Communication and Broadcast Engineering

VOL NO. 5

MAY, 1935

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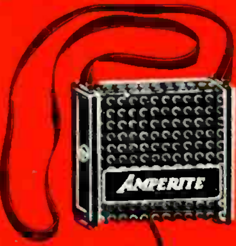

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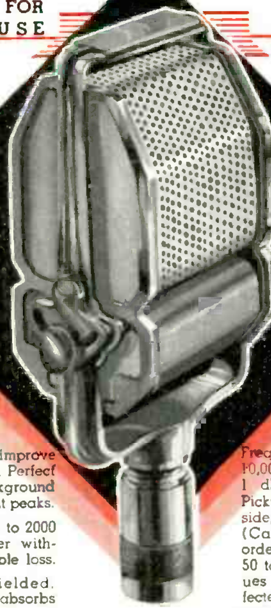

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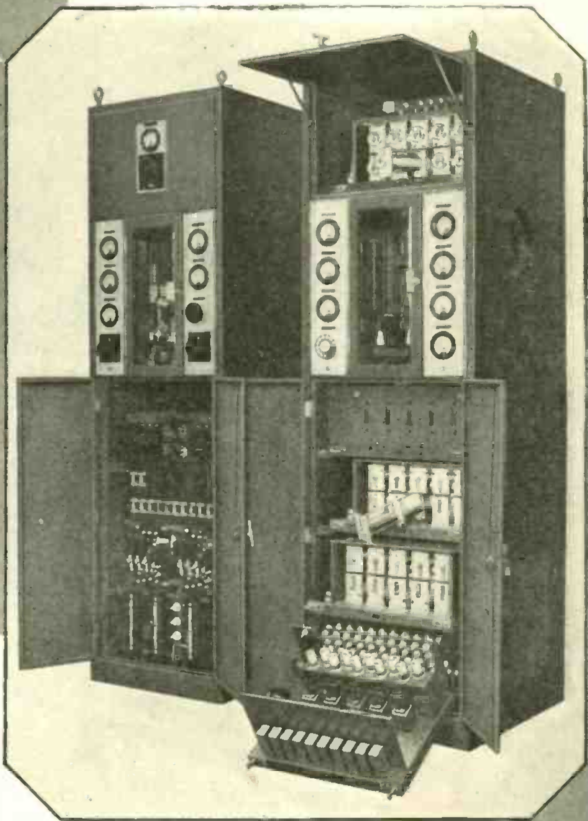

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EDITORIAL

TELEVISION—II

THE STATEMENT ON TELEVISION, by David Sarnoff, President, Radio Corporation of America, made at the annual meeting of RCA stockholders, should be of particular significance to everyone in the broadcast and communication fields. The statement is significant because the action to be taken by the Radio Corporation will serve as a definite security against premature establishment of television services, and against exploitation.

Portions of Mr. Sarnoff's statement will bear quoting. The italics are ours:

"Our laboratory efforts have been guided by the principle that the commercial application of such a service could be achieved only through a system of high-definition television which would make the images of objects transmitted, clearly recognizable to observers. The results obtained by RCA in laboratory experiments go beyond the standards accepted for the inauguration of experimental television service in Europe. We believe we are further advanced scientifically in this field than any other country in the world.

"In the sense that the laboratory has supplied us with the basic means of lifting the curtain of space from scenes and activities at a distance, it may be said that television is here. But as a system of sight transmission and reception, comparable in coverage and service to the present nation-wide system of sound broadcasting, *television is not here, nor around the corner*. The all-important step that must now be taken is to bring the research results of the scientists and engineers out of the laboratory and into the field.

"Because of the technical and commercial problems which the art faces, this system must be built in *progressive and evolutionary stages*.

"Considering these factors and the progress already made . . . the management has formulated and adopted the following three-point plan:

"1. Establish the first modern television transmitting station in the United States, incorporating the highest standards of the art. This station will be located in a suitable center of population. . .

"2. Manufacture a limited number of television receiving sets. These will be placed at strategic points of observation in order that the RCA television system may be tested, modified and improved under actual service conditions.

"3. Develop an experimental program service with the necessary studio technique to determine the most acceptable form of television programs.

"Through this three-point plan of field demonstration we shall seek to determine from the practical experience thus obtained, the technical and program requirements of a regular television service for the home.

"It will take from *twelve to fifteen months* to build and erect the experimental television transmitter, to manufacture the observation receivers and to commence the transmission of test programs.

"Our research and technical progress may be judged by the fact that upon a laboratory basis *we have produced a 343-line picture*. . . These advances enable the reception, over limited distances, of relatively clear images whose size has been increased without loss of definition.

"Important as it is from the standpoint of public policy to develop a system of television . . . *premature standardization would freeze the art*. It would prevent the free play of technical development and retard the day when television could become a member in full standing of the radio family. Clearly, the first stage of television is field demonstration by which the basis may be set for technical standards."

One of the problems to be faced is "the fact that if the new art of television is to make the required technical progress, there will be *rapid obsolescence of both television transmitters and television receivers*."

And thus is the future of television at least temporarily safeguarded. Mr. Sarnoff has definitely set a mark on the technicalities and the standards of service which must be met. Anything short of this mark will be doomed to failure.

COMMUNICATION & BROADCAST ENGINEERING

FOR MAY, 1935

Portable Carrier-Current System

By F. B. BRAMHALL, E. S. GRIMES and A. J. BOUDREAU
RESEARCH LABORATORIES, WESTERN UNION TELEGRAPH CO.

● **THE PORTABLE CARRIER 2-A, DEVELOPED BY WESTERN UNION ENGINEERS, FOR USE AS A SUPPLEMENTARY CHANNEL TO HANDLE TEMPORARY PEAK TRAFFIC ON EXISTING TELEGRAPH LINES.**

A PORTABLE CARRIER-CURRENT system which may be installed within ten minutes has been developed by Western Union engineers to meet emergencies requiring an increased message-carrying capacity on existing telegraph lines.

The set is proving its great usefulness and will be employed when floods or storms curtail the number of lines into an area or when vacation resort activities, sport events, trials or other news occur at points where there are few lines. At such times a temporary increase in message-carrying capacity is urgently needed. By sending the portable set to the place where it is needed, however, the capacity of any two wires reaching that point may be increased easily and thus relieve the situation. The Portable Carrier 2-A is designed to provide an extra two-way circuit for telegraph operation over two-line wires for distances up to 300 miles. The channels derived by the portable carrier are of high quality and do not degrade the regular telegraph circuits.

THEORY OF OPERATION

On a normal telegraph circuit two-way communication is accomplished by a duplex arrangement. By comparing the duplex circuit and the two-way carrier circuit of Fig. 1, it may be shown how these two schemes differ. Battery at Terminal A, of the duplex telegraph circuit operates Relay No. 2. With a proper adjustment of the artificial line, Relay No. 1 can not be operated by the battery at this terminal. Terminal B functions in a similar manner, the battery at Terminal B operates Relay No. 1, but has no effect on Relay No. 2 when the artificial line is properly adjusted. Transmission in both directions simultaneously over the same wire is possible with this circuit.

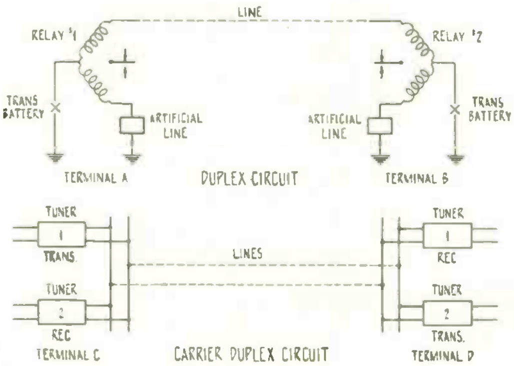


FIG. 1. STANDARD DC DUPLEX CIRCUIT COMPARED WITH CARRIER DUPLEX CIRCUIT.

Two-way communication over the carrier circuit, also shown in Fig. 1, is readily accomplished by providing two different carrier frequencies, one for each direction of transmission. The frequencies used on the portable carrier are 1050 cycles and 1650 cycles. The channels derived by the use of these frequencies are indicated in Fig. 1 as No. 1 and No. 2. Tuners are employed at Terminals C and D to separate these frequencies. Channel No. 1 sends at C and receives at D, while Channel No. 2 sends at D and receives at C. Trans-

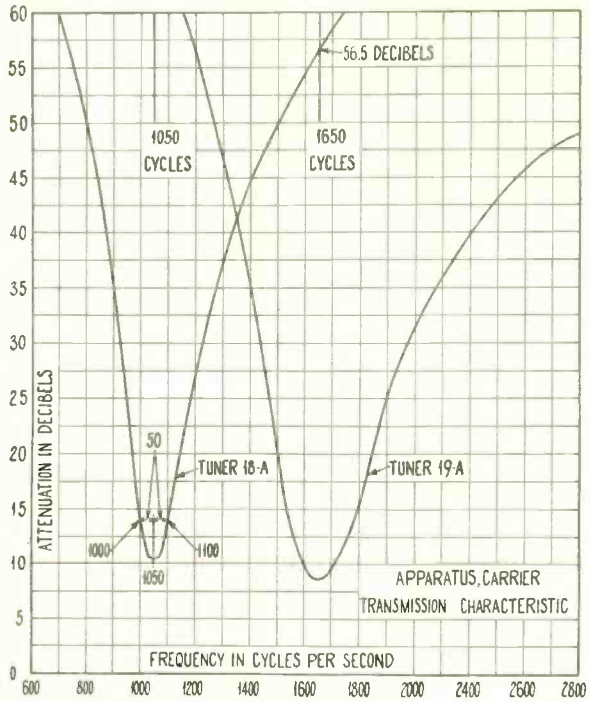


FIG. 2. TRANSMISSION CHARACTERISTICS OF THE 18-A AND 19-A TUNERS.

mission on each channel is in one direction only.

ANALYSIS OF TUNERS

An analysis of the tuner or filter characteristics given in Fig. 2 illustrates how Channels No. 1 and No. 2 are separated at the Terminals. Tuner 18-A, adjusted for 1050 cycles, passes this frequency at a small loss in power. At 800 cycles and at 1650 cycles the power loss in db is high, with the result that the 1650-cycle carrier frequency is attenuated sufficiently to prevent actuation. Tuner 19-A, adjusted for 1650 cycles, has a small loss in power at this frequency, but at 1050 cycles and 2800 cycles the power loss in db is high. On the curve of Tuner 18-A, the loss of 56.5 db at 1650 cycles indicates that one four-hundred thousandth of the power available at the input at this frequency reaches the output. Under normal operating conditions, therefore, this tuner will reject almost entirely, the 1650-cycle currents transmitted by Tuner 19-A. A loss of over 60 db on Tuner 19-A at 1050 cycles indicates that less than one-millionth of the 1050-cycle power available at the input reaches the output. Under normal operating conditions this tuner will reject almost entirely the 1050-cycle current transmitted by Tuner 18-A. Both terminals of a circuit established by using a portable carrier have tuners with these characteristics. The switching is arranged to provide for sending or receiving on either tuner.

A modulated carrier current contains two sideband frequencies in addition to the carrier. Modulating 1050 cycles with a 50-cycle telegraph circuit produces a lower sideband frequency of 1000 cycles and an upper sideband frequency of 1100 cycles. An indication of the ability of Tuner 18-A to handle 50-cycle transmission can be seen from the curve. At 1000 and 1100 cycles the power loss is 3 db more than it is at 1050 cycles. This characteristic shows that at 50 cycles of telegraph speed only a small amount of distortion will be caused by Tuner 18-A. Experiments prove this fact to be true. An analysis of Tuner 19-A indicates that this channel is capable of handling a slightly higher telegraph speed.

ANALYSIS OF COMPOSITE UNIT

The portable carrier is not connected directly to the line wires. A network known as Composite 13-A is first inserted between the lines and the telegraph sets working on the lines. Portable Carrier 2-A is then connected to this network.

The composite is primarily a device for separating the physical or dc telegraph circuits normally on the line from the voice-frequency carrier current. A composite, as shown in Fig. 3, establishes a direct-current circuit from the telegraph set at Terminal 3 through the coils at A and B to the line wire at Terminal No. 1. A direct-current circuit is also made between the telegraph set at No. 4 to the line wire at No. 2. Through condensers between Lines No. 1 and No. 2 and the carrier terminals No. 5 and No. 6 the voice-frequency carrier circuit is established. Impedance arms A, B, C, and D are designed to prevent frequencies of 1050 cycles and 1650 cycles from passing between the telegraph sets and the lines. Under normal operating conditions, the composite

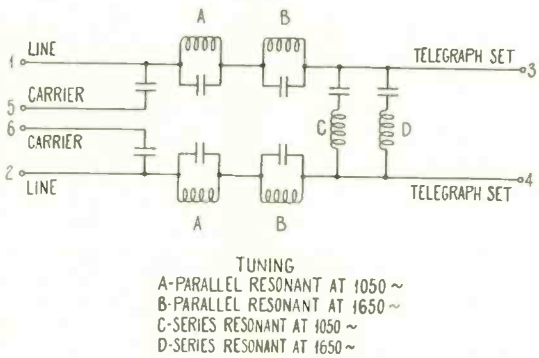


FIG. 3. (ABOVE.) ILLUSTRATIVE CIRCUIT OF COMPOSITE 13-A.

