THE AMPERITE CORPORATION ANNOUNCES

free trial offer

of 7-POINT Velocity MICROPHONES

... a microphone for every purpose...

PERFECT REPRODUCTION and GREAT VALUE combined in these mikes

PROVE THIS FOR YOURSELF AT NO COST OR OBLIGATION

We believe that we have the finest microphones available today, regardless of price! That's why we will send any one of our models to any responsible broadcaster for a TWO WEEKS' FREE TRIAL! No deposit, no obligation, no strings attached. You simply return the microphone if you don't agree that it's the greatest value available today. PERFECT DEFINITION achieved. Instead of just a general effect of music, each instrument is clearly defined. Also, the specially hand-hammered ribbon is unaffected by even a 40 mile gale... Learn what these top-notch microphones can do. Don't hesitate. There's no obligation. Write us on your business letterhead... NOW!

FOR ANNOUNCING AND REMOTE

Model R.B.S. Especially designed for speech. New Super-Bux nickel aluminum magnets are used... more powerful than even 36% Cu-Belt. Since the microphone has no peaks, it gives perfectly lifelike reproduction (not mechanical) and does not tire the listener. Eliminates acoustic feedback in P.A. work... Model R.B-M can be used for both speech and music. Excellent for remote work.

ENGINEERS SAY:

"Best we have tested... irrespective of price!"

"Replaces three of our old microphones in ensemble work!"

"After plenty of punishment, still as good as ever!"

FOR SPOT BROADCASTING

THE LITTLE VELOCITY WITH UNIFORM OUTPUT

Output uniform with speaker head at any angle. Output level practically equal to large velocity. Frequency response 60-7500 cycles. Reproduction lifelike. Eliminates audience noise. Transformer included within microphone case. Rugged construction. New chrome aluminum magnets used. Weight only 8 ounces. Size 2 1/4 x 1 1/4 x 1 1/2.

A-C PRE-AMPLIFIER and LINE AMPLIFIER

THOROUGHLY SHIELDED AND GUARANTEED HUMLESS

Another great Ampereite value included in FREE TRIAL offer. Frequency range 50-14,000 cycles (1 db.). Hum level -100 db. Input and output 50 to 2000 ohms. Other values if requested. Not affected by temperature, pressure, or humidity.

AMPERITE 7-POINT Velocity MICROPHONES

GUARANTEED TO BE THE GREATEST VALUE IN MICROPHONES AVAILABLE TODAY!

(Cable Address: Alkom, New York)
In the following pages your attention is called to the invitation of the Technical Editor to discuss technical subjects in which sufficient interest appears to be present.

Early in the month the so-called Wagner bill was signed by the President. It is rather surprising to find criticism of the bill in certain labor circles, but no more so than to find certain loyal paid up members of labor organizations come to meetings with the usual shout, "We pay our dues and get nothing for them." What both mean is, "We want more!" A perfectly human, if not excusable, trait.

The old expression, "The rich get richer, the poor get troubles," seems to hold good with the broadcast stations of the country. The big stations get bigger, and the little fellow certainly gets his share of troubles. It is probably for the same reason; the big fellow spends his energy figuring out how to get bigger, and the little fellow spends his trying to bite off more than he can chew.

Your assistance is asked in our personals. No more interesting reading is possible than the little goings on around you. Not only is the man close to these little personals interested, but others as well find them worth while. We will appreciate the favor if you will tell us more of what is going on in your own station as others have been doing so well for you in our pages.
Ghirardi's RADIO PHYSICS COURSE

The most popular basic text on radio in existence, used by students, schools, technicians and experimenters the world over. Everything from fundamental electrical theory right up to the latest applications and developments. Clear, concise, complete, up-to-date, written in language easy to understand, with over 500 diagrams and illustrations. Invaluable for broadcast technicians for rounding out their radio background. You need this great book in your work. (972 pages, $4.00 postpaid.)

RADIO OPERATING QUESTIONS AND ANSWERS
Nilson & Hornung

This book gives over 600 questions and answers covering all radio operator license examinations. Questions are typical of those used on examinations; answers are full and well illustrated. This edition has been enlarged to include information on broadcasting, marine, aeronautical, police and amateur radio operating and contains many new questions and answers on new transmitters, new radio laws and license regulations, etc.

5th edition
388 pages, 5x8, 96 illustrations
$2.50

RADIO TRANSMISSION
Practical Radio Communication, Nilson & Hornung $6.00
How to Pass U. S. Govt. License Examinations, Duncan & Drew (1928) 3.00
Radio Traffic Manual and Operating Regulations (1929) 5.00
Radio Operating Questions and Answers, Nilson & Hornung 5.00
Practical Radio Telegraphy, Nilson & Hornung 5.00
Principles of Wireless Telegraphy, George W. Pierce 5.00
Principles of Radio Communication, J. H. Morecroft 7.00

RADIO THEORY
Radio Frequency Electrical Measurements, H. A. Brown 4.00
Electric Oscillations and Electric Waves, G. W. Pierce 5.00

VACUUM TUBES
Electron Tubes and Their Application, J. H. Morecroft 8.50
Theory of Thermionic Vacuum Tubes, E. L. Chaffee 6.00
Theory of Thermionic Vacuum Tube Circuits, L. J. Peters 4.00
Radio Receiving Tubes, Moyer & Wostrel 3.50

TELEVISION
Photocells & Their Application, Zworykin & Wilson 8.50
Practical Radio—including Television, Moyer & Wostrel 4.50
Television—its Methods and Uses, E. J. Felix 5.00

SOUND
Recording Sound for Motion Picture Reproduction, L. Cowan 5.00
Projecting Sound Pictures, A. Nadell 5.00

ELECTRICAL SERVICE
Radio Construction and Repairing, Moyer & Wostrel 5.00

GENERAL
Principles of Radio, Keith Henney 5.10
Elements of Radio Communication, J. H. Morecroft 5.00
Radio Engineering Handbook, Keith Henney 5.00
Radio Engineering Handbook, P. E. Terman 5.00
Radio Engineering Principles, Lazer & Brown 4.50
Radio Handbook, Moyer & Wostrel 4.50
Radio Telegraphy and Telephony, Duncan & Drew 7.00

RECTIFICATION
Mercury Arc Rectifiers, Maret & Winograd 6.00
Electric Rectifiers & Valves, L. R. Gauthereschule 4.00

TESTING
Elementary Electrical Testing, V. Karapetoff 4.00
Electrical Measurements and Testing, C. L. Dawes 1.75

MOTORS
Armature Winding and Motor Repair, D. H. Braymer 5.00
Rewinding Small Motors, Braymer & Roe 4.50
Alternating Current Armature Winding, T. Croft 3.50
Commercial Dynamo Design, W. L. Waters 2.00

COMMUNICATION ENGINEERING
Automatic Telegraphy, Smith and Campbell 2.50
American Telegraph Practice, D. McNeil 2.00

Send Check or Money Order Only. Do Not Send Cash

Commercial Radio, Book Dept. 7 West 44th Street
NEW YORK, N. Y.

Page Four

Mention Commercial Radio when answering Advertisements
Police Radio Combating Crime

By MATT SLOAN

The number of municipalities in the United States using police radio systems is rapidly increasing, and what was first looked upon as just a new branch of radio work is now a matter of serious intent.

Today, there are close to two hundred cities, and almost a dozen states using this type of radio. About fifty have been added in the last year. Due to the speed with which intelligence may be transmitted to all points within the working range, there is nothing to compete with the radio system in police work.

The early systems called for a central transmitting point, generally police headquarters, for the transmitting. More recent developments of the two-way communication is fast gaining popularity, and the police cruising cars are carrying their own means of reporting back to headquarters their positions, and acknowledgements of messages received. This also affords a means of immediately advising headquarters of instructions followed and results obtained.

Transmitters are sometimes remotely located from police headquarters. This is often advisable in the case of ultra short wave transmission, to give a better aerial facility for sending.

It is always possible for cities at present using the medium high frequency police transmitter to install two-way communication by providing ultra high frequency "report back" transmitters in police cars, by providing a suitable headquarters receiver and antenna point.

Cost of Systems

A 50 to 200 watt transmitter with from .5 to 1 KW power output may be purchased and completely installed for less than $5,000 and often will more than pay for itself in economics made possible elsewhere in less than one year. A 500 watt transmitter with approximately 4 KW antenna power completely installed. In some cities a large number of cars are equipped with receivers, and a fewer number with two-way communication. This allows immediate contact with all cars, and report back facilities from a selected few.

At headquarters, where two-way communication is used, the cost of receivers will run a little higher than ordinary fixed receivers, as a better type of receiver, and of a more permanent and reliable nature, is used. Also, a suitable location of the antenna which must be high is a matter that may lend additional cost to this item bringing it in most cases to about $350 for a first class installation.

Where line amplifiers are required for remote control as have been adopted in many points where police headquarters do not afford the best location for transmitters, an additional cost factor enters into the picture to the sum of about $500 additional cost.

Two-Way Is More Costly

The ultra high frequency two-way
communication while affording the better means and more satisfactory in many cases, increases the cost. The results more than warrant the additional cost of such installations.

In two-way communication it is sometimes possible to use the car battery charger with the standard generator supplied with the car. However, it is considered better practice to replace this charger, never intended for such heavy duty, with a more suitable type of charger. The special charging generator involves in the cost about $50 additional completely installed.

License Required

The usual formality preceding any installation is to first submit plans and outlines of the radio equipment to the Federal Communications Commission and receive a "license to construct" before any actual installation work is attempted. This point is entirely covered in a printed pamphlet which may be had from the Superintendent of Documents, Government Printing Office, Washington, D.C. at a cost of 30 cents.

When construction permit has been issued, it is entirely satisfactory to go ahead with installation work, as it is sanctioned by the Federal Communications Commission. When construction has been completed along the lines given in the original plans submitted to the Commission an operating license will readily be granted.

Those actually engaged in operating the transmitter itself must of course have a commercial radio operating license. No one else is at any time to take charge of the transmitter while it is on the air. Where commercial radio men are not engaged for this work it has been the practice to have certain men trained and licensed for this work.

