

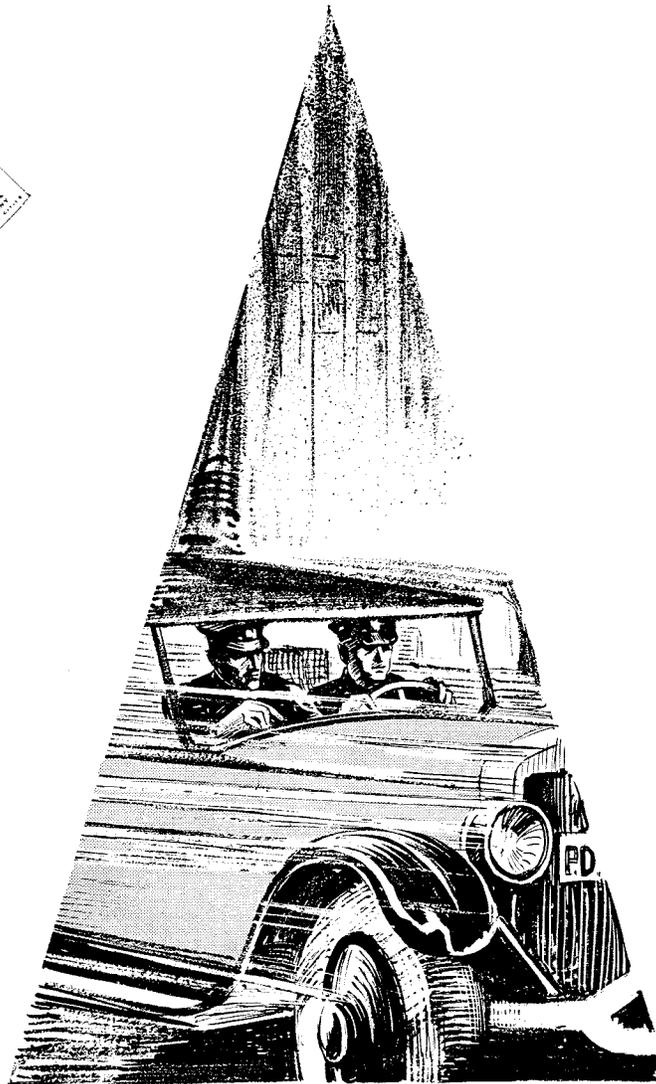
# POLICE RADIO TELEPHONE EQUIPMENT



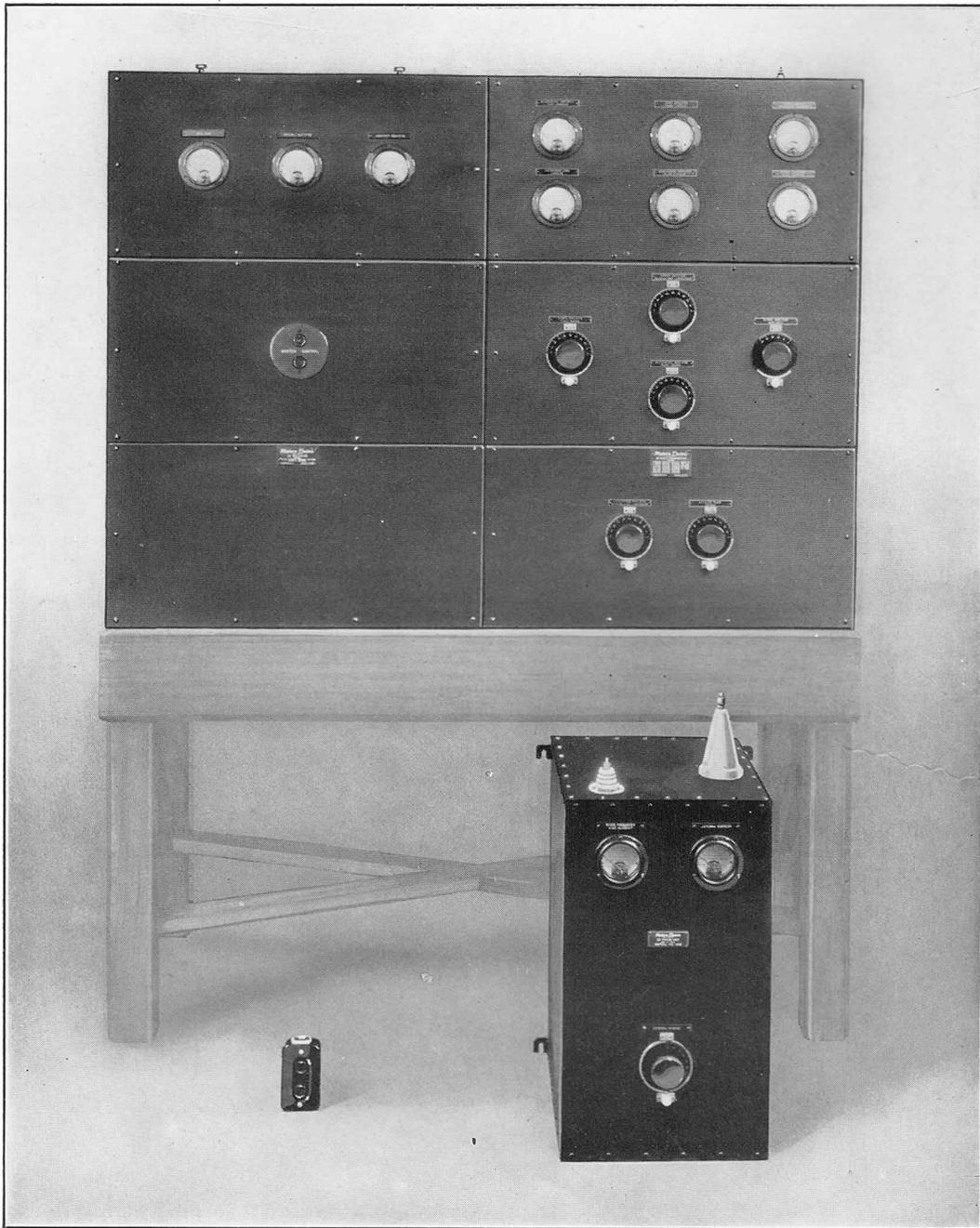
*Western Electric*



# *Western Electric* Police Radio Telephone Equipment



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#### **400 Watt Radio Transmitter and Associated Apparatus**

The transmitter is a compact and comparatively small unit, measuring overall only 3' 4" in height, 2' 1" in width and 2' in depth, and weighing only 200 pounds. A clearance of 2 feet is required to open the rear door.