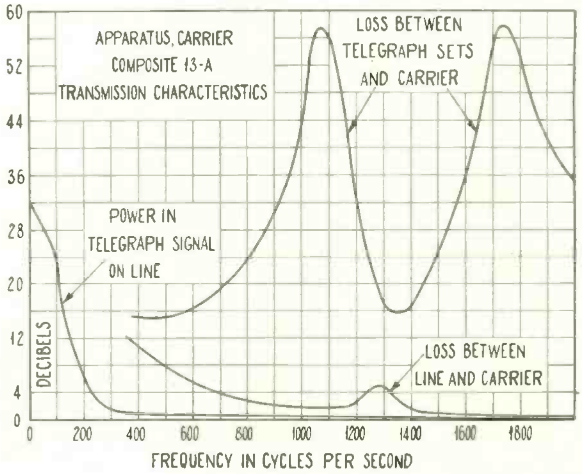


FIG. 4. TRANSMISSION CHARACTERISTICS OF COMPOSITE 13-A.

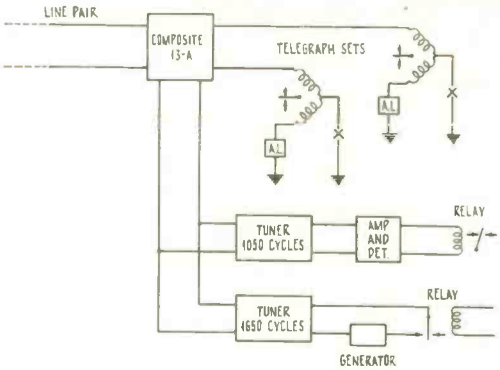


FIG. 5. BLOCK CIRCUIT OF CARRIER SYSTEM CONNECTIONS TO LINES THROUGH THE COMPOSITE.

prevents disturbances of these frequencies which originate in the set, from reaching the lines. Impedance arms A and B also prevent a loss of carrier power into the telegraph sets through this path. The condensers connected between the lines and the carrier terminals No. 5 and No. 6 will not pass direct currents and offer a high impedance to low frequencies. These condensers have small capacity and do not appreciably increase cross-fire between lines.

The transmission characteristics of the composite are shown in Fig. 4. The curves show the characteristics of the various branches of the composite network. The curve of loss between the telegraph sets and the carrier terminal, indicates the extent to which impedances A, B, C, and D prevent 1050 cycles and 1650 cycles from passing between these points. The curve of loss between the lines and carrier terminal, indicates how freely 1050 cycles and 1650 cycles pass through the line coupling condensers. The dotted curve represents the power distribution of the telegraph signals in the lower end of the frequency spectrum. This curve is only approximate but illustrates the point that the interfering power at 1050 cycles and 1650 cycles is very small under normal operating conditions. The loss in the composite between the telegraph set and the line reduces the power at these frequencies to the vanishing point and so protects the carrier channel against interference from this source.

CARRIER OPERATION

The portable carrier terminal and the telegraph sets are shown connected to the composite in Fig. 5. Telegraph signals on the sending leg of the carrier modulate the 1650-cycle generator current by making and breaking the circuit at the tongue of the relay. The carrier terminal at the distant end receives this frequency. The receiving leg of the carrier is operated by 1050 cycles transmitted from the distant end. Signals transmitted over 1050 cycles are amplified and detected, thereby causing the relay in this leg to operate. The telegraph sets may handle morse or high-speed multiplex traffic. Tuners separate the sending and receiving legs of the carrier and the composite separates the physical telegraph circuits from the carrier channels.

It is desired that the lines do not have a power loss of more than 20 db. In other words, at least one one-hundredth of the power sent should arrive at the receiver. A 20-db loss corresponds to the loss in a pair of copper wires on a pole line over 300 miles long. By using paired line wires the cross-fire from other circuits on the same pole line is reduced.

The outstanding circuit accomplishment, then, of the portable carrier is high-quality, two-way communication over a pair of line wires, without degrading the telegraph circuits normally operating on the lines.

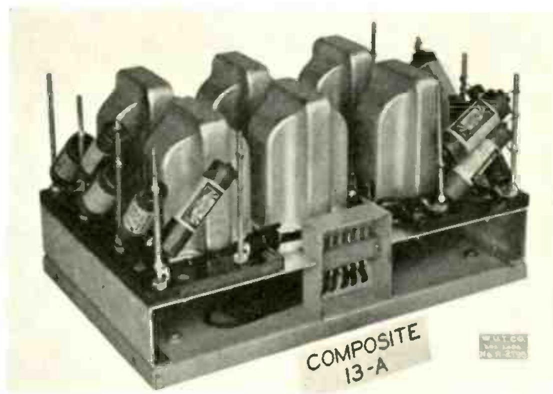


FIG. 7. COMPOSITE 13-A WITH PROTECTIVE COVER REMOVED.

DESIGN FEATURES

In contemplating the design of the Carrier Terminal 2-A and its attendant equipment, primary consideration was given to four factors, which are, in the order of their importance, size, efficiency, simplicity of operation, and cost.

It was felt that the unit should be as light and compact as was consistent with good telegraph efficiency and a reasonable cost. To be considered portable it was desired that it could be handled by one man without assistance.

If we define efficiency as the net increase of message-handling ability, it appears that we have here two points to be considered: The efficiency of the circuits already operating on the line wires must not be impaired. Then the design of the carrier equipment itself must be such as to provide a channel capable of handling the highest probable circuit

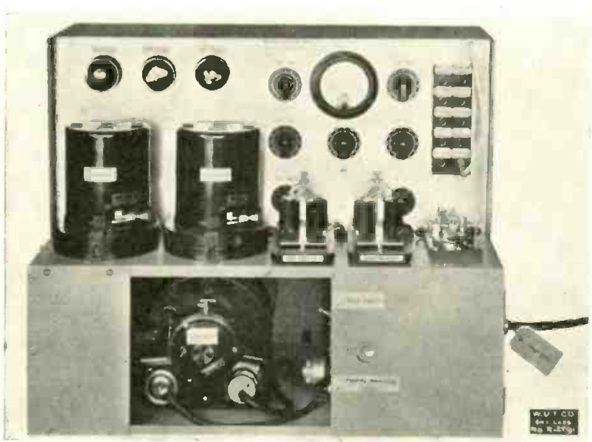


FIG. 6. FRONT VIEW OF THE CARRIER TERMINAL 2-A.

"TERRA-WAVE"

A Resume of the Development of Ultra-High-Frequency Communication Equipment

By PIERSON A. ANDERSON
and
W. L. LYNDON
RCA MANUFACTURING CO.

FIG. 1. TYPE ET-5000 TRANSCEIVER—A COMPLETE TELEPHONE AND TELEGRAPH TRANSMITTER AND RECEIVER WEIGHING LESS THAN EIGHT POUNDS.

DURING 1929, THE RCA Victor Company, predecessor to the RCA Manufacturing Company, Inc., engaged in intensive tests and experiments with very small compact low-powered transmitters and receivers in the ultra-high-frequency band. As a result of the remarkable results obtained with such highly portable equipment, several commercial installations were made, particularly for Government service. From these tests and equipment there was developed a very small compact ultra-high-frequency unit called the "Transceiver," which was capable of covering the frequency range from 45 to 60 megacycles and 27 to 36 megacycles. (See Fig. 1.) This unit employed a total of four battery-type tubes and had an output of approximately .2 watt.

In 1931 this unit was manufactured in large quantities and sold initially to the Government. The Sales Department undertook to develop this field from the sales angle to determine the possibilities of such equipment and engaged in a number of very interesting tests and experiments. Several of these units were installed in automobiles and airplanes and tests were conducted in communicating between fixed points and automobiles, between moving automobiles and airplanes and between airplanes. Remarkable results were obtained under certain conditions. For example, in tests conducted with the New Jersey State Forestry Service, communication was held with this extremely low power between an automobile and the airplane of the State Fire Warden up to distances as great as 52 miles, with the airplane at an elevation of about 3000 feet.

TWO-WAY OPERATION

What was probably the first two-way police communication was made during tests in Camden with the cooperation of Mr. J. Howell, Chief of the Electrical Bureau, during which two-way conversations were maintained between police headquarters and automobiles within the limits of the city of Camden. Early in 1932, at Pitcairn field near Hatboro, Pa., this equipment was installed in a Pitcairn autogiro. Demonstrations were made to the officials of the Philadelphia Police Department at that time under the direction of Mr. Kern Dodge, Director of Public Safety. During these tests, the plane located certain automobiles and by giving the proper directions to the police car equipped with the "Transceiver," it was possible to locate, follow and overtake the cars designated by the observer in the plane. This latter application was actually used at a little later date to prevent a real crime, with great success.

During this year, while the new Eighth Avenue subway was under construction in the city of New York, a gas-driven flat car was equipped with one of these units and perfect two-way communication was held between this car running through the subway with an automobile similarly equipped, running through the streets above the subway and at no time was communication lost, even when the automobile was several thousand feet away from the car in the subway.

USE ON TRAINS

During this period of experimentation, the cooperation of the New York, New Haven and Hartford Railroad and the Central Railroad of New Jersey were secured to determine the feasibility of ultra-high frequencies for front to rear end communication. During these tests a caboose and a locomotive were equipped with the Transceivers and, despite a power of less than .2 watt, very excellent communication was had at all times between the front and rear end of the train at times with 86 cars between the head end and the rear end on runs between New Haven, Connecticut, and Maybrook, New Jersey. During these tests, part of the run was under electrified sections of this railroad without any interference and on the Central Railroad of New Jersey between Jersey City and Wilkes-Barre, Pa. The equipment was also used at the Cedar Bridge Yards of the New York, New Haven and Hartford Railroad for the classification of

FIG. 2. ET-5004 ULTRA-HIGH - FREQUENCY TRANSMITTER, 30-36 MEGACYCLES, 15 WATTS. MASTER OSCILLATOR, POWER AMPLIFIER TYPE.

freight cars and through the use of this equipment it was possible to classify cars as rapidly as switching operations would permit and indicated clearly that relatively low powers of these frequencies would provide excellent means of communication for this type of service.

POLICE RADIO

The growing demand on the part of Police Departments for radio facilities led to considerable effort and study of this problem. Conventional police channels were allocated in that portion of the radio spectrum between 1572 and 2508 kilocycles, the channels allocated being limited in number. As transmission at these frequencies was capable of transmitting signals to great distances outside of the area to be served, it was realized that as the number of cities equipped increased rapidly, a serious problem of congestion and interference was inevitable.

Now it happens that for municipal police, particularly the smaller cities, coverage is only desired within the local area of such municipalities. It was apparent that ultra-high frequencies appeared to possess tremendous advantages for such applications.

In the meantime, the introduction of the Transceiver led to a popular demand and was used for such applications as portable broadcast pickup, local communication to airplanes, police work and general experimental purposes. The Federal Communications Commission recognized the desirability of aiding in the development of such equipment in the hope that it might ultimately prove commercial and authorized experimental licenses on 34.6 megacycles.

"TERRA-WAVE"

The results of these tests indicated that a transmitter of approximately 15 watts output would give very satisfactory results in all but the larger cities. The RCA Manufacturing Company therefore developed and designed a transmitter of this power for such service. (Fig. 2.) It was felt desirable to have a special designation for this type of equipment and the word "Terra-Wave" was coined by Mr. P. A. Anderson, as being descriptive of the characteristic feature of these frequencies in that, for all practical purposes, only the ground wave was used.

FIG. 3. ET-5017 ULTRA-HIGH-FREQUENCY TRANSMITTER, 25 WATTS, CRYSTAL CONTROL, 30-41 MEGACYCLES.

The transmitter was a push-pull, master oscillator, driving a push-pull power amplifier stage using the 210 type of tube and was plate-modulated by a Class B modulator. The transmitter was designed to couple to a ½-wave vertical radiator through a voltage-fed transmission line. Designed to operate with this equipment, was a five-tube super-regenerative automobile receiver, which operated from the car battery and obtained its power supply from a dynamotor. This receiver had a built-in loudspeaker and was provided with an external control box which clamped to the steering column of the automobile.

The success of the operation of the first few of these installations indicated the worthiness of such frequencies for this service and the Government assigned for experimental police service four channels, namely, 30.1, 33.1, 37.1 and 40.1 megacycles. for further investigation in this class of service. Over 50 installations of this type of equipment were installed throughout the country for police service. Contrary to expectations, transmitters of this extremely low power were able to cover greater areas than at first thought possible. For example, cities such as Fort Worth, Texas; Camden, New Jersey; Chattanooga, Tennessee, and Norfolk, Virginia, and a number of others, covering relatively large areas, are obtaining exceptionally satisfactory performance, free from static and fading, and yet not interfering with similar services in other cities relatively near to them.

ANTENNA SYSTEMS

The type of antenna that has been recommended and used in conjunction with this type of equipment is a simple ½-wave radiator which is usually mounted on top of a wooden pole and for this purpose a special Dural half-wave attachment was developed for attachment to the wooden pole. In certain cases, a special steel self-supporting vertical mast was supplied and by proper connection of the transmission line, served as an excellent radiating medium while at the same time being electrically grounded insured lightning protection. In the case of the wooden pole type of antenna support, a quarter-wave section is connected to the transmission line and grounded to insure lightning protection.