Frequencies Available

Frequency allotments in the band between 1712 and 2490 kilocycles have been given to police departments by the Commission. Two-way communication is in use on the ultra high frequency in many of the larger cities of the country, and is proving very satisfactory. The Boston (General Electric), Newark, N.J. (Western Electric), and the uncompleted Erie, Pa. (Westinghouse), police radio installations are considered models of what may be accomplished as they are the products of three of the largest manufacturers, working with the best available engineering staffs, on two-way ultra high frequency installations.

About two-thirds of the police radio installations of the country today are in the medium high frequency band, and one-third in the ultra high frequency band. The trend is toward the ultra high frequency band.

Power Allotment

In the matter of State Police Transmitters a slightly different problem offers itself than in the case of municipalities. The distance covered does not lend itself to the ultra high frequency transmission, and it then becomes a problem of power for coverage. Authorizations have been made from 400 watts to 5 KW, but the Commission's attitude is to not allow anything above 5 KW, and to encourage the construction of several transmitters at different points within one state rather than to try to cover the entire territory with one transmitter. With one transmitter the power required may be above the 5 KW limit already set. Ultra high frequency lends itself well to city police work. The range is limited depending on the elevation of the transmitter, and earth curvature. Where the ground is fairly flat it is most satisfactory. Where mountains or hills, or large metal structures such as buildings, etc., are between the receiver and the

Layout of complete equipment for two-way communication as installed in a police car Western Electric Photo

transmitter it will give "dead spots".

(Continued on Page 23)
MUltiVIBRATORS

BERNARD EPHRAIM, E.E.

An Analysis and Discussion Replete With Practical Notes and Technical Information
IN FOUR PARTS—PART I

IN foreign and domestic engineering journals, there have appeared a number of general discussion treating the theory, design or technique of the multivibrator. To the technician, laboratory, and practical radio engineer, it is regrettable that most of the featured material has been either intensely objective, highly academic or too technical, or the papers have been cast in foreign languages which necessitates costly translation. In this series of papers these complexities have been largely overcome; and herein will be found the essence of many authoritative papers published in scattered journals throughout the world. In preparing these articles, the technical theme has been interwoven whenever possible, yet at all times it has been the endeavor to keep within the practical aspects of the subject; hence, for the first time, a practical presentation of the theory, design, and technique appears under one general heading.

Definition

The multivibrator, an invention of H. Abraham and E. Bloch (France), is a type of harmonic oscillator consisting of a two-stage capacity-resistance coupled amplifier in which the output is connected back to the input in order to produce a distorted wave form containing a powerful high-harmonic output.

The basic principle underlying the action in a multivibrator is dependent upon the phenomenon known as a "relaxation oscillation." A complete survey of the electrical phenomena leading up to a relaxation oscillator is so vast and the ramifications are so far reaching, that it would be practically impossible to be content with the brevity of the subsequent exposition. However, for those who desire greater detail than that which is encompassed herein, reference should be made to the footnotes and to the appended bibliography.

Relaxation Oscillations

Any type of oscillatory phenomena that wholly or partially comes to rest, or is appreciably retarded during any part of its harmonic motion is called a relaxation oscillation. This specie of oscillation can be electrically produced by automatically allowing a condenser to be quickly charged, then allowed to gradually discharge over a high resistance, or by permitting the condenser to slowly charge, then rapidly discharge over a comparatively low resistance.

Relaxation oscillations produced by the slow charge-fast discharge method are commonly generated by oscillators employing neon or grid-glow (thermu-tron type) tubes. The shape of the voltage wave-form produced by the gas tube relaxation oscillator during condenser charge and discharge cycles is shown in Figure 1. By closely examining the curve, it will be seen that the condenser charging voltage rises slowly and linearly to some fixed and finite amplitude. The linearity of the charging time is due to the charging epoch occurring over a limiting device, such as a pure resistance or saturated pe节点-type vacuum tube. The finite amplitude attained by the accelerating voltage is governed by the ignition level of the gas in the tube. When the critical ignition point is reached, the gas in the tube ionizes which provides a low resistance path over which the condenser quickly discharges. The curve shows this speedy discharge by almost dropping vertically from the critical ignition level down to where the voltage across the tube can no longer maintain ionization. As soon as this extinguishing point has been reached, the charge again begins to build up as shown by the rising characteristic in the second part of the curve. It should be observed that the relaxation period in the oscillator occurs to suddenly relieve the charge on the condenser; this is depicted in the Figure by the abrupt drops in the saw-shaped sinusoid. This same period also occurs in certain types of multivibrators, although the rapidity of relaxation is often lengthened into a more gradual discharge.

Relaxation Characteristics in the Multivibrator

In the multivibrator the principle relaxation-oscillations are produced by utilizing two separate condenser charge and discharge paths. Here, the condensers are alternately allowed to either charge or discharge slowly or rapidly in their respective circuits, while the reversals of each alternation are being governed by the values given to the resistance in the various circuit branches. A simple circuit by which it is possible to trace the aforementioned electrical paths is shown in Figure 2. A typical relaxation-oscillation curve, produced in the grid circuit of any one of the vacuum tubes referred to in the above diagram, is shown in Figure 3. An inspection of the curve will show how the relaxation characteristic is developed. Note that the curve "jumps" from point "a" to "b." Next the curve slowly drops down from "b" to "c" where then it suddenly drops thru zero axis to point "d." Here the curve gradually increases to "e," then suddenly jumps to "f" or "g" as above, thus starting another relaxation-oscillation.

By closely examining the wave form, it will be seen that relaxation-oscillation has a form that reaches a definite amplitude after one relaxatory period. (In any other oscillator, save the relaxation type, the wave-form is built up slowly and exponentially from a zero state to a finite stationary amplitude after a series of sinusoidal oscillations.) The finite amplitude attained during any one period of relaxation is governed by the amount of negative resistance in the circuit and upon the characteristic curvature of the tube's operating resistance. The stability of amplitude (meaning the condition necessary for maintenance of a steady state of oscillation for an uncontrolled multivibrator) is maintained by claims B. van der Pol' (Holland), by the inherent residual inductance is the grid circuit leads, there being no "jumped" inductance in the circuit. On the other hand, K. Heegner' (Germany), states that the steady state is maintained by the "falling characteristic" of the system (a property inherent in any regenerative amplifier. Of late, Y. Watannabe' (Japan), building upon Heegner's theory, claims that the steady state can be maintained by both falling and non-falling characteristics. Whether the theories of these able investigators can be melded into a single generalization is without the scope of

---

4 B. van der Pol, Loc. cit. No. 2.
a symmetry exists, the multivibrator has SYMMETRICAL CHARACTERISTICS. The reason for excluding this topic is because the multivibrator system cannot be exactly analyzed or investigated by the Fourier method. The wave patterns may, never-the-less, be qualitatively studied through the medium of the cathode-ray or string oscillograph device.

Since the control function in most all types of vacuum tubes depends upon the grid bias, it is obvious that if this bias were of a symmetrical alternating voltage, and each alternation had sufficient amplitude, the tube could be swept over its entire characteristic. Through such control, and by proper selection of the circuit constants, the condensers in the multivibrator can be made to quickly charge and slowly discharge or vice versa in practically any sequence with respect to time. Thus, a wave-shape of the familiar saw-tooth configuration can be developed in the system. This waveform is similar to that produced by a neon-tube oscillator with the exception that the progression of the wave development is reversed in the multivibrator. For comparison, see Figures 1 and 3.

The general outline of the wave-form depends upon the time periods allowed to the alternate condenser charge and discharge transitions. If these periods be equal, that is, if the charging times be of one value and the discharge times another, the contour of the voltage curves described by the alternate condenser charge and discharges will have practically the same shape. When such

In the Figure, open and closed arrows indicate the direction in which the current flows during alternate condenser charge and discharge periods. Plus and minus signs show the grid voltage biases on the respective tubes during inter-circuit reversals.

GENERAL EXPLANATION: Refer to either drawing "a, b" or "c, d" in Figure 4, then assume that the plate supply voltage has suddenly been applied to the plate circuits. Now, from a brief examination of either diagram, it would seem that if resistors r1 and r2 were of an equal value, an equal charge would be placed upon condensers C1 and C2 thereby stabilizing the system. But, in a symmetrical or unsymmetrical combination, experiment and theory prove that an unbalanced condition exists in the intra-circuit of some one tube causing an unsymmetrical current equilibrium to be established between one tube and the other. This instability causes the circuits to feed back upon each other producing self-excited oscillations.

CIRCUIT ACTION: To properly depict the circuit action together with the building up of the relaxation characteristic, reference will be made to the diagrams in Figure 4 together with the graphical representations shown in Figure 5. As regards the graphs, these describe excursions of the plate voltage E1, E2, plate currents I1, I2, grid voltages Egrid, Egrid and condenser voltages C1, C2.

In drawing "a" suppose that the potential applied to plates E1, E2, to condensers C1, C2 were one value. (This is strictly a supposition as such conditions do not exist for even the duration of a moment. In experiments it has been repeatedly demonstrated that in order for self excited oscillations to be produced it is a necessary condition that there be no point of equilibrium with respect to the direct current.) Now, if the plate current is flowing through r1, should slightly increase (1) (these numbers refer to portions of the curves shown in Figure 5) a small voltage drop (2) would occur at E1 due to the IR drop in r. The reduction of voltage at E1 permits condenser C1 to slightly discharge (3) through the elements of tube number 2, then the bias as to the negative side of C1. During this slight discharge, the voltage across Rc increases the negative bias Egrid (4) which decreases the plate current I1 (5) more times (amount governed by the mu of the tube) than the initial current change through r1. The decreasing plate current at I1 increases the voltage at E1 6, which starts to increase the charge on C1. The charge acting through C1 decreases the negative bias Egrid (7) which, when multiplied by the nu of the tube, is great enough when carried back to E2, to drive the grid so negative (8) that the plate current I2 (9) is suddenly cut off. This, of course, increases the voltage at E2 10, which charges condenser C2 (11). The charge acting through the condenser drives grid Egrid positive (12), which increases the plate current I2 (13) and decreases the voltage at E2 14, causing condenser C2 to discharge (15). The condenser will continue to discharge until the grid voltage on E2 has reached such a value (16) that the plate current increases to cut off (17). At this instant, refer now to diagram "b", the voltage E1 across r1 begins to drop (18) causing condenser C1 to slightly discharge (19) across Rc, which, due to the IR drop therein, causes Egrid to be driven slightly negative (20). This change decreases I1 (21) and in-

![Diagram](image_url)
variations may be determined are:

(6) Two changes in condenser
(5) Two changes in plate
(4) Two changes in grid current
(3) Two changes in condenser
(2) Two changes in plate

These appear below.1Pi

The variations in current and voltage occurring during any relaxation-oscillation may be determined by inserting a simple vacuum-tube voltmeter in any of the branch circuits shown in Figure 6. When using the meter, it is essential that its damping constant be higher than the CR period of the multivibrator, in seconds. This limitation means that only quantitative readings can be obtained at only very low relaxation frequencies. With the meter it is possible to determine six voltage and six current variations during each oscillation, a list of which appears below:

(1) Two changes in grid voltage
(2) Two changes in plate voltage
(3) Two changes in condenser charges
(4) Two changes in grid current
(5) Two changes in plate current
(6) Two changes in condenser charge and discharge currents

Equations by which any of the above equations may be determined are:

GRID VOLTAGES:

\[ E_{g1} = I_{g1}R_{g1} = R_{g1}(I_{g11} + I_{g12}) \]
\[ E_{g2} = I_{g2}R_{g2} = R_{g2}(I_{g21} + I_{g22}) \]

PLATE VOLTAGES:

\[ E_{p1} = I_{p1}R_{p1} = R_{p1}(I_{p11} + I_{p12}) \]
\[ E_{p2} = I_{p2}R_{p2} = R_{p2}(I_{p21} + I_{p22}) \]

CONDENSER CHARGES

\[ E_{c1} = C(E_{g1} - E_{c1}) \]
\[ E_{c2} = C(E_{g2} - E_{c2}) \]

GRID CURRENTS:

\[ I_{g1} = \phi(E_{g1}, E_{c1}) \]
\[ I_{g2} = \phi(E_{g2}, E_{c2}) \]

PLATE CURRENTS

\[ I_{p1} = \phi(E_{p1}, E_{c1}) \]
\[ I_{p2} = \phi(E_{p2}, E_{c2}) \]

CONDENSER CHARGE AND DISCHARGE CURRENTS:

\[ I_{c1} = C \frac{dE_{c1}}{dt} \quad \text{Condenser charging} \]
\[ I_{c2} = C \frac{dE_{c2}}{dt} \quad \text{Condenser discharging} \]

The condenser charge and discharge currents must be determined by differentiating over the charge and discharge times. In practice, it is seldom necessary to determine these values.

Frequency Determination

The fundamental frequency of the multivibrator cannot be determined from formula enclosed in determining frequency in other types of oscillatory systems. This is because the sustained oscillations produced in the multivibrator are not oscillations of the second type. In this category the reduced Thomson formula is valueless because the circuits comprising each shunt branch have no effective inductance during the times when the current remains substantially at one value over a certain part of each relaxation-oscillation. However, the fundamental frequency may be closely approximated by computing the relaxation-oscillation time constant of the system. This constant may be determined from the following expression

\[ T = RC \log \frac{V_1}{V_2} \]

where \( C \) is the total capacity in the circuit, \( R \) the total effective resistance in series with the capacity, and \( V_1 \) and \( V_2 \) the initial and final voltages, respectively, across the condenser.

Another method for calculating the frequency of the system, while not as accurate as the above, consists of simply taking the CR product of the grid circuits. Expressions for calculating frequency by this method are

\[ f = \frac{1}{C_1 + C_2 (R)} \]

where \( f \) is the frequency in cycles; \( C_1 \), the capacity in microfarads; and \( R \), the ohmage of one of the grid leak resistors.

Applying one of the above equations, take the following example:

If a multivibrator had grid leak resistors of 20,000 ohms each, condensers of 500 micro-microfarads each, the frequency could be determined by the following solution:

**SOLUTION:**

\[ f = \frac{1}{C_1 + C_2 (R)} \]

\[ = \frac{1}{500 + 500 (20,000)} \]

\[ = \frac{1}{500,000} \]

\[ = 0.0002 \]

**Note on Technique:**

To find the value of the grid leaks for some specific frequency when the value of the condensers is known, use the following method:

(1) Take the frequency in cycles and

(Continued on Page 21)
Automatic Receiver For Distress Signals

By O. BRACKE and P. GIROUD

Introduction

According to their classification and importance, all seagoing ships are compelled to have one, two or three wireless operators on board, who, under the Merchant Shipping Act of 1927, are to keep a wireless watch during certain hours imposed by the rules laid down in the Act.

Outside these watch-keeping periods, the ships have been unable to receive distress signals. To obviate this inconvenience and in order to reduce the number of required wireless operators, the Washington International Wireless Telegraphy convention of 1927, instituted the wireless watch during certain periods, the ships and it has been standardised by the International Marine Radio Company, Ltd.

Numerous types of automatic receivers are being developed by different firms, the signal time checking being done by tuned relays, pendulum clock systems, or clutch or motor driven switches. All of them are based on the principle of the direct measurement of the duration of the individual dash and interval.

The duration of the dashes is a relatively stable element; atmospheric interference or powerful signals other than distress signals can only add to their duration without changing their characteristics. The intervals which, according to the regulations, may be as short as 0.2 second are, on the contrary, liable to be upset to a greater extent by the interference. Consequently, under normal service conditions, two consecutive dashes are not separated by an interval of the correct duration but by an interval containing a number of extraneous short signals.

By eliminating the measurement of the interval separating two consecutive dashes and substituting a check of the total time from the end of a first dash to the end of the following second consecutive dash, the new auto-alarm developed by the Laboratories completely solves the problem. The principal cause of failure of the other types of automatic distress signal receivers is suppressed.

Description

The equipment consists of:

1. A watertight box containing the automatic distress signal receivers.

The automatic distress signal receivers are tuned by a pendulum clock and driven by a motor.

Signal Time Checking

Numerous types of automatic receivers have been developed by different firms, the signal time checking being done by tuned relays, pendulum clock systems, or clutch or motor driven switches. All of them are based on the principle of the direct measurement of the duration of the individual dash and interval.

The duration of the dashes is a relatively stable element; atmospheric interference or powerful signals other than distress signals can only add to their duration without changing their characteristics. The intervals which, according to the regulations, may be as short as 0.2 second are, on the contrary, liable to be upset to a greater extent by the interference. Consequently, under normal service conditions, two consecutive dashes are not separated by an interval of the correct duration but by an interval containing a number of extraneous short signals.

By eliminating the measurement of the interval separating two consecutive dashes and substituting a check of the total time from the end of a first dash to the end of the following second consecutive dash, the new auto-alarm developed by the Laboratories completely solves the problem. The principal cause of failure of the other types of automatic distress signal receivers is suppressed.

Circuit schematic of A.A.S.B. type auto-alarm

(Continued on Page 15)
Short Wave Programs for Waldorf Guests

By H. T. BUDENBOM

Member of Technical Staff, Bell Telephone Labs.

Since its opening some four years ago, the new Waldorf-Astoria Hotel has provided radio broadcast programs for its guests in over two thousand rooms. A horizontal antenna, suspended between towers forty-seven stories above the street, is connected to high-quality Western Electric receivers on the sixth floor, from which point the programs are distributed over a building-wide network developed by the Laboratories. Since the Waldorf enjoys an international reputation, and attracts many foreign guests, the management felt it would be desirable to make available to them radio programs broadcast on short waves from their own countries, in addition to our local broadcasts. Moreover, the general interest in short-wave reception would make the availability of short-wave programs an attractive feature for American patrons. To receive such programs the Waldorf has now installed a Western Electric short-wave receiver which can be connected to any of the circuits of the present distributing system.

Most of the short-wave programs are broadcast at frequencies from 6 to 25 megacycles, corresponding to wave lengths from fifty down to twelve meters, and it was decided that the Western Electric 13A Radio Receiver would provide the best quality of signal and most general satisfaction over this range. This receiver was designed for various applications in the short-wave field, including aviation, point-to-point, and ship-to-shore. It was first applied to the Caribbean radio telephone project, as already described in our September, 1933 issue, but has since been widely used both at home and abroad. As shown in Figure 1, all the apparatus is housed in a seven-foot cabinet about twenty inches wide. The cabinet itself forms the back, sides, and top for a number of units, each of which has its own function and carries its own front panel. The scope of the receiver may be broadened, after purchase, by the addition of other units as desired.

Units available are three radio-frequency amplifiers, each with a different frequency range, an intermediate frequency amplifier, and an audio-frequency amplifier and power supply unit, as well as antenna tuning units, a patching panel, and an oscillator panel, which allows the set to be used for receiving telegraph signals. There is also available a panel, used chiefly for point-to-point communication, which may be employed to disable the receiver either when no carrier is being received or when the transmitter associated with the receiver is on the air. Of these various panels available, the installation at the Waldorf includes only the audio and intermediate-frequency amplifiers and the three radio-frequency amplifiers, which are sufficient for broadcast reception over the frequency range from 2.2 to 25 megacycles. Such an arrangement will permit them to receive not only all the short-wave broadcasts, but many police, aviation, and amateur radio-telephone channels as well.

The use of three separate radio-frequency amplifiers makes it much easier to tune in on a given station promptly. Depending on the time of day, a broadcast station may employ any of several frequencies. If it were desired to get a station which used either 6, 9, or 15 megacycles, for example, one amplifier could be tuned to 6 megacycles, one to 9,
and one to 15, and all three would be
connected to the intermediate-frequency
amplifier. If the station were on the air
it would be immediately heard, and the
two unnecessary amplifiers turned off.
If it had not yet come on the air the
operator would hear it the moment it
did and would not lose the station an-
nouncement by having to tune succes-
sively to several frequencies.

The 13A Receiver is completely a-
operated: the necessary transformers,
rectifiers, and filters being incorporated
in the voice-frequency amplifier unit.
The signal gathered by the antenna first
enters one of the radio-frequency ampli-
diers where it is amplified, passed through
a series of selective circuits, and is then
beaten down to a frequency of 385 ke.
the frequency of the intermediate am-
lifier.* Here undesired frequencies are
filtered out by sharply tuned circuits,
further amplification is obtained, and
the signal is detected. The resulting au-
dio-frequency signal, which covers the
band from 40 to 5000 cycles, is then fur-
ther amplified in a suitable audio am-
plifier before distribution over the Wal-
dorf system.