The rectifier or power unit is practically the same size as the transmitter. Its dimensions are 3' 2 $\frac{3}{4}$ " high, 2' 1 $\frac{3}{8}$ " wide and 1' 11 $\frac{1}{2}$ " deep. The weight is 600 pounds.

The antenna tuning unit measures overall 2' 3 $\frac{1}{2}$ " in height, 1' 3 $\frac{3}{4}$ " in width and 1' 2" in depth.

*Western Electric*



# *Western Electric*

## Police Radio Telephone Equipment

**A development of Bell Telephone Laboratories, Incorporated,  
the research laboratories of the American Telephone and  
Telegraph Company, and the Western Electric Company**



RADIO now is used for the capture of criminals—and another service to society is added to the many already credited to this most modern method of communication. Because criminals are quick to adopt any development of science and engineering which will aid them in their work, police must combat lawlessness with apparatus and methods equal to or better than those used by the lawbreakers.

Western Electric Radio Telephone Equipment, as a weapon for the further suppression of crime, offers many possibilities. The use of radio by the police will inspire considerable fear, even superstition, in many criminal minds due to the rapidity with which radio enables the police to cope with lawless activities.

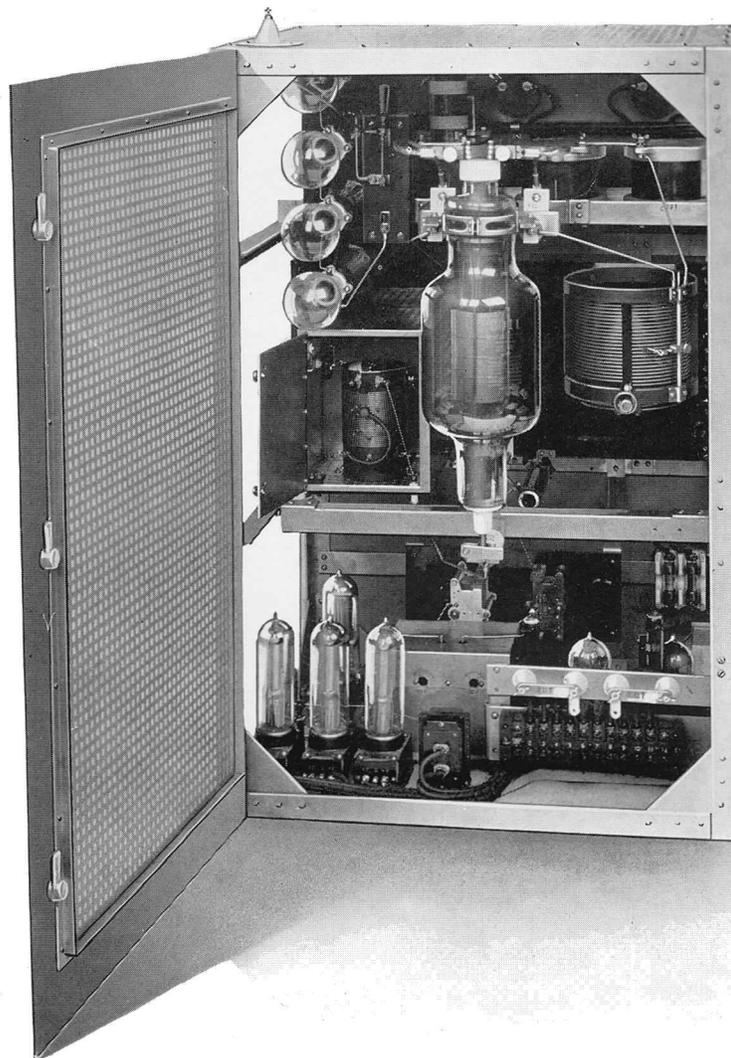
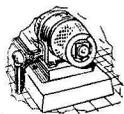
Radio transmission is instantaneous. Information which is broadcast from headquarters is received immediately by those of the police force provided with receiving sets and all officers receive the information at the same time. With time and numbers against him, the chances that the lawbreaker will escape are lessened.

Radio not only saves time in catching criminals but also makes it possible to catch them while actually committing crimes.

### **Improves Service**

Radio affords one of the finest means of improving the service of the police department. In those cities where transmitters have been installed and cars equipped with receivers, tests under actual conditions have proved this fact conclusively. By means of radio, districts which before gave infinite trouble have been controlled quickly.

Recently a group of thieves attempted to loot a bank. An employee operated an alarm system which notified police headquarters and the information was broadcast to cruising



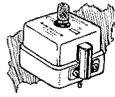
Interior view of the 400 Watt Radio Transmitter

cars. So quick was the response that the robbers scarcely had time to reach their car which stood at the entrance to the bank before the police arrived on the scene.

While this response may seem exceptional, the average time consumed in one city between report and response was found to be only 59 seconds.

