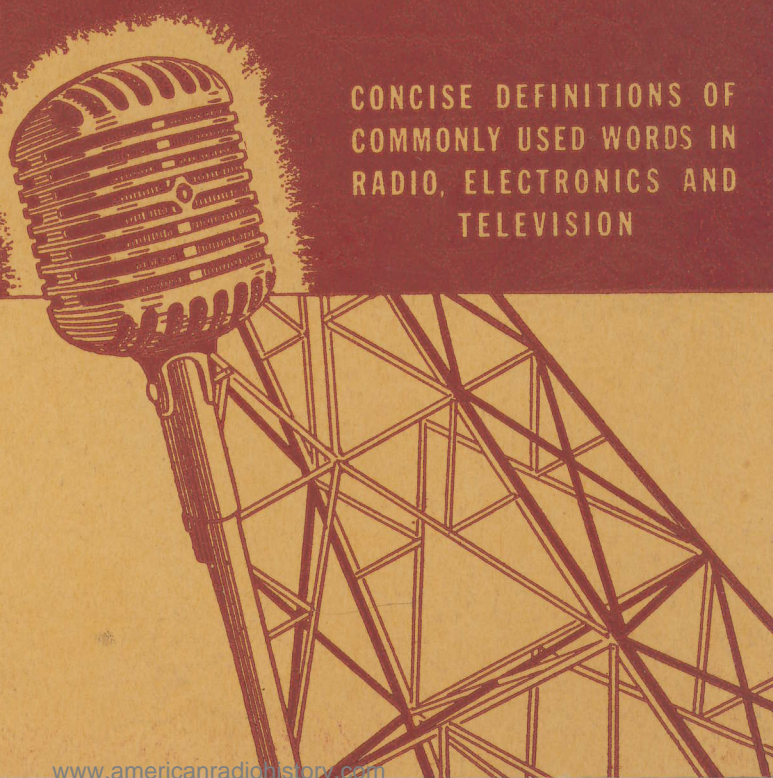




**A DICTIONARY OF**

**RADIO  
TERMS**



**CONCISE DEFINITIONS OF  
COMMONLY USED WORDS IN  
RADIO, ELECTRONICS AND  
TELEVISION**

# HISTORIC RADIO DATES ★ ★ ★ ★

- ★1883 Edison demonstrated that an electric current could pass between a heated filament and a cold plate in a vacuum.
- ★1886 Hertz proved that electromagnetic waves could be sent through space.
- ★1895 Marconi sent and received wireless signals in Italy.
- ★1901 Marconi received at Newfoundland the letter S transmitted from Poldhu, England.
- ★1904 Fleming invented the diode vacuum tube detector.
- ★1906 Lee de Forest invented the audion, a triode tube.
- ★1912 Saving of 705 lives after Titanic disaster proved value of wireless at sea. De Forest invented regenerative circuit.
- ★1915 First radiotelephone communication between Arlington, Va. and Paris, France.
- ★1920 Regular radio broadcasting begins with sending of Harding-Cox election returns by KDKA, Pittsburgh.
- ★1921 Practical horn loudspeakers were developed.
- ★1922 Superheterodyne demonstrated by inventor E. H. Armstrong.
- ★1923 Hazeltine announces his invention of the neutrodyne circuit.
- ★1925 Heater-type vacuum tubes make possible the first all-electric receivers. Dynamic loudspeakers appear.
- ★1926 Dirigible Norge broadcasts from North Pole.
- ★1927 Single-dial tuning featured on radio receivers.
- ★1929 Screen grid tubes developed; pentodes one year later.
- ★1934 WLW in Cincinnati increases power to 500,000 watts.
- ★1935 Frequency modulation system of broadcasting demonstrated by E. H. Armstrong.
- ★1936 Regular television broadcasts begin in London.
- ★1938 Regular television broadcasts begin in New York.
- ★1940 Frequency modulation broadcasting begins.
- ★1942 Radio production for civilian use stopped by order of the War Production Board to divert vital materials for military purposes. Huge radio training program started.
- ★1943 Radar and its use as a detection and range finding device first announced to the public.
- ★1944 Radar, radio communication and electronics play vital part in Allied land, sea and air victories.

# A DICTIONARY OF RADIO TERMS

☆

Concise Definitions of commonly  
used words in Radio, Electronics  
and Television

★

Compiled under the direction of  
the Technical Staff of  
Allied Radio Corp.

★

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# FOREWORD

The need of simple explanations of commonly used radio terms has existed ever since there has been general public interest in radio. This need has especially been made evident from thousands of letters handled annually by the Technical Staff of the *Allied Radio Corporation*. *Allied* has, therefore, made this dictionary available to speed the progress of radio beginners, experimenters and students and to serve as a reference to advanced radio men who seek to refresh their memories on precise meanings of the more technical radio terms.

This booklet contains simple, easy-to-understand definitions of approximately 800 radio terms and abbreviations most likely to be encountered in magazine articles, books and lectures on radio and its allied fields of electronics, television and facsimile broadcasting.

Schematic symbols, tips on reading circuit diagrams, instructions for using the R.M.A. Color Code, and other useful radio data are grouped at the end of the book.

**THE LANGUAGE OF RADIO** — Radio, like any other specialized field of endeavor, has a special language which facilitates explanations and discussions of its problems. This language includes words, abbreviations, letters, and schematic symbols, each representing an idea or a picture.

Radio terms like *plate*, *choke*, *spider*, and *jamming* are ordinary words to which radio men have assigned special meanings. Only a few entirely new words were created during the rapid development of radio: *superheterodyne*, *pentode*, and *microphone* are examples.

By reading this entire dictionary carefully just once, a few pages each day, anyone can become surprisingly familiar with the verbal portion of the language of radio. This will include also the abbreviations and letters used for convenience to represent single words.

The schematic symbols which a radio man uses to show circuit connections might be called a system of radio shorthand, for these odd combinations of lines, arrows and curves allow him to draw complete diagrams of radio sets in a few minutes. The meanings of these symbols are given near the end of this booklet. Once you learn to recognize each one, you will oftentimes prefer these symbol diagrams to more elaborate pictorial diagrams.

# A DICTIONARY OF RADIO TERMS

## A

**A-** (A negative or A minus.) Symbol used to designate the point in a circuit to which the negative terminal of the filament supply is to be connected.

**A+** (A positive or A plus.) Symbol used to designate the point in a circuit to which the positive terminal of the filament supply is to be connected.

**A battery.** The battery (often a single dry cell) used for supplying heating current to the filaments of radio tubes.

**AB power pack.** A combination of batteries or devices in a single housing, used to supply operating potentials for receivers, especially portable sets.

**a.c.** Alternating current.

**acoustic.** Pertaining to sound.

**acoustic feedback.** Transfer of sound waves from a loudspeaker to any previous part, such as a microphone, in the same amplifying or broadcasting system. It can cause howling and overloading of tubes.

**a.c.-d.c. receiver.** A receiver which will operate either from an a.c. or d.c. power source. It does not have a power transformer.

**a.c. receiver.** A receiver designed to operate only from an a.c. power source. Power packs of these sets invariably employ a power transformer for stepping the a.c. line voltage up or down.

**adapter.** Any device used for changing temporarily or permanently the terminal connections of a circuit or part.

**admittance.** The measure of ease with which an alternating current flows in a circuit. The reciprocal of impedance. Measured in micromhos or mhos.

**aerial.** An antenna.

**a.f.** Audio frequency.

**a.f.c.** Automatic frequency control.

**air-cell A battery.** A non-rechargeable wet-cell battery which usually is built to deliver 2 volts, for use chiefly in battery-operated home radio receivers. Its carbon electrodes are porous and absorb oxygen from the air during use. Rated life in normal radio use is 500 to 1500 hours, depending upon battery size and current drain.

**air-core.** A term used to describe coils or transformers which have no iron in their magnetic circuits. Air-core construction is used chiefly in r.f. circuits.

**air gap.** A path for electrical or magnetic energy through air between two objects, such as between the electrodes of a spark gap or between core sections of an iron-core transformer.

**airplane dial.** Popular name for a circular-shaped radio receiver dial with a rotating pointer, resembling the dials and pointers of airplane instruments.



TYPES OF ALIGNING TOOLS

**aligning tool.** An essentially non-metallic screwdriver or socket wrench used for adjusting the trimmer condensers and adjustable coils which are provided in radio receivers for aligning purposes or for pre-setting push-button tuners.

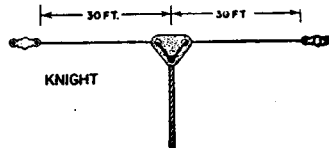
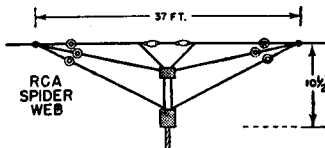
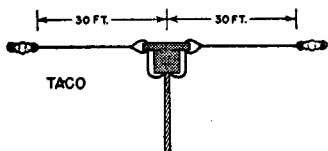
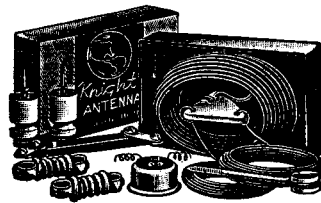
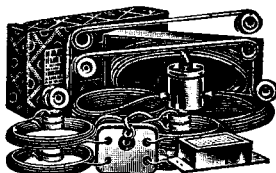
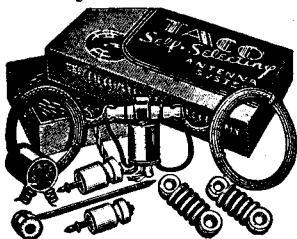
**alligator clip.** A long-nose clip with spring-controlled meshing jaws used on test leads for making quick temporary connections.



**all-metal type tube.** A vacuum tube having a metal envelope instead of a glass envelope. Electrode connections are made through glass beads fused into the top and bottom of the metal envelope. The octal bakelite base is designed to take eight equally spaced terminal prongs, but some of the prongs are omitted on tubes having less than eight terminals.

**alloy.** A mixture of two or more metals.

**all-wave antenna.** A receiving antenna designed to pick up stations reasonably well over a wide range of carrier frequencies including short-wave bands as well as the broadcast band. It may be a single doublet antenna or a combination of two or more doublets.



TYPES OF ALL-WAVE ANTENNAS

**all-wave receiver.** A receiver capable of receiving stations on all of the commonly used wavelengths in short-wave bands as well as the broadcast band.

**alternating current.** An electric current which reverses its direction of flow at regular intervals many times per second.

**a.m.** Amplitude modulation. Also written as a-m or AM. See amplitude modulation.

**amateur.** Any person who operates and experiments with short-wave transmitters as a hobby rather than for profit.

**amateur bands.** Bands of frequencies assigned exclusively to radio amateurs by the Federal Communications Commission.

Amateur band limits are:

1,715 to 2,000 kc.	28,000 to 30,000 kc.
3,500 to 4,000 kc.	56,000 to 30,000 kc.
7,000 to 7,300 kc.	112,000 to 116,000 kc.
14,000 to 14,400 kc.	224,000 to 230,000 kc.

Amateurs may also operate on any frequency above 300,000 kc.

**amateur operator.** A person holding a valid license issued by the F.C.C. authorizing him to operate licensed amateur stations.

**amateur station.** A radio station used by an amateur for personal communication with other amateurs.

**amateur station call letters.** Identifying call signal assigned to a licensed amateur operator to identify his station. Amateur calls in a given country begin with a one or two-letter prefix (W or N for U.S., and K for U.S. possessions), followed by a location-indicating numeral and two or more additional letters.

**American Morse Code.** A dot-and-dash code which is commonly used for telegraphic communication over wires. It differs considerably from the International Morse Code which is used in radio.

**ammeter.** An instrument used for measuring the current flow in amperes in a circuit.

**amp.** Ampere.

**ampere.** The practical unit of electric current flow. The movement of 6,280,000,000, 000,000,000 electrons past a given point in a circuit in one second corresponds to a current of one ampere. When a one ohm resistance is connected to a one volt source, one ampere will flow.

**ampere-hour.** A current of one ampere flowing for one hour. This unit is used chiefly to indicate the amount of electrical energy a storage battery can deliver before it needs recharging.

**amplification.** The process of increasing the strength (current, voltage or power) of a signal. Amplification can be provided by transformers and feed-back circuits as well as vacuum tubes.

**amplification factor.** A vacuum tube rating indicating the theoretical maximum increase in signal strength which can be provided by a given tube.