Outstanding features of this receiver
are the high degree of selectivity, an
 electrical and mechanical design that
insures dependable operation as well as
high quality reception, and a sensitivity
that permits good reception on signals
as low as one microvolt. In the radio-
frequency amplifiers there are five tuned
circuits ahead of the modulator. These,
together with the beating oscillator, are
tuned by a six-gang condenser operated
through a carefully constructed worm
drive, shown in Figure 2, which gives
very accurate selection. Frequencies sepa-
rated less than one-tenth of one per-
cent may be readily tuned in. In the in-
termediate-frequency amplifier, Figure
5, there are eight additional tuned cir-
cuits. In this amplifier there is also a
hand-changing switch which, in the
event of bad noise conditions, can be
used to decrease the width of the audi-
ble frequency band and thus reduce the
interference. Automatic gain control is
provided, which is particularly important
for short-wave reception, where the var-
ation in signal strength with time may
be considerable.

No matter how efficient a radio recei-
ver may be, it must depend on the an-
tenna to extract the maximum amount of
energy from the arriving signal with the
least amount of noise. Considerable
attention was therefore given to the de-
sign of an antenna that would best se-
cure these results, and at the same time
would not mar the appearance of the
building with tall ungainly structures.
The multiple-doublet arrangement pro-
vided serves admirably to receive sig-
als over a wide range of frequency and
direction of arrival with a maximum of
noise elimination.

When a horizontal wire is exposed to
a high frequency electro-magnetic field,
it acts somewhat as a tuned circuit, and
a current-measuring device placed at the
mid-point would show maximum current
when the length of the wire was approx-
imately half the length of the radio
wave. Such a wire differs in action from
a tuned circuit, however, as responding
to only not to the fundamental frequency
but to all odd multiples of this frequen-
cy. Thus a wire equal in extent to a
half wave-length of a 3000 kilocycle
signal, or 50 meters, would respond to
frequencies of 3,000, 9,000, 15,000, and
21,000 kilocycles, and so on. If such a
wire is broken at its mid-point and a
tuned circuit or a transmission line lead-
ing to a tuned circuit is inserted, the re-
sulting arrangement is known as a dou-
blet. After the introduction of this as-
cociated circuit the tuning of the wire
is only moderately sharp, and as a re-
sult it responds fairly well over a fre-
cency range extending perhaps 20 per-
cent above and below the various fre-
cuencies corresponding to the length of
the wire. By using several of these
doublets, therefore, it is possible to se-
cure good reception over a wide range
of frequencies.

In the Waldorf installation, three
such doublets are employed, having ap-

*Suppressor grid modulation is em-
ployed.
In Baltimore, vacations are the order of the day. At WPRR: Control Man Racket and Announcer Hieken have just returned from a trip to Bermuda. Neither will admit having felt the least bit seasick.

Stewart Kennard, that demon of Me- nos, has journeyed to Ocean City, Md. We all expect to hear some fine fish stories when Stewart gets home.

Edie Moore has a nice mountain tour mapped out for his vacation. Bill Kelly will journey down Norfolk and Virginia Beach way.

The Chief—W. J. Ranft—has just returned from his vacation down on the Maryland Eastern Shore and Ocean City.

Carlton Nopper will celebrate his first year of married bliss down at Atlantic City.

The studios and transmitter shack of WPRR have been all fixed up with air conditioning equipment to keep the boys cool off.

Clem Holloway promises himself a trip back home for his vacation. Norman O'Hara is the Relief Engineer at WPRR again this year.

At WBAL:

W. J. Kelly spent his vacation down at Ocean City, Md. Edward K. Thrifthof used his vacation days for a honeymoon. Good luck, fellow, and may the Sea of Matrimony be as smooth as those local pugs of WBAL.

Wm. C. Barham spent his vacation down on the Chesapeake Bay.

John Mutch says he expects to spend his vacation at Ocean City, Md., also.

Stafford Carson is a new man at WBAL, moving there in February.

Andrew Mansey is the relief man on the WBAL staff.

At WCAO:

Marvin is going down Virginia way in his new Ford.

The Chief—James Schultz—whether to start work on his ham station or take a trip to New York City is the question.

Lynch has left WCAO and has gone down South to take a job with EAT.

Charlie Seibold made a trip to N. Y. C. to see the big time radio.

Sydney Bauford is planning a very quiet vacation at home.

At WDBM:

Sammy Houston was married recently and used his vacation for a belated honeymoon trip to Norfolk and Virginia Beach. Happy landings, fellow, and may your new job run very much more smoothly than that Ford you used to drive.

August Eekles is planning a trip to the Midwest. Frank Snyder, they say, is getting fat—maybe he’ll spend his vacation relaxing.

Ed Laker—a sound man—will journey out to Akron, Ohio.

George Porter Houston—the Chief—who had expected to go to Ocean City, Md., for his time off.

WITH THE TECHNICAL EDITOR

**England’s First Television Station**

LONDON, England: The first television station in England, under the new British Broadcasting Corporation’s high-definition system, is to be built immediately. The transmitter will be located in the Alexander Palace; this building is in the London sector.

Bids for transmitters have been tendered to the Baird Television Company ($40 line type) and to the Marconi EMI Television Company (405 line type). The British are going on the double to beat U. S. broadasters to this television thing.

---

**AT&T Television 12 Month (?) Away**

By using a coaxial cable, see Electrical Engineering, October 1934, the AT&T Company plan elaborate tests with the new cable which is capable of transmitting (corresponding to the cable diameter) a frequency of 1000 kilocycles.

The cable is useful for interlinking transmitters for chain visual broadcasts. At present, plans are being drawn and monies appropriated for constructing a line between New York City and Philadelphia. According to New York research experts, it is rumored that the project will cost over a half million dollars.

In this country the ultimate destination of television will greatly depend upon the co-ordinated experiments of both the AT&T and RCA companies.

(Note: An article treating the practical, economic, and professional world with its latest development—frequency modulation—frequencies above and below the carrier; these are then combined in a circuit having linear frequency response, the output being demodulated in the conventional manner.

Further details on the Armstrong innovation will appear in this journal, as soon as released by the IRE. Until such time, the reader is referred to U. S. Pat. Nos. 1,941,069 and to "A Treatise on Frequency Modulation" published in the June issue of Communication and Broadcast Engineering.

---

**Wanted: A Silent Tuning Aid**

At present there is a trend toward incorporating auxiliary beat-frequency oscillators in broadcast receivers to obtain an audible beat-note signal for indicating and bringing to resonance strong or weak signals. While this method of tuning materially aids in resonating to the signal frequency, it has a number of disadvantages; some of these are enumerated below:

(1) Close manual adjustment and tedious concentration are required by the user who is generally unskilled in the manipulation of such devices.

(2) The beat-note whistle, which is a varying high-to-low pitched tone, is not only irksome but is also disagreeable to the ear.

(3) Exact or near-resonance tuning is largely accidental; the users of broadcast receivers are not as accurate in their tuning as many engineers would believe them to be. Witness, for example, that receivers equipped with tuning meters usually are tuned 200 to 500 cycles off resonance.

(4) At present beat-oscillators are provided with a cut-out switch to enable the user to silence the beat-note tone. This switch becomes a nuisance in tuning distant stations.

(5) It is practically impossible to leave the beat oscillator permanently connected in the circuit due to variations in the oscillator frequency caused by temperature, humidity, and supply voltage fluctuations.

To eliminate the disadvantages enumerated above involves the design of a circuit in which the beat-oscillator remains operative only until the resonance curve of the receiver is aligned or nearly aligned with the signal frequency. When this point is reached, the oscillator must automatically stop oscillating, and at the same time the amplitude control in the receiver must be unblocked.

In designing the circuit, provision must be made for the receiver to control the beat-frequency "band width," so that the receiver may be adjusted to tune; that is, to trigger the amplifier within 0 to 200 cycles off resonance.

---

**Frequency Modulation**

Major E. H. Armstrong, famous for regeneration, the superheterodyne, and super regeneration, now starts the professional world with his latest development—frequency modulation.

Briefly, the invention essentially consists of displacing the station frequency a certain number of cycles each side of the carrier. **Frequency modulation** is accomplished by frequency modulation of the power output being demodulated in the receiver. The frequency modulated signals, hence, consist of carriers at frequency above and below the carrier.

One of the salient features of the development, which is contradictory to all accepted theory, is that the wider the band the better will be the signal to noise ratio. Usually receivers are made highly selective so as to admit only the desired signal; here is a system where just the opposite is true!

Conventional receivers cannot receive the frequency-modulated signals, hence, an auxiliary device must be used to convert the received signal into an amplitude-modulated signal before demodulation is possible. Push-pull radio frequency input stages operating each side of resonance are required for receiving the signal. The stages select the amplified frequencies above and below the carrier. These are then combined in a circuit having linear frequency response, the output being demodulated in the conventional manner.

---

**JULY-AUGUST, 1935**

Page Thirteen
this manner the receiver may be adjusted at one's discretion to respond to either narrow or broad resonance peaks. In addition to this refinement, the user should be able to switch "in" or "out" the RF oscillator at will.

It is requested that some of our inventive readers will offer suggestions toward the solution of this problem.


"Mail Order" Education

Here is an excerpt from a letter that tells a complete story—the writer wishes to remain anonymous:

"Has it ever occurred to you by what means the purveyors of mind-training systems, no matter how superficial and metrical, achieve such a measure of success? It is simply owing to the fact that a man, when he has put down a substantial sum, is possessed by subconscious determination to avoid at all cost the humiliation of feeling that he has been such a nincompoop as to have thrown all that money away. Accordingly, he applies himself for the first time in his life, and with grim determination, to the reform of his own mind. Under such circumstances, the pursuit of any system whatever is bound to meet with a certain measure of success."

Notes on Fixed Attenuation Networks

Since attenuation networks are composed of resistances, it is important that each resistive element employed in the various circuit branches be of certain design; that is, if stability and permanence of calibration are desired. The major factors dealing with the design of the resistive elements are:

(1) Each resistive winding must have a low temperature coefficient over ambient room temperatures. This means that the resistance of each winding must not change appreciably over ordinary room heats.

(2) Each winding must be free of resistance effects and have a low or zero phase angle. In other words, the windings must be non-inductive wound.

(3) The resistance of each winding must be free from frequency variations between wide limits throughout the entire audio-frequency spectrum. If the elements have poor frequency characteristics, certain frequencies will be attenuated more than others. This effect is especially noticeable in the zones of the upper register.

