station needs. Write for further details.

Get in touch with one of these offices:

New York, 1270 Sixth Ave.; Chicago, 111 No. Canal St.; San Francisco, 170 Ninth St.; Dallas, Santa Fe Building; Atlanta, 144 Walton St., N.W.

RCA

TRANSMITTER SECTION

RCA Manufacturing Co., Inc., Camden, N. J., a subsidiary of the

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