**amplifier.** A device consisting of one or more vacuum tubes and associated parts, used to increase the strength of a signal.

**amplify.** To increase in strength.

**amplitude modulation.** The common system of radio broadcasting, in which the deviation in frequency above and below the assigned carrier frequency value is equal to the frequency of the sound wave being

transmitted. The amplitude of the transmitted signal varies in accordance with the instantaneous amplitude of the sound wave being transmitted. Abbreviated as a.m., a-m or AM.

**analyzer.** A test instrument used for checking radio parts and circuits. It sometimes includes a special plug-in system which can be inserted in a tube socket to extend the socket terminals for convenience in making measurements.

**anode.** The radio tube electrode to which the main electron stream flows. The anode is also called the plate, and is usually placed at a high positive potential with respect to the cathode. It is usually identified on diagrams by the letter P.

**ant.** Antenna.

**antenna.** A metallic structure or an arrangement of conducting wires or rods used for picking up or radiating radio waves. Also known as an aerial.

**antenna coil.** That coil in a radio receiver through which the antenna current flows. This coil is usually directly connected to the antenna and ground terminals inside the set.

**armature.** Usually the movable portion of a magnetic circuit, such as the rotating section of a generator or motor, the pivoted iron portion of a magnetic loudspeaker, or the spring-mounted iron portion of a buzzer or relay.

**aspect ratio.** In television, a numerical ratio equal to picture width divided by picture height.

**atmospheric interference.** Cracking and hissing noises reproduced in the radio loudspeaker due to electrical disturbances occurring in the atmosphere surrounding the earth; these disturbances radiate electro-magnetic waves which are picked up by antenna systems of receivers. Also called static interference, and particularly noticeable during thunderstorms.

**atom.** One of the elemental particles into which all matter is divided. An atom has a nucleus consisting of electrons and protons, with additional electrons revolving around the nucleus. Each of the 93 known elements has a different number and arrangement of electrons and protons in its atoms.

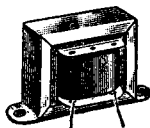
**attenuation.** Reduction in the strength of an electrical impulse.

**audible.** Capable of being heard by the human ear.

**audio amplifier.** A vacuum tube device which increases the voltage and power of an audio frequency signal. It may be a separate piece of equipment or a section in a radio receiver.

**audio frequency.** A frequency corresponding to an audible sound wave. The extreme limits of audio frequencies vary with the individual and are from about 20 cycles to about 20,000 cycles per second.

**audio transformer.** An iron-core transformer used for the dual purpose of coupling together two audio amplifier circuits and changing the value of an audio signal.





**audio oscillator.** An oscillator which generates audio frequency voltages.

**automatic bass compensation.** A special resistor and condenser circuit used in some radio receivers to make low audio frequency notes sound more natural at low volume control settings. The circuit automatically compensates for the poor response of the human ear to weak low-frequency sounds.

**automatic brightness control.** A circuit which automatically keeps the average brightness of the reproduced image constant in a television receiver.

**automatic frequency control.** A special radio circuit which keeps a superheterodyne receiver tuned accurately to a given station. Used chiefly on push-button tuned receivers to correct slight inaccuracies in operation of the automatic tuning system.

**automatic record changer.** An electrically operated mechanism which automatically



feeds, plays and rejects a number of records in sequence. Consists of a motor, turntable, pickup arm and changer mechanism.

**automatic tuning.** An electrical, electro-mechanical or mechanical system which tunes a radio receiver automatically to a predetermined station when a button or lever is pushed.

**automatic volume control.** A radio circuit which automatically maintains the output value of a radio receiver constant within limits while the carrier signal picked up by the antenna is varying in amplitude over a wide range. It is used in practically all modern receivers, for it minimizes annoying fading of distant stations and prevents blasting when tuning suddenly from a weak station to a strong station.

**automatic volume expansion.** A special audio circuit which increases the volume range of a radio program or phonograph record by making the weak passages weaker and the loud passages louder.

**a.v.c.** Automatic volume control.

**aviation channels.** Frequency bands assigned to aviation service for radio communication between aircraft and ground stations. These bands are both above and below broadcast-band frequencies.

## B

**B-** (B negative or B minus.) Symbol used to designate the point in a circuit to which the negative terminal of the plate supply is to be connected.

**B+** (B positive or B plus.) Symbol used to designate the point in a circuit to which the positive terminal of the plate supply is to be connected.

**background noise.** Noise heard along with a received radio program, due to atmospheric interference or to circuit conditions.

**baffle.** A wood, metal or composition horn or flat surface used with a loudspeaker to increase the length of the air path from the front to the back of the loudspeaker diaphragm, thereby reducing interaction between sound waves produced simultaneously by front and back surfaces of the diaphragm. A baffle thus serves to direct the sound produced by a loudspeaker and improve the fidelity of reproduction.

**bakelite.** A phenolic compound having high electrical resistance, used as an insulating material in the construction of radio parts such as panels, coil forms, tube sockets, etc.

**balanced armature unit.** An electro-magnetic sound-producing device used chiefly in magnetic loudspeakers. It has a small moving iron armature which is surrounded by windings carrying audio currents. The armature is pivoted between the poles of a permanent magnet. Variations in the audio current cause corresponding changes in magnetism, making the armature rock back and forth. A diaphragm coupled to the armature produces sound waves.

**ballast resistor.** A special type of resistor used in radio apparatus to compensate for fluctuations in a.c. power line voltage. It

is usually connected in series with the power supply to the receiver or amplifier. The ohmic value of a ballast resistor increases automatically with increases in current through it, thereby tending to maintain essential constant current despite variations in line voltage.

**ballast tube.** A ballast resistor mounted in an evacuated glass or metal envelope. This construction improves the automatic voltage regulating action by reducing radiation of heat from the resistor element.

**band.** In radio, frequencies which are within two definite limits and are used for a definite purpose. Thus, the standard broadcast band extends from 550 kc. to 1600 kc.

**B. & S. gauge.** Brown and Sharpe wire gauge, the standard gauge used in the United States to specify wire sizes.

**band switch.** A switch which simultaneously changes all tuning circuits of a radio receiver or transmitter to a desired band of frequencies.

**bandsread tuning control.** A small variable condenser connected in parallel with the main tuning condenser of a short-wave receiver to provide more accurate tuning.

**bantam tube.** A compactly designed tube having a standard octal base but a considerably smaller glass envelope than does a standard glass tube. Bantam tubes are used chiefly in compact table model receivers and in battery-operated portable sets.

**bantam jr. tube.** An extremely small glass vacuum tube with a special bantam jr. base, used chiefly in hearing aid units.



**bass.** Low audio frequencies.

**bass control.** A manually-adjusted control provided on a radio receiver for the purpose of emphasizing the loudness of the bass notes in a radio program.

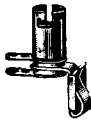
**bass compensation.** Any means of offsetting the natural drop in the response of the human ear to low audio frequencies at low volume levels.

**bass response.** The ability of a loudspeaker to handle low audio notes, or the sensitivity of the human ear to low audio notes.

**battery.** One or more dry cells or storage cells connected together to serve as a d.c. voltage source.

**battery receiver.** A receiver which uses batteries as a power source.

**bayonet base.** A type of tube and lamp base having two projecting pins on opposite sides of the smooth cylindrical base; these engage in corresponding slots in the bayonet-shell socket.



**B battery.** A battery having many small cells connected in series, used for supplying d.c. voltages to the plate and screen grid electrodes of radio tubes used in battery-operated equipment.

**beam power amplifier tube.** A special type of vacuum tube designed for use in the output stage of a radio receiver. Deflecting electrodes concentrate the electrons into beams to give high power output along with desirable operating characteristics.

**beat-frequency.** The frequency obtained when signals of two different frequencies are combined and rectified. The beat frequency is equal in numerical value to the difference between the original frequencies.

**beat-frequency oscillator.** An audio-frequency oscillator whose output is obtained by combining and rectifying two known higher-frequency signals which are generated by or obtained from separate circuits.

**B eliminator.** An a.c. power pack which converts a.c. power line voltage to the pure d.c. voltages required by plate and screen grid circuits of radio tubes, thereby eliminating the need for B batteries.

**bell wire.** A common term for the cotton-covered B. & S. No. 18 copper wire used for making doorbell and thermostat connections in homes.

**bias.** The fixed voltage applied between the control grid and cathode electrodes of a radio tube. Also called C bias.

**bias cell.** A tiny 1-volt or 1½-volt cell used singly or in series to provide a negative C bias voltage for a vacuum tube amplifier circuit. It will last indefinitely if not overloaded.



**blasting.** Overloading of an amplifier or loudspeaker, resulting in severe distortion of loud sounds.

**bleeder current.** A current drawn continuously from a power pack to improve its voltage regulation or to increase the voltage drop value across a particular resistor.

**bleeder resistor.** A resistor which is used to draw a fixed bleeder current.

**blocking condenser.** Any condenser used in a radio circuit to block the flow of direct current while allowing a.c. signals to pass.

**blooper.** Slang term applied to a regenerative receiver which radiates a signal when improperly tuned.

**body capacity.** The capacity existing between the human body and a piece of radio apparatus.

**bonding.** Connecting the metal housings and shields of radio parts together or to the chassis with heavy wire so they will be at the same potential (usually ground potential.)

**breakdown voltage.** The voltage at which the insulation between two conductors will break down.

**brightness control.** In a television receiver, the control which varies the average illumination of the reproduced image.

**broadcast.** A radio transmission intended for reception by the general public.

**broadcasting.** A general term applied to the radiation of radio waves carrying programs intended for public interest, education, or entertainment.

**broadcast band.** The band of frequencies between 550 kc. and 1600 kc., to which are assigned all standard broadcast stations operating in the United States.

**broadcast station.** A radio station used for transmitting programs to the general public.

**broad tuning.** A condition wherein two or more stations are picked up at one setting of a receiver tuning dial, due to lack of selectivity in the tuning circuits.

**brush.** A metal or carbon block used to make contact with a rotating or otherwise moving part in an electrical circuit.

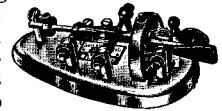
**buck.** To oppose.

**buffer.** Any part or circuit used to reduce undesirable interaction between radio circuits.

**buffer condenser.** Any condenser connected in an electronic circuit for the purpose of reducing peak or surge voltage amplitude in protection to other parts in the same or following circuits.

**buffer stage.** An amplifier stage used to prevent feed-back of energy from a power stage to a preceding stage.

**bug.** A semi-automatic code transmitting key in which movement of a lever to one side produces a series of dots, and movement to the other side produces a single dash.



**built-in aerial.** An aerial which is an integral part of a radio receiver. It may be a loop aerial, a power line connection or a sheet of metal mounted in the receiver cabinet.

**buzzer.** An electromagnetic device in which attraction of an armature by an electromagnet interrupts the current flow; a spring then pulls the armature back, closing the circuit again so that the process repeats itself and creates a buzzing sound.

**BX.** Flexible metal conduit used to protect power line wiring in buildings and in high-power radio apparatus.



**by-pass condenser.** A condenser used to provide a low-impedance path for radio or

audio signals around a resistor or between a circuit terminal and ground.

## C

**C.** Letter used to designate a condenser, a grid bias voltage, or the centigrade temperature scale.

**C-** (C negative or C minus.) Symbol used to designate the point in a vacuum tube circuit to which a negative terminal of the grid bias source is to be connected.

**C+** (C positive or C plus.) Symbol used to designate the point in a vacuum tube circuit to which the positive terminal of the grid bias source is to be connected.

**cadmium.** A metal sometimes plated on a steel chassis to improve its appearance and prevent rusting.

**call letters.** Government-assigned identifying letters for a radio station.

**cam.** An irregular-shaped rotating or sliding part used to convert rotary motion to linear motion, or vice versa. Used extensively in mechanical push-button tuning systems.

**capacitance.** Electrostatic capacity.

**capacitor.** Condenser.

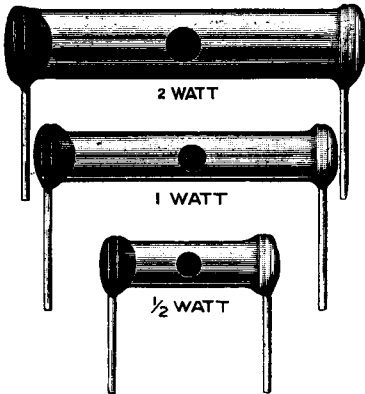
**capacity.** The electrical size of a condenser, determining the amount of electrical energy which can be stored in a condenser by a given voltage. In radio work, capacity is measured in microfarads (mfd.) and micro-microfarads (mmfd.); 1 mfd. is equal to 1,000,000 mmfd.