The height of the vertical radiator

FIG. 4. CONTROL BOX FOR ET-5017 TRANSMITTER.

plays an important part in the successful operation of this type of equipment and it is of far more importance in determining the area which may be covered than is the actual power used. It was found in a number of cases that doubling the height of the antenna was equivalent to increasing the power of the transmitter by four. Increase in power apparently does not materially increase the range of the transmitter with a given antenna, but rather increases the field strength within the area.

NEW EQUIPMENT

In further developing this market, there has been added a completely new line of ultra-high-frequency equipment for police service known as the "De-Luxe Terra-Wave." The new main transmitter (Fig. 3) has a power of 25 watts and is crystal controlled and employs the latest type of tubes that have been designed to provide efficient operation at these ultra-high frequencies. For the frequency stabilizing circuit, a "V"-cut crystal is utilized, dispensing with all forms of temperature control. An overall design of the equipment has been made so that it is possible to add a 100-watt amplifier to the top of the exciter unit, thus making a complete 100-watt, ultra-high-frequency transmitter. All parts are conveniently mounted to facilitate servicing and the equipment has been designed so that it will provide satisfactory performance in hot, humid climates.

The transmitter is designed with suitable protective relays and sufficient speech amplifying equipment to operate directly from a double-button carbon microphone without additional external speech amplifying equipment. It is provided with a control box containing a microphone and a means for controlling the transmitter in the transmit or standby position (Fig. 4). At points which are remote from the transmitter, a different form control box is employed which includes a microphone amplifier.

THE RECEIVERS

While the super-regenerative type of receiver has proven extremely satisfactory, employing a minimum of tubes and possessing high sensitivity with an inherent automatic volume control, it was necessary in general procedure to operate the main transmitter with the carrier on at all times, cutting the microphone in the standby position in order to back down the increasing super-regenerative hiss common to this type of circuit. With the introduction of two-way communication between headquarters and the police cars, it is necessary, particularly in simplex operation, to operate with the carrier off.

After considerable development and study, a new type receiver has been introduced (Fig. 5). This is a nine-tube superheterodyne and consists of four main items; namely, power supply unit; receiver unit; loudspeaker and control unit. The power supply is obtained from a highly efficient dynamotor which is mounted in a separate case with a suitable filter and is usually located on the engine side of the fire wall of the automobile. The loudspeaker is a small magnetic unit housed in a protected case and is provided with a connecting cable which allows it to be located so as to provide the best signal to the operator. The receiver and chassis are mounted in a metal cabinet which can be opened readily by removing two thumb nuts. This facilitates tuning, changing tubes, servicing or repairing the receiver.

One very desirable feature which has been provided in this receiver, is the antinoise circuit. This circuit is so arranged that when the carrier of the transmitter is in the "Off" position, certain tubes within the receiver are biased so that no sound comes through the speaker. This part of the circuit is adjustable from the front of the receiver and may be disconnected if so desired. It is adjustable over a considerably wide range and can be adjusted in the individual patrol cars to give the best performance in the districts in which they will operate.

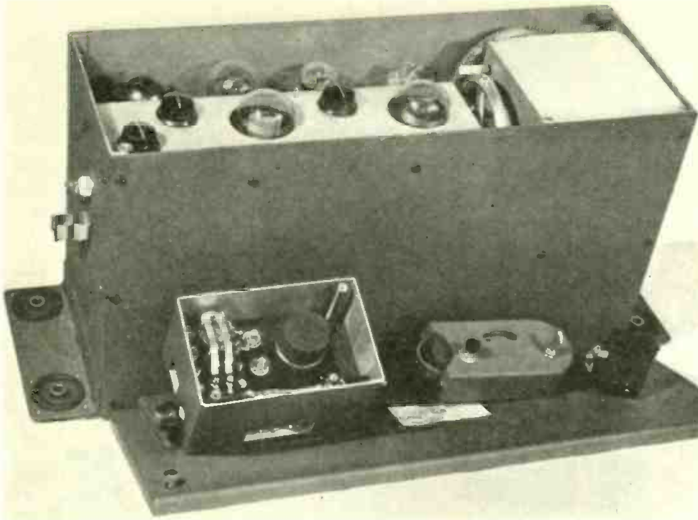


FIG. 6. ET-5022 MOBILE ULTRA-HIGH-FREQUENCY TRANSMITTER, 25 WATTS, SHOWING CASE OPEN.

The receiver is of the fixed-tuned type, the adjustment of which can be conveniently made when the receiver case is opened up. In order to facilitate the tuning of the receiver, a jack is provided in which a meter can be inserted which will always insure that the receiver is properly resonated to the proper frequency. The design is such that the receiver will hold its tuning over relatively long periods of time without frequent adjusting. The steering column control unit is entirely mechanical and contains one "On-Off" power switch and volume control. The design of the receiver is such that a vernier adjustment is not necessary to provide satisfactory operation. The drain from the car battery is 7.2 amperes at 6.3 volts.

The station house receiver employs the same radio-frequency chassis as that of the automobile receiver. This chassis is mounted in a two-tone gray cabinet and is provided with a power supply unit which permits its operation from 105/125 volts, 50/60 cycle ac power. On the front of the cabinet an "On-Off" power switch, volume control; antinoise circuit control; red indicating power "On-Off" lamp and a grille covering an eight-inch dynamic speaker, are located.

MOBILE TRANSMITTER

A number of years have been spent on the development of a suitable mobile transmitter for two-way communication and, although many types of transmitters were tried, it was not felt desirable to release such equipment commercially until the requirements and power necessary for best results within the limitations of such equipment were thoroughly investigated. As a result of this research, there has been developed a mobile transmitter (Fig. 6), which has a rating of 25 watts and is capable of covering the band of 30 to 40.1 megacycles.

The equipment consists of four main items—the transmitter proper, junction box, control box and generator. Due to the difficulties which are usually encountered during the winter months of the year from storage battery performance and the high drain necessary for a transmitter of this power, it was designed to obtain its power supply from a belt-driven generator operating from the fan belt of the automobile. This generator is provided with a regulator

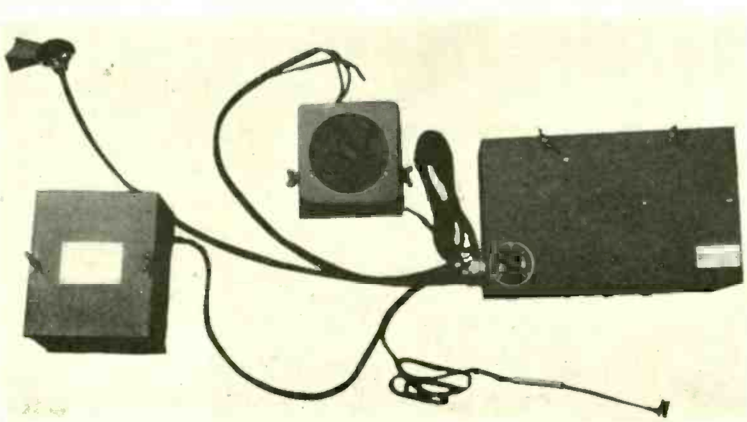


FIG. 5. AR-5019 ULTRA-HIGH-FREQUENCY AUTOMOBILE RECEIVER. SUPERHETERODYNE USING 9 TUBES, COMPLETE WITH DYNAMOTOR, LOUDSPEAKER AND CONTROL.

which maintains its output voltage substantially constant over the normal automobile operating speed. The only power supply obtained from the car battery for the transmitter is .7 ampere, which is used to operate the master oscillator filament circuit.

The transmitter is housed in a durable shock mounted case, approximately 22 inches long, 8 inches wide and 12 inches high. The radio-frequency circuit employes three tubes, using the 801 in the output stage. In order to obtain good frequency stability, all coils and condensers are rigidly built and housed in an aluminum casting having walls one-quarter inch thick. Two large precision dials are provided on this unit which are used as a means of setting the frequency at the desired point.

The oscillator tube operates on the car battery and is so connected in the circuit that when the receiver is turned on, the filament of this tube is also lighted, which means that this compartment is always kept warm due to the heat generated by the filament circuit. In order to alleviate the difficulties encountered by frequency modulation and the reaction from the modulator on the oscillator circuit, the oscillator is operated at a considerably lower frequency than the output of the transmitter, thus preventing poor frequency stability from this source. The modulator consists of two 841's that plate modulate the power amplifier stage. The modulator is driven by a 71A and this in turn is excited by one stage of speech amplification. The transmitter is capable of being modulated 100%. The tubes, plate current jacks and tuning circuits are all adjustable from the top of the transmitter when the lid is removed.

JUNCTION BOX

The Junction Box which is usually located on the driver's side of the fire wall, contains a calling tone generator, field relay and receptacles for the termination of all interconnecting cable plugs. The control unit which mounts on the starting column contains the button for controlling the tone signal generator, the master "On-Off" power switch, which controls the power supply for the receiver as well as the filament supply for the transmitter oscillator circuit and a meter which acts as a modulation meter and as a means of indication to the operator whether the transmitter is functioning properly.

When the receiver is used in conjunction with this mobile transmitter, its control unit is not employed as provisions have been made in the transmitter control unit to provide the necessary receiver control. With this equipment there is furnished a special type magnetic microphone which has relatively high output and is capable of providing good speech quality and does not necessitate the use of any exciting or polarizing voltage. On this microphone is located a button which controls the generator relay for placing the transmitter in the operating position. A small bracket is provided which permits the microphone to be mounted on the dashboard of the automobile and the microphone is provided with a cord and plug so that it can readily be removed from the Junction Box, thus preventing the operation of the transmitter by unauthorized persons.

MOBILE ANTENNA

With this type of mobile transmitter a vertical rod mounted to the rear bumper is recommended for use as an antenna. The transmitter is coupled to this antenna through a flexible waterproof concentric transmission line. This transmitter is capable of being coupled to concealed types of antennas, but usually such types of antennas have relatively low efficiency and are recommended only in special cases. Incorporated within the transmitter is a low-capacity relay which permits a means of switching the transmitting antenna so that it can be used for receiving purposes and thus permitting simplex operation.

CONCLUSION

The results which have been obtained in the ultra-high-frequency band have clearly indicated that these frequencies will play a very important part in the future of radio communication and will no doubt lead to applications which are as yet undreamed of. Already considerable activity is becoming evident as to the possibilities of these frequencies for strictly local broadcasting of entertainment programs where through the limitations of range, local coverage may be secured comparable to cleared-channel operation with remarkably small amounts of power and freedom from the difficulties of static and fading. Possible uses of still higher frequencies are receiving the attention of many engineers and we may look forward to a most interesting future of development and application in this important branch of radio engineering.

WSVA

(*Continued from page* 11)

ingham and Augusta counties in the center of the valley had no bank failures during the recent unpleasantness. From a statistical viewpoint the four cities: Lexington, Staunton, Harrisonburg and Winchester, are comparatively small. Each is, however, the seat of its county and its merchants supply the needs of at least four times the stated population. Radio promised to be a most logical medium for advertising to their scattered agricultural communities.

The power needed to cover the proposed area was the next consideration. As has been mentioned the frequency 550 kc is excellent for broadcast transmission. It has, however, the disadvantage that prodigious antenna heights are required for good radiation efficiency. A quarter-wave radiator for this frequency would be 450 feet high, a radiator of optimum height over 1,000 feet. Such structures are not for the small station.

DIRECTIONAL ANTENNA

The shape of the service area immediately suggested the use of a directional antenna which would concentrate the signal in the valley. With reasonably good transmission characteristics it was estimated that 500 watts delivered to a comparatively simple form of directive system would give the required coverage. Measurements made by Glenn D. Gillett during the early part of April showed that with the proposed system a signal intensity of 1 mv/M might be expected at a distance of 50 miles along the line of transmission. As there is at present no signal approaching ½ mv/M in the proposed service area, it is expectel that WSVA will have the undivided attention of listeners during the daylight hours.

ADVERTISING RATES

Advertising rates were arrived at by taking the average of the published rates of other Virginia stations, dividing these by their estimated audience, using theoretical contours and census figures, to obtain the costs per listener. It was then assumed that a minimum of 25% of the available facilities of the station would remain sold throughout the year. Based on these hypothetical earnings an investment of $25,000 appeared to be justified.

Within the above figure there is under construction at the present time, two studios and control room, sound proofed, acoustically treated and air-conditioned, three offices and two reception rooms, the broadcasting transmitter and associated equipment, a six-room building for the transmitter and living quarters for the operator and a directional antenna system.

The design and construction of each portion of the plant will be described in following articles.

(*To be continued*)

BROADCAST TRANSMITTERS *UP-TO-DATE*

By JOHN P. TAYLOR

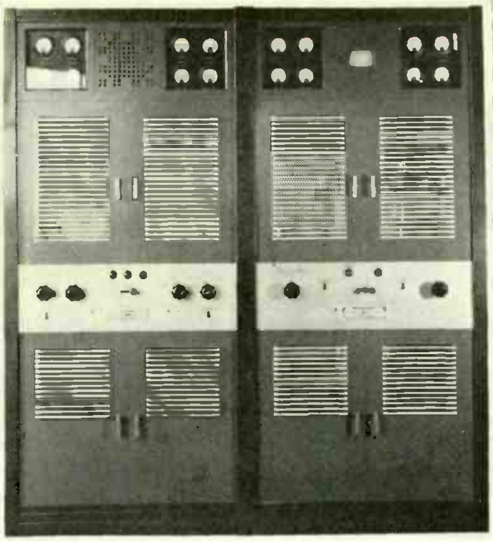


FIG. I. FRONT VIEW OF THE AMPLIFIER - MODULATOR UNIT (RIGHT) ASSEMBLED WITH THE TRANSMITTER - EXCITER UNIT (LEFT) DESCRIBED LAST MONTH.