(4) The impedance of the circuit elements must not vary with frequency else there will be an over-emphasis or loss of certain audio components during random levels of attenuation.

The above requirements have been principally given to show that a great deal of care must be taken in designing or selecting resistors for use in looser or impedance-matching networks. It is well to bear in mind, that it is almost impossible to satisfactorily pattern a fixed network with just "ordinary" or "cheap" resistors of inferior design.

A 13.5 to 550 Meter Receiver

THE R.M.10 Radio Receiver is a nine valve superheterodyne general purpose receiver designed for telegraphy and telephony. The range of 13.5 to 550 metres is covered by five sets of plug-in coils. The high frequency coils for each band are ganged on a single triangular unit and changed simultaneously. The large drum dial is calibrated directly in kilocycles for each of the five wave ranges.

The appropriate calibration track is automatically illuminated by insertion of a coil unit.

Rapid adjustment of tuning is done by turning the knurled rim of the drum dial, and fine adjustment by means of an anti-backlash worm drive. The reduction of the worm drive is sufficient to produce band spread coils unnecessary.

A local beat-oscillator is provided for reception of C.W. telegraphy and a control for adjusting the pitch of the received note is also provided.

For conditions of extreme selectivity an audio frequency filter panel passing a band of 900 to 1,100 p.s is available. To match the receiver to all types of antenna systems, an antenna impedance matching panel is provided. This supplementary panel adds an extra balanced tuned circuit which improves second channel selectivity and assists in duplex operation in addition to providing the correct matching impedance for all types of antenna. This device also considerably attenuates noise pick-up on the transmission line from a doublet antenna.

Further refinements are provided in a time lag control for the automatic voltage control permitting the choice of a long time lag in low speed telegraphy, or a short time lag in telephony or high speed telegraphy. The resonance meter is provided with a switch and multiplier to check high tension voltages. A crash limiting circuit is provided for headphone or loudspeaker operation.

The receiver can be supplied either with four sets of coils to cover 13.5-200 metres or with five sets to cover 13.5-550 metres.

The receiver illustrated, the first model of which was manufactured by Kolster Brandes Limited, Sidcup, covers the wave range of 13.5-200 metres. The units from top to bottom are:

(1) Combined power (coil rack and power supply unit).
(2) Antenna matching panel.
(3) Receiver unit.
(4) 1,000 p.s note filter.

PX or position reporting kept the Pope Field, Fort Bragg, N. C., commerce station pretty busy recently during the seventh annual All American Air Races at Miami. PX traffic was January 9, 117; January 10, 177; January 11, 296; January 12, 135; January 13, 175; January 14, 202. Pretty heavy traffic we think.
Automatic Receiver for Distress Signals

(Continued from Page 10)

wireless receiver

(2) A similar box containing the signal selector device, whenever a radio signal of required frequency is received.

A safety relay is connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve operates the selector device, whenever a radio signal of required frequency is received.

A safety relay is connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.

A relay connected in the plate circuit of the low frequency detector valve opera-
tes the selector device, whenever a radio signal of required frequency is received.
Antenna Change-Over Switch

A three-pole change-over switch is provided for changing over from normal reception to auto-alarm reception. This switch is so connected that one pole transmits the antenna from the normal receiver to the auto-alarm receiver. The two other poles control, respectively, the power supply for the received signal relay circuit and the power supply for the motor.

Power Supply and Charging Panel

The power supply consists of a low tension battery of 24 volts, the current drain for the receiver and selector being approximately 2.5 amperes, and a high tension battery of 120 volts, the current drain for the receiver being approximately 0.025 amperes.

A spare low and high tension battery is furnished up as a standby.

The charging panel is for operation from the ship's mains and includes all the necessary fuses, switches, and meters.

Operation

Before explaining in detail the operation of the various possibilities which may arise while the equipment is in service and ready to receive the distress signal, the following are as follows:

(1) First dash of correct duration;
(2) Second dash of correct duration;
(3) Third dash of correct duration;
(4) Dash of too short a duration;
(5) Dash of too long a duration;
(6) Spurious dashes of incorrect duration;
(7) Distress signals superimposed on other signals.

Possibilities (1), (2), and (3) correspond to the case of reception of a correct distress alarm signal not marred by any interference.

Possibility (4) corresponds to the case of reception of a spurious signal mixed with interferences on atmospheric circuits.

Possibility (5) corresponds to the case of reception of a correct distress alarm signal on which are superimposed other signals on atmospheric circuits.

The general schematic of the A.A.2. auto-alarm is shown in circuit schematic and selector. It is assumed that the receiver and selector mechanism have been switched on by throwing the antenna changeover switch to the operating position. The equipment is ready for operation after the short time necessary for the indirectly heated valves to be warmed up.

(1) First Dash of Correct Duration

When the first dash of a distress signal is received, the rectified current corresponding to this first dash energizes relay Sr which pulls up and operates in turn the input relay Ar of the selector. The electromagnet of the first timing switch M1 is energized and the contact brushes N1 and N2 start rotating. Contact brush N1 connects negative potential to the contact segment BC maintaining the contact on same during the time of rotation of arm N1 either way. The other brush N1 leaves the home contact segment HC. After 3.5 seconds when brush N1 leaves segment C4 and energizes relay Kr1 which operates and through its front contact 2, energizes the winding of relay Lr1 which is short-circuited and therefore does not operate.

As it is assumed that the received dash is of the correct length, it will cease while the brush N1 is still on segment C4 and before it reaches segment C5. Segment C5 is located on the arc in such a position that the time brush reaches this contact after 4.5 seconds. Relay Sr will release at the end of the dash, as will also relay Ar. The magnetic clutch M1 being deenergized, the brushes N1 and N2 will return to their home position during the influence of the resetting spring.

As soon as the brush N1 leaves the segment C4, relay Lr1 is no longer short-circuited. It becomes energized and causes the following operations,

(a) By means of its contact 2, it transfers segment C4 to the second group of counting relays Kr2 and Lr2 in order to allow the recording of the second dash, provided this dash be of correct duration.

(b) Through its contact 3, it energizes the magnetic clutch M2 and the timing brush N2 starts rotating.

(2) Second Dash of Correct Duration

When a second dash of correct duration, preceding the distress signal, is received, the cycle of operations described above will again take place, but instead of energizing relay Kr1, the brush N1 now energizes relay Sr.

When the second signal ceases, the time-arm N1 leaves the segment C4, and relay Kr2 locks up in series with the winding of relay which operates.

By means of the front contact of relay Lr2, segment C4 is now connected to the third group of counting relays Kr3 and Lr3 and the circuit is ready for the recording of a third dash of correct duration.

(3) Third Dash of Correct Duration

When a third dash of correct duration is received, the same sequence of operations will be repeated as previously described for the first and second dashes but now the brush N1 will energize, through segment C4, relay Kr3 which locks up in series with the winding of relay Lr3 as soon as the signal has ceased, that is, to say, when brush arm N1 leaves segment C4. Relay Lr3 then operates, closing its front contact 2.

When the brush arm N1 has returned to its home position, the alarm bell circuit is energized. In the same time relay Ar operates and locks up over its own contact, maintaining the alarm bell operated.

It should be noticed that 12.4 seconds after the recording of the first dash of correct duration, the brush arm N2 makes contact with segment C13, thus energizing relay Gr which operates. The back contact 2 of relay Gr breaks. This opens the feeding circuit of counting relays Lr1 to Lr3 and Kr1 to Kr3 and all these relays come to rest. The magnetic clutch M2 is no longer energized and the brush arm N1 returns to its home position by means of the resetting spring.

The selector is now ready to record other alarm signals.

Should still another correct distress signal be received, the circuit operates as before, but the alarm bell circuit itself remains independently closed. To stop the alarm bells ringing it is necessary to depress key KK which opens the alarm bell circuit and the locking circuit.

(4) Dash of Too Short a Duration

Any signal having a wavelength between 855 and 615 metres will energize relays Sr and Ar and consequently the magnetic clutch M1.

As the duration of the signal is below 3.5 seconds, the brush arm N1 cannot reach segment C4 before the termination of the signal. When the signal ceases, the alarm brush arm N1 returns to its home position.

As soon as the signal has ceased, relay Ar is deenergized and closes its back contact 2, causing relay Er to energize and lock up through its front contact 1. At the same time, the back contact 2 of relay Er breaks and opens the feeding circuit of magnetic clutch M2.

The time brushes N1 and N2 start rotating as if a correct signal had been received.

After 3.5 seconds, contact arm N1 reaches segment C4 and energizes relay Kr (1, 2 or 3) which operates and thru its front contact is placed in series with the winding of its associated relay Lr (1, 2 or 3). Relay Lr does not operate, but now the brush N1 is still on segment C4 and before it reaches segment C5.

As it is assumed that the received dash be of too long duration, the brush N1 will continue to rotate, and will pass on to segment C5, causing relay Gr to be energized and the following operation takes place:

(a) The opening of the back contact 2 of relay Gr causes the feeding circuit of the counting relays to be broken, and so annuls the signals which may already be recorded. Relay Lr1 is deenergized and its associated relay Lr2, thus deenergizing the magnetic-clutch M2. The timing brush N2 stops rotating and returns to its home position.

(b) By the closing of the front contact 2 of relay Gr the latter locks itself.

When the signal ceases, the magnetic clutch M1 is deenergized and the brushes N1 and N2 return to their home position. As long as brush N1 is in contact with segment BC, the time influence remains locked and prevents the recording of the signal during the passage of brush N1 over segment C4.

Relay Er will release and bring back the magnetic clutch circuit to normal only when brush arm N1 has left segment BC and has reached its home position. In this way, if another signal is received during the return to its home position of timing switch M1, this signal will be without effect.

(5) Spurious Dashes of Correct Duration

Due to the superimposition of several radio signals and also due to atmospheric interference, it may happen that relay Sr in the receiver remains energized during a duration of dash corresponding exactly to the duration of a dash originated by a distress signal.

In this case, the selector will operate in a similar way as when a first dash of correct duration is received. Counting relays Kr1 and Lr1 will lock up and the timer brushes N2 will start rotating.

If the signals following the loss of too short a duration, the operation of the selector will be the same as in the case of a received signal of too short a duration.