**capacitive coupling.** A type of coupling in which a condenser provides a direct path for signal energy between two circuits.

**capacitive reactance.** The reactance which a condenser offers to a.c. or pulsating d.c. It is measured in ohms, and decreases as frequency and capacity are increased.

**carbon.** An element used in the construction of radio parts such as resistors, dry cells, and microphones.

**carbon resistor.** A resistor made of carbon particles and a ceramic binder molded into a cylindrical shape, with leads attached to opposite ends.



**carborundum.** A compound of carbon and silicon used in crystal form to rectify or detect radio waves, as in a crystal detector.

**carrier.** A current, voltage or radio wave having the assigned frequency of a radio

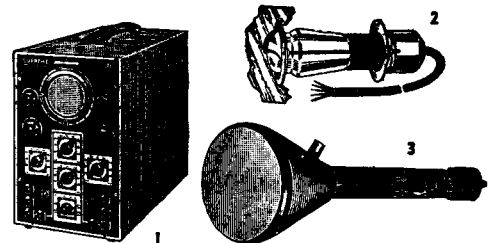
station. When no sounds are being transmitted, such as during a pause between portions of a program, only the unmodulated carrier signal is present in the transmitting and receiving system.

**carrier frequency.** The frequency of the original unmodulated radio wave produced by a transmitter. In the case of a broadcast station, the carrier frequency must be maintained within a few cycles of the frequency value assigned to that station by the Federal Communications Commission.

**cathode.** The electron-emitting electrode of a radio tube. Thermionic vacuum tubes employ heated cathodes; the heat is either supplied indirectly by a filament located inside the cathode, or is supplied by current flowing through the cathode itself. In this latter case, the cathode is also the filament.

**cathode ray.** A ray or beam of electrons emitted from a cathode.

**cathode ray tube.** A special type of vacuum tube in which a beam of electrons is directed at a fluorescent screen by an electron gun, producing a green or white glow on the screen at the point of impact. The beam passes between electrostatic deflecting plates or electromagnetic deflecting coils which can make it bend enough to produce any desired pattern or picture on the screen when the proper varying voltages are applied to the deflecting system.



(1) Cathode Ray Oscilloscope.  
(2) Cathode Ray Tuning Indicator.  
(3) Cathode Ray Television Tube.

**cathode ray television tube.** The cathode ray tube used in modern television receivers to reproduce the scenes being transmitted.

**cathode ray tuning indicator.** A small cathode ray tube used in radio receivers to indicate when a station is tuned in accurately.

**cathode ray oscilloscope.** A test instrument using a cathode ray tube to make visible the wave form of a varying current or voltage.

**catwhisker.** A small, sharply pointed wire used in a crystal detector to make contact with a sensitive point on the surface of the crystal.

**C battery.** The battery used for supplying a negative C bias to the control grid of a vacuum tube.

**C bias.** An applied voltage used to make the control grid of a vacuum tube negative with respect to the cathode.

**cell.** A single unit capable of serving as a d.c. voltage source. A primary cell, such as a dry cell, cannot be recharged when exhausted. A secondary cell, such as the cell of a storage battery, can be recharged when exhausted by passing a current through it in the reverse direction.

**centering control.** In a television receiver, a control used to shift the entire reproduced image on the screen. The horizontal centering control moves the image horizontally in either direction, while the vertical centering control shifts the image up or down.

**Centigrade.** The European scale of temperature in which 0 is the temperature of melting ice and 100 is the temperature of boiling water, at sea level.

**centimeter.** In the metric system of measurements, a unit equal to one-hundredth of a meter, or approximately .39 inch. There are 2.54 centimeters in one inch.

**chain.** In radio, a network of radio stations connected together by special telephone lines so that all can broadcast simultaneously a program originating at a key studio.

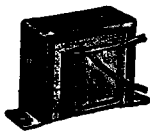
**channel.** A narrow band of frequencies including the assigned carrier frequency, within which a radio station is required to keep its modulated carrier signal in order to prevent interference with stations on adjacent channels. Also, one branch or path over which radio signals may travel; thus, a p.a. system may have several input channels, each with its own sound pickup device, transmission line and volume control.

**charge.** A quantity of electrical energy held on an insulated object. The electrical energy stored in a condenser. The act of supplying electrical energy to a metal object, to a condenser, or to a storage battery. When an object has more electrons than normal, it has a negative charge. When an object has less electrons than normal, it has a positive charge.

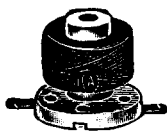
**charger.** A device used to convert alternating current into a pulsating direct current which can be used for charging an exhausted storage battery.

**chassis.** The metal framework on which the parts of a radio receiver or transmitter are mounted. Also used to designate the completed piece of radio equipment before it is mounted in a cabinet.

**choke coil.** A coil used to limit the flow of alternating current while allowing direct current to pass. R.F. choke coils have air or pulverized iron cores, while a.f. choke coils and filter chokes have iron cores.



(1) A.F. Choke.



(2) R.F. Choke.

**circuit.** A complete path over which an electric current can flow.

**clip.** A small spring-type clamp having any of several different designs, used for mak-

ing a readily removable connection to a terminal.

**clockwise.** The direction in which the hands of a clock move.

**coaxial cable.** A two-conductor cable in which one conductor is a flexible or non-flexible metal tube and the other is a wire centrally supported inside the tube by insulators.

**cm.** Centimeter.

**code.** A system of dot and dash signals used in the transmission of messages by radio or wire telegraphy. The International Morse Code (also called the Continental Code) is used everywhere for radio telegraphy. The American Morse Code is used commonly for wire telegraphy.

**code recorder.** An instrument which makes a permanent record of code messages received by radio or otherwise.

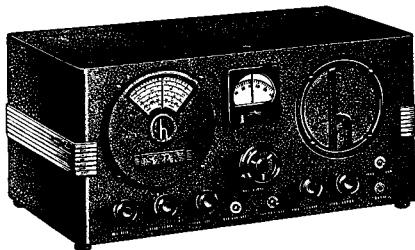
**coil.** A number of turns of wire wound on an iron core or on a coil form made of insulating material. A coil offers considerable opposition to the passage of alternating current but very little opposition to direct current.

**coil form.** The tubing or solid object on which a coil is wound. It can have any shape and can be made from any insulating material, such as paper, cardboard, fiber, bakelite, a plastic or ceramic material, or wood.

**cold cathode.** A cathode which does not depend upon heat for electron emission. The cold cathode of a photoelectric tube emits electrons when exposed to light, while in a type BH rectifier tube the electrons are pulled out of the cold cathode by a sufficiently high voltage applied to the pointed anode.

**color code.** Any system of colors used to specify the electrical value of a radio part or identify terminals and leads.

**communication receiver.** A receiver designed especially for reception of code or voice messages transmitted by short-wave radio communication services.



**concentric cable.** Coaxial cable.

**condenser.** A radio part consisting of two conducting surfaces separated from each other by an insulating material such as air, oil, paper, glass or mica. A condenser is capable of storing electrical energy. In radio circuits, condensers are used to block the flow of direct current while allowing alternating and pulsating currents to pass. The electrical size or capacity of a condenser is specified in microfarads and micro-microfarads.

**conductivity.** The ability of a material to

carry electric current.

**conductor.** A wire or other metal structure which provides a path for electric current between two points. A conductor is thus a material which offers little opposition to the continuous flow of electric current.

**cone.** The conical-shaped paper or fiber diaphragm of a magnetic or dynamic loud-speaker.

**console.** A large radio receiver cabinet, designed to rest on the floor rather than on a table.

**contact.** A terminal to which a connection can be made. A joining of bodies to permit the flow of electrical current.

**Continental Code.** Same as the International Morse Code. Used universally for radio telegraphy.

**contrast control.** In a television receiver, a manual control which adjusts the range of brightness between highlights and shadows of the reproduced image.

**control grid.** That electrode in a vacuum tube which has the most effective control over the plate current passed by the tube. The control grid is usually the electrode nearest to the cathode.

**converter.** That section of a superheterodyne radio receiver which changes incoming modulated r.f. signals to a lower frequency known as the i.f. value; the converter section includes the oscillator and the first detector. Also, a device, usually rotary, changing electrical energy from one form to another, as AC to DC, etc.

**copper-oxide rectifier.** A rectifier made up of discs of copper coated on one side with cuprous oxide. The discs allow direct current to flow in one direction but allow very little current flow in the reverse direction.

**core.** The center of a coil.

**counter-clockwise.** In a direction opposite that in which the hands of a clock rotate.

**countersink.** To ream, drill or cut a conical depression around a hole for a flat-head screw, so that the screw head will be flush with the surface of the work.

**coupling.** The means by which signals are transferred from one radio circuit to another. Coupling can be direct through a conductor, electro-static through a condenser, or inductive through a transformer. Also, a connecting device.

**c.r.o.** Cathode ray oscilloscope.

**crystal.** A piece of natural quartz or similar piezo-electric material which has been ground to a size which will vibrate naturally at a desired radio frequency and generate that frequency when set into vibration. A quartz crystal is used in radio transmitters to generate with a high degree

of accuracy the assigned carrier frequency of a station, and is used in crystal filters of radio receivers to improve the selectivity of the i.f. amplifier. The mineral used in a crystal detector is known as a crystal.

**crystal control.** Use of a quartz crystal to maintain operation of a radio station at its assigned frequency within the limits prescribed by law.

**crystal detector.** A detector utilizing a crystal such as silicon or galena in contact with a pointed wire to rectify an incoming radio signal. Used in crystal receivers.



TYPES OF CRYSTAL DETECTORS

**crystal filter.** A highly selective tuning circuit employing a quartz crystal, sometimes used in the i.f. amplifier of a communications receiver to improve selectivity so as to permit reception of a desired station even when there is strong interference from other stations on nearby channels.

**crystal pick-up.** A type of phonograph pick-up in which the needle movements bend or twist a Rochelle salt crystal element and cause the crystal element to generate an audio frequency voltage corresponding to the recorded sound waves.

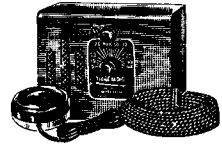
**crystal set.** A radio receiver which uses a crystal detector for signal rectification, and has no vacuum tubes.

**current.** The movement of electrons through a conductor. Current is measured in amperes, in milliamperes and in microamperes.

**cutting head.** That part of a sound recorder which cuts or embosses on a disc, the irregular grooves corresponding to the wave form of the sounds being recorded.

**c.w.** Continuous wave.

**cycle.** One complete reversal of an alternating current, including a rise to a maximum in one direction, a return to zero, a rise to a maximum in the other direction, and another return to zero. The number of cycles occurring in one second is the frequency of an alternating current. The word cycle is commonly interpreted to mean cycles per second, in which case it is a measure of frequency.



## D

**db.** Decibel.

**d.c.** Direct current.

**d.c.c.** Double cotton covered insulation on wires.

**d.c. receiver.** A receiver designed to operate from a d.c. power line, such as from the 110-volt d.c. lines still being used in older sections of some cities.

**D'Arsonval meter movement.** The commonest movement employed in precision direct current measuring instruments. It consists essentially of a small coil of wire supported on jeweled bearings between the poles of a permanent magnet with a spiral spring holding the coil and the attached indicating pointer at the zero position on the meter

scale. When the current to be measured is sent through this coil, the magnetic fields of the coil and magnet interact to cause rotation of the coil and pointer.

**dead spot.** A region in which signals from certain radio stations are poorly received.

**decibel.** A unit used for comparing the power level of a signal to a fixed reference level of power. Also a measure of power, current or voltage gain.

**decoupling.** A method of isolating individual stages of an amplifier to prevent inter-stage feedback through power supply circuit.

**delayed a.v.c.** An automatic volume control circuit which does not begin to act until signals reach a certain strength. It permits improved reception of weak signals.

**definition.** In television, the clearness with which video details are reproduced.

**degeneration.** A type of feed-back which improves amplifier quality.

**demodulation.** The process of rectifying or detecting a modulated radio signal in order to remove the carrier and obtain the desired audio or picture signal.

**detector.** That stage in a receiver at which demodulation takes place. In the detector stage of a t.r.f. receiver, the r.f. signals are separated from the desired audio signal. In the second detector of a super-heterodyne receiver, the i.f. signals are separated from the desired audio signal.