PART II: A 500/1000-WATT AMPLIFIER-MODULATOR UNIT

IN THE FIRST PART of this article the low-power unit of a new line of "high-fidelity" transmitters was described. This was a unit of universal design such that it could be used interchangeably as a 100-watt transmitter, as a 250-watt transmitter, or as the exciter of higher powered transmitters. In this article the second unit of this new line will be described. This is an amplifier modulator designed to provide for increase of power to 500 or 1000 watts. As the description of this second unit progresses, the intergrated design of these new transmitters, which was briefly noted in the first part of the article, will become more evident.

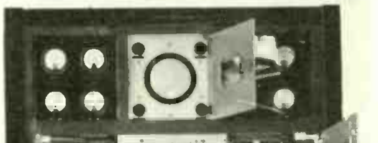


FIG. 2. INTERIOR OF THE AMPLIFIER-MODULATOR UNIT. NOTE THE CATHODE-RAY MODULATION INDICATOR AT THE TOP CENTER OF THE UNIT.

"NEW" IDEA IN UNIT DESIGN

Also mentioned before, but not enlarged upon, was the "new" idea in unit construction embodied in these transmitters. The bare idea of unit construction is, of course, hardly new. In the past several years attempts have been made to have transmitter designs conform to this conception—at least to the extent of making it possible to increase power merely by addition of new units to the existing plant. However, the units of various powers were almost never designed at the same time and so there was seldom more than a faint similarity in construction and appearance. As a result transmitters made up of such units usually presented a more or less composite appearance.

But even more of a drawback was the fact that power increases were invariably accomplished by the straightforward addition of linear amplifiers. This practice had several disadvantages:

First, the step-up of such amplifiers was conventionalized at 10 to 1 and power increases had thus to follow this ratio. In the early days this was little handicap because power increases of less than 10 to 1 were not considered worthwhile and power classifications of 500, 5000, and 50,000 watts predominated. However, a gradual change in attitude in this regard, together with other modifications, such as those occasioned by higher daylight powers, led to the establishment of intermediate-power classifications. As a result the powers in common use today increase approximately in steps of two, viz., 100, 250, 500, 1000, 2500, 5000, 10,000, etc. No system of linear amplifiers alone can be devised which will efficiently take care of this number of power classifications.

Second, linear amplifiers are inherently wasteful of both tube capacity and plate power. In certain power classifications their use, because of the limitations of available tube capacities, is still necessary; but in most other cases the better efficiency of high-level modulation makes it the first choice.

Third, linear amplifiers have a tendency to produce a relatively large amount of distortion, and this is particularly true where several such stages are employed in tandem. Generally speaking, it is now considered poor practice to use more than two linear amplifier stages in series.

The new idea made use of in the arrangement of the transmitters referred to here overcomes these failings. All of the units were planned at the same time and the design intergrated throughout. As a result they match in appearance probably as nearly as units of widely different powers can be made to do. And the circuit layouts tie in so that there is negligible overlap between units. The restrictions of linear amplifiers have been mostly overcome by judicious use of Class B modulators. The use of these where tube sizes permit provides increased efficiency in all power classifications. Moreover, the increased flexibility thus allowed provides for all power classifications without burdensome waste of tube capacity. Finally, while linear amplifiers are used in some of the higher power classifications, the interposition of high-level modulation for the alternate power increases limits the maximum number of such stages to two, for the highest power unit. The description, which follows, of the second of these transmitter units will bring out more sharply the advantages of this arrangement.

THE 500/1000-WATT AMPLIFIER-MODULATOR

Two views of the 500/1000-watt amplifier modulator, the second unit of this new line of transmitters, are shown in Figs. 1 and 2. In dimensions it is identical to the transmitter-exciter unit and in appearance closely the same, so that the two when placed together (Fig. 1) are mutually complementary. The details of the mechanical design of this second unit (Fig. 2) are also generally similar to those of the transmitter-exciter unit.

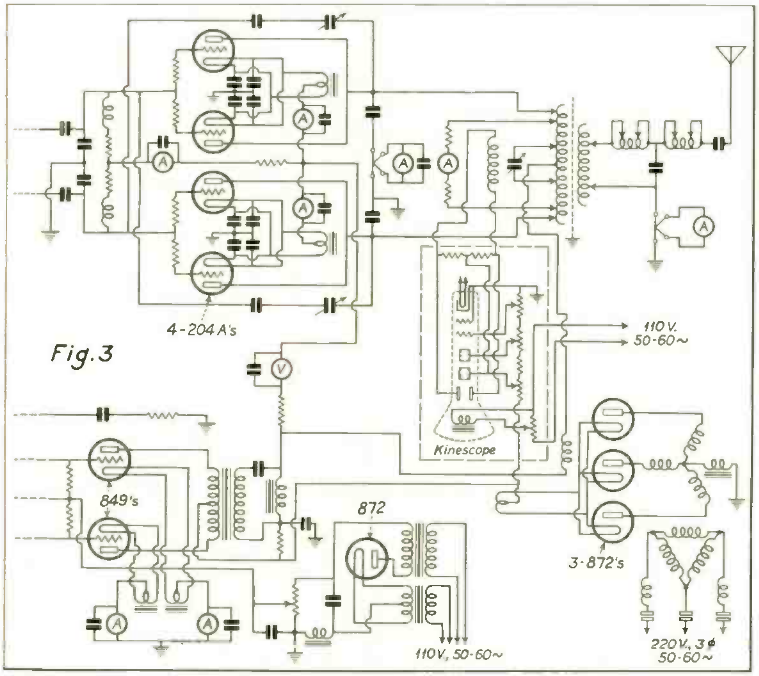
The construction of the cabinet is identical, as is also the manner of grouping the tuning controls and meters. These features have been previously described and hence need only be mentioned here.

The arrangement of components is fairly evident in the front open view of the unit. As in the case of the exciter all radio-frequency components are located in the upper part of the unit and audio and rectifier components in the lower part. Modulator tubes are mounted in a cushioned cradle. Fuses and breakers are conveniently mounted on a panel just inside the lower left door.

The simplified schematic of the amplifier-modulator unit is shown in Fig. 3. It will be seen that, electrically, the unit is made up of two distinct parts—a Class C amplifier and a Class B modulator. The amplifier employs two 204-A's for 500-watt operation and four 204-A's for 1000-watt operation; while the modulator utilizes two 849's, Class B. The method of driving these is indicated in Fig. 4. The two 203-A's forming the output stage of the 100-watt transmitter become the r-f driver, while what was the modulator of the low-power unit is now the driver for the 849 modulators. The only change required in the exciter is the substitution of an audio coupling transformer for the modulation transformer. All necessary leads to accomplish this having originally been provided, this is a minor change.

HIGH-LEVEL CLASS B MODULATION

The use of high-level modulating systems (as made possible by the development of Class B modulators) and the general advantages of such use have been discussed previously in a number of places and hardly need to be further elaborated upon here. The particular advantage for this power classification (1 kw) is, however, worthy of note. This follows from a consideration of tube capacities and will be made clear by a glance at Table I which indicates



SIMPLIFIED SCHEMATIC OF THE AMPLIFIER-MODULATOR UNIT. FOR TRANSMISSION-LINE COUPLING THE HARMONIC FILTER IS OMITTED.

TABLE I

The installed tube capacity required for each of four possible modulating systems which might be used in a 1000-watt transmitter. Small tubes, which add a negligible amount to the total and are in any case about the same for each system, are omitted. The R-F stage efficiencies are those used by the FCC in calculating output power by the indirect-measurement method.

Modulating System	Tube Capacity of Last R-F Stage	Tube Capacity of Modulator Stage	Total Tube Capacity
High-level (Class A Mod.)	1,000 watts (60% Eff.)	3.000 watts (20% Eff.)	4,000 watts
Low-level (Plate Mod.)	4.000 watts (33% Eff.)	....	4.000 watts
Low-level (Grid Mod.)	4.000 watts (22% Eff.)	....	4.000 watts
High-level (Class B Mod.)	1.000 watts (60% Eff.)	800 watts (60% Eff.)	1.800 watts

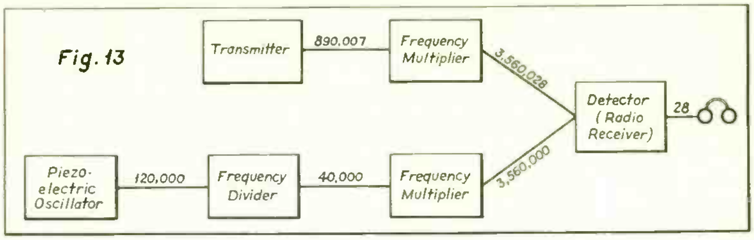
the installed tube capacities required by the four possible methods of accomplishing modulation in a transmitter of this size. As will be seen a total power rating of 4 kw is required by each of the first three modulating arrangements. This can be obtained only by the use of: (a) An inordinate number of small tubes, (b) a water-cooled tube, or (c) two large air-cooled tubes.

The first two of these have obvious disadvantages. The third escapes the handicap of a large number of tubes or of a water-cooling system, but has the disadvantage that air-cooled tubes of this size are relatively expensive. In contrast to these is the high-level Class B modulating system requiring an installed tube capacity of only 1.8 kw, a total easily supplied by a sensible number of smaller air-cooled tubes of sizes and types noted among operators for their long life. Because of its high efficiency such a system also, of course, requires less plate power, and, finally, removal of two of the amplifier tubes permits of economical operation at 500 watts—which is not possible with less flexible systems employing a fewer number of tubes.

AC OPERATION

In the amplifier-modulator unit shown here, as well as in the other units of this new line, plate voltages and such bias voltages as are necessary are furnished by mercury-vapor rectifiers; while ac is used directly on the filaments. This, together with the use of air-cooled tubes, makes possible a 1 kw transmitter without any rotating machinery—and with consequent reduced interruptions, servicing and replacements. As in the case of the exciter, the rectifiers necessary to supply the required power are built into the unit. These include a plate-voltage rectifier employing three 872's in a three-phase half-wave rectifier circuit and a single 872 rectifier supplying bias voltage for the modulators. The amplifiers are self-biased. An auto-transtormer provides unitary control of all voltages.

Starting controls, which include sepa-

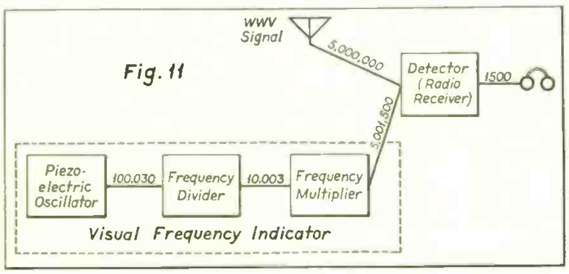


TRANSMITTER BEING SET TO COMPARATOR.

trol, which became effective in 1932, require that frequency be maintained within 50 cycles, and that each station be equipped with a visual-frequency indicator which reads deviation of the transmitter up to 50 cycles from its assigned frequency directly on a meter dial.

One type of visual monitor is similar to the aural monitor shown in Fig. 8, except that a frequency meter calibrated from zero to 50 cycles is substituted for the headphones. In order to determine whether the transmitter is above or below the assigned frequency, the operator presses a button which connects a small condenser across the piezoelectric crystal, lowering the oscillator frequency by one cycle. If the transmitter frequency is 8 cycles above the oscillator frequency, the button increases the reading to 9. If the transmitter is below its assigned frequency, the reading decreases.

Another instrument which is similar,



CALIBRATION OF VISUAL-FREQUENCY INDICATOR FROM STANDARD SIGNAL.

except in the source of the standard frequency, is shown in Fig. 9. The piezoelectric oscillator has a frequency of 100,000 cycles. This frequency is divided by 10 to obtain 10,000 cycles, and then is multiplied by any integer, 89 in the example, to obtain the transmitter frequency. A multivibrator serves simultaneously as a frequency divider and a frequency multiplier.

Division by a factor greater than 10 is rarely attempted in one step because the difficulty of maintaining the adjustment of the controlled oscillator becomes too great. While harmonics higher than the third are seldom used in transmitters, much less energy is required in a frequency-measuring circuit, and consequently harmonics as high as the 500th are used.

The type of monitor shown in Fig. 9 has the advantage that it may be used for any broadcast frequency without changing the crystal in the oscillator.

DIRECT INDICATING MONITOR

Fig. 10 illustrates a quite different kind of visual-frequency indicator which has proven highly satisfactory. It has the advantage of indicating directly the sign of the frequency deviation. A beat is produced between the transmitter and a piezoelectric oscillator which has a frequency 500 cycles lower than the assigned frequency of the transmitter. This beat operates a frequency meter which reads frequencies from 450 to 550 cycles, with 500 at the center of the dial. The meter dial is recalibrated to read from —50 to 50 cycles, with zero at the center. When the transmitter is operating on exactly its assigned frequency, the 500-cycle beat makes the frequency meter read zero. In the figure, the transmitter 8 cycles above its assigned frequency produces a 508-cycle beat with the standard frequency, and causes the frequency meter to read 8 cycles.