### **Many Applications**

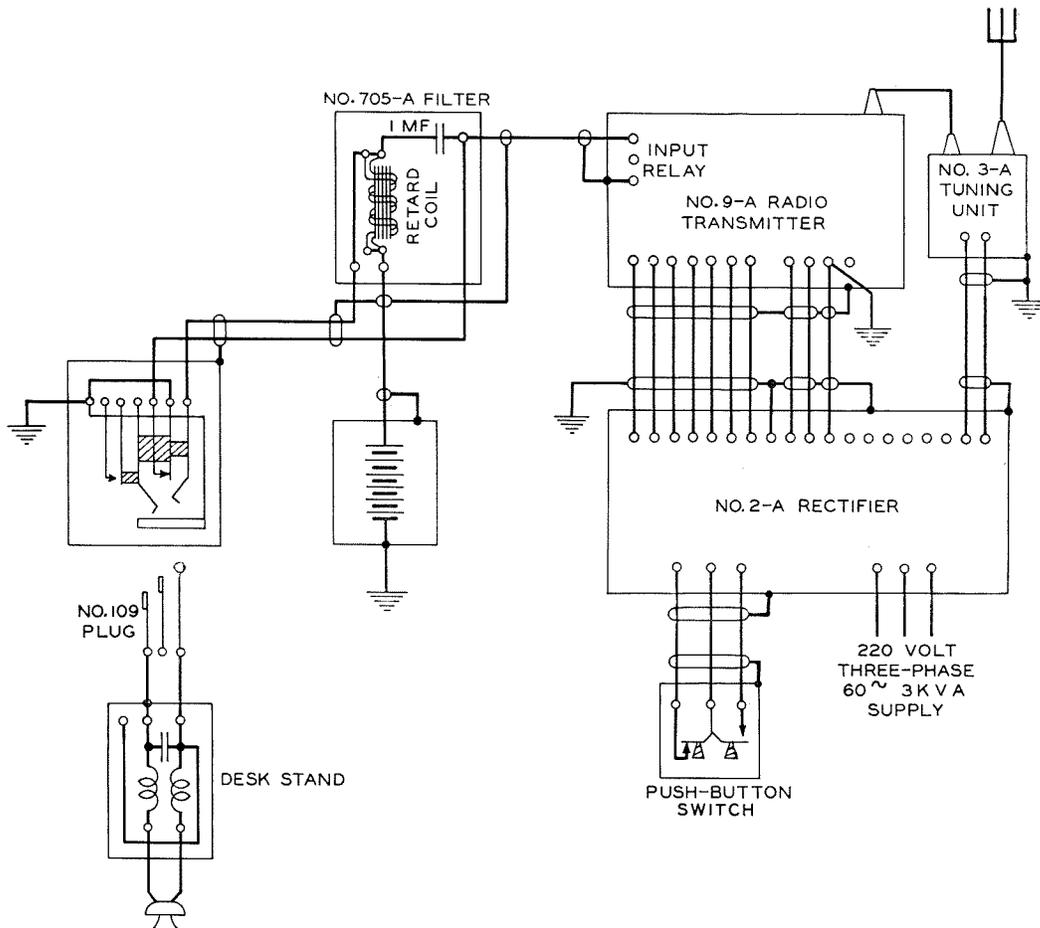
Not only will Western Electric Police Radio Equipment aid in apprehending criminals, but it will also prove of material assistance in other branches of police activity. Cruising cars may be directed quickly to the scene of a fire, accident, riot or other



disturbance. By the same means, descriptions of escaping criminals may be broadcast, making it possible to intercept them in their flight. Forces may be concentrated or by directing information to certain cars a definite beat may be patrolled or a single station assigned some particular duty.

### Quality Construction

Design, dependability in operation, quality of workmanship and material are assured by the same rigid requirements that characterize all the products of the Western Electric Company, as manufacturer of the nation's telephones and other communication equipment for more than half a century.



Typical installation diagram of 400 Watt Radio Transmitter with its associated Rectifier and Antenna Tuning Unit

### Transmitters have Distinctive Features

Either of two transmitters is recommended for installation at police headquarters or other location selected for the purpose. One is the Western Electric 1000 watt trans-



mitter, similar to that used by many up-to-date broadcasting stations. The other is the Western Electric 400 watt transmitter, similar to the transmitter used in aircraft communication. The reliability of the 400 watt transmitter is attested by the large number of air transport companies which have selected Western Electric airport equipment.

### **Low Operation and Maintenance Costs**

Western Electric Police Radio Telephone Equipment is designed to operate at maximum efficiency and low cost. The cost of maintenance is relatively small and the need for replacements is almost negligible.

### **One Hundred Per Cent. Modulation**

Western Electric radio transmitters are designed for one hundred per cent. modulation. As a result, the capacity for performance of all radio transmitters manufactured by this company is much greater than the specified carrier ratings may indicate. For example: With 100 per cent. modulation, which gives a maximum signal from a given carrier, the peaks of power output from the 400 watt transmitter are 1600 watts, while those from the 1000 watt transmitter are 4000 watts.

### **Crystal Control**

Crystal control is used to maintain frequency stability. This control eliminates adjustment of the frequency by the station operator and assures closer adherence to the frequency assigned to the station than can be attained even under the most favorable conditions of manual control.



This Crystal Control unit is used to maintain frequency stability in the 400 Watt Transmitter

The crystals are housed in individual, insulated containers. These containers are electrically heated and thermostatically controlled to maintain the constant temperature necessary for operation at the desired frequency.



### **Ventilation and Safety Devices**

All apparatus is designed to permit the free circulation of air. Every modern method is used to prevent members of the personnel coming into contact with high voltages. Safety devices automatically shut off all power before internal adjustments may be made.

## **400 Watt Radio Transmitter and Associated Apparatus**

Associated with the 400 watt transmitter is a rectifier which supplies plate and filament voltages and a tuning unit for coupling into the antenna.

### **Frequency Range**

The transmitter is designed to operate within the range of 1500 to 6000 kilocycles (50 to 200 meters).

### **Frequency Stability**

Frequency stability, within the limits assigned by the Federal Radio Commission, is maintained easily by the use of the temperature controlled quartz crystal oscillator.

### **Circuit Characteristics.**

The transmitter employs a crystal controlled oscillator, frequency doubler, modulating amplifier, power amplifier and an audio amplifier which produces 100% modulation on the plate of the modulating amplifier.

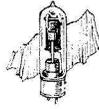
A 5 watt Western Electric vacuum tube is employed in the oscillator. This tube is controlled in the grid circuit by a quartz crystal operated at one-half the desired frequency. A second 5 watt vacuum tube with a high negative bias is used to produce harmonics. The second harmonic is selected in the plate circuit of this tube and impressed on the grid of the 50 watt Western Electric modulating amplifier tube. Modulation is produced in the plate of this latter tube by the output of the audio frequency amplifier which is connected through an impedance matching transformer. The audio frequency amplifier uses three 50 watt Western Electric vacuum tubes connected in parallel.

The radio frequency power amplifier employs a single air cooled Western Electric vacuum tube, the plate potential of which is 2500 volts.