**dial.** Any means for indicating the value to which a control knob has been adjusted. Tuning dials of broadcast band receivers indicate the frequency to which the receiver is tuned, either in kilocycles directly or in kilocycle values having one zero removed; sometimes the wavelength in meters will also be indicated.

**dial cable.** The braided cord or flexible wire cable used to make a tuning knob control the position of the pointer or dial which indicates the frequency to which a radio receiver is tuned.

**dial light.** The pilot lamp which illuminates the tuning dial of a radio receiver.

**diaphragm.** A thin, flexible metallic or non-metallic sheet which vibrates when struck by sound waves, as in a microphone, or which produces sound waves when moved back and forth at an audio rate, as in a headphone or loudspeaker.

**dielectric.** The insulating material between the plates of a condenser.

**diode.** A vacuum tube having two electrodes, one being the cathode and the other the plate or anode. A diode allows electrons to pass in only one direction, from the cathode to the anode.

**direct coupling.** The use of a conductor to connect two circuits together and provide a direct path for signal currents.

**direct current.** An electric current which flows in only one direction. It is not necessarily constant in value.

**directional antenna.** Any antenna which picks up or radiates signals better in one direction.

**direction finder.** A special type of radio receiver employing a highly directional

loop antenna so as to permit determining the direction from which radio waves are arriving.

**discriminator.** In an F.M. receiver, the section which converts frequency modulated signals into audio signals.

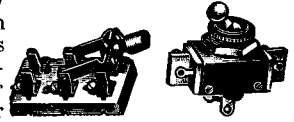
**distortion.** Unfaithful reproduction of sound or television signals due to changes occurring in the wave form of the originating signal somewhere in the course it takes through the transmitting and receiving system.

**distributed capacity.** Capacity distributed between conducting elements such as wires, as distinguished from capacity concentrated in a condenser. Usually used to specify the small capacity existing between the turns of wire in a coil.

**double-button carbon microphone.** A carbon microphone employing two buttons or containers for carbon granules, one on each side of the diaphragm, so as to secure a push-pull action which gives increased signal output.

**double pole switch.** A switch which simultaneously opens or closes two separate circuits or both sides of the same circuit.

**double throw switch.** A switch which connects one set of terminals to either of two other sets of terminals.



**doublet antenna.**

KNIFE  
D.P.D.T. SWITCHES

An antenna system with an insulator inserted at its exact center, with one lead of a two-wire transmission line connected to each half of the antenna at this insulator.

**d.p.d.t.** Double pole, double throw.

**d.p.s.t.** Double pole, single throw.

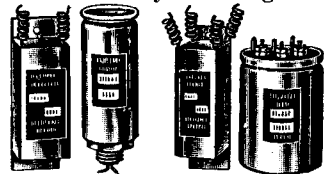
**drain.** A term used to indicate that current is being taken from a voltage source.

**driver.** A stage of amplification used to feed or drive a final stage of amplification for the purpose of making the final stage operate at maximum efficiency.

**drop.** The voltage drop developed across a resistor due to current flow through the resistor.

**dry cell.** A type of primary cell in which the electrolyte is in the form of a paste rather than a liquid. Dry cells are used extensively in radio batteries.

**dry electrolytic condenser.** An electrolytic condenser in which the electrolyte is a paste rather than a liquid, to permit using the condenser in any position without danger of the electrolyte leaking out.



Dry Electrolytic Condensers

**d.s.c.** Double silk covered insulation on a wire.

**dummy antenna.** A resistor or other device which duplicates the electrical characteris-

tics of a transmitting antenna without radiating radio waves. Used for testing and adjusting transmitters.

**duralumin.** An alloy of aluminum which is comparable in strength and hardness to soft steel. It contains 95.5 parts aluminum, 3 parts copper, 1 part manganese and .5 part magnesium.

**DX.** A slang expression for distance, used chiefly in connection with reception of distant radio stations.

**dynamic loudspeaker.** A loudspeaker in which the diaphragm or cone is attached to a small coil mounted so it can move within

a constant magnetic field. Audio frequency currents flowing through this coil (called the voice coil) make it move in and out, thereby causing the diaphragm to reproduce sound waves. The magnetic field is produced by a permanent magnet in p.m. dynamic loudspeakers, and by an electromagnet in electrodynamic loudspeakers.

**dynamotor.** A rotating device acting both as motor and generator, used to change a d.c. voltage to an a.c. voltage or to a higher d.c. voltage. It is used chiefly for portable and mobile operation of radio transmitters and P.A. amplifiers from storage batteries.

## E

**E.** Commonly used symbol for voltage.

**eddy currents.** Circulating currents induced in conducting materials by varying magnetic fields. They are undesirable because they represent loss of energy and cause heating. Eddy currents are kept at a minimum by employing laminated construction for the iron cores of transformers, a.f. choke coils, and other magnetic devices.

**Edison base.** The standard screw base used for ordinary electric light bulbs in this country.

**effective current.** That value of alternating current which will cause the same heating effect as a given value of direct current. For sine wave alternating currents, the effective value is approximately seven-tenths of the peak value.

**efficiency.** The ratio of energy output to energy input, usually expressed as a percentage. A perfect electrical device would have an efficiency of 100%.

**electralloy.** A soft iron alloy used for radio chassis construction.

**electrical transcription.** A disc recording of a complete program, as contrasted with a phonograph record which ordinarily contains only a single musical selection. Transcriptions are made to permit broadcasting of a particular program at any desired time by any number of stations.

**electric eye.** Popular expression for a cathode ray tuning indicator tube used in modern radio receiving sets. Consists of a fluorescent screen with a dark sector which varies in direct proportion with the strength of the incoming signal. Also used in connection with photoelectric cells.

**electric field.** A region in space surrounding a charged object. Lines drawn to represent the direction in which the electric field will act on other charged objects are called electric lines of force. A moving electric field, such as that associated with electrons in motion or with a radio wave, is always accompanied by a moving magnetic field.

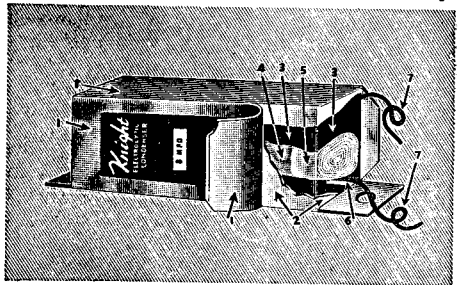
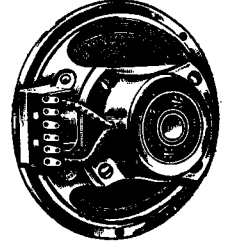
**electricity.** A general term used when referring to the energy associated with electrons at rest or in motion.

**electrode.** An essential part inside a vacuum tube, such as the cathode, the various grids and the anode. Also, the plates of a primary cell, secondary cell or electrolytic condenser.

**electrodynamic loudspeaker.** A dynamic loudspeaker in which the constant magnetic field is produced by an electromagnet. The coil of this electromagnet is known as the field coil.

**electrolyte.** The liquid or chemical paste which is used between the electrodes of a dry cell, storage battery or electrolytic condenser.

**electrolytic condenser.** A fixed condenser in which the dielectric is a thin film of gas formed on the surface of one aluminum electrode by a liquid or paste electrolyte



**ELECTROLYTIC CONDENSER**

1. Cardboard container.
2. Wax-impregnated inner liner.
3. Pure wax filter.
4. Etched aluminum foil.
5. Cellulose separator.
6. Terminal lead.
7. Insulated push-back leads.

**electromagnet.** A coil of wire, usually wound on an iron core, which produces a strong magnetic field when current is sent through the coil.

**electromotive force.** Voltage.

**electron.** A small active particle of negative electricity. Some electrons are closely associated with atoms of matter, while others, called free electrons, move readily between atoms under the influence of electric or magnetic fields. It is the movement of electrons through a conductor which constitutes an electric current.

**electron emission.** The ejection of electrons from the surface of a material into surrounding space due to heat, light, high voltage or other causes. In a thermionic

vacuum tube, electron emission from the cathode is produced by heat from the filament.

**electronic control.** The control of a machine or device by apparatus employing electron tubes.

**electronics.** A broad field of electricity covering work with all types of apparatus employing electron tubes for industrial applications. Radio and television are major branches of the electronic field.

**electron tube.** Any partly-evacuated, completely-evacuated or gas-filled tube used to control the flow of electrons in a circuit. Vacuum tubes, phototubes, mercury vapor rectifier tubes and cathode ray tubes are all electron tubes.

**element.** One of the ninety-three known basic forms of matter which make up the universe. The term is also used to refer to the

important parts of a device; thus, the cathode, grid and plate would be called the elements of a triode vacuum tube.

**e.m.f.** Electromotive force or voltage.

**enameled wire.** Wire coated with an insulating layer of baked enamel.

**energy.** Ability to do work. Thus, the electrical energy stored in a dry cell has the ability to heat a radio tube filament, operate a buzzer, etc.

**envelope.** The glass or metal housing of a radio tube.

**escutcheon.** The ornamental wood, metal or plastic framework for a radio dial, tuning indicator or other panel-mounted part in a radio receiver or amplifier.

**ether.** The medium which is supposed to fill all space, and through which radio, heat, and light waves are supposed to travel. Its existence has not yet been definitely proved.

## F

**f.** frequency.

**F.** Fahrenheit. Scale of temperature.

**facsimile.** A system of radio communication in which photographs, drawings, handwriting, and printed matter of any kind are transmitted to receivers which feed into facsimile recorders.

**facsimile recorder.** An instrument which reproduces on paper the illustration, writing or printed matter being transmitted by a facsimile system.

**fading.** An essentially regular rise and fall due to variations in transmission conditions along the path taken by the radio waves from the transmitting station to the receiver.

**Fahnestock clip.** A spring-type terminal to which a temporary connection can readily be made.

**Fahrenheit.** The temperature-measuring system generally used in the United States, in which 32 degrees is the temperature of melting ice and 212 is the temperature of boiling water at sea level.

**farad.** The basic unit of capacity, but too large for practical use. The microfarad, equal to one millionth of a farad, is a more practical unit for radio work. An even smaller unit, the micro-microfarad, is also used in radio; it is equal to one millionth of a microfarad.

**F.C.C.** Federal Communications Commission. A commission appointed by the President of the United States possessing licensing and regulating authority on matters dealing with wire and radio communication in the United States and its possessions.

**feedback.** Transfer of energy from one point in an electrical system to a preceding point, such as from the output back to the input.

**fidelity.** The faithfulness with which part or all of an electrical system delivers a reproduction of the input signal wave form.

**field.** The effect produced in surrounding space by an electrically charged object, by electrons in motion, or by a magnet.

**field coil.** In an electrodynamic loudspeaker, the coil which produces the constant-strength magnetic field.

**field frequency.** In television systems employing interlaced scanning, this term refers to the number of times per second the frame area is fractionally scanned.

**filament.** The resistance wire through which filament current is sent in a vacuum tube to produce the heat required for electron emission. When electron emission is from the surface of the filament wire itself, the filament is also serving as the cathode. When the filament merely supplies heat to a separate cathode electrode, we have a heater-type or indirectly-heated tube.

**filament circuit.** The complete circuit over which filament current flows from the A battery, filament winding or other filament voltage source to the filament of radio tubes and pilot lamps.

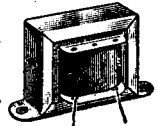
**filament current.** The current supplied to the filament of a vacuum tube for heating purposes.

**filament voltage.** The voltage value which must be applied to the filament terminals of a vacuum tube in order to provide the rated value of filament current.

**filament winding.** A separate secondary winding provided on the power transformer of a radio receiver or other a.c.-operated apparatus for use as a filament voltage source.

**filter.** A resistor, coil, condenser or any combination of these parts which is used to block or attenuate alternating currents at certain frequencies while allowing essentially unimpeded flow of currents at other frequencies or of direct current. Thus, the filter in a radio power pack is a coil, condenser and resistor combination which receives a pulsating direct current having many a.c. components, but delivers an essentially pure and constant direct current.

**filter choke.** A coil used in a filter system to pass low frequency currents or direct current while limiting or blocking the flow of higher-frequency alternating or pulsating currents.





**filter condenser.** A condenser used in a filter system to permit passage of higher-frequency currents while limiting or blocking the flow of lower-frequency currents and direct current.