Similar monitors are used which have a piezoelectric oscillator with a frequency 1000 cycles below the assigned frequency, and a frequency meter which gives a mid-scale reading on a 1000-cycle signal.

COMPARATORS

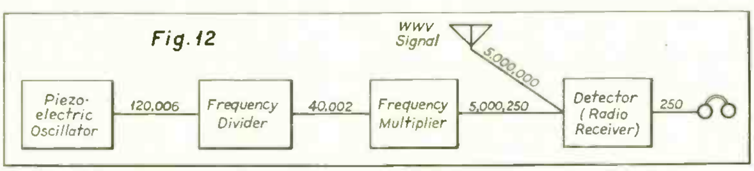
The next step in measuring the transmitter frequency is to obtain a comparison of either the transmitter or the monitor with a standard outside the station. This is accomplished either by obtaining a measurement of the transmitter frequency by a remote frequency-measuring station, or by using a comparator in the station to compare the frequency of the transmitter or the monitor with the frequency of a remote transmitter of known accuracy. The other possible method of transporting an oscillator physically from a calibrating laboratory to the transmitter is unsuited to precision work, since the first requisite of a stable oscillator is freedom from any disturbance.

The visual-frequency indicator shown in Fig. 9 also serves as a comparator. Fig. 11 illustrates the method of adjusting the frequency of this instrument by comparison with the standard-frequency transmission from WWV at the United States Bureau of Standards. A 30-cycle error is indicated in the piezoelectric oscillator which produces a 1500-cycle tone in the headphones. When the oscillator is adjusted so that the tone falls to zero, the oscillator has a frequency of exactly 100,000 cycles.

A comparator which is used to compare the frequency of the transmitter with WWV is shown in Figs. 12 and 13. In the first figure a beat is obtained between a local oscillator and the standard signal. The local oscillator is then adjusted to obtain a zero beat, which requires that the local oscillator frequency be exactly 120,000 cycles. The instrument is then operated as shown in Fig. 13, producing a beat between the local oscillator and the transmitter. When the transmitter is adjusted until a zero beat is obtained, it is operating on exactly its assigned frequency.

REMOTE FREQUENCY MEASUREMENT

When the station does not have a comparator, the service of a remote frequency-measuring station is used for a periodic check on the control and measurement apparatus in the station. The



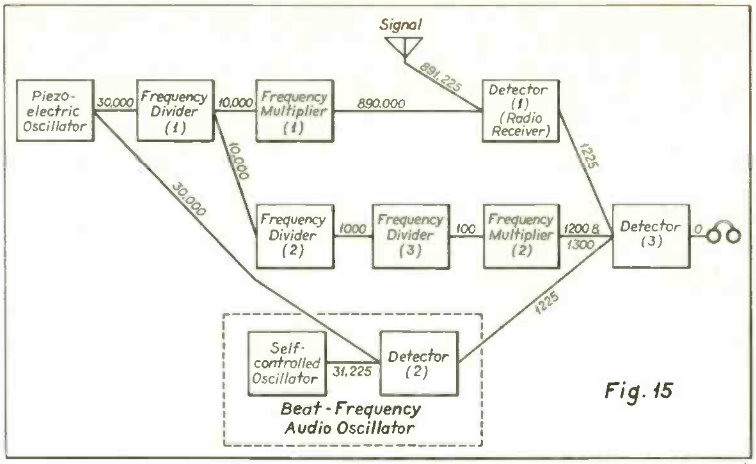
COMPARATOR BEING SET TO STANDARD SIGNAL.

Federal Communications Commission also has a chain of such stations for observing the performance of transmitting stations. A remote frequency-measuring station has two unique requirements. The first is that a complete radio receiver is used instead of a pick-up coil and detector. The second is that means must be provided for measuring stations at various frequencies.

The circuit shown in Fig. 9 is suitable for remote measurement of stations when the frequency of the station does not vary more than 50 cycles from a multiple of 10,000 cycles. A similar circuit is used with headphones instead of the frequency meter, and a piezoelectric oscillator which can be adjusted over a range of about 0.01 percent of its frequency. The adjustment on the oscillator is accurately calibrated, and the change in frequency of the harmonic which is being compared to the distant station is proportional to the change in frequency of the oscillator. By adjusting the oscillator frequency so that a zero beat is heard in the phones and reading the adjustment, the station frequency may be calculated.

A station less restricted in the frequencies which it can measure is shown in Fig. 14. Here zero beats are obtained first between a self-excited oscillator and the station, and then between the self-excited oscillator and standard frequencies near the unknown frequency. The latter points, usually one at lower and one at higher frequency than the unknown, furnish calibration points for the oscillator, so that it is not necessary that it should hold a constant frequency for more than a few seconds. The stability of the oscillator frequency and the linearity of its calibration are serious limitations of this method.

For measurement at any frequency the most accurate, but also most complicated, method consists of obtaining a beat between the unknown signal and one of a series of standard harmonic frequencies, and then measuring the frequency of the beat. A one-cycle error in measuring the beat frequency introduces a one-cycle error in the entire measurement, but this is far less in percentage of the radio frequency than of the beat frequency. Consequently the method of measuring the beat frequency may be simpler than any method of directly measuring the radio frequency. The easiest method of measuring the beat frequency is to compare it with the frequency of a calibrated audio oscillator.



FREQUENCY-MEASURING STATION OF THE FEDERAL COMMUNICATIONS COMMISSION.

FCC FREQUENCY-MEASURING EQUIPMENT

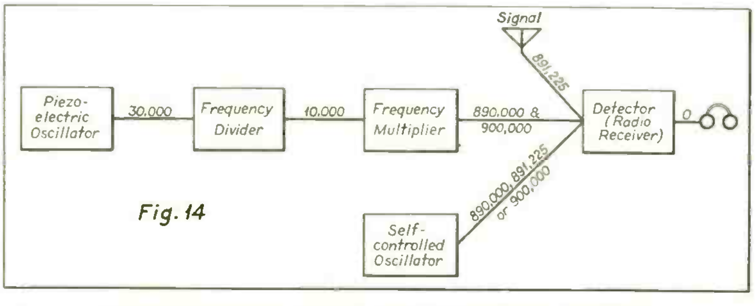
The frequency-measuring equipment used by the Federal Communications Commission consists of this method of producing a beat and comparing it with an audio oscillator. However, a calibrating means for the audio oscillator, similar to that shown in Fig. 14, is provided. The entire system of a government station is shown in Fig. 15. This apparatus is suitable for measuring stations on any frequency between 10,000 and 30,000,000 cycles. The frequency to be measured produces a beat of not over 5000 cycles in the radio receiver with some harmonic of the 10,000-cycle standard frequency. A separate calibrated oscillator, which is not shown, is used to determine which harmonic is nearest the signal frequency. The next step is to measure the frequency of the beat obtained. An audio oscillator with a range from 0 to 5000 cycles is adjusted to zero beat with the audio beat in the receiver. A beat-frequency audio oscillator is required in order to obtain very low frequencies. The standard 30,000-cycle piezoelectric oscillator is used for one of the signals in the beat-frequency oscillator. The self-controlled oscillator tunes from 30,000 to 35,000 cycles. A calibration curve is drawn giving the output frequency from 0 to 5000 cycles.

AUDIO-OSCILLATOR CALIBRATION

Since the calibration of the audio oscillator does not remain sufficiently accurate over long periods of time, a means is provided for recalibrating it at any time, in the form of a 100-cycle harmonic generator. In the figure, the two calibration frequencies 1200 and 1300 cycles which are adjacent to the measured frequency 1225 are indicated. Switches on the input to detector (3) permit connecting only the desired inputs at any one time. The inputs from detectors (1) and (2) are connected when a station is being measured. The inputs from multiplier (2) and detector (2) are connected when the audio oscillator is being calibrated.

When a signal of higher frequency than 5,000,000 cycles is being measured, an auxiliary oscillator is introduced. It is adjusted so that one of its harmonics zero beats with the signal, observing the beat in a high-frequency radio receiver. Then the frequency of this oscillator is measured in the manner just described.

(*To be continued*)



FREQUENCY-MEASURING STATION USING INTERPOLATION OSCILLATOR.

BROADCASTING IN SHANGHAI

IN SPITE OF the efforts of various administrative authorities, there is still no effective control of broadcasting wave lengths in Shanghai, with the result that much overlapping exists.

Two new municipal-owned and operated stations are scheduled for erection in 1935. One, 10-kilowatts, will be Chinese and the other, 4-kilowatts, French. Both will be subsidized. (*Electrical Division, Department of Commerce.*)

Federal Communications Commission Reports

BICKLEY APPOINTED CHIEF ACCOUNTANT FOR TELEPHONE INVESTIGATION

ON APRIL 5, the Federal Communications Commission announced the appointment of John H. Bickley as Chief Accountant for the Telephone Investigation recently authorized by Congress and approved by the President on March 15, 1935.

Mr. Bickley is now Chief Accountant and Director of the Department of Accounts and Finance for the Public Service Commission of Wisconsin, which position he has held since May, 1931. Prior to this he was a public utility expert for the Federal Trade Commission at Washington, D. C., from May, 1928, to May, 1931.

Before joining the staff of the Federal Trade Commission, Mr. Bickley served as Chief Auditor, through competitive examination, on the Public Service Commission of Maryland, for the period from October, 1925, to December 31, 1926, and for a short time engaged in private practice at Baltimore, Md.

Mr. Bickley, who is 42 years of age, is a Certified Public Accountant from both the States of Maryland and Wisconsin. His earlier training consisted of a four years' course at the Technical High School at Harrisburg, Pa., a college course with the degree of Bachelor of Science in Economics at the University of Pennsylvania in 1915. In 1917 he did graduate work at Columbia University. He was Instructor, Assistant Professor, and Associate Professor in charge of accounting instruction, at Lehigh University, from September, 1915, to June, 1924.

He has appeared before the Federal Commissions as Chairman of Committees of Accountants for the State Commissions. He has also presented papers and participated in discussions of accounting matters before the conventions of the National Association of Railroad and Utilities Commissioners.

LLOYD E. BEMIS RECEIVES APPOINTMENT

THE FEDERAL COMMUNICATIONS COMMISSION announced, on April 6, the appointment of Lloyd E. Bemis, 203 South Dearborn Street, Chicago, Ill., as an accountant, CAF-13, for the Telephone Investigation authorized by Senate Resolution 46.

Mr. Bemis is a Certified Public Accountant from the State of Illinois by virtue of an examination in 1926. He is a son of the late E. W. Bemis, who was very prominent as an engineer and accountant in public utility matters. He has participated in numerous telephone investigations and cases throughout the Middle West, South and the Central West. He has also participated in a large number of other utility cases and investigations.

Mr. Bemis is 37 years of age. He has a college degree in Civil Engineering from Cornell University and took a post-graduate course at Harvard University, where he pursued selected courses in engineering, economics and accounting, relating to the subject of public utility regulation.

ARNOLD APPOINTED TO LAW DEPARTMENT

THE FEDERAL COMMUNICATIONS COMMISSION also announced, on April 6, the appointment of Carl F. Arnold, Dean of the Law School of the University of Wyoming, as an Assistant General Counsel of the Law Department.

Mr. Arnold will devote his time and studies to problems connected with the Telegraph and Telephone Divisions.

He comes to the Commission highly endorsed for his legal training and ability, having specialized in utility law.

Mr. Arnold was born at Laramie, Wyoming, in 1896. His scholastic and legal training, in brief, follows: A.B. with honor, Princeton, 1917; L.L.B. with honor, University of Wyoming, 1926; admitted to practice in Wyoming, 1926; Yale Law School 1926-1927; J.S.D. Yale Law School, 1929; staff of Law School, University of Wyoming, 1927; and Dean of Law School University of Wyoming since 1932.

For some time he practiced law with his father, Constantine P. Arnold, a noted Wyoming lawyer, at Laramie.

From 1917 to 1919 he served in the U. S. Army and was discharged as First Lieutenant from the 38th Machine Gun Battalion, Camp Lewis, Washington.

Mr. Arnold has had much experience in research work in matters closely allied with the problems before the Communications Commission. In his university work he has made an intensive study of the financial structures of utility companies and other large corporations, and has cooperated with the Attorney General of Wyoming in legal matters dealing with the Government.

ARNOLD C. HANSEN

MR. ARNOLD C. HANSEN, Chief of the Accounting, Statistical, and Tariff Department of the Federal Communications Commission, died on Sunday, April 14, 1935. At a special session of the Commission, held at its offices in Washington, D. C., on April 15, the following Resolution of Appreciation and Sympathy was adopted:

Whereas on Sunday, the fourteenth day of April, 1935, Mr. Arnold C. Hansen, Chief of the Accounting, Statistical, and Tariff Department of this Commission, departed this life;

Whereas Mr. Hansen rendered highly efficient and meritorious service to this Commission in organizing that Department and continued to render such service up to the time of his death in supervising and directing that Department; and

Whereas Mr. Hansen by his unselfish loyalty and devotion to this Commission and to the public and by his high professional and personal character has ingratiated himself with the members of this Commission who are therefore profoundly grieved by his death:

Now, therefore, as an expression by this Commission of its appreciation of his invaluable service, of his unselfish loyalty and devotion, and of his high professional and personal character, and as an expression of its sympathy with the bereaved members of his family and with his friends:

It is ordered, that this resolution of appreciation and sympathy be adopted and that a copy thereof be sent to members of his family with the condolences of this Commission.