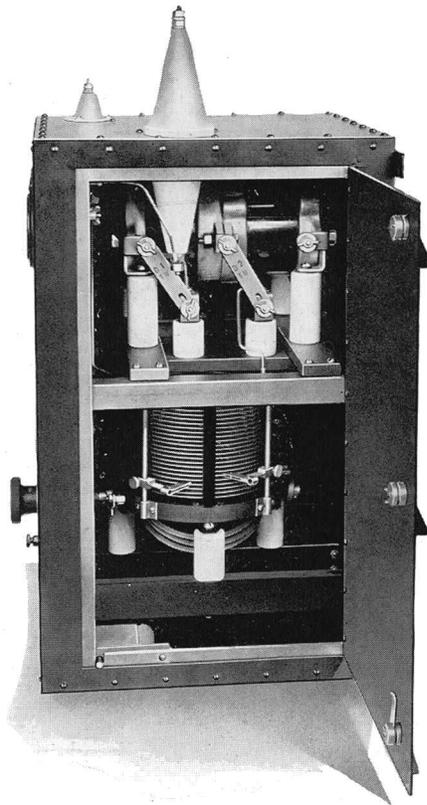
The transmitter may be tested by means of an artificial load resistance which replaces the transmission line between the transmitter and the antenna tuning unit, when the test is made.

### **Construction of the Cabinet**

The top, sides and back are of metal grill work to provide ventilation. The back is



hinged to permit ready access to all tubes and other associated apparatus. The rear door is provided with a switch which automatically shuts off power to the transmitter as soon as the door is opened.



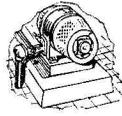
Open view of the Antenna Tuning Unit

### **Antenna Tuning Unit**

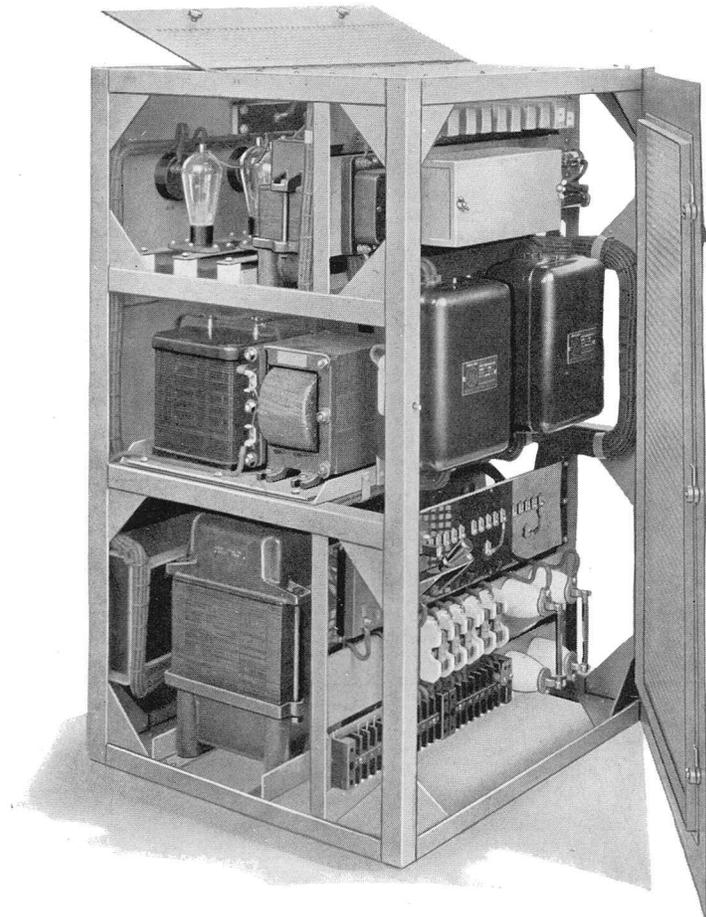
The tuning unit should be installed at the antenna, although the transmitter may be placed in a broadcasting room or other convenient place. It is recommended that the distance between the transmitter and the tuning unit not exceed 200 feet. This unit is provided with a door which when opened makes the component apparatus accessible. A switch shuts off power as soon as the door is opened.

### **Power Supply Unit**

This unit consists of two three-phase rectifiers, one single phase rectifier and a transformer. It is designed to operate from 220-volt, three-phase, 60-cycle mains and to supply potentials of 2500, 1000, 200 and 55 volts D.C. and 10 volts A.C. required to operate the transmitter.



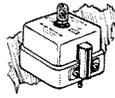
Seven Western Electric low voltage, mercury vapor rectifier tubes are used. These tubes are dependable and long lived and aid in the reduction of operating costs.



View of Rectifier with sides removed to show interior arrangement

The front panel of the unit has three meters: "grid bias", "1000 volt-rectifier" and "2500-volt rectifier." These meters are used for indicating the grid bias voltage, low voltage plate supply and high voltage plate supply respectively. A master control "stop-start" switch is also located on the front panel. If desired, another switch may be connected in parallel with the switch on the front of the rectifier, and remotely located. This arrangement permits the rectifier to be turned on and off from an office or other convenient location.

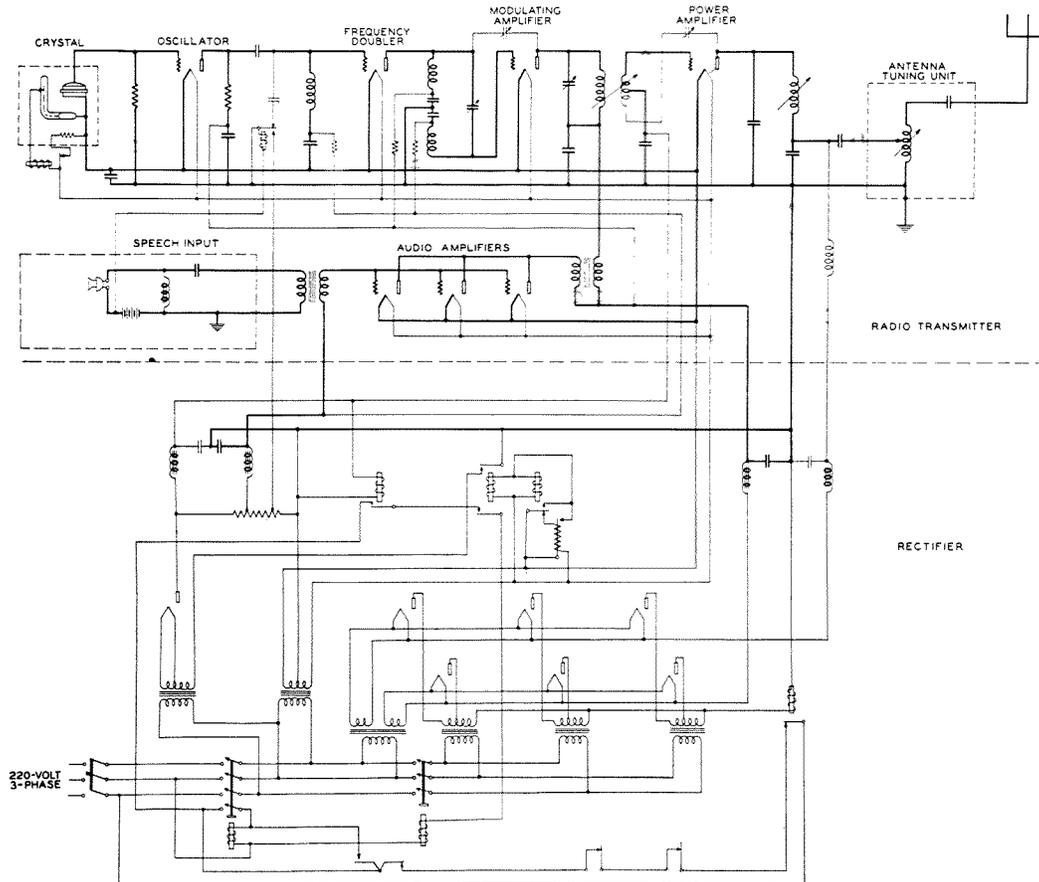
The top, sides and back of the rectifier are of metal grill work to provide necessary ventilation.