Here again it should be noted that 12.4 seconds after the recording of the correct signal, the time brush N2 will come
Total Operating Revenues of Different Radio-Telegraph Concerns

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Radio Telegraph Co.</td>
<td>$25,296.49</td>
<td>$43.11</td>
<td>$26,437.86</td>
<td>$26,437.86</td>
</tr>
<tr>
<td>Globe Wireless, Ltd.</td>
<td>$25,296.49</td>
<td>$43.11</td>
<td>$26,437.86</td>
<td>$26,437.86</td>
</tr>
<tr>
<td>Mackay Radio &amp; Tel. (Cat.)</td>
<td>79,835.08</td>
<td>74,925.69</td>
<td>83,196.45</td>
<td>87,174.86</td>
</tr>
<tr>
<td>Mackay Radio &amp; Tel. (Del.)</td>
<td>65,906.73</td>
<td>59,227.59</td>
<td>56,685.16</td>
<td>56,685.16</td>
</tr>
<tr>
<td>Magnolia Radio Corp.</td>
<td>209.10</td>
<td>251.30</td>
<td>212.40</td>
<td>191.68</td>
</tr>
<tr>
<td>Mutual Tel. Co. (Wireless)</td>
<td>4,235.25</td>
<td>3,602.61</td>
<td>4,073.11</td>
<td>4,207.09</td>
</tr>
<tr>
<td>Olympic Radio Corp.</td>
<td>174.57</td>
<td>174.57</td>
<td>174.57</td>
<td>174.57</td>
</tr>
<tr>
<td>Pacific Marquett Radio Corp.</td>
<td>788.48</td>
<td>734.52</td>
<td>677.94</td>
<td>1,143.94</td>
</tr>
<tr>
<td>R.A.C. Communications, Inc.</td>
<td>353,398.11</td>
<td>310,271.41</td>
<td>345,866.89</td>
<td>339,608.90</td>
</tr>
<tr>
<td>Radiomarine Corp. of Amer.</td>
<td>71,069.38</td>
<td>70,847.09</td>
<td>75,984.34</td>
<td>76,065.88</td>
</tr>
<tr>
<td>Tokyo Radio &amp; Tel. Co.</td>
<td>387.55</td>
<td>380.10</td>
<td>501.27</td>
<td>222.36</td>
</tr>
<tr>
<td>Tropical Radio Telegraph Co.</td>
<td>71,776.53</td>
<td>45,171.31</td>
<td>58,048.63</td>
<td>57,133.14</td>
</tr>
<tr>
<td>U. S. Liberia Radio Corp.</td>
<td>4,252.94</td>
<td>5,728.33</td>
<td>5,405.90</td>
<td>5,068.11</td>
</tr>
<tr>
<td>Wabash Radio Corp.</td>
<td>985.97</td>
<td>985.97</td>
<td>1,264.70</td>
<td>1,030.68</td>
</tr>
</tbody>
</table>

Results of Practical Tests

The type A.A.R. equipment as described above was submitted for approval to the General Post Office of Great Britain, which carried out the following trial tests:

(a) The complete outfit was installed in a small building along one of the quays at Ramsgate, situated at the northern entrance of the Dover Straits. At this particular spot, the interference from numerous ships and coastal transmitting stations is exceedingly heavy.

(b) The receiver was locally excited by an oscillator operating on a wavelength between 385 and 615 metres, and "distress signals" were keyed by a Weston transmitter. Eleven different combinations of signals, taking into consideration the different tolerances on the duration of the dashes and the intervals, were sent out. Each combination was repeated ten consecutive times. Under these conditions, there were no failures in the operation of the auto-alarm.

(c) According to the Board of Trade's Statutory Rules and Orders, 1932, No. 897, the equipment when installed in an area of intense interference for a continuous period of six weeks, must not give more than two false calls in any week, while on the other hand, it must respond to 90 per cent. of test calls.

For these tests, the receiver was connected to an antenna and the "distress signal" received consisted of twelve dashes of 4 seconds separated by intervals of one second, the transmission of the signals being made at random intervals.

During these tests, lasting for two months, there were only eight failures to respond to the test calls out of a total of 70 such failures. Although the "distress signal" was transmitted only during certain periods, the equipment was permanently in service and was subjected to the action of atmospherics and signals other than distress signals. Not more than the prescribed two false calls in any one week were recorded during the testing period.

During the test, the equipment was placed in an oven as required by the Board of Trade Rules, and raised to a temperature of 113° F. for two hours on every third day for four weeks. The efficiency of the equipment was maintained during the operation of this test.

In addition to the foregoing, the equipment was also submitted to the most severe test, which may be called the "bumping test." The apparatus was mounted on a platform which was capable of being raised or lowered, and of being dropped vertically through a distance of three to five feet every seven seconds. This rough treatment, continued for one hour a day for four weeks, did not affect the efficiency of the apparatus, or its ability to function satisfactorily during the actual periods of "bumping."

As a result of the above mentioned trial tests, the equipment was approved by the General Post Office of Great Britain for installation on board of all compulsory ships.

AIRWAY NEWS

RUMOR has it that Tom Wollon is looking for another place to live. -The operator in charge at Nashville Airway Radio and Range Bureau is making his home. -It is reported that Nashville's last Campbell building is to be used for Sky Harbor. -The new flying instructor at Nashville Airway Radio and Range Bureau is keeping his ear to the ground and is extremely inconvenient to operate the Department of Commerce Weather Bureau at Sky Harbor and have the radio personnel all located some eighteen miles away at Danielson. -The Bureau has started several times to build better radio facilities at Sky Harbor but this extremely inconvenient to operate the Department of Commerce Weather Bureau at Sky Harbor. 

* * *

Charley Goldtrap, America Air Lines acting Flight Superintendent, is a firm believer in radio facilities and he knows how to use them, too. He is blind landing and beam flying instructor for transport pilots and can land and take off with a covered cockpit. Charley has one of the finest note books giving comprehensive sketches of each airport and the radio facilities available there that his correspondent has ever come across.

* * *

The Second Air Navigation Division District Headquarters, Atlanta, Ga., has had a new assistant manager appointed to take the place of Mr. VanderWater, now in the First District. The new assistant for Mr. Iri D. C. Copeland, and he is said to be a nephew of Senator Copeland.

Only two stations in the entire country use the same letters of the alphabet as does KROW of Oakland and San Francisco. They are WORK at York, Penna., and WIBK at Rockford, Ill.
Experimental Visual Broadcast

Stations in the United States

<table>
<thead>
<tr>
<th>Call Letters</th>
<th>Power (watts)</th>
<th>Company</th>
<th>Frequency (kilocycles)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W9XDR</td>
<td>500</td>
<td>Radio Pictures, Inc.</td>
<td>2500-2800</td>
<td>Long Island City, N. Y.</td>
</tr>
<tr>
<td>W8XAN</td>
<td>100</td>
<td>Sparks-Withington Co.</td>
<td>2200-2500</td>
<td>Jackson, Mich.</td>
</tr>
<tr>
<td>W9XK</td>
<td>50</td>
<td>University of Iowa</td>
<td>1900-2200</td>
<td>Iowa City, Ia.</td>
</tr>
<tr>
<td>W9XAK</td>
<td>125</td>
<td>Kansas State College of Agriculture and Applied Sciences</td>
<td>1800-2100</td>
<td>Manhattan, Kan.</td>
</tr>
<tr>
<td>W6XAH</td>
<td>1000</td>
<td>Pioneer Mercantile Company</td>
<td>1000-2000</td>
<td>Bakersfield, Calif.</td>
</tr>
<tr>
<td>W3XAK</td>
<td>5000</td>
<td>National Broadcasting Co.</td>
<td>2700-2900</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>W9XAP</td>
<td>2500</td>
<td>National Broadcasting Co.</td>
<td>1900-2200</td>
<td>Bellmore, N. Y.</td>
</tr>
<tr>
<td>W2XBB</td>
<td>5000</td>
<td>National Broadcasting Co.</td>
<td>1700-2000</td>
<td>Kansas City, Mo.</td>
</tr>
<tr>
<td>W9XAK</td>
<td>500</td>
<td>First National Television Corp.</td>
<td>1600-1900</td>
<td>West Lafayette, Ind.</td>
</tr>
<tr>
<td>W9XG</td>
<td>1500</td>
<td>Purdue University</td>
<td>1000-1200</td>
<td>New York, N. Y.</td>
</tr>
<tr>
<td>W2XAB</td>
<td>50</td>
<td>Atlantic Broadcasting Corp.</td>
<td>1200-5600</td>
<td>New York, N. Y.</td>
</tr>
<tr>
<td>W2XAO</td>
<td>100</td>
<td>Don Lee Broadcasting System</td>
<td>1500-1700</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>W9XAD</td>
<td>150</td>
<td>First National Television Corp.</td>
<td>1400-1600</td>
<td>Kansas City, Mo.</td>
</tr>
<tr>
<td>W9XG</td>
<td>500</td>
<td>General Television Corp.</td>
<td>1300-1500</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>W9XD</td>
<td>500</td>
<td>The Journal Company</td>
<td>1200-1400</td>
<td>Milwaukee, Wis.</td>
</tr>
<tr>
<td>W2XBT</td>
<td>750</td>
<td>National Broadcasting Co.</td>
<td>1100-1300</td>
<td>Portable</td>
</tr>
<tr>
<td>W2XF</td>
<td>500</td>
<td>National Broadcasting Co.</td>
<td>1000-1200</td>
<td>New York, N. Y.</td>
</tr>
<tr>
<td>W3XE</td>
<td>1200</td>
<td>Philadelphia Storage Battery Co.</td>
<td>900-1100</td>
<td>Portable</td>
</tr>
<tr>
<td>W3XAD</td>
<td>2000</td>
<td>RCA Manufacturing Co., Inc.</td>
<td>800-1000</td>
<td>Camden, N. J.</td>
</tr>
<tr>
<td>W10XX</td>
<td>50</td>
<td>RCA Manufacturing Co., Inc.</td>
<td>700-900</td>
<td>Portable mobile (vicinity of Cananda)</td>
</tr>
<tr>
<td>W2XDR</td>
<td>1000</td>
<td>Radio Pictures</td>
<td>600-800</td>
<td>Long Island City, N. Y.</td>
</tr>
<tr>
<td>W8XAN</td>
<td>100</td>
<td>Sparks-Withington Company</td>
<td>500-700</td>
<td>Jackson, Mich.</td>
</tr>
<tr>
<td>W9XK</td>
<td>100</td>
<td>University of Iowa</td>
<td>400-600</td>
<td>Iowa City, Ia.</td>
</tr>
<tr>
<td>W9XAT</td>
<td>50</td>
<td>Dr. George W. Young</td>
<td>300-500</td>
<td>Portable</td>
</tr>
</tbody>
</table>