APPLICATIONS GRANTED FOR NEW STATIONS

Telegraph Division

March 19, 1935.

CITY OF KINGSTON, New York, granted construction permit and license covering same, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

CITY OF ONEONTA, New York, granted construction permit, 30,100 kc, 50 watts. Also granted authority to communicate as municipal police station in emergency service on an experimental basis only under exceptions of Rule 320. Also granted construction permit, 2 applications, portable-mobile, 33,100 kc, 10 watts.

CITY OF LANSING, Michigan, granted construction permit, mobile, 30,100 kc, 3 watts; also authority to communicate as municipal police station in emergency service on an experimental basis.

TURLOCK POLICE DEPARTMENT, Turlock, Calif., granted construction permit, 30,100, 33,100, 37,100, 40,100 kc, 5 watts.

HARVARD UNIVERSITY, Cruft Lab., Cambridge, Mass., granted license to operate transmitter already constructed, 55,000, 62,500 kc, 1 kw. Also granted license to operate transmitter already constructed on 55,000, 62,500 kc, 500 watts, portable.

TROPICAL RADIO TELEGRAPH CO., Hialeah, Florida, granted license, 2,264 kc, 350 watts. Transmitter licensed for station WAN.

CITY OF NORFOLK, Nebraska, granted construction permit, 2,490 kc, 25 watts.

CITY OF NEW HAVEN, Conn., Police Department, granted construction permit, 2,466 kc, 100 watts.

March 25, 1935.

WILLIAM W. SKAGGS, Los Angeles, Calif., granted construction permit, general experimental, 37,100 kc, 25 watts. Same except 10 watts granted for portable-mobile equipment.

TOWNSHIP OF MILLBURN, New Jersey, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 30 watts. Also granted construction permit, 3 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 2.5 watts. Authority also granted to communicate as municipal police station in emergency service on experimental basis only.

PAUL D. LANGRICK, doing business as Langrick Radio Engineering Service, Los Angeles, Calif., granted construction permit, general experimental, portable-mobile, 30,100, 31,100, 33,100, 34,600, 35,600, 37,100, 37,600, 40,600, 41,000, 86,000-400,000 kc, 10 watts.

THE ASSOCIATED PRESS, Augusta, Georgia, granted license to cover construction permit, portable-mobile, general experimental service, 31,100, 34,600, 37,600, 40,600 kc, .5 watt.

TOWN OF HULL, Mass., granted construction permit, 2 applications, portable-mobile, general experimental service, 40,100 kc, 10 watts.

CITY OF HAMMOND, Indiana, granted construction permit, general experimental service, 40,100 kc, 20 watts.

CITY OF MACON, Georgia, granted construction permit, police service, 2,414 kc, 50 watts.

TENNESSEE HIGHWAY PATROL, Nashville, Tenn., granted construction permit, special experimental, 1,666 kc, 5 kw.

TOWN OF WEST HARTFORD, Conn., granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 25 watts.

April 2, 1935.

FRANK JACOBS, Richmond Hill, N. Y., granted construction permit, portable-mobile, 31,600, 35,600, 41,000 kc, 10 watts.

ROBERT C. BOONE, Hollywood, Calif., granted construction permit, 3 applications, portable, 41,000 kc, .07 watt.

CITY OF TULSA, Oklahoma, Police Department, granted construction permit, 2 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

CITY OF SANTA BARBARA, California, granted construction permit, portable-mobile, 30,100 kc, 7 watts.

CITY OF TULSA, Oklahoma, Fire Department, granted construction permit, 2 applications, portable-mobile, 33,100 kc, .5 watt.

CITY OF SIOUX CITY, Iowa, Police Department, granted construction permit, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 7.5 watts.

THE GAMEWELL CO., Newton, Mass., granted construction permit, 1614, 2398, 30,100, 31,600, 33,100, 35,600, 37,100, 38,600, 40,100, 41,000, 86,000-400,000 kc and above, 5 kw; same organization also granted construction permit, 4 applications, portable, 1614, 2398, 30,100, 31,600, 33,100, 35,600, 37,100, 38,600, 40,100, 41,000, 86,000-400,000, 401,000 kc and above, 500 watts.

CITY OF SALINAS, California, Police Department, granted construction permit, 30,100, 33,100, 37,100, 40,100 kc, 15 watts. Also granted 7 applications, portable-mobile, same frequencies, 5 watts.

CITY OF BETHLEHEM, Pennsylvania, granted construction permit, 4 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 9 watts.

CITY OF PERU, Illinois, granted construction permit, 30,100, 33,100, 37,100, 40,100 kc, 50 watts.

CITY OF CLEVELAND, Ohio, Department of Police, granted construction permit, 5 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 10 watts.

CITY OF ORANGE, California, granted construction permit, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 4.5 watts.

ASSOCIATED AIR SERVICES, Ltd., Palo Alto, California, granted construction permit, 31,600, 35,600, 41,000 kc, 40 watts. Same for portable-mobile equipment, 20 watts.

RCA MANUFACTURING CO., Inc., Camden, N. J., granted construction permit, 2612, 2854, 2946, 3072.5, 3147.5, 3242.5, 5582.5, 5652.5, 4740, 10,190 kc, 1 kw.

AERONAUTICAL RADIO, Inc., Kansas City, Missouri, granted license to cover construction permit, 278 kc, 15 watts.

BRANIFF AIRWAYS, Inc., aboard NC-14905, granted license, 3105 kc, 50 watts.

PAN AMERICAN AIRWAYS, Inc., Territory of Hawaii, granted construction permit: (a) 2870, 8220, 12,330, 16,440 kc; (b) 2648, 16,240 kc—900 watts. Frequencies for use as follows: (a) Primarily with aircraft stations in Transpacific service, and (b) with aeronautical point-to-point stations in Transpacific service. Also granted additional special experimental authority for the period of tests covered by Rules 217 and 218 covering the following frequencies: (a) Primarily for communication with aircraft stations in Transpacific service, 5035 and 5165 kc, unlimited hours; (b) for communication with aeronautical point-to-point stations on Transpacific route, 2986, 5035, and 5165 kc unlimited, and 6570, 6580, 8220, and 12,330 kc, subject to condition that no interference is caused to international mobile service. Same also granted for Guam, Midway and Wake.

ALASKA SOUTHERN PACKING CO., *La Merced* (moored in vicinity of False Pass), granted construction permit, 2986 kc, 50 watts.

CITY OF GAINESVILLE, Florida, granted construction permit, 2466 kc, 50 watts.

April 9, 1935.

RICHARDSON WATTS, Inc., NC-14255, granted aircraft-aviation license, 3105 kc, 50 watts.

CITY OF NEW YORK, Department of Docks, Brooklyn, N. Y., granted aviation-airport construction permit, 278 kc, 15 watts.

TURLOCK POLICE DEPARTMENT, Turlock, Calif., granted construction permit, 2 applications, portable-mobile, 30,100, 33,100, 37,100, 40,100 kc, 5 watts.

WATSONVILLE POLICE DEPARTMENT, Watsonville, Calif., granted construction permit, 30,100, 33,100, 37,100, 40,100 kc, 5 watts. Two similar applications for portable-mobile equipment were also granted.

STATE OF WASHINGTON, Highway and Police Department, Wenatchee, Washington, granted construction permit, 2490 kc, 50 watts. Same also granted for Spokane, Washington.

STATE OF INDIANA, Department of Public Safety, Columbia and Seymour, Indiana, granted construction permits, 1634 kc, 1 kw. Similar construction permit, 1634 kc, 100 watts, license covering same, granted for Indianapolis.

AERONAUTICAL RADIO, Inc., Dallas, Texas, granted construction permit, special experimental, portable-mobile, for purpose of conducting field-strength tests only, 2912, 5042.5 kc, 125 watts. Also granted license to cover same.

CITY OF NEWARK, N. J., granted construction permit, mobile, 30,100, 33,100, 37,100, 40,100 kc, 5 watts. Also granted authority to communicate as municipal police station in emergency service on an experimental basis only under exceptions of Rule 320.

CITY OF SHREVEPORT, Louisiana, granted construction permit, 2430 kc, 100 watts, towers to be marked and painted according to specifications of Department of Commerce, Bureau of Air Commerce.

April 16, 1935.

CITY OF SIOUX FALLS, South Dakota, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 15 watts; also authority to communicate as a municipal police station in emergency service on an experimental basis only.

GEORGE P. FULLER, on NC-14252, granted aviation-aircraft license, 3105 kc, 25 watts.

CITY OF CHICAGO HEIGHTS, Illinois, granted construction permit, general experimental, 30,100, 33,100, 37,100, 40,100 kc, 15 watts.

VILLAGE OF HERKIMER, N. Y., granted construction permit, general experimental, 30,100 kc, 15 watts.

CITY OF CHARLOTTE, North Carolina, granted construction permit, general experimental service, 30,100, 33,100 kc, 50 watts. Also granted construction permit for mobile equipment operating on the same frequencies and with a power of 10 watts.

CITY OF SAN BERNARDINO, California, granted construction permit, 2 applications, mobile, general experimental service, 33,100 kc, 10 watts.

CITY OF MONESSEN, Pennsylvania, granted construction permit for police station, 2482 kc, 50 watts.

E. L. CORD, aboard NC-24256, granted construction permit to operate aircraft radio station as follows: 3105 kc unlimited; 3222.5 kc day only; 3127.5, 3232.5, 3242.5, 3257.5, 3447.5, 3457.5, 3467.5, 3485, 4917.5, 5602.5, 5612.5, 5632.5 kc unlimited. The power is 50 watts.

April 23, 1935.

AERONAUTICAL RADIO, Inc., Washington, D. C., granted construction permit, portable-mobile, aviation-aeronautical, 2930, 6615 kc, 25 watts.

AERONAUTICAL RADIO, Inc., Washington, D. C., granted license to cover construction permit, portable-mobile, aviation-aeronautical, 2930, 6615 kc, 25 watts.

INTER-ISLAND AIRWAYS, Ltd., Honolulu, T. H., granted construction permit, aviation-aeronautical and aeronautical point-to-point, 5375, 6610 kc, 125 watts, to operate from 6 a.m. to 7 p.m. daily.

AERONAUTICAL RADIO, Inc., Dallas, Texas; Brownsville, Texas; Chicago, Illinois; Oklahoma City, Oklahoma; Houston, Texas; Kansas City, Missouri; Amarillo, Texas; Corpus Christi, Texas; Austin, Texas; San Antonio, Texas; Fort Worth, Texas; Waco, Texas; Ponca City, Oklahoma; Burlington, Iowa; Wichita, Kansas, granted construction permits, 2912, 5042.5 (aeronautical); 2640 kc (aeronautical point-to-point); 125 watts. The same construction permit was also granted for Wichita Falls, Texas, with the exception of 50 watts power.

VANCE F. SUTTER, Pillar Bay, Alaska, granted construction permit for point-to-point telephone coastal harbor station in fixed public-public coastal service, 2994 kc, 50 watts.

TOWNSHIP OF UNION, N. J., Police Department, granted construction permits for 4 general experimental stations communicating as municipal police stations in emergency service, 30,100, 33,100, 37,100, 40,100 kc, 7.5 watts.

SNUG HARBOR PACKING CO., Snug Harbor Cannery, Chisik Island, Alaska, granted construction permit for a point-to-point telephone station in fixed public service, 3190 kc, 16 watts.

CITY OF SALINA, Kansas, granted construction permit for municipal police station, 2422 kc, 50 watts.

CITY OF ROANOKE, Virginia, granted construction permit for municipal police station, 2450 kc, 100 watts.

CITY OF BROWNWOOD, Texas, granted construction permit for police station, 2458 kc, 50 watts.

Broadcast Division

April 2, 1935.

NATIONAL BROADCASTING CO., granted construction permit, portable-mobile, special experimental service, 13,050 kc, 10 watts.

April 16, 1935.

KTAR BROADCASTING COMPANY, Pheonix, Arizona, granted construction permit, portable-mobile, general experimental, 31,100, 34,600, 37,600, 40,600 kc, 10 watts.

EVANGELINE BROADCASTING CO., Lafayette, Louisiana, granted construction permit, 1310 kc, 100 watts, unlimited time.

Telephone Division

April 3, 1935.

RCA COMMUNICATIONS, Inc., Kahuku, Hawaii, granted coastal telephone license for public coastal service, 5845, 7520, 11,680, 16,030 kc, two transmitters (1 and 40 kw), emission A3, to communicate with the SS *Empress* of Britain.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

"S O S"

UNTIL TODAY, THE story of the part radio communication has played in increasing the safety of life at sea, and a history of the major disasters in which radio has been instrumental in summoning succor for vessels fighting a losing battle with the elements or ravaged by fire at sea, had not been published.

To Karl Baarslag, Veteran member of our Association, goes the distinction of having collected and presented in a most interesting manner the sagas of SOS in his book, "SOS to the Rescue," published by Oxford University Press.

We present a biographical sketch of Mr. Baarslag.

Born November 25, 1900, on Wealthy Avenue—one of Grand Rapids' poorest streets behind the gas-house. His father left a successful legal practice in Amsterdam, Holland, to try his fortune in the new world and found nothing but hardship and poverty; he died in 1907, leaving Karl and his mother in absolute poverty.