A section of the top cover is hinged so that the vacuum tubes are easily accessible. The entire back is hinged, giving access to the three-phase main disconnect switch, all fuses and relays. The power supply unit like the other equipment, is constructed to prevent operators making contact with high voltage. The back and top doors are provided with switches. These automatically shut off all power as soon as either door is opened. A clearance of 9 inches is required to open the top door and 2 feet to open the back door.

### Simplicity of Operation

This Western Electric Radio Transmitter and associated apparatus are so designed and constructed that trained operators are not required. The lack of complicated control devices makes it possible for members of the regular personnel to operate the transmitter with but few instructions.



Schematic circuit of the 400 Watt Radio Transmitter, Rectifier and Antenna Tuning Unit



## 1000 Watt Radio Transmitter

The Western Electric 1000 watt transmitter is designed for long range work and is recommended when unusually large territories are to be covered. It incorporates many of the features of Western Electric high power equipments used for commercial broadcasting and is designed to operate at the frequencies assigned for police work by the Federal Radio Commission.

### General Description

Two units or panels each measuring 6' 9 $\frac{5}{8}$ " in height, 2' 8" in width and 2' 3 $\frac{1}{2}$ " in depth comprise the 1000 watt transmitter. The first is called the oscillator unit, the second the amplifier unit. All instruments and controls are mounted on "dead-front" panels and located so as to be most convenient for the operator. The apparatus is assembled compactly and the complete equipment when installed presents an attractive appearance.

### Tubes Used

#### *Oscillator Unit*

3 248-A (50 watt)  
2 102-E

#### *Amplifier Unit*

1 248-A (50 watt)  
2 212-D (250 watt)  
1 228-A (5 kilowatt)  
1 205-D (used for monitoring)

Western Electric tubes are noted for their long life. Although tubes are guaranteed for 1000 operating hours, experience indicates that from 2000 to 2500 hours will frequently be obtained. This feature is obviously most important to anyone interested in decreasing operating cost.

### Crystal Control Facilities

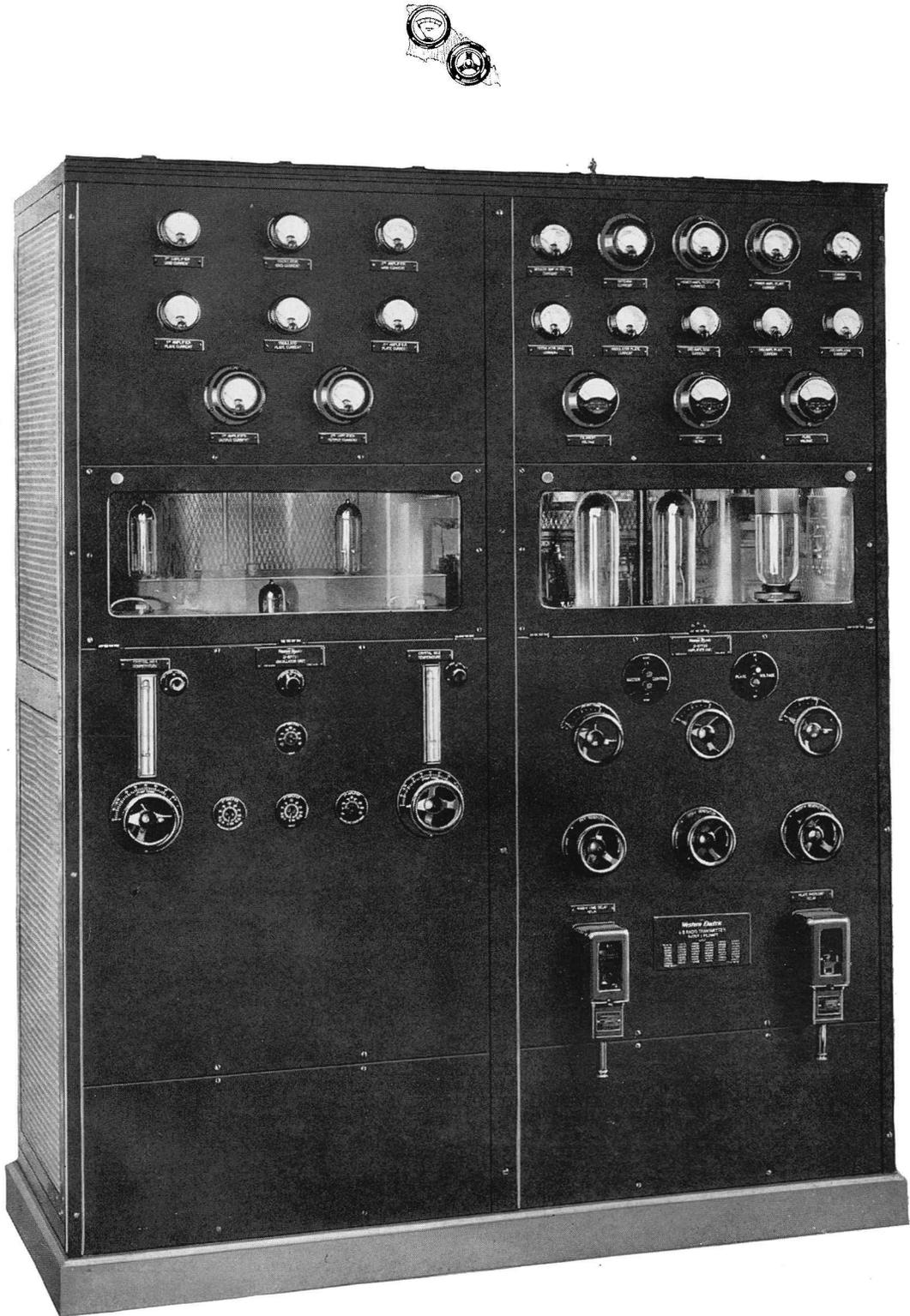
The crystal control facilities provided in this transmitter have been developed to such an efficient degree that a carrier frequency well within the limits assigned by the Federal Radio Commission is easily maintained.