---

Relay Broadcast Stations

in the United States

<table>
<thead>
<tr>
<th>Frequency (kHz)</th>
<th>Power (watts)</th>
<th>Call Letters</th>
<th>Company</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>650-700</td>
<td>4.5</td>
<td>W4XBR</td>
<td>Isle of Dreams Broadcasting Corp.</td>
<td>Miami Beach, Fla.</td>
</tr>
<tr>
<td>1000-1050</td>
<td>6</td>
<td>W3XAV</td>
<td>WCAU Broadcasting Co.</td>
<td>Newton Square, Penna.</td>
</tr>
<tr>
<td>1000-1050</td>
<td>10</td>
<td>W8XKX</td>
<td>The Crossing Radio Corp.</td>
<td>Mason, Ohio.</td>
</tr>
<tr>
<td>1000-1050</td>
<td>10</td>
<td>W9XAA</td>
<td>Chicago Federation of Labor</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>1050-1100</td>
<td>10</td>
<td>W8XKX</td>
<td>National Broadcasting Co. Inc.</td>
<td>Bound Brook, N. J.</td>
</tr>
<tr>
<td>1200-1250</td>
<td>50</td>
<td>W1XAV</td>
<td>World Wide Broadcasting Corp.</td>
<td>So. Schenectady, N. Y.</td>
</tr>
<tr>
<td>1350-1400</td>
<td>50</td>
<td>W3XAV</td>
<td>WCAU Broadcasting Co.</td>
<td>Newtown Square, Penna.</td>
</tr>
<tr>
<td>1450-1500</td>
<td>50</td>
<td>W8XKX</td>
<td>Atlantic Broadcasting Corp.</td>
<td>Wayne, N. J.</td>
</tr>
<tr>
<td>1500-1550</td>
<td>10</td>
<td>W9XAX</td>
<td>Chicago Federation of Labor</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>1600-1650</td>
<td>20</td>
<td>W1XAV</td>
<td>World Wide Broadcasting Corp.</td>
<td>Nr. Saxonburg, Penna.</td>
</tr>
<tr>
<td>1650-1700</td>
<td>25</td>
<td>W8XKX</td>
<td>Atlantic Broadcasting Corp.</td>
<td>Wayne, N. J.</td>
</tr>
<tr>
<td>1800-1850</td>
<td>30</td>
<td>W1XAV</td>
<td>World Wide Broadcasting Corp.</td>
<td>Bound Brook, N. J.</td>
</tr>
<tr>
<td>2100-2150</td>
<td>40</td>
<td>W1XAV</td>
<td>National Broadcasting Co. Inc.</td>
<td>So. Schenectady, N. Y.</td>
</tr>
</tbody>
</table>

---

Both a substantial increase in wages and a reduction in working hours.

"The intelligence cooperation on both sides will go far to avert unnecessary industrial strife."

The decision also calls for a continuous vacation of three weeks with pay for each radio officer for each three-year period. In the past, radio operators received no vacations.

---

COMMERCIAL RADIO
Radio officers assigned Mackay Radio, New York:

Yorba Linda—T. J. Burns
Shawnee—P. B. Kimball (Jr.)
San Jacinto—E. H. Cole (Chief)
Black Osprey—R. C. Horcroft
Manhattan—F. W. Kent (4th)
Waldorf—W. E. Smith (5th)
Thos. P. Beal—J. J. Bamberg
Sage Brush—A. Adamson
Cherokee—T. J. Cain (Jr.)
W. R. Keever—C. R. Hamilton
Scarpes—H. Weinstein (Chief)
Edouard Jeramee—H. Mcgoldrick (Ch.)
Edouard Jeramee—M. Gardiner (2nd)
Edouard Jeramee—R. C. Williams (3rd)
City of Fairbury—W. B. Kimball (Jr.)
Shawnee—A. Sopko (Jr.)

Short Wave Programs for Waldorf Guests

(Continued from Page 12)

A 20 per cent spread on each side of the frequency range brought in, allowing antennas are indicated by the vertical responses of the various frequencies above 6000 kilocycles, etc. The power of the signal is increased a hundred thousand million fold providing the greatest effects on vertical receiving antennas. In traveling great distances, however, these waves undergo a series of reflections between the earth and the ionized regions of the atmosphere. By this multiple reflection their vertical polarization is changed to an elliptical polarization, with the result that they may produce interference effects on a horizontal antenna than on a vertical one. For this reason the horizontal structure used on the Waldorf is very sensitive to waves coming from remote points, where because of the great distances involved the greatest sensitivity in reception is required. This form of antenna will also minimize interference by nearby stations, the waves of which are vertically polarized. It happens, moreover, that the waves from most man-made sources of interference affect a horizontal doublet much less than a vertical antenna. Most of this form of interference is at the higher frequencies and thus does not prove objectionable over the range from 2000 to 6000 kilocycles where the vertical section of the antenna becomes effective. Stations operating at these lower frequencies are for the most part local, representing mainly police, aviation, and amateur radio telephone channels. These waves retain sufficient of the vertically polarized component to be readily picked up by the vertical antenna.

This multiple antenna system is thus highly suited to picking up high-frequency signals coming from great distances and lower frequency signals from nearby stations, both with a large signal-to-noise ratio compared to vertical receiving antennas. The effectiveness of the antenna is further enhanced, however, by taking advantage of the directional characteristics of a horizontal doublet. Greatest sensitivity is obtained for waves arriving in a direction at right angles to the doublet. In Figure 4 is a map of the world in gnomonic projection centered at New York. The distinguishing feature of such a scheme of projection is that a line joining any two points and any part of the world lies in the true direction over which radio waves would travel. The horizontal antenna system of the Waldorf—considerably enlarged in scale—is superimposed on this map at New York, and it is at once evident that waves from most of the international broadcast stations would reach the antenna from a favorable direction. The end-on directions of the antenna are toward the South Atlantic and North Pacific oceans where there are practically no stations, but even end-on, the antennas have some response because the short-wave signals arrive at a slight angle above the horizontal.

With these facilities the Waldorf is now in a position to offer its patrons short-wave radio broadcast programs of a high order of merit. Short-wave stations in London and Daventry, England, in Paris, France, in Madrid, Spain, in Koenigsruetherhausen, Berlin, Germany, at Rome and in the Vatican, can be as readily heard as local broadcast stations under favorable conditions. Even the short-wave stations in remote locations such as Moscow, Tokyo, Rabat in Morocco, Melbourne in Australia, and the various South American stations will at times be available for instruction and amusement.
The following is an extract from the *Nautical Magazine*, describing the excellent results obtained by the Anglo-Saxon Petroleum Company with this type of equipment, which has been installed as part of the radio equipment on their most recently commissioned tankers.

"The four 12,000 ton tankers built in Great Britain for the Anglo-Saxon Petroleum Co., have all passed into commission after very successful trials. All these vessels had a speed of 13 knots in loaded trim. They are fitted with all the latest appliances including the new short and medium wave wireless equipment supplied by the International Marine Radio Co. of London. The first ship Angulus while on trials off the Tyne called up an American station which reported the reception was excellent. The second vessel Arcurus, while on trials in Belfast Lough, called up and spoke to her sister ship the Angulus which was then over 3,000 miles away and nearing the West Indies. Again the sending and reception from both ships were excellent. Arcurus communicated with the short wave station at Portishead every other day during her voyage to Curacao and was then ordered through the Panama Canal to San Pedro. It then became a real test, for while in the Pacific and right up to the day before arrival at San Pedro, she was in direct communication with Portishead, a distance of 5,400 miles. The direct line to ship’s position was across the Atlantic and right across the United States. The last two ships, Anadara and Amastra, while on trials at the entrance to the Firth of Clyde, were both in communication with Portishead, which was then 2,000 miles out in her voyage to the West Indies. These results will astonish the average shipowner and seafaring man because we have imagined up to the present that the range of an ordinary wireless as fitted in our ships was 500 to 700 miles at the utmost. But what has been a dream has now come true, and this new direct service with Portishead as the receiving station for Great Britain is in full operation. What has been the privilege of the big liners up to the present is now open to the Mercantile Marine as a whole. This new development has only been made possible by the introduction of the International Marine Radio Co. of their new crystal control short wave. It was introduced for the first time on a cargo boat or tanker on the Angulus, this crystal control having hitherto been exclusively confined to large passenger vessels. Instead of waiting days for a reply to a message sent, while it was being relayed by other vessels, the direct communication now offered enables a reply to be received the same night of the next day. Then again these ships are acting as wireless transmitting stations sending messages from other vessels which have only medium wave equipment. This is indeed a great stride ahead and shipowners will be quick to see its advantages."

**NIKOLA TESLA NOW 79**

On July 10, 1935, Nikola Tesla, well known member of the scientific world who celebrated his seventy-ninth birthday, Tesla, as is usual on his birthday celebrations called attention to several of his "pet" developments.Listing them himself, he believed would come to be his greatest development, the one by which mechanical energy can be transmitted to any part of the terrestrial globe. Those who have followed Tesla’s thoughts for many years will be familiar with the many plans he has worked on for this.

Second, he placed a new method and apparatus for producing direct current without a commutator. He said he has found a solution to this problem, but details were not made public.

**New Orleans Airway Radio Station on Ancient Graveyard**

During the last two months the FERA and Tulane University have been undertaking excavations in the marsh land along the banks of Lake Ponchartrain and have discovered some extremely interesting material in the old shell banks near Hayne Blvd. and the road from Shushan Airport along the lake front.

Several skeletons were removed from the shell right under the loops of the New Orleans Radio Station and Indian pottery, beads, arrowheads, and other relics and remains are constantly being unearthed. The skeletons are believed to be those of Indians while the Smithsonian and Tulane experts have not made a complete study as yet, it is thought that the graves are very old, probably pre-Columbian.

At the present time many of the bones and skulls are lying on the ground as they were first uncovered preparatory to being photographed and it is not gruesome and ghastly sight to see these old boys grinning at one with their empty eye sockets staring so intently. These skulls show wonderful teeth almost without exception.