Karl commenced work at the age of 9, and at 12 was earning his own clothes and spending money selling papers. Constructed his first ham receiver in 1913, everything from crystal holder to loose coupler handmade, except the phones, which came from the Electro Importing Company.

He worked on farms during the summer and as a magazine salesman, and later a Western Union messenger after school hours during the school year. Managed to attend high school for two years, working nights—from 5 P. M. to 1 A. M.—as a Post Office messenger. Rejected by the Navy during the war as under age, became a railway mail clerk and later a transitman on a government plant survey.

Hair-raising tales of Singapore, Cairo and Tunis by an old Navy radioman returned to Grand Rapids in 1912, and who first instructed Karl in the mysteries of radio in 1913, determined his next step. He would go to sea. Hitch-hiked across the prairies and was probably one of the first in America to discover the travel possibilities of "thumbing" one's way in 1918. Later took to the "road" as a faster means of locomotion and soon graduated from a "gay-cat" or green novice to a real "blowed in the glass passenger stiff" holding down the Overland Mail and other fast transcontinental trains for 500 to 800 miles at a stretch across the great plateau states—Wyoming, Utah, Nevada and California.

He later joined the U. S. Shipping Board Training Service and was sent to the historic old *U. S. S. Meade* at Boston. Graduated a certificated "third cook," he boarded his first ship "through the hawse pipe" as an ordinary seaman on the old German *Prinz Oscar*, re-christened *Orion*. His first voyage, a tough one under a bullying mate, took Karl to Sweden, England and back to New York. Radio was in his blood. So that he might attend the Marconi Institute, he took a job as watchman on the docks of Brooklyn in the bitter cold winter of 1920. Was so sleepy and hungry at night that he drowsed through most of the lectures and, as a result, learned very little about radio, but managed to pick up enough code to pass a 20-word-a-minute test. No shipping in 1920 or 1921, so worked for several years in the General Post Office in Brooklyn making trips to sea on leaves of absence as seaman or oiler.

Karl secured his first commercial license in 1925 and he joined the Yacht *Oceanus* for a southern cruise. During the past ten years employed on various of the I. W. T. and Radiomarine Corporation equipped ships. The "boom" days found him radio operating aboard yachts. He has been yachting most of the last five years.

At the outset—when Mr. Baarslag first contemplated collecting the material for his book—he anticipated its completion in five or six months. However, the job was far more difficult than he imagined. A determination to finish a job started even though its magnitude and ramifications appalled him, coupled with an earnest desire to see a printed record of the part radio—and the men who operate it—have played as a humanitarian instrumentality in sea disasters, kept him at it. Research on the *Titanic* disaster alone took three months, while unemployed. The collected data fills two large suitcases gathered during a total elapsed time of five years, 16 months of which were spent "on the beach." To assure authenticity and accuracy, Mr. Baarslag has spent all of his spare time to the exclusion of everything else, including pleasure and relaxation, in gathering material in the United States, Canada and England, perusing government records, visiting newspaper "morgues," and in personal interviews with radiomen and other crew members—surveyors of the disasters he so graphically portrays in his factual treatise—"SOS to the Rescue."

MEMORIAL DAY

On Thursday, May 30, 1935, a one-minute silent period will be observed by the entire radio communications industry of the United States as well as the government radio services at noon in tribute to deceased radiomen, at the request of the V. W. O. A.

Memorial Services will be held at the Wireless Operators' Monument in Battery Park, New York City, at noon time by the Veteran Wireless Operators' Association, at which time a wreath will be placed on the monument and a eulogy delivered by officers of the association.

Mrs. Ernest E. Dailey, widow of the heroic Chief Radioman of the ill-fated Dirigible *Macon*, was in New York City recently en route to Washington, and her first request was to visit the monument, which visit was subsequently made with representatives of the Association. Mrs. Daily plans to come to New York on Memorial Day to attend the services during which a bronze tablet bearing the name of Ernest E. Dailey, will be placed on the monument.

The services at the monument on Memorial Day each year under the auspices of the Association are indeed impressive and we urge all our members to attend and participate in this tribute to the deceased heroes of our craft.

CONTRIBUTIONS

Once again we request our membership to forward to the Secretary any and all interesting material for use in this page. Just a short note concerning a particular item will suffice. We should like to make the page as representative as possible and this will be possible only with the cooperation of our members. Some time ago we requested anecdotes of the early days of wireless. We are still interested and will be pleased to receive them now or any time in the near future.

SHORT ITEMS

Lee M. Frink, who formerly resided in Washington, D. C., now lives in Flushing, L. I., and is on the staff of Hearst Radio, Inc. . . . As is W. R. Schwalm, formerly a Navy Chief Radioman and a former Director of our Association. . . . Fred Muller, too, is on the staff of Hearst Radio. What a staff! . . . Karl Baarslag, just today (May 2nd), has returned from an extended cruise of the islands of the South Pacific on the Yacht *Vagabondia*. He appeared well tanned and well equipped to withstand the rigors of a northern summer. . . . The Bulletin of Radio Intelligence, Ltd., contained an interesting article concerning heroism of several radiomen in recent sea disasters, some of whom have been honored by the award of Testimonial Scrolls. Those not recognized will be referred to our Awards committee for their action. In this connection we request information concerning the work of radiomen under difficult circumstances. . . . Melvin P. Beckvold, Henry T. Hayden, Thomas D. Entz and many others have recently sent in the necessary for 1935. . . . We again request our members who have not already sent in 1935 dues to do so at once. . . . The Boston Chapter has held several meetings since the Annual Banquet in February. . . . The New York Chapter contemplates holding a "stag" some time late in May or early in June before the vacation period sets in.

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DAVID SARNOFF HONORED BY FRANCE

The Cross of the Legion of Honor was conferred by Consul General Charles de Fontnouvelle of France upon David Sarnoff, President of the Radio Corporation of America and pioneer in the science of radio. The presentation took place in the Consulate General in La Maison Francaise, Rockefeller Center.

In presenting the Cross and the Diploma of the Legion of Honor, Mr. Fontnouvelle said:

"It is my great pleasure to inform you that the President of the French Republic has bestowed upon you the Cross of Knight of the Legion of Honor, in recognition of your pioneering and great accomplishments in the science of radio."

OVER THE TAPE...

NEWS OF THE RADIO, TELEGRAPH AND TELEPHONE INDUSTRIES

SAY IT WITH CANDY!

After dictating a telegram from a coin-box telephone, a patron dropped in an extra nickel. "Here, baby," he said. "You've been a good little girl. Buy yourself a chocolate bar."—*Dots and Dashes.*

RAYTHEON BULLETINS

The Raytheon Manufacturing Company, 190 Willow Street, Waltham, Mass., have recently made available a number of interesting bulletins.

Bulletin No. DL48-44 covers the Delta High-Voltage Rectifiers (1000 to 5000 volts), Delta Low-Voltage Rectifiers (up to 50 volts), Raytheon Voltage Regulators (up to 2000 watts), Delta Intermediate-Voltage Rectifiers (100 to 1000 volts), Raytheon Amplifiers and Acme-Delta Transformers and Chokes. Bulletin No. DL48-101 covers the Raytheon Sound Rectifiers for motion-picture theatres, while Bulletin No. DL48-71 gives complete information concerning Raytheon Voltage Regulators. Recti-Filters, for converting ac to dc, are treated in Bulletin No. DL48-102, and complete information concerning Acme-Delta Transformers and Chokes is contained in Bulletin No. DL48-13.

All of these Bulletins may be had on request.

SHERWOOD APPOINTED SALES MANAGER OF CARDWELL

Charles M. Sherwood, well-known radio executive, has been appointed General Sales Manager of the Allen D. Cardwell Mfg. Corporation, pioneer variable-condenser makers, of 81 Prospect Street, Brooklyn, N. Y.

For six and a half years Mr. Sherwood was Eastern Sales Manager of F. A. D. Andrea, Inc. He was one of the founders of Shipowners Radio, Inc., in 1919, and was an active amateur as far back as 1910.

RCA LICENSING LABS. MOVES

Radio receiving sets are again in operation at the old NBC Studios, 711 Fifth Ave., New York City. This time, however, they are there for testing and measuring purposes.

The redecorated and remodeled studios were taken over on March 8 by the RCA License Division Laboratories. This institution, formerly of 75 Varick Street, is under the supervision of Arthur Van Dyck, and provides engineering service to licensees on technical problems relating to RCA patents. The License Division also acts as a clearing house on general information for manufacturers, approximately fifty receiving sets and fifteen tube organizations being served by them.

The small studios formerly used for auditions were found to be well suited for experimental purposes. Acoustical tests of high-fidelity receivers are conducted in studio Y to which a direct line has been run from the NBC studios in Radio City, the amplifiers used being similar to those in NBC control rooms. Studio X is now used as a standardization room for checking instruments used in the laboratories.

The new quarters provide more room and better facilities than did the downtown offices, and the nearness to the Patent Department in the RCA Building is also advantageous.

NEW ERIE RESISTOR PLANTS

The Erie Resistor Corporation has recently completed an addition to their Erie plant. Approximately 5,000 square feet of additional floor space is available through this addition. A large portion will be used for the manufacture of insulated carbon resistors, recently placed on the market by this company.

The Erie Resistor Ltd., an English subsidiary, has moved into their new factory, located at Queensbury, about seven miles from London. This building, specially designed for the manufacture of resistors and suppressors, is one of the most modern and best-equipped factories in Great Britain.

RAYTHEON'S SAFETY RECORD

During the last five years, not one employee of the Raytheon Production Corporation has lost time because of a major accident in the factory at Newton, Mass. Up to January 27, 1935, more than 5,900,000 man-hours had been worked with no time out for serious injuries.

Visitors to the Raytheon Factory can see a growing list of awards for safety and factory efficiency. In January, 1931, the factory management erected a bronze plaque "In Recognition of the Excellent Safety Record Made by the Employees of this Plant. Working without a Loss-Time Accident Since January 26, 1930, to January 26, 1931". Each year thereafter, another bar has been added to the plaque, until now it has a total of four . . . one for January, 1931, to January, 1932; one for January, 1932, to January, 1933; one for January, 1933, to January, 1934; and the newest one for January, 1934, to January, 1935.

These employees and the factory at Newton, Mass., produce all of the Raytheon 4-Pillar Radio Receiving Tubes that are used.

OPERATING DATA FROM MONTHLY REPORTS OF RADIO COMPANIES

Compilations, subject to revision, from reports of revenues and expenses of radio companies.

Name of Company	Total operating revenues	Total operating expenses	Operating income	Net income
	For the Month of December, 1934			
Aeronautical Radio, Inc.	......	$1,216.66	$1,216.66	......
Central Radio Telegraph Co.	$1,198.60	291.08	552.05	$652.05
Globe Wireless, Ltd.	21,327.39	18,790.68	2,307.25	2,336.95
Mackay Radio & Telegraph Co., (Calif.)	76,032.57	77,276,14	[d]2,306.65	[d]15,991.17
Mackay Radio & Telegraph Co., Inc. (Del.)	68,761.48	127,383.33	[d]59,401.04	[d]87.652.64
Magnolia Radio Corp.	238.94	280.28	[d]148.50	[d]148.50
Michigan Wireless Telegraph Co.	79.68	285.53	[d]196.21	[d]196.21
R.C.A. Communications, Inc.	362,228.47	329,985.55	68,940.58	35.963.98
Radiomarine Corp. of America	75,398.04	61,755.53	14,732.99	11,435.20
Tidewater Wireless Telegraph Co.	325.40	367.21	[d]47.57	[d]47.57
Tropical Radio Telegraph Co.	78,270.38	48,366.84	35,896.38	34,244.38
U. S.-Liberia Radio Corp.	4,769.06	6,401.60	[d]2,090.20	[d]2,086.53
Total	688,630.01	672,400.43	59,455.74	[d]21,490.06
	For Twelve Months Ended with December, 1934			
Aeronautical Radio, Inc.	$52.69	$15,285.93	$15,233.24	......
Central Radio Telegraph Co.	7,596.53	6,588.42	[d]2,530.86	[d]$680.86
Globe Wireless, Ltd.[1]	136,188.42	133,307.10	1,276.42	1,078.20
Mackay Radio & Telegraph Co., (Calif.)	871,023.83	896,276.08	[d]45,225.82	[d]192.506.19
Mackay Radio & Telegraph Co., Inc., (Del.)	756,687.29	938,887.54	[d]188,758.55	[d]510,276.11
Magnolia Radio Corp.	2,481.40	3.752.80	[d]1,385.16	[d]1,385.16
Michigan Wireless Telegraph Co.	5,490.51	4,001.33	1,239.72	1,239.72
R.C.A. Communications, Inc.	4,194.373.68	3,595,428.51	842.711.01	546,782.61
Radiomarine Corp. of America	920.072.97	734,950.64	154,077.72	111,444.55
Tidewater Wireless Telegraph Co.[2]	2,173.82	2,189.40	[d]44.64	[d]44.64
Tropical Radio Telegraph Co.	534.136.43	559,190.61	13,528.99	1,538.40
U. S.-Liberia Radio Corp.	55,859.05	57,893.44	[d]4,629.69	[d]4,624.04
Total	7.486.136.62	6,947,751.80	785,492.38	[d]47.433.52

[d]Deficit or other reverse item.
[1]Started operations Apr. 20, 1934.
[2]Report for six months ended Dec. 31. 1934.