**first audio stage.** The first stage in the audio amplifier of a radio receiver. Audio signals are fed into this stage by the detector of a t.r.f. receiver, and by the second detector of a superheterodyne receiver.

**first detector.** That stage in a superheterodyne receiver in which the incoming modulated r.f. signal and the r.f. signal from the local oscillator are combined to produce the i.f. signal.

**fixed condenser.** A condenser having a definite capacity value which cannot be adjusted.

**fixed resistor.** A resistor having a definite ohmic value which cannot be adjusted.



**fluorescent screen.** A coating of chemical material which glows when bombarded by electrons. In a cathode ray tube, the coating is on the inside surface of the evacuated glass envelope of the tube.

**f.m.** Frequency modulation. Also written as f-m or FM. See frequency modulation.

**focusing control.** In a cathode ray oscilloscope or television system, the control which adjusts the size of the visible spot produced at the screen by the electron gun in a cathode ray tube.

**frame.** In television, one complete scanning of every part of the field of view being transmitted.

**frame frequency.** In television, the number of times per second the frame area is completely scanned.

**framing control.** In television, a general term applying to any of the control knobs used for adjusting the centering, width and height of the reproduced image.

**free electrons.** Those electrons which are free to move between the atoms of a material when acted upon by electric or magnetic forces.

**frequency.** The number of complete cycles per second which an electric current, a sound wave or a vibrating object undergoes. Frequency is equal to the velocity divided by the wavelength.

**frequency converter.** A circuit or device which changes the frequency of an alter-

nating current. Thus, the oscillator and mixer first-detector stages make up the frequency converter of a superheterodyne receiver.

**frequency distortion.** A type of distortion which occurs when a circuit or device amplifies or transmits unequally the different frequencies it is handling.

**frequency modulation.** A relatively new system for radio broadcasting perfected by Major E. H. Armstrong, in which the amount of deviation in frequency above and below the resting frequency is at each instant proportional to the amplitude of the sound wave being transmitted. The number of complete deviations per second above and below the resting frequency is equal to the frequency of the sound wave being transmitted.

Advantages of this system include almost complete freedom from atmospheric and man-made interference, as well as little or no interference between stations, thereby permitting the transmission of a much greater volume range and a wider audio frequency range than is possible with amplitude modulation. One disadvantage is the necessity of employing ultra-high carrier frequencies, at which the range of a station is limited to approximately 100 miles.

**frequency response.** A rating or graph which expresses the manner in which a circuit or device handles the different frequencies falling within its operating range. Thus, the frequency response of a loudspeaker may be specified as being essentially flat or uniform between 100 and 6000 cycles.

**full-wave rectifier.** A radio tube or other device which rectifies an alternating current in such a way that both halves of each input a.c. cycle appear in the pulsating rectified output. A full-wave rectifier tube contains two separate diode sections, one passing current during one alternation, and the other passing current during the opposite half cycle.

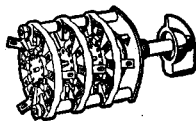
**fuse.** A protective device consisting of a short piece of wire which melts and breaks when the current through it exceeds the rated value of the fuse. Fuses are inserted in radio circuits to open the circuits automatically in case of serious overload, thereby preventing damage to parts in the circuit.

**gain.** In an amplifier stage or system, the ratio of output voltage, current or power to input voltage, current or power. Usually expressed in decibels.

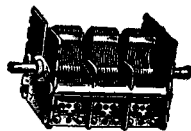
**galena.** Lead sulphide, a shiny bluish gray mineral often used as the crystal in a crystal detector.

**gang switch.** Two or more rotary switches mounted on the same shaft and operated by a single control.

**gang tuning condenser.** Two or more variable tuning condensers mounted on the same shaft and operated by a single control.



GANG SWITCH  
(ROTARY)



GANG TUNING  
CONDENSER

**gaseous tube.** An electronic tube into which a small amount of gas or vapor is admitted after the tube has been evacuated. Ionization of the gas molecules during operation of the tube gives greatly increased current flow.

**generator.** A rotating machine which converts mechanical energy into electrical energy. Also, a radio device or circuit which develops an a.c. voltage at a desired frequency when energized with d.c. or low-frequency a.c. power.

**getter.** An alkali metal introduced into a vacuum tube during manufacture and vaporized after the tube has been evacuated, to absorb any gases which may have been left by the vacuum pump. The silvery deposit on the inside of the glass envelope of a tube, usually near the tube base, is the result of getter vaporization.

**ghost image.** In television, an undesired duplicate image appearing a fraction of an inch to one side of the desired image, due to reception of a reflected signal along with the signal coming directly from the television station. The remedy involves using a directional receiving antenna adjusted so it will receive signals coming over only one path.

**glass-type tube.** A vacuum tube or gaseous tube having a glass envelope or housing.

**glow lamp.** A gaseous tube having a glass envelope through which can be seen a glow due to ionization of the molecules of gas. Neon gas gives a red glow, mercury vapor gives blue, and argon gas gives a light purple glow. Also called glow tube.



**gram.** The unit of weight in the metric system. One pound is equal to 453 grams.

**grid.** An electrode mounted between the cathode and the anode of a radio or electronic tube to control the flow of electrons from cathode to anode. The grid electrode is usually either a cylindrical-shaped wire screen or a spiral of wire through which electrons can readily move.

**grid bias.** Another term for C bias, which is the voltage used to make the control grid of a radio tube negative with respect to the cathode.

**grip clip.** A spring clip used to make an easily removable connection to the cap terminal located at the top of some radio tubes.



**grid condenser.** A small fixed condenser inserted in the grid circuit of a vacuum tube.

**grid leak.** A resistor of high ohmic value, used to connect the control grid to the cathode in a grid leak-condenser detector circuit.

**grid leak-condenser detector.** A type of detection in which a.f. potentials developed across a grid resistor by the flow of grid current through that resistor result in plate current changes at the desired audio frequencies. This type of detector is identified by the presence of a grid leak and grid condenser in the grid circuit.

**grid return.** The lead or connection which provides a path for electrons from the grid circuit or C bias battery to the cathode.

**grille.** An arrangement of wood or metal bars placed across the front of the loudspeaker in a radio receiver for protective purposes and to enhance the design of the cabinet.

**grille cloth.** A loosely woven cloth stretched behind the loudspeaker grille of a radio receiver to keep dust and other foreign matter out of the loudspeaker, as well as to conceal the loudspeaker diaphragm. Sound waves travel unimpeded through this cloth.

**grommet.** A special washer, made of rubber or other insulating material, used to prevent a wire from touching the sides of a chassis hole through which the wire is run.

**ground clamp.** A metal strap or clamp used for making a good electrical connection to a ground rod or grounded pipe. The clamp has a screw terminal or soldering lug to which the ground wire of a radio receiver can readily be attached.

**ground wire.** The wire used to connect the ground terminal of a radio receiver or transmitter to a ground clamp or other grounded object.

**ground waves.** Radio waves which travel along the surface of the earth instead of going up into the sky.

**guy wire.** A wire used to brace the mast or tower of a transmitting or receiving antenna system.

## H

**half-wave rectifier.** A radio tube or other device which converts alternating current into pulsating direct current by allowing current to pass only during one half of each alternating current cycle. A half-wave rectifier tube contains only one diode section.

**harmonic.** A multiple of any particular frequency. Thus, the second harmonic of a fundamental frequency would be equal to two times that fundamental frequency.

**harmonic distortion.** Another name for wave form distortion.

**Hartley oscillator.** A vacuum tube oscillator circuit identified by a tuned circuit which employs a tapped winding connected between the grid and plate of the vacuum tube, with the tap going to the cathode.

**Hazeltine licensed.** Radio apparatus which

uses Hazeltine patents under a licensing agreement with the Hazeltine Corporation.

**headphone.** A small telephone receiver, held against the ear by a clamp passing over the head. Used for private reception of radio programs or for reception of signals which are too weak to provide loudspeaker volume. Headphones are usually used in pairs, one for each ear, with the clamping strap holding them both in position.



**heater.** A filament used in a vacuum tube only for the purpose of supplying heat to an indirectly heated cathode.

**Heaviside layer.** A layer of ionized gas which scientists believe exists in the region between 50 and 400 miles above the surface

of the earth, and which reflects radio waves back to earth under certain conditions. Also called the Kennelly-Heaviside layer.

**henry.** The practical unit of inductance.

**high-fidelity receiver.** A receiver capable of reproducing audio frequencies in a range from 50 to about 8,000 cycles or wider without serious distortion. A receiver which approaches the goal wherein the reproduced program cannot be distinguished from the original studio program.

**high-frequency trimmer.** In a superheterodyne receiver, the trimmer condenser which controls the calibration of a tuning circuit at the high-frequency end of a tuning range.

**hold controls.** In a television receiver, the two manually-adjusted controls which adjust the natural oscillating frequencies of the oscillators employed in the horizontal and vertical sweep circuits.

**hook-up.** A diagram giving circuit connec-

tions for a radio receiver, amplifier or transmitter.

**hot-cathode tube.** A vacuum or gaseous tube in which the cathode is heated to provide electron emission.

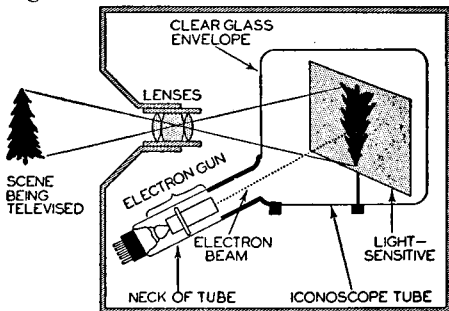
**howl.** An undesirable audio frequency oscillation occurring in a radio or amplifier system, due either to electrical or acoustic feedback.

**hum.** A low and constant audio frequency, usually either 60 to 120 cycles, heard in the background of a received radio program. A defective filter condenser in an a.c. power pack is a common cause of hum in a radio receiver.

**hysteresis.** Failure of the magnetic flux to increase or decrease immediately in accordance with changes in the magnetizing force acting on a magnetic material. This lag in the magnetization causes losses in iron-core transformers which are known as hysteresis losses.

I. Commonly used to designate current.

**iconoscope.** A cathode ray television pick-up tube for use in electronic television cameras. It converts each tone value of the scene being televised into a corresponding electrical impulse. Scanning of the image is accomplished by sweeping an electron beam rapidly back and forth across the light sensitive mosaic screen.



**i.f.** Intermediate frequency.

**image.** An interfering signal whose frequency is twice the I.F. frequency above or below the wanted signal.

**image dissector.** A cathode ray television pickup tube. Construction and operating principles are different from those of the iconoscope, but serves essentially the same purpose of converting a scene into corresponding electrical impulses.

**image ratio.** The ratio of the strength of a signal to its image. Used to indicate selectivity of a receiver.

**image reconstructor.** The cathode ray tube used in a television receiver to convert received signals to original picture.

**impedance.** The total opposition which a radio part or circuit offers to the flow of alternating or pulsating direct current at a particular frequency. Impedance is a combination of resistance and reactance, and is measured in ohms.

**impulse.** A sudden momentary increase in the current or voltage in a circuit.

**indoor antenna.** A receiving antenna system located entirely inside a building, either under a rug, around the walls of a room, between the walls, or in the attic.

**induced voltage.** A voltage produced in a circuit by changes in the number of magnetic lines of force which are linking or cutting across the conductors of the circuit.

**inductance.** That property of a coil or other radio part which tends to prevent any change in current flow. Inductance is effective only when varying or alternating currents are present; it has no effect whatsoever upon the flow of direct current. Inductance is measured in henrys.

**induction.** An action whereby the variable flow of current through one coil produces a voltage in a nearby coil even though there is no electrical connection between the coils. The coupling is produced by magnetic lines of force.

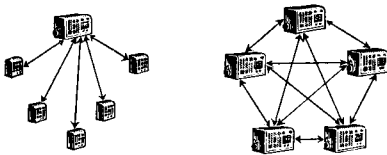
**inductive coupling.** A form of coupling in which energy is transferred from a coil in one circuit to a coil in another circuit by induction. Magnetic lines of force produced by the flow of current through one coil cause an a.c. voltage to be induced in the other coil.

**inductive reactance.** Reactance due to the inductance of a coil or other part in an alternating current circuit. Inductive reactance is measured in ohms, and is equal to the inductance in henrys multiplied by the frequency in cycles, times the number 6.28; inductive reactance therefore increases with frequency.