This precision is accomplished by the crystal controlled oscillator, located in the oscillator unit.

To provide for emergencies, a second crystal (an exact duplicate of the first), complete with container, thermostat control and heater is included. It is possible to switch from one crystal to the other while the transmitter is in operation.

### Harmonic Suppression

Connection between the power amplifier and the antenna is made by means of a special double tuned circuit. A condenser of relatively large capacity acts as the

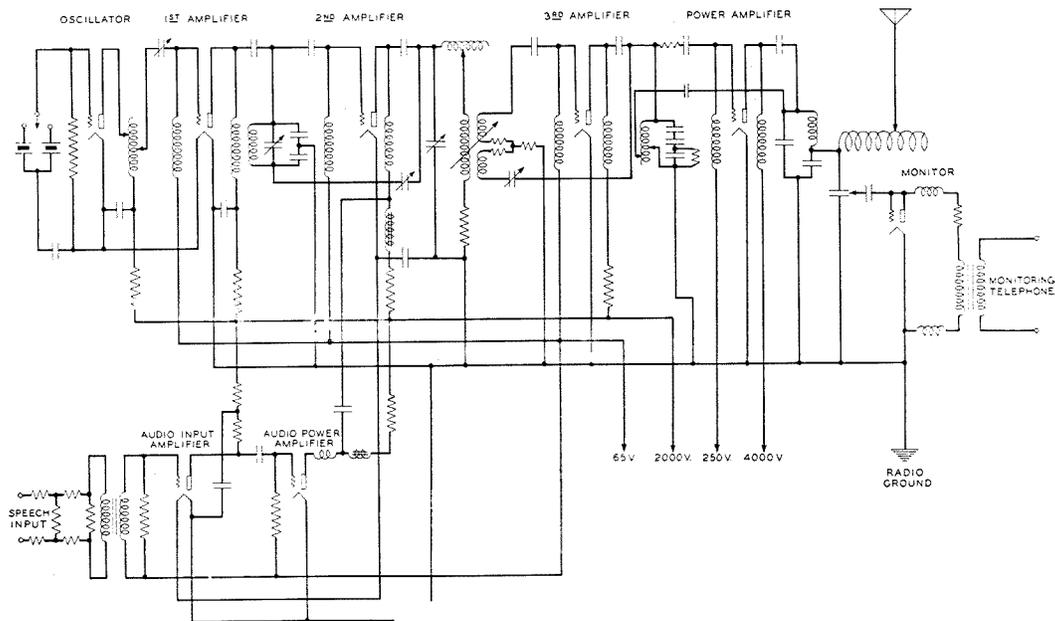


### The 1000 Watt Radio Transmitter

It consists of an Oscillator Unit and an Amplifier Unit. This equipment is designed for long range work and closely resembles the high power apparatus used for commercial broadcasting

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*Western Electric*



Schematic circuit of the 1000 Watt Radio Transmitter

coupling to the antenna. This arrangement effectively suppresses the harmonics of the carrier frequency before they reach the antenna.

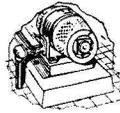
### Precautions Against Disruption of Service

Protective devices eliminate the possibility of damage from circuit overloads, partial or complete failure of the cooling system, failure of the grid bias voltage and other possible service interruptions.

### Safety Features

Ample protection against contact with high voltages is provided. Both the oscillator and amplifier panels are "dead-front." Contact with high voltages anywhere on the panels or through the instruments mounted on them is impossible. The panels are provided with plate glass windows behind which the tubes are located. Should it be necessary to open a window, a control circuit automatically shuts down the transmitter. The windows make the tubes easily accessible for replacements while safety features eliminate all danger of accidental contact with high voltage.

The equipment behind the panels is entirely enclosed. It is impossible to reach operating equipment except through mesh doors at the back. These doors when opened

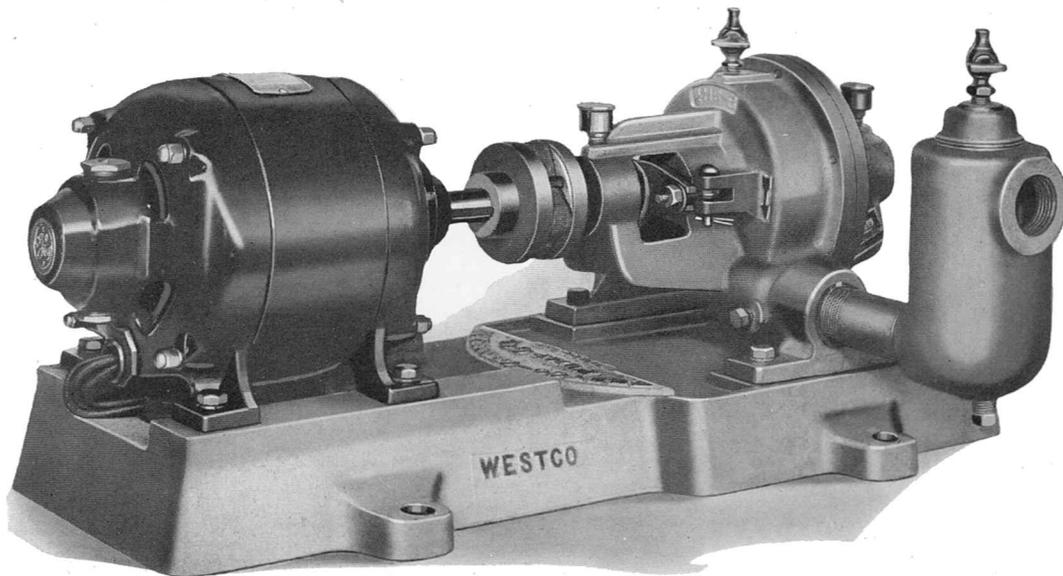


make all parts easily accessible. When either door is opened a switch in the control circuit is automatically opened and the whole system is shut down. The transmitter cannot be started without first closing the windows in the panels and the doors at the back.