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATION AND BROADCAST FIELDS

BROADCASTING FROM THE FIELD

The Radio Transceiver Laboratories, 8627 115th St., Richmond Hill, N. Y., are offering a portable pack transmitter for the broadcasting of sport and field events from the scene of action. This organization specializes in the development of ultra-high-frequency equipment and has recently introduced compact transmitters and receivers of low and medium power.

Type PTR-19 is designed along the lines of the Type 19 Transceiver, which has supplanted the low-powered 30-33 combination where dependability is desired over short distances, it is said. Types 19 and PTR-19

employ three 19 twin triodes and have a carrier power of ten times that of the 30-33 combination.

The pack unit is not a transceiver, however, although it employs a 19 push-pull unity-coupled oscillator, a 19 Class B modulator and a 19 Class A driver as does the Type 19 transceiver. A separate one-tube super-regenerative receiver is incorporated for listening to cues from the pickup station or for two-way conversation. An additional stage of amplification is incorporated for the use of a double-button microphone. High-fidelity HA type UTC transformers are employed.

Type PTR-19 is equipped with plate-current meter, standard three-contact microphone receptacle, gain and mike current controls and filament rheostats. Three Burgess 5308 and two No. 6 dry cells are self-contained. Canvas case and leather carrying straps and handle are standard equipment. The entire unit weighs 35 pounds with batteries and telescoping 4- to 9-foot aluminum antenna.

Type PTR-19 operated from the announcer's back radiates signals of sufficient volume for rebroadcasting at practically any location within one mile. Greater distances depend on the topography. The receiver is said to pick up cues from ultra-high-frequency stations 25 miles distant.

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UTC VARITONE

The UTC Varitone is an audio device which permits control of the frequency response of any audio amplifier or receiver. Using this device tone correction can be effected for defects in accoustic conditions or overall audio response, it is said. It is also possible to produce new tonal effects from phonograph records or radio broadcasts. This device is made in three types, as follows:

The VT-1 is incorporated with a universal audio transformer. Two primaries are provided. One is suitable for working from a single or double-button microphone, a low-impedance pickup or a line. The other primary is designed to work out of the plate of a tube or from a high-impedance pickup. The secondary winding is center-tapped and is equally suitable for working into one or two grids.

The VT-2 is a varitone control unit incorporated with an impedance-matching device so that it can be connected directly across a 200 or 500-ohm line, low-impedance pickup or mike. It can also be used in shunt with the plate circuit of triode or a high-impedance pickup.

The VT-3 is a complete, self-contained unit which does not use external control. The components are adjusted so that 10 db equalization is effected at 80 and 7,000 cycles. This unit is connected directly from plate to B plus of first audio triode.

These units are manufactured by the United Transformer Corporation, 264-266 Canal Street, New York, N. Y.

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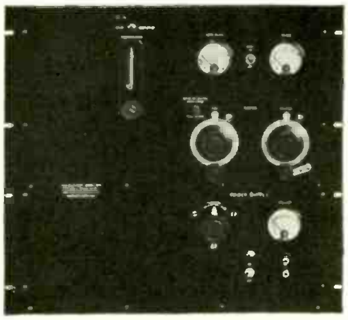
POLICE-FREQUENCY MONITOR

To meet the requirements of both the Federal Communications Commission and the operating personnel of police radio stations, the General Radio Company, 30 State Street, Cambridge, Mass., has developed the Type 475-A Frequency Monitor shown in the accompanying illustration.

This monitor consists essentially of a



piezo-electric quartz plate adjusted to the frequency of the station, an associated oscillator circuit, a heterodyne detector and an audio-frequency amplifier. The temperature of the quartz plate is maintained, within narrow limits, at a constant value by means of automatic temperature control. The oscillator has voltage stabilization to eliminate frequency changes due to line-voltage variations.

The output from the amplifier, with moderate coupling to the transmitter, is sufficient to operate a loudspeaker, it is stated. The presence of an audible beat note between the transmitter and the crystal oscillator indicates to the operating personnel that the transmitter has deviated from its assigned frequency.

The audio-frequency amplifier is resistance coupled to the detector circuit in order that satisfactory response at very low beat frequencies may be obtained. The internal output impedance of the amplifier is adjustable for either headset or loudspeaker monitoring.

The monitor is completely self-contained and ac operated. The only connections required are a 110-volt, 60-cycle ac supply source and a simple pickup lead near the transmitter.

Two pairs of terminals within the temperature-controlled box are provided for two Type 376-J or Type 376-K quartz plates. A control on the front of the panel selects either of the plates desired, in order that the unit may be used to monitor the transmitter alternately on either of two channels without delay.

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BRUSH PIEZO-ELECTRIC HEADPHONES

The Brush Development Company, Cleveland, Ohio, have recently announced their Type A piezo-electric headphones. These are high-impedance units that are said to possess high current sensitivity

and to find ready application in a wide variety of uses, being especially well adapted for monitoring work.

The piezo-electric drivers used in these Brush headphones are bimorph elements of typical Brush assembly. Plates used in the bimorph elements are cut from Rochelle Salt crystals, in accordance with the methods developed by Brush technicians. In standard Type A headphones the two plates in the bimorph element are 5/8 inch square by 0.010 inch thick. They are cemented together in opposition and provided with silver electrodes. The unit is then water-proofed. Three corners of the bimorph element are cemented to thin rubber pads and secured in the case . . . leaving the fourth corner disengaged.

ALSIMAG PARTS

Alsimag is a ceramic composition of practically pure Steatite. The name is coined from the principal alloying constituents. It was designed for the radio and electrical-apparatus fields because of its characteristics as an insulator body.

Dielectric strength at room temperature is 200 volts per mil in a disc ¼-inch thick. As temperature increases it remains an excellent insulator long after other materials have broken down, it is stated. Dielectric constant is 5.2, power factor .22, and loss factor 1.14.

The manufacturer asserts that in physical strength it is superior to any other ceramic material, having a modulus of rupture as tested on cylinders 1⅛ inches in diameter and 6 inches long of 18,600 pounds per square inch. Porosity test shows less than .02 percent absorption. It has compressive strength of 79,000 pounds to the square inch. Co-efficient of thermal expansion at 20 degrees is 6.37×10^{-6}. A hardness equivalent of 8-8½ makes it exceedingly resistant to wear or abrasion. In the green state the material can be machined by the manufacturer, turned, threaded or shaped in much the same manner as metal and with great accuracy. Tubes or rods are extruded in various shapes and sizes, while other parts are pressed to shape on automatic presses.

Extruded parts at present are limited to 3 inches in diameter and inasmuch as turned parts are made from extruded blanks, these also are limited to that diameter, while length may be considerably more. Pressed parts are limited to about 3 inches in diameter and may be up to 1 inch in thickness.

It is used extensively in electric appliances, especially where heat is a factor, in radio sets and broadcasting equipment and in vacuum tubes for broadcasting use.

Alsimag parts are manufactured by The American Lava Corporation, Chattanooga, Tenn.

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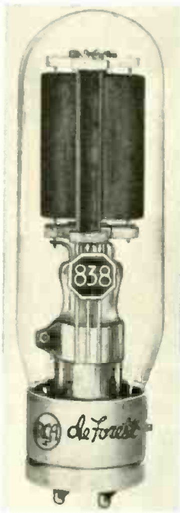
THE NEW RCA-838

The RCA Radiotron Company's new Type 838 tube is shown in the accompanying illustration. This tube may be used as a Class B modulator or audio-frequency amplifier, as a Class B radio-frequency amplifier, as a plate-modulated Class C radio-frequency amplifier, and as a Class C r-f amplifier for telegraph service.



The RCA-838 is a three-electrode type of tube designed primarily for use as a zero-bias Class B audio-frequency power amplifier. The grid is designed so that the amplification factor of the tube varies with the amplitude of the input signal. This feature facilitates the design of Class B amplifiers to give high output with low distortion. In Class B audio service two of these tubes are capable of giving an output of 260 watts with less than 5 percent distortion. The 838 may also be used as a radio-frequency power amplifier and oscillator at maximum ratings for frequencies as high as 30,000 kc. For any class of service, the maximum plate dissipation of the RCA-838 is 100 watts.

●

EISLER AIR-OPERATED ELECTRIC SPOT WELDERS

Electric Spot Welders which utilize air pressure for closing the electrodes upon the work have recently been developed by Charles Eisler of the Eisler Engineering Co., 768 So. 13 St., Newark, N. J.

These air-operated types are the latest addition to the line of foot-operated and motor-driven welders manufactured by the above company.

Available in sizes from five to seventy-five kva and capable of welding metals up to .750" in thickness, these new air-operated welders, because of the particular design of the air cylinder, require a very small volume of air for their efficient and economical operation. Air pressures up to 80 pounds are used; the pressure depending upon the size of welder used.

INDEX OF ADVERTISERS

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

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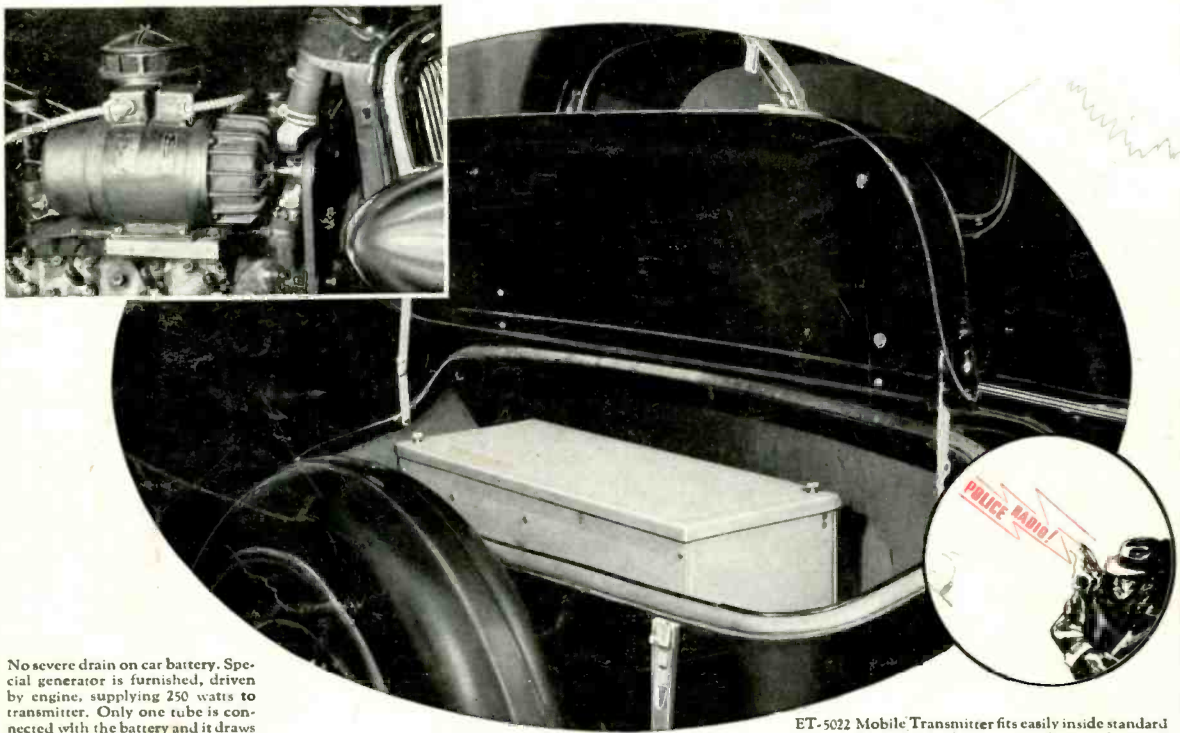
RCA Makes Another Great Contribution to Crime Control



No severe drain on car battery. Special generator is furnished, driven by engine, supplying 250 watts to transmitter. Only one tube is connected with the battery and it draws less current than a headlight. Tubes are easily replaced and are standard types obtainable anywhere.

ET-5022 Mobile Transmitter fits easily inside standard rear trunks. May also be located within car if desired. Self-contained in strong but light aluminum case, mounted on shock absorbers. Total weight about 60 lbs.

Adds 2-way communication to Terra-Wave Police Radio System

Here is the biggest news since the introduction of the famous RCA Terra-Wave Police Radio! Now your patrol cars can be equipped for 2-way radio communication, easily doubling the effectiveness of the system. Cars using the new RCA Terra-Wave Mobile Transmitter can call headquarters by radio to transmit important information, acknowledge orders, answer questions, ask for help, advise when returning to service. Within 3 seconds after pressing a switch, every word spoken by the driver is heard by the despatcher. There is no interruption of work on the immediate emergency.

Several years of intensive research went into this remarkable development. It had to be 100% right before it was worthy to bear the RCA Terra-Wave name. Power is 25 watts actually put on the air, the highest ever offered for such use. Our tests prove conclusively that this much power must be used if complete reliability is to be had—and nothing less than absolute reliability is good enough for police use.

The transmitter is compact, simple to operate and so sturdy that only a major collision can injure it. No changes are required in your present RCA Terra-Wave equipment. The 2-way feature is obtained merely by installing the new transmitter in each of your cars. Write for complete details and specifications of this second great RCA contribution to the speed and efficiency with which your department controls crime.

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