**insulation.** Any material which has a sufficiently high electrical resistance to permit its use for separating one electrical circuit, part or wire from others. Cotton, silk, baked enamel, mica, porcelain, rubber and bakelite are a few of the common insulating materials used in radio.

**intelligence signal.** Any signal which conveys information, such as voice, music, code, television pictures, facsimile photo-

graphs, diagrams, written and printed matter, etc.



INTERCOMMUNICATION SYSTEMS

**intercommunication system.** An amplifier system which provides two-way communication between two or more rooms in a building. Each station in the system contains a microphone and loud-speaker, usually combined as a single dynamic unit; a headphone or telephone receiver is sometimes provided also for private reception of messages. The stations may be connected to each other by wire cables, or may receive and transmit messages through the electric wiring system in the building.

**inter-electrode capacity.** The capacity which exists between two electrodes in a vacuum tube. Although this is usually a very low value, it becomes extremely important when tubes are operated in ultra-high frequency circuits.

**interference.** Noises or undesired radio programs which interfere with reception of a desired radio program.

**interference filter.** A device used between source of interference and a radio to attenuate or eliminate noise. Generally consists of capacity and inductance which offers a high impedance to noise impulses.

**interlaced scanning.** In television, a type of scanning to which every other line of the image is scanned during one downward travel of the scanning beam, and the remaining lines are scanned during the next downward travel of the scanning beam.

**intermediate frequency.** In a superheterodyne receiver, the frequency to which all incoming carrier signals are converted before being fed into the intermediate frequency amplifier.

**intermediate frequency amplifier.** That section of a superheterodyne receiver which is designed to amplify signals with high efficiency at a predetermined frequency called the intermediate frequency of the receiver.

**intermediate frequency transformer.**

A transformer used at the input and output of each i.f. amplifier stage in a superheterodyne receiver for coupling purposes and for providing selectivity.

**intermittent reception.** A type of radio receiver trouble in which the receiver performs normally for a time, then becomes dead or distorts the programs, with the process repeating itself.

**International Morse Code.** The code used universally for radio telegraphy, and also used for wire telegraphy in some European countries. It is also known as the Continental Code.

**inverse feedback.** Intentional negative feedback or degeneration, introduced in an amplifier or single vacuum tube stage for the purpose of reducing distortion, thereby permitting greater power output.

**inverted L antenna.** The conventional antenna used for broadcast reception, having a long horizontal portion suspended between insulators, with the single wire lead-in connected to one end of the horizontal portion.

**ion.** An atom or molecule which has fewer or more electrons than normal. A positive ion is one which has lost electrons, and a negative ion is one which has acquired more electrons than normal.

**ionization.** The breaking up of a gas atom into two parts, a free electron and a positively charged ion. This process corresponds to the "break-down" of an insulator. Ionization makes a gaseous tube more conductive than an equivalent vacuum tube.

**IR drop.** A technical expression sometimes used to designate the voltage drop developed across a resistance by the flow of current through the resistance.

**iron-core coil.** A coil having an iron core center. The iron is usually in the form of laminations, but it may also be pulverized iron mixed with a binding material.

**iron-core transformer.** A transformer in which iron makes up part or all of the path for magnetic lines of force traveling through the transformer windings.

**Isolantite.** A high-quality insulating material used in the construction and mounting of radio parts, particularly those employed in ultra-high frequency circuits.



## J

**jack.** A plug-in type spring terminal widely used in radio apparatus for temporary connections. A connection is made to a jack simply by plugging into it a probe or plug attached to a flexible insulated wire or cable. Some jacks have extra contacts which are opened or closed when the probe

is inserted, thereby giving automatic switching action.

**jamming.** Intentional transmitting of radio waves in such a way as to interfere with reception of signals from another station.

**jumper.** A wire used to connect two points together temporarily.

## K

**K.** Letter used to designate the cathode of a radio tube.

**kc.** Kilocycle.

**Kennelly-Heaviside Layer.** A layer of ionized

gas supposed to exist in the region between 50 and 400 miles above the surface of the earth. It reflects radio waves back to earth under certain conditions, making

possible long-distance reception.

**key.** A lever-type switch designed for rapid opening and closing of a circuit for transmission of code signals.



**kilocycle.** One thousand cycles but commonly interpreted as 1,000 cycles per second.

**kilowatt.** One thousand watts.

**kinescope.** A cathode ray tube developed by the Radio Corporation of America and used in television receivers for the purpose of reproducing on a screen the scene originally televised.

**Kirchoff's Current Law.** A fundamental electrical law which states that the sum of all the currents flowing to a point in a circuit must be equal to the sum of all the currents flowing away from that point.

**Kirchoff's Voltage Law.** A fundamental electrical law which states that the sum of all the voltage sources acting in a com-

plete circuit must be equal to the sum of all the voltage drops in that same circuit.

**knife switch.** A switch in which one or more flat metal blades, each pivoted at one end, serve as the moving parts. The blades are usually of copper; when the switch is closed, they make contact with flat gripping spring clips and complete the circuit.



TYPES OF RADIO KNOBS

**knob.** A round, hexagonal, or pointer shaped part secured to the end of a control shaft, by means of which the shaft is easily rotated. A pointer-knob also indicates the degree of rotation, or circuit position of the unit thus controlled.

**kw.** Kilowatt.

**L.** The letter commonly used on circuit diagrams and in formulas to designate an inductance or coil.

**laminated.** A type of construction widely used for the cores of iron core transformers, choke coils, electromagnets, motors and generators. It involves building up the desired shape of core with thin strips of a magnetic material such as soft iron or silicon steel.

**lapel microphone.** A small microphone which can be attached to a lapel or pocket by means of a clip.

**layout.** A diagram indicating the placement of parts on a panel or chassis.

**lead-in.** A wire which serves to connect the signal pickup portion of an antenna system with the antenna terminal of a radio receiver.

**lead-in insulator.** A porcelain tube inserted in a hole drilled through an outer wall or window frame of a house. The lead-in wire of the antenna is run through this tube.

**leakage.** Undesirable flow of current through or over the surface of an insulating material. This term is also used to describe magnetic flux which wanders off into space without doing useful work.

**leakage flux.** That portion of the total magnetic flux which does not link all of the turns of wire in a coil or transformer and is consequently wasted.

**leakage resistance.** The resistance of a path taken by leakage currents. Thus, the leakage resistance of a condenser is the normally high resistance which it offers to the flow of the direct current.

**lightning arrester.** A protective device used to sidetrack directly to ground a discharge of lightning which strikes a radio receiving or transmitting antenna.



**limiter.** In an F.M. receiver, the section which removes amplitude variations from the F.M. signal at the output of the I.F. amplifier, thereby limiting interfering noises.

**line cord.** A two-wire cable terminating in a two-prong plug, used to connect a radio receiver to an a.c. or d.c. wall outlet. Sometimes this cord also includes a resistance wire used for the purpose of reducing the line voltage to the value required by the series-connected filaments of the tubes.

**line filter.** A device inserted between the line cord plug of a radio receiver and the power line to block noise signals which might otherwise enter the receiver from the power line. It contains one or more choke coils and condensers.



**lines of force.** Imaginary lines used for convenience in designating directions in which electric or magnetic forces act in space.

**line voltage.** The voltage existing at a wall outlet or other terminals of a power line system. In the United States, the line voltage is usually between 115 and 120 volts, but may vary at times as much as five volts above and below these limits.

**load.** That part or combination of parts into which power is fed to accomplish a desired result.

**log.** A list of radio stations. A record of stations with which a radio transmitter has been in communication; amateur radio operators are required by law to keep this log. A detailed record describing the program being broadcast each minute of the operating day by a broadcast station. A record of the meter readings which are required by law to be taken at regular intervals in a broadcast transmitter and in certain other types of transmitters.

**logging.** Making a record of the exact dial setting at which a radio station is received, or making a written record of any other essential data in connection with radio equipment.

**lokta! tube.** A small-size glass radio tube having a special base construction which locks the tube firmly in the corresponding special 8-prong lokta! socket. Lokta! tubes are used chiefly in midget a.c.-d.c. receivers

and in auto radios.

**long waves.** Wave lengths longer than the longest broadcast band wave length of 545 meters. Long waves correspond to frequencies between about 20 kilocycles and 550 kilocycles.

**loop antenna.** An antenna consisting of one or more complete turns of wire. It may be built into a radio receiver cabinet or separately mounted, and is usually tuned to resonance by a variable condenser. Loop antennas are used extensively in radio direction-finding apparatus.

**losses.** Energy which is dissipated before it accomplishes useful work.

**loudspeaker.** A device for converting audio frequency signals into sound waves.

**louver.** A type of loudspeaker grille con-

struction in which sloping slats or equivalent parts of a molded plastic cabinet hide the loudspeaker yet allow sound waves to emerge unhindered. Also spelled *louvre*.

**low-frequency padder.** In a superheterodyne receiver, a semi-adjustable condenser which is placed in series with the oscillator tuning circuit to control the calibration of the circuit at the low-frequency end of the tuning range.

**low-loss construction.** A type of radio part construction involving the use of insulating materials which maintain their insulating characteristics at high radio frequencies.

**lug.** A small strip of metal placed on a terminal-screw or riveted to an insulating material to provide a convenient means for making a soldered wire connection.

## M

**M.** A letter sometimes used to indicate that a particular resistance value is to be multiplied by 1,000. Thus, 50M would mean 50,000 ohms.

**ma.** Milliampere.

**magnet.** A piece of iron or steel which has the property of attracting other pieces of magnetic material such as iron, and has the property of attracting or repelling other magnets.

**magnet wire.** Insulated copper wire in sizes commonly used for winding coils used in electro-magnetic devices such as transformers, choke coils and relays.

**magnetic circuit.** A complete path for magnetic lines of force. It always includes the permanent magnet or electromagnet which is producing the magnetic lines of force.

**magnetic field.** A region in space surrounding a magnet or a conductor through which current is flowing.

**magnetic lines of force.** Imaginary lines used for convenience to designate the directions in which magnetic forces are acting throughout the magnetic field associated with a permanent magnet, electromagnet or current-carrying conductor.

**magnetic loudspeaker.** A loudspeaker consisting essentially of a permanent magnet, a pivoted armature which is mechanically connected to the diaphragm or cone, and a coil which is connected to the output stage of a radio receiver or other apparatus. Interaction between the permanent magnetic field and that developed in the armature by the coil results in movement of the armature and production of sound waves by the diaphragm.

**magnetic pick-up.** A phonograph pick-up consisting of a permanent magnet, one or two coils, an iron armature and a core structure so arranged that movement of the phonograph needle in the record groove varies the amount of magnetic flux passing through the coils, thereby inducing audio frequency voltages in the coils.

**magnetic flux.** Total number of magnetic

lines of force acting in a magnetic circuit.

**man-made static.** High-frequency noise signals which are produced by sparking in electrical apparatus or power lines and picked up by radio receivers, with the result that buzzing and crashing sounds are heard along with a desired radio program.

**manual tuning.** Tuning a radio receiver to a desired station by rotating the tuning control knob by hand.

**matching.** Connecting two circuits or parts together with a coupling device in such a way that the impedance of either circuit will be equal to the impedance existing between the coupling terminals to which that circuit is connected.

**maximum undistorted output.** The maximum audio power output which a radio receiver or audio amplifier will deliver without having more than 10% total harmonic distortion. Tests have shown that this amount of distortion is not ordinarily noticeable or objectionable.

**MAYDAY.** The international distress call for radiotelephone communication. It is derived from the French pronunciation of "M'aidez," meaning "Help me."

**mc.** Megacycle.

**meg.** Megohm.

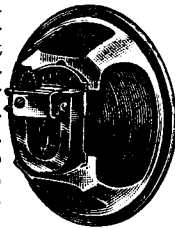
**megacycle.** One million cycles per second.

**megohm.** One million ohms.

**mercury.** A heavy, silvery-colored metal which is liquid at ordinary room temperatures. When heated, it gives off a vapor which is highly conductive when ionized.

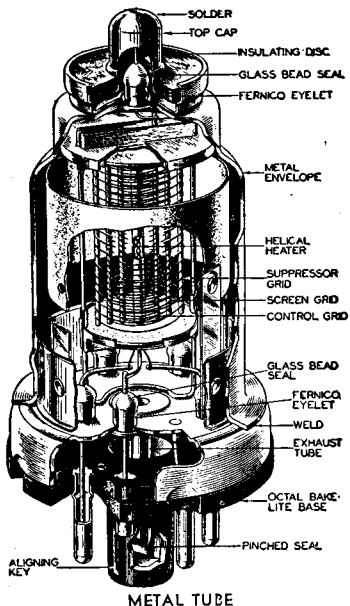
**mercury vapor rectifier tube.** A rectifier tube containing a small amount of mercury. When the filament or heater-type cathode is heated, mercury vapor is produced, and the resulting ionization of the mercury vapor molecules gives a much higher plate current than would be obtained in an equivalent vacuum type rectifier tube.