Gov’t Price for Communication

On June 27, 1935, the Federal Communication Commission, in Order No. 15, sheet 13,518, issued a lengthy order covering "Rates of Pay for Government Communication by Telegraph." Those interested may secure copies by writing the Secretary of the Commission.
MULTIVIBRATORS

(Continued from Page 9)

divide into 1; this gives the time constant in seconds.

(2) Divide the time constant by the SUM of the condensers in micro-farads; the result gives the value of each grid leak resistor in ohms.

ILLUSTRATION: Given a frequency of 50 KC/sec, and two 500 mfd, condensers. Find the value of the grid leak resistors to obtain the given frequency.

SOLUTION:

\[
\begin{align*}
&\text{time constant} = \frac{1}{2 \times 10^6} = 0.0002 \text{ or } 2 \times 10^{-6} \text{ seconds} \\
&50,000 \times \frac{2 \times 10^{-6}}{2} = 20,000 \text{ ohms per grid leak resistor}
\end{align*}
\]

Producing Sinusoidal Oscillations in a Symmetrical Circuit

In an engineering paper by Y. Watannabe (Japan), it was shown that sinusoidal oscillations could be produced in a symmetrical multivibrator if capacitances Cx and Cy were shunted across the plate resistors in the respective circuits. Mr. Watannabe says, "If the shunted capacitances Cx and Cy has some given value, sinusoidal oscillations could be produced under the following conditions:

\[
G_m = \frac{1}{R_1}, \quad C_x, \quad C_y
\]

Where \( G_m \) and \( R_1 \) are respectively the mutual conductance and the plate resistance. The angular velocity of the vector representing the sinusoidal oscillation is

\[
w^2 = \frac{1}{R_1 C_x}, \quad \frac{1}{R_1 C_y}, \quad \frac{1}{R_1 R_2}
\]

When the system is arranged to function as a producer of sinusoidal oscillations, the operating condition of each tube must be adjusted to give the maximum value of mutual conductance; that is, the point of equilibrium with respect to the direct current must be nearly in the middle of the characteristic curve. It is an interesting fact that one can produce either sinusoidal or relaxation oscillations by means of a two tube symmetrical multivibrator by simply varying one of the anode capacities over a certain setting."

(Radio Operators Win a Rise in Pay)

(Continued from Page 18)

Table 'advance over the "abominable" situation preceding the strike, he said.

The detailed monthly pay schedule follows:

**Class A Ships**

- Chief Radio Operator: $155
- First Assistant: $140
- Second Assistant: $125
- Third Assistant: $120

**Class B Ships**

- Chief Radio Operator: $155
- First Assistant: $130
- Second Assistant: $120

**Class C Ships**

- Chief Radio Operator: $120
- First Assistant: $110
- Second Assistant: $100

**Class D Ships**

- Operator: $110

(N. Y. Times, July 6, 1935)

**Can Serve Only One**

Ten prominent officials of communications companies who sought permission of the Federal Communications Commission to serve as officers or directors of more than one carrier subject to the Communications Act, were denied that right, on June 10th, by the Federal Communications Commission.


Commissions: Walker, Payne, Case, Sykes and Pratt voted in the negative, Commissioners Stewart and Brown voted in favor of granting said petitions.

The order was made effective August 9, 1935.

Federal Communications

Commission Memorandum

The Commission on July 2, 1935, directed that the present Rule 258 be renumbered as Rule 258(a). In addition, the Commission adopted Rule 258(b) as follows:

258(b) Airport marker beacon transmitting equipment will not be separately licensed, but shall be described in the application for construction permit and license for the airport station with which it is associated. When such an application is approved the marker beacon transmitting equipment will be considered as an integral part of the airport station and its authority for operation will be included in the instrument of authorization for the airport station. Airport marker beacons may be operated during periods when no interference will be caused to airport radiotelephone communication. The frequency to be used by marker beacons shall be 1000 cycles plus or minus the frequency assigned the airport station, and the transmitting equipment shall be installed so that the direction of radiation will be substantially vertical.

Herbert L. Pettett, Sec.

**New Apparatus**

One radio development of the year is the announcement of P. R. Mallory & Co., Inc., that the well-known line of Mallory Replacement Vibrators is now complete—and completely competitive. At the moment more than 50 per cent of the two million vibrator units now in use on all makes of automobile radio receivers are Mallory Vibrators. In the future this will be greatly increased. In the past the service man was limited by reason of limitations of the line. His practice, based on performance, was to replace with a genuine Mallory Vibrator wherever he could. Now, new types and new low prices enable him to meet vibrator replacement requirements with Mallory Replacement-Vibrators.

In 1934 Mallory Replacement Vibrators were available for the following sets: Admiral, Airline, Arecida, Audio-1, Belmont, Blackhawk, Bosch, Cadillac, Captain, Colonial, Commander, Console, G-E, Governor, Guibrannen, Lafayette, Lt. Governor, Majestie, Motoralia, Pilot, President, R. C. A.-Victor, Recorder, Sowar, Star, Stromberg-Carbon, Tropic-Aire, Truestone, Truevalue, Wells-Gardner.

Additional auto radio sets for which
Mallory Replacement Vibrators are now available include Buick-Olds Pontiac 980383, 980393, 980455, 980459; Buick Pontiac 544245, 544246; Chevrolet 364-441, 600153, 600565, 600689, 601-603, 601716, 601171, 6011717; Clarion 100, TCE 20; Consolidated 51; Crosley 98, 99, 101, 119, 5 A2; Detrola 60, 1100, 1100A; Deconsolidated 51; Crosley 98, 99, 102, 103, 108, 601176, 601177; Clarion 100, TC50; 441, 600153, 600566, 600249, 600565, 601-Pontiac 544245, 544246; Chevrolet 980383, 980393, 980455, 980459; Buick available

Mallory’s announcement of a Replacement Vibrator line is an important announcement—and the news of new low prices, standard distribution and dealer discounts is good news. Another bit of information equally interesting concerns the preparation of the new Mallory Auto Radio Service and Replacement Manual. This new manual, to contain accurate schematic charts of more than 200 popular automobile radio receivers, will be one of the finest works of its kind ever published. It will be available, without charge, to all authorized service men.

WHERE YOU WILL FIND IT

In an article under the title of “Noise and Its Measurement,” by A. J. Mochow, in the G. E. Review, the author says the following measurements were made using sound level meters made up of Microphone, Amplifier, and output meter.

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Power Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 18.1 megacycles, with carrier power output of 400 watts at the lower frequencies, and 300 watts at the higher.</td>
<td></td>
</tr>
<tr>
<td>In an article under the title of “Airport Radio,” covering their products of receivers, transmitters, and direction finders for aircraft. For free copy address Mr. Johnson, business manager.</td>
<td></td>
</tr>
</tbody>
</table>

2000,000th PATENT ISSUED

Joseph Ledwinka, Chief Engineer of the Edward G. Budd Mfg. Co., of Philadelphia, recently had the honor of receiving U. S. Govt. Patent No. 2,000,000. The first million patents were issued between the years 1790 to 1911, and the second million since that time.

The first patent was issued with the signatures of President George Washington, Secretary of State Thomas Jefferson, and Attorney General Edmund Randolph in 1790.

Send $2.00 at once to

CQ Magazine Co., 7 West 44th st., New York City

Mention Commercial Radio when answering Advertisements
Police Radio Combating Crime

(Continued from Page 6)

due to the actions of the shorter wave following the straight line radiation principle of light, and metal absorption quality. The other factor that must be considered here is that in two-way communication from patrol cars on ultra high frequency the headquarters receiving antenna must be well elevated to receive as the patrol car cannot have a high transmitting antenna.

**Distance Covered**

Where the suburban territory to be reached are of great distance ultra high frequency becomes a matter of height for the transmitting antenna, as the distance is largely a matter of antenna height. If the surrounding territory is fairly flat and a suitably high transmitting antenna point can be established by either the flag pole of a large building, or a very high transmitting antenna tower the ultra high frequency transmission will reach a large area. Other than these conditions medium high frequency affords the better system.

Electrical and other disturbances must be considered in business and industrial locations when considering the range of transmitters. Where a signal strength of 1.0 millivolt is considered necessary in the receiving antenna in business sections, a .2 millivolt antenna signal will often serve in rural territory, and a .05 millivolt antenna signal will serve very well in rural territory. The reason for this is that the antenna at former locations is bound to pick up some slight impulse as signal and when amplified in the receiver the unwanted signal will be proportionately amplified with the desired one, and it has been found that at least 1.0 millivolt signal is necessary to prevent this condition in business territory.

Mention Commercial Radio when answering Advertisements
Group Your Subscription Save $ $ $ $ $ 

BY SENDING ALL YOUR MAGAZINE SUBSCRIPTIONS IN AT ONE TIME TO US YOU SAVE BOTH TIME AND MONEY!

<table>
<thead>
<tr>
<th>Club Price</th>
<th>Alone</th>
<th>Club Price</th>
<th>Alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.25</td>
<td>$2.50</td>
<td>Commercial Radio</td>
<td>$2.00</td>
</tr>
<tr>
<td>2.00</td>
<td>2.50</td>
<td>Communication &amp; Broadcast Engineering</td>
<td>3.00</td>
</tr>
<tr>
<td>1.75</td>
<td>2.00</td>
<td>Electronics</td>
<td>3.00</td>
</tr>
<tr>
<td>9.25</td>
<td>10.00</td>
<td>Broadcasting</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>2.50</td>
<td>Radio</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q S T</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R S T</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radio Amateur Call Book</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radio Music Merchant</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radio &amp; Electric Sales</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radio World</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radio Retailing</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Electrical Engineering 12.00
General Electric Review 3.00
Electric Journal 2.00
Bell System Tech. Journal 1.50

SUBSCRIPTIONS ARE IMMEDIATELY CLEARED BY US TO THE PUBLISHERS OF YOUR FAVORITE MAGAZINES

If there are any magazines on which you wish a special quotation not listed above, or any group of magazines—write us. We have a limited number of catalogues of magazine subscription prices and will send for the asking while they last.

DO NOT SEND CASH. SEND CHECK OR MONEY ORDER

SUBSCRIPTION DEPARTMENT
CQ MAGAZINE COMPANY, 7 WEST 44TH ST., NEW YORK CITY

Mention Commercial Radio when answering Advertisements