### **Simplicity of Control**

Instead of a manual system involving a number of switches a single master control button is used to start operation. As soon as contact is made with the master control button the control system is energized. Time delay relays automatically apply the voltages in the proper sequence.

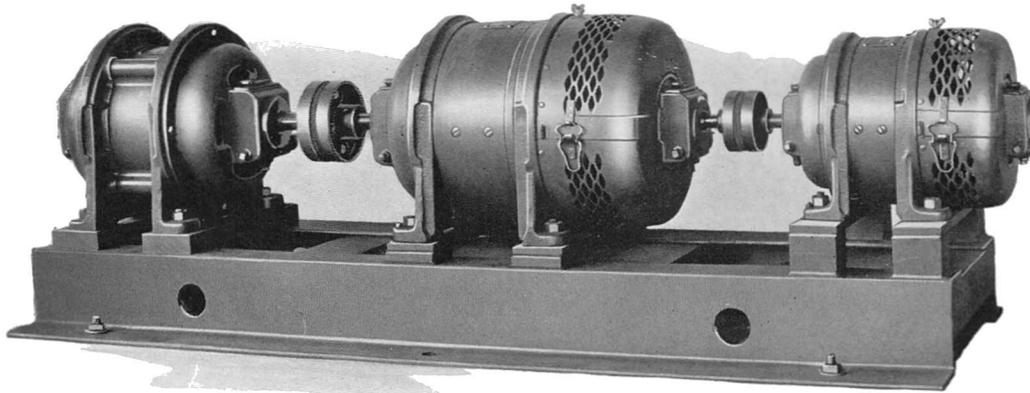
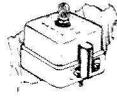
This procedure is not only less subject to error than the manual system but is more rapid and also guards against damage to equipment due to failure of any part to operate. With this system, failure to apply the power in the proper sequence cannot occur.



### **Cooling System**

A complete water cooling system is furnished for the water-cooled vacuum tube of the power amplifier unit. This consists of an electrically driven water circulating pump, a radiator of ample radiation capacity and an expansion tank .

Water is pumped through rubber tubing to the jacket of the tube and then through the radiator. Constant circulation through the radiator assures proper temperature of the water for cooling purposes.

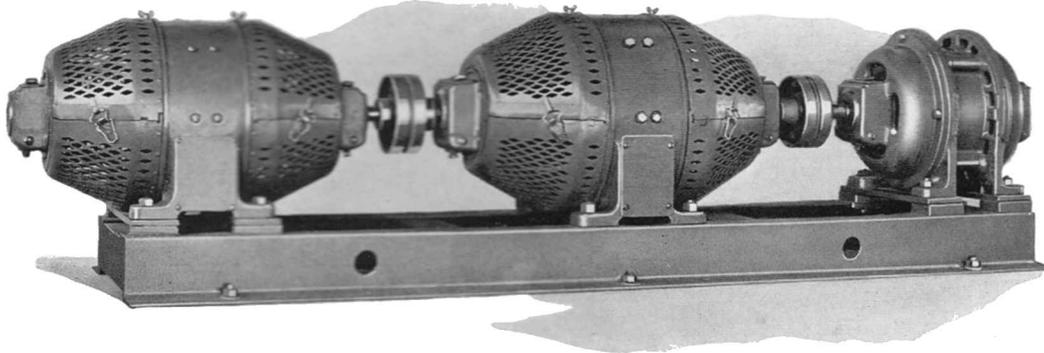


### Power Equipment

Motor generator sets provide the power supply for the transmitter. One set consists of a 24-volt generator for filament supply and a 250-volt generator for grid voltage supply and excitation of the high voltage machines. Both generators are mounted on the same base with a 4-HP driving motor. The other motor generator set consists of two 2000-volt generators driven by an 8-HP motor. One of these generators furnishes current at 2000 volts to the plate circuit of the radiation cooled tubes.

The plate circuit of the water-cooled tube is supplied at 4000 volts from the two 2000-volt generators connected in series. The equipment can be furnished to operate from a power supply of either 220 to 240 volts, 3-phase, 50 or 60-cycle, alternating current or 110 to 120 or 220 to 240 volts direct current. The question of operation from other power sources should be referred to the nearest Western Electric distributor.

The automatic motor starters for both motor generators operate on the impulses of the starting and stopping push buttons. These automatic motor starters together with a safety type line switch and the fuses for the driving motors are designed to mount on a wall contiguous to the motor generator sets. The starters, safety switch and fuses are enclosed in black steel cabinets of convenient size.