**metallized resistor.** A resistor made by depositing a thin film of high-resistance metal on the surface of a tube or rod made of glass or other insulating material. Leads are attached to opposite ends of the unit.





**metal-type tube.** A vacuum or gaseous tube having a metal envelope or housing with electrode connections being made through glass beads fused into the metal envelope.



METAL TUBE  
Courtesy R.C.A. Mfg. Co., Inc.

**meter.** The unit of length in the metric system; one meter is equal to 3.28 feet. An instrument used for making electrical measurements. Examples: voltmeter, ammeter, milliammeter, ohmmeter.

**mfd.** Microfarad.

**mh.** Millihenry.

**mho.** A unit of conductivity. The reciprocal of ohm.

**mica.** A transparent flaky mineral which splits readily into thin sheets and has excellent insulating and heat-resisting qualities. It is used extensively to separate the plates of condensers, to insulate electrode elements of vacuum tubes, and for many other insulating purposes in radio.

**mica condensers.** A condenser which employs sheets of mica as the dielectric material between plates.



MICA CONDENSERS

**micro.** A prefix meaning one millionth.

**microampere.** One millionth of an ampere.

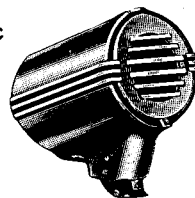
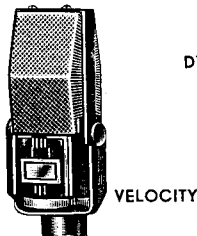
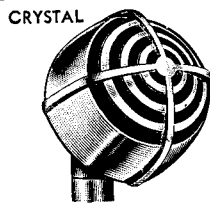
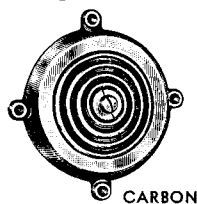
**microfarad.** A unit of capacity equal to one millionth of a farad. The microfarad is the capacity unit most commonly used in radio work. It is abbreviated as mfd.

**micromho.** One millionth of a mho. Used to measure tube transconductance.

**micro-microfarad.** A unit of capacity equal to one millionth of a microfarad, and abbreviated as mmfd.

**microphone.** A device which converts sound waves into corresponding audio frequency electrical energy. It contains some form

of flexible diaphragm which moves in accordance with sound wave variations. This movement, in turn, generates a minute voltage which is fed to the input of an amplifier where it is amplified many times. There are several types of microphones available, but they all operate on the above principle. **Carbon Microphone.** A microphone in which loosely packed carbon granules complete the electrical circuit between two terminals. The resistance of this circuit varies in accordance with variations in the pressure exerted on the granules by the sound-actuated diaphragm. In a single-button carbon microphone, the granules are on only one side of the diaphragm. In a double-button carbon microphone the granules are on both sides of the diaphragm, giving a push-pull action which greatly increases the resistance change produced by a given diaphragm movement. **Condenser Microphone.** A microphone in which the diaphragm serves as one plate of a condenser. Sound waves move the diaphragm in and out, causing the capacity of the microphone and the current through it to vary in accordance with the sound waves. **Contact Microphone.** A microphone designed to pick up mechanical vibrations directly and convert them into electrical impulses. It is used chiefly with string, wind, and percussion musical instruments, and is simply strapped or clamped to the housing of the instrument.



**Crystal Microphone.** A microphone depending upon the piezoelectric effect of Rochelle salt crystals to transform the mechanical stress produced by sound waves into electrical output. In general, crystal mikes are non-directional and have good frequency response. **Dynamic Microphone.** A microphone in which the diaphragm moves a voice coil back and forth in a constant magnetic field, causing audio currents to be induced in the coil. A small dynamic loudspeaker is often made to serve also as a dynamic microphone, particularly in two-way intercommunication systems. **Velocity or Ribbon Microphone.** A microphone in which a thin light-weight ribbon or duralumin alloy serves as the

diaphragm. This ribbon is mounted in a powerful fixed magnetic field. Audio frequency voltages are induced in the ribbon when it is moved back and forth through the magnetic field by sound waves.

**microphone pre-amplifier.** An audio amplifier which amplifies the output of a microphone sufficiently so that the audio signal may be sent over a transmission line to the main amplifier. Sometimes, particularly with condenser microphones, this microphone amplifier is mounted right on the microphone stand or in the microphone housing itself.

**microphone button.** A button-shaped container filled with carbon particles. When attached to the diaphragm of a microphone, the resistance between the terminals of the button varies in accordance with movements of the diaphragm.

**microphone stand.** A table or floor-type stand used to support a microphone in a desired position.

**microphone transformer.** The iron-core a.f. transformer which couples the microphone to a microphone amplifier, to a transmission line, or to the input circuit of the main audio amplifier.

**microphonic.** A condition in which mechanical movement of some radio part other than a microphone causes corresponding variations in circuit current. A radio tube is microphonic if a pinging sound is heard in the loudspeaker when the side of the tube is tapped with a finger; the tapping is then setting the internal elements into vibration. If sound waves from the loudspeaker are producing this vibration of tube elements, the sound will be sustained as a howl.

**mike.** A microphone.

**milli.** A prefix meaning one thousandth.

**milliammeter.** A measuring instrument which measures current flow in milliamperes.

**milliampere.** A unit of current equal to one thousandth of an ampere.

**millihenry.** A unit of inductance equal to one thousandth of a henry.

**millimeter.** A metric unit of length equal to one thousandth of a meter. One millimeter is approximately equal to one twenty-fifth of an inch.

**millivolt.** A unit of voltage equal to one thousandth of a volt.

**mixer.** A control which permits combining the output signals of two or more microphones or other a.f. signal sources in any desired proportion before these signals are fed to the input of the main a.f. amplifier. Also, the stage in a superheterodyne receiver in which the incoming modulated r.f. signals are mixed with the local oscillator signals to produce the i.f. signal.

**mm.** Millimeter.

**modulated amplifier.** The r.f. stage in a movable location such as on an automobile, fire truck, railway train, ship or airplane.

**modulated amplifier.** The r.f. stage in a transmitter at which the intelligence signal is made to modulate the r.f. carrier signal.

**modulated wave.** A radio wave which varies

either in frequency (frequency modulation) or in amplitude (amplitude modulation) in accordance with the wave form of the intelligence signal being transmitted.

**modulation.** The process of varying the frequency or the amplitude of an r.f. carrier signal in accordance with the wave form of the intelligence signal being transmitted.

**modulator.** The final audio stage in a radio transmitter. It feeds the intelligence signal into the modulated amplifier stage, where the signal is made to modulate the r.f. carrier signal.

**molecule.** The group of atoms which constitutes the smallest particles in which a compound or material can exist separately.

**monkey chatter.** Garbled speech or music heard along with a desired program. This type of interference occurs when the side frequencies of an adjacent-channel station beat with the desired station signal.

**monoscope.** A special type of cathode ray tube which produces television picture signals corresponding to the design or picture which has been printed on its screen. This tube is used in television picture signal generators to provide a satisfactory signal source for television receiver test purposes during those times when no television station is on the air.

**Morse Code.** A system of dot and dash signals used in the transmission of messages by radio or wire telegraphy. The International Morse Code (also called the Continental Code) is used universally for radio telegraphy, while the American Morse Code is used only for wire telegraphy.

**mosaic.** The light-sensitive plate in an iconoscope. The scene being transmitted is projected upon this plate, and is then scanned by the electron beam to produce the picture signal output of the television camera.

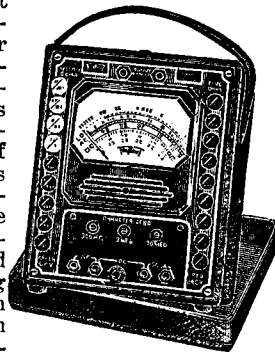
**motor.** A machine which converts electrical energy into mechanical energy.

**motorboating.** Regeneration occurring at audio frequencies in a radio receiver or audio amplifier, resulting in put-put-put sounds resembling those made by a motorboat.

**motor-generator.** An electric motor directly connected to one or more generators for the purpose of converting a power line voltage to other desired voltages or frequencies.

**mu.** Amplification factor.

**multimeter.** A test instrument having provisions for measuring voltages and currents, as well as resistance. It usually consists of one or sometimes two meters provided with the necessary number of scales, and a range-selecting switch which places a meter in the correct cir-



cuit for a particular measurement. Also known as a multitester, multiple-purpose tester or volt-ohm-milliammeter.

## N

**needle.** That part of a phonograph pick-up which converts the variations in the record grooves into mechanical movements which are in turn converted into audio frequency signals by the pick-up element. The needle must be carefully shaped to follow faithfully the high-frequency variations in the grooves without causing excessive record wear.

**negative.** A term used to describe a terminal which has more electrons than normal. Electrons flow out of the negative terminal of a voltage source.

**negative bias.** The use of a voltage which makes the control grid of a radio tube negative with respect to the cathode.

**negative feedback.** Degeneration, causing a reduction in signal strength.

**negative modulation.** In television, a method of transmission in which a decrease in scene illumination causes an increase in the radiated power of the transmitter.

**neon.** A pure gas sometimes used in electronic tubes. It produces a characteristic red glow when ionized.

**neon glow lamp.** A neon-filled gaseous tube having a glass envelope through which can be seen the characteristic red glow of neon when ionization occurs during operation of the tube.

**network.** Any complex electrical circuit. A group of broadcasting stations connected together by radio or wire telephone lines so that all stations can broadcast a program originating at one of the stations.

**neutralization.** A term used in radio to describe any process which balances out or prevents an undesirable effect such as oscillation.

**neutralizing tool.** A small screwdriver or socket wrench, constructed partly or entirely from non-metallic materials, and used for making neutralizing or aligning adjustments in radio receivers. It eliminates the body capacity effects which would affect the accuracy of the adjustments if an ordinary metal wrench or

**multiplier.** A resistor used in series with a voltmeter to increase the range of the meter.

screwdriver were used.

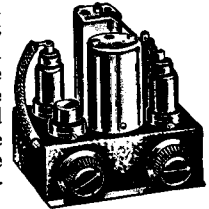
**nichrome.** An alloy of nickel, iron and chromium which has a high resistance per unit volume and is capable of withstanding high temperatures. It is used extensively in the construction of wire-wound resistors, as well as in the heating elements of soldering irons and other electrical heating appliances.

**noise.** In radio, a term used chiefly in connection with interfering sounds heard along with desired programs.

**noise filter.** A device which is inserted between a wall outlet and the power cord plug of a radio receiver to block noise interference which otherwise might enter the receiver.

**noise limiter.** A special radio circuit which limits the effects of interfering noises by cutting off all noise peaks which are stronger than the highest signal peak being received.

**noise silencer.** A special vacuum tube circuit which can be introduced into superheterodyne receivers to reduce the effects of static and man-made interference noises. Its chief value is in short wave communication receivers.



**noise-reducing antenna system.** An antenna system in which the only part capable of picking up signals is the antenna proper, this being erected high enough to be out of the noise-interference zone. The lead-in is a special shielded cable or twisted two-wire line which can pass through the interference zone without picking up noise signals.

**non-conductor.** Any material which offers very high opposition to the flow of electricity. An insulating material.

**non-magnetic.** Materials such as glass, wood, copper, brass and paper which are not affected by magnetic fields.

**obsolescence-free.** Not liable to become out of date because of new developments or new inventions. A term applied particularly to tube testers and other test instruments.

**octal base.** A type of tube socket base having eight equally-spaced prongs and a central aligning key. When some of the prongs are not needed, they are omitted without changing the positions of the remaining prongs.

**octal glass-type tube.** A glass tube having an octal base.

**ohm.** The unit of electrical resistance. The resistance of a device is one ohm when a d.c. voltage of one volt will send a current

of one ampere through that device. The Greek letter omega ( $\omega$  or  $\Omega$ ) is commonly used to represent ohms.

**ohmmeter.** A test instrument which measures and indicates directly the resistance of a part or the resistance between any two points in a circuit. It consists essentially of a milliammeter in series with a suitable d.c. voltage and suitable series or shunt resistors.