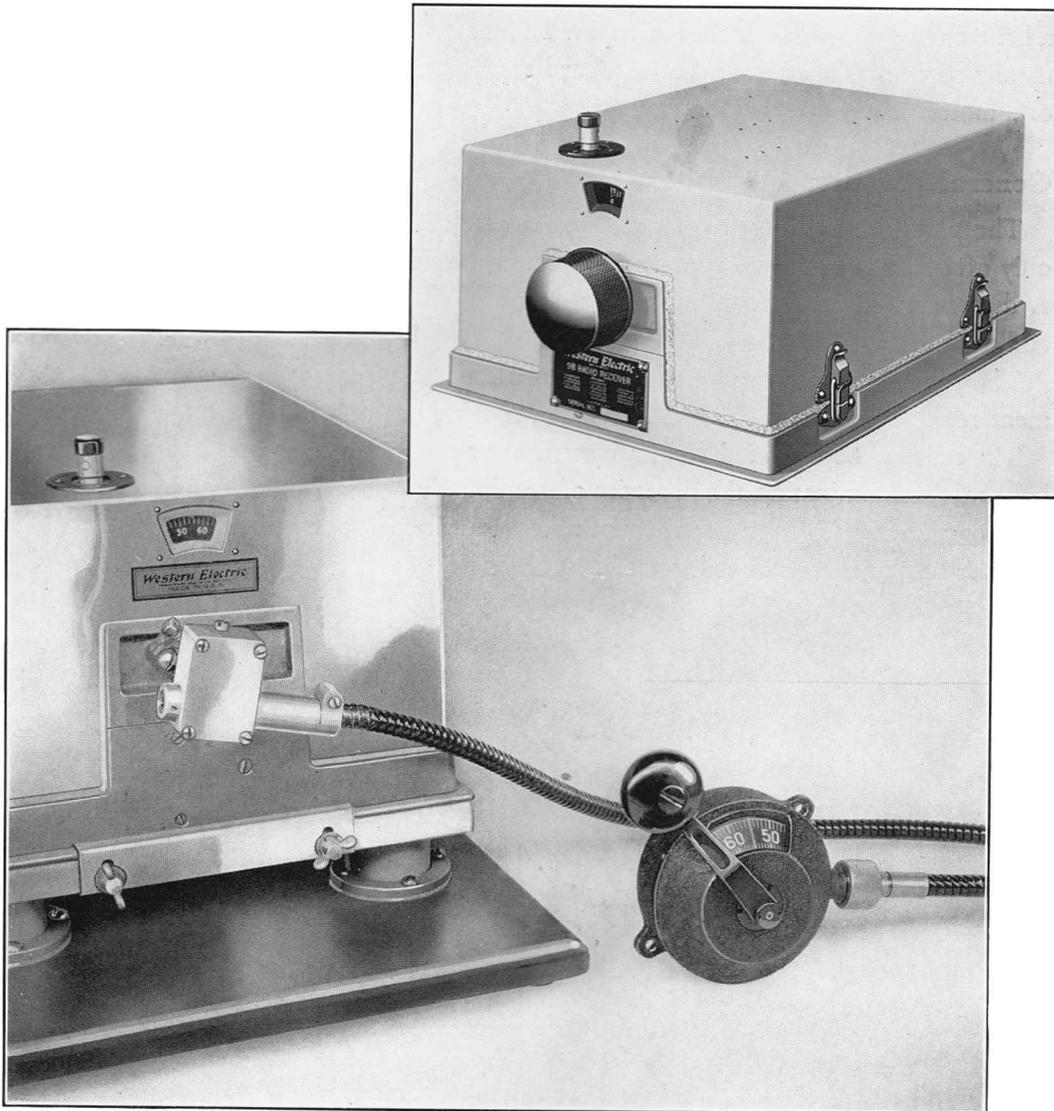
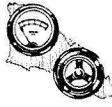
One desk stand type microphone is furnished with the equipment. Flexibility is obtained by installing additional microphones at convenient places

## **Speech Input Equipment**

Western Electric microphones are famed for their efficiency and have been accepted as standard the world over.

The microphone furnished with this equipment may be installed anywhere within a thousand feet of the radio transmitter. This distance may be increased by using an amplifier in conjunction with the microphone. The use of an amplifier increases the strength of the signal delivered to the radio transmitter, thus insuring the proper level for broadcast.

While only one microphone is furnished, flexibility may be obtained by installing additional microphones at convenient places.



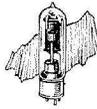
The Western Electric Short Wave Radio Receiver is small and compact. It is built to give dependable service under the most severe conditions. Either remote or local tuning control may be used

### **Short Wave Radio Receiver**

The Western Electric Short Wave Radio Receiver is designed especially for use with the transmitters described.

#### **Portability**

This receiver is small in size, measuring ten inches in width, six inches in height and



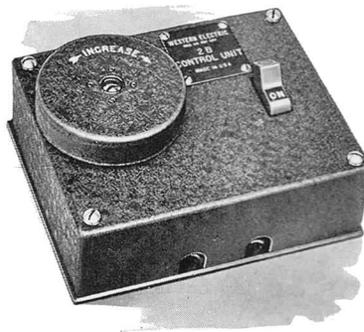
a little more than twelve inches in depth. The set, complete with tubes, weighs approximately seventeen pounds. It can be placed easily in a small car or even in the side car of a motorcycle.

### General Features

The parts are assembled compactly on a cast aluminum chassis and were selected only after the most severe tests had indicated their suitability for this type of service. A duralumin cover encloses the whole, so as to afford complete protection from dirt and moisture.

The rugged construction of the set assures long and satisfactory service. The equipment requires no attention as it is seldom, if ever, out of adjustment.

The set may be operated from a dynamotor operated in conjunction with a storage battery, thus eliminating the necessity of continually replacing "B" batteries. This feature, combined with long life vacuum tubes, contributes to low maintenance cost. The receiver has an output impedance of 250 ohms.

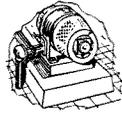


This unit is a combination of the remote volume control, the jack and the switch for turning the power on and off.

### Tuning Facilities

Either a knob provided on the face of the receiver or a remote tuning unit may be used for tuning. When remote tuning is desired the tuning unit is installed on the dashboard of a car or in some other convenient place while the receiver is placed anywhere in the car as desired.

As a rule it will be necessary to receive messages broadcast from one transmitter only. Where this procedure is followed the receiver is tuned to the same frequency as the transmitter and then locked at that setting.



### **Amplifying Facilities**

Amplification is controlled by means of a volume control unit. Usually this is installed adjacent to the receiver, although any location may be selected.

This unit contains the switch for turning the power on and off and a jack for connecting a loud speaker or headset to the output of the receiver.

### **Vacuum Tubes**

Five Western Electric vacuum tubes are used. Three are radio frequency amplifier tubes. The fourth is a space charge grid detector and the fifth is an audio frequency amplifier.

The tube elements are solidly supported so as to make the tubes non-microphonic and not susceptible to external mechanical jars.

The long life of these tubes makes frequent replacements unnecessary and eliminates the usual large expenditure of money for this purpose.

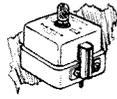
### **Resilient Mounting**

A resilient mounting, specially designed for use with the receiver acts as a shock absorber and protects the set from mechanical strain caused by vibration.

The mounting is intended for permanent installation. Wing nuts and clamps hold the receiver securely, and permit it to be quickly removed from the mounting whenever occasion demands.

### **Additional Information Furnished**

Requests for further information should be sent to any Western Electric distributor whose name is given on the last page of this bulletin.



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ELECTRIC COMPANY

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