**ohmic value.** The resistance in ohms which a part or circuit offers to the flow of direct current.

**Ohm's Law.** A fundamental electrical law which expresses the relationship between

voltage, current, and resistance in a direct current circuit, or the relationship between voltage, current and impedance in an a.c. circuit. The three forms of the law in each case are given below, in which E is the pressure in volts, I is current in amperes, R is resistance in ohms and Z is impedance in ohms.

#### D.C. FORMS

$$E = I \times R$$

$$I = E \div R$$

$$R = E \div I$$

#### A.C. FORMS

$$E = I \times Z$$

$$I = E \div Z$$

$$Z = E \div I$$

**ohms-per-volt.** A sensitivity rating for meters. It is obtained by dividing the resistance in ohms of any meter range by the full scale voltage reading of the meter at that range. The higher the ohms-per-volt rating, the more sensitive is the meter.

**operator.** A person whose duties include the adjustment, maintenance and operation of radio transmitting equipment.

**oscillation.** A condition whereby high-frequency currents are generated in a circuit.

**oscillator.** The stage in a radio receiver, transmitter or other apparatus in which a vacuum tube and associated parts generate alternating current energy when fed with direct current energy. Thus, the oscillator stage in a superheterodyne receiver generates an r.f. signal of the correct frequency to produce the i.f. carrier signal when mixed with an incoming station signal. In a transmitter, the oscillator stage generates the carrier frequency of the station or a frequency equal to some definite fraction of the assigned frequency.

**oscillograph.** A test instrument which records photographically the wave form of a varying current or voltage.

**P.** A letter used to designate power, the plate electrode of a tube, or the primary winding of a transformer.

**p.a.** Public address.

**padder.** In a superheterodyne receiver, the trimmer condenser placed in series with the oscillator tuning circuit to control the receiver calibration at the low-frequency end of a tuning range.

**panel.** A sheet of metallic or non-metallic material on which the operating controls of a radio device such as a receiver, transmitter, or p.a. amplifier are mounted.

**paper condenser.** A fixed condenser employing foil plates separated by paraffined or oiled paper.

**parallel connection.** A connection in which current divides between two or more parts, as contrasted to a series connection in which the same current flows equally through all parts. Batteries are connected in parallel by connecting the positive terminals together, then connecting the negative terminals together.

**parallel resonant circuit.** A tuning circuit consisting of a coil and condenser connected in parallel. At resonance, it offers a high impedance, so that a large value of signal voltage is developed across it at the frequency to which it is tuned.

**oscilloscope.** A test instrument which shows visually on a screen the wave form of a varying current or voltage.

**outlet.** A set of terminals from which electric power may be obtained. Thus, power at the a.c. line voltage may be obtained from a wall outlet in a building connected to an a.c. power system.

**output.** The useful electrical energy delivered by a radio receiver, a.f. amplifier, electrical generator, or any other signal or power source.

**output impedance.** The impedance as measured between the output terminals of a radio device, receiver or amplifier at a definite frequency or at a predominant frequency in the audio range which the device is to handle. For maximum efficiency, the load impedance should match or be equal to this output impedance.

**output meter.** A meter connected to the output of a receiver or amplifier for the purpose of measuring variations in output signal strength.

**output stage.** The final stage in a receiver or a.f. amplifier. In a radio receiver, the output stage feeds the loudspeaker directly. In an a.f. amplifier, the output stage may feed into one or more loudspeakers, a transmission line, or a cutting head in the case of a sound recording system.

**output transformer.** An iron-core a.f. transformer used to provide efficient coupling between the output stage of a radio receiver or a.f. amplifier and its load.

**output tube.** A tube designed for use in the output stage. It is a power amplifier tube, whereas the other tubes in a receiver are usually voltage amplifier tubes.

## P

**peak.** The maximum instantaneous value of a varying voltage or current.

**pentode.** A vacuum tube having five electrodes. Ordinarily these will be the cathode, control grid, screen grid, suppressor grid and anode.

**permanent magnet.** A piece of hardened steel or other magnetic material which has been magnetized and retains its magnetism.

**permanent magnet dynamic speaker.** A moving coil speaker with its field supplied by a permanent magnet.

**permeability tuning.** Tuning of radio by means of adjustable iron-core inductance in place of tuning condenser.

**Phillips screw.** A screw having an indented cross is its head in place of a single slot.

**phone.** A headphone.

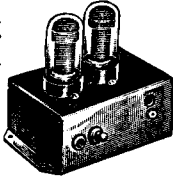
**Phonograph.** A device for converting mechanical vibrations into sound waves.

**Electrical Phonograph.** A phonograph in which the motor derives its power from an electrical source. **Mechanical Phonograph.** A phonograph utilizing a hand-wound type of mechanical motor.

**phonograph connection.** A set of two terminals sometimes provided at the back of a radio receiver for making connections to a phonograph pick-up. The terminals connect to the input of the a.f. amplifier. This

connection permits use of the entire audio amplifier and loudspeaker to reproduce phonograph records.

**phonograph oscillator.** An r.f. oscillator arranged for modulation by the output of a phonograph pick-up, so that the resulting modulated r.f. signal can be fed to the antenna and ground terminals of a radio receiver. This permits using the entire receiver (rather than just the a.f. amplifier) for amplifying and reproducing phonograph records.



**phonograph pick-up.**

A device which converts variations in the grooves of a phonograph record into corresponding audio signals. It consists essentially of a needle which converts record groove variations into mechanical movements, and a crystal, dynamic or photoelectric system which converts these mechanical movements into the audio signals.



**photoelectric cell.** A device which converts variations in light into corresponding variations in voltage or current.

**picture element.** In a television system, the smallest portion of a picture or scene which is individually converted into an electrical signal and transmitted.

**picture frequency.** In television, the number of complete pictures which are scanned and transmitted in one second.

**pigtail.** A flexible connection between a stationary terminal and a part or terminal which has a limited range of motion.

**pilot lamp.** A small lamp mounted on the panel of a radio receiver to illuminate the tuning dial, or mounted on the panel of other radio apparatus to indicate when the apparatus is turned on.



**plastic.** A general term used in connection with any of the black or colored materials used for molding radio receiver cabinets, control knobs, tube bases, sockets, and the insulating portions of many other radio parts. It is an excellent insulating material and has a natural smooth glossy surface which requires no finishing or polishing operations after molding.

**plate.** The anode in a radio tube. It is usually at a high positive potential with respect to the cathode, and therefore attracts the electrons emitted by the cathode.

**plate circuit.** A circuit including the plate voltage source and all other parts connected between the cathode and plate terminals of a radio tube.

**plate current.** The current flowing through the plate circuit of a radio tube and between the plate and cathode inside the tube. The electrons which make up the plate current always flow in the direction from the cathode to the plate.

**plate supply.** The voltage source used in a vacuum tube circuit to place the plate at a high positive potential with respect to the cathode. The plate supply voltage is

always higher than the actual plate voltage, because of the voltage drops across resistances in the plate circuit.

**plate voltage.** The d.c. voltage existing between the plate and cathode terminals of a radio tube.

**plug.** A connecting device at the end of a flexible cord, used for making an instantly-removable connection to a corresponding terminal jack or outlet.

**plug-in coil.** A coil having as its terminals a number of prongs arranged to fit into a socket mounted on the radio chassis. With this arrangement, the tuning range of a receiver or transmitter can be changed simply by pulling out one coil and inserting another in the socket.



**polarity.** In a radio part or circuit, the quality of having two opposite charges, one negative and the other positive. In a magnetic circuit or part, the quality of having two opposite poles, one North and the other South.

**pole.** One end of a magnet. One electrode of a battery.

**police calls.** Broadcasts or calls made by police radio stations. Many modern single-band receivers are capable of picking up police radio stations operating on frequencies between 1626 kc. and 1712 kc. (just beyond the high-frequency end of the broadcast band).

**positive.** A term used to describe a terminal having fewer electrons than normal, so that it attracts electrons in seeking to return to its normal state. Thus, electrons flow into the positive terminal of a voltage source.

**positive feedback.** Regeneration, causing an increase in signal strength.

**positive modulation.** In television, a method of transmission in which an increase in scene illumination causes an increase in the radiated power of the transmitter.

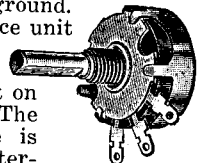


PORTABLE RECEIVERS

**portable receiver.** A completely self-contained radio receiver having the loudspeaker, all necessary batteries, and a loop antenna built into a compact carrying case. Terminals are sometimes provided for external antenna and ground connections.

**potential.** The voltage existing between one point in a circuit and another point, or between one point and ground.

**potentiometer.** A resistance unit having a rotating contact arm which can be set at any desired point on the resistance element. The total available voltage is applied to the fixed end terminals of the resistance element, and the output circuit is connected between the movable contact and



one end terminal. Rotating the movable contact thus varies the proportion of the total voltage which is transferred to the output circuit. The volume control of a receiver or p.a. amplifier is generally a potentiometer.

**power.** The rate at which electrical energy is delivered and consumed. Electrical power is measured in watts.

**power amplifier stage.** An audio amplifier stage which is capable of handling a relatively large amount of audio power without distortion. An r.f. amplifier stage in a transmitter which serves primarily to increase the power of the r.f. carrier signal.

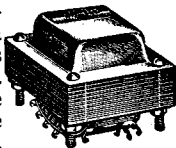
**power factor.** A percentage rating obtained by dividing the resistance of a part or circuit by its impedance at the operating frequency, then multiplying the result by 100. A resistor has a power factor of 100%; high-quality condensers and coils have very nearly zero percent power factor.

**power level.** The amount of electrical power passing through a given point in a circuit. Power level can be expressed in watts, in decibels, or in volume units.

**power level indicator.** An a.c. voltmeter which is calibrated to read in terms of audio power level.

**power pack.** The power supply unit of a radio receiver, amplifier, transmitter, or other radio apparatus. Its function is to convert the available power line or storage battery voltage to the values required by filament, grid and plate circuits.

**power transformer.** An iron-core transformer having a primary winding which is connected across the a.c. power line, a high-voltage secondary winding for the power pack rectifier tube, and one or more low-voltage secondary windings which supply the required a.c. voltages to the tube filaments.



**power output tube.** A radio tube especially designed for use in the a.f. output stage of a radio system. It is capable of handling much greater current than the ordinary amplifier tube, and hence delivers high output power.

**preselector.** That circuit or r.f. amplifier stage in a superheterodyne receiver which amplifies the incoming modulated r.f. signal before it is converted to the i.f. signal by the oscillator-mixer-first detector section.

**pri.** Primary.

**primary.** First in order of time, placement, development or importance.

**primary cell.** A type of cell in which the generated voltage is due to permanent chemical changes in the cell material. A primary cell cannot be recharged. This is the earliest known type of cell.

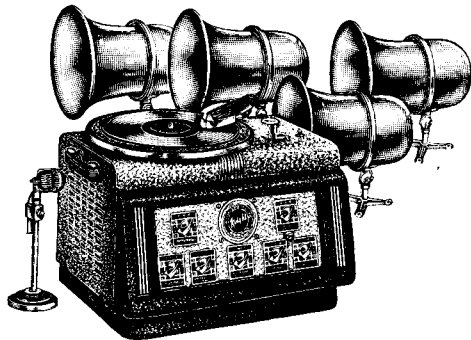
**primary winding.** The input winding of a transformer. It can be identified by the fact that the r.f., a.f. or power line alternating current or pulsating d.c. is sent through this winding.

**proton.** One of the positively charged particles which, together with electrons (nega-

tively charged particles), make up the structure of an atom.

**public address amplifier.** An audio amplifier capable of supplying sufficient audio power to loudspeakers for adequate sound coverage of public gatherings.

**public address system.** A complete system for reproducing voice and speech with adequate volume for large public gatherings. It includes one or more microphones a powerful audio amplifier with suitable power supply, and a sufficient number of loudspeakers to give coverage of the auditorium, stadium or other large space. Most installations also include a phonograph which may or may not be of the automatic record changer type.



PUBLIC ADDRESS SYSTEM

**pulsating current.** A direct current which changes in amplitude with a definite degree of regularity but which never changes polarity.

**pulse.** A momentary sharp change in a current or voltage.

**push-back hook-up wire.** Tinned copper hoop-up wire covered with a loosely braided, cotton insulation which can be pushed back from the end of a wire length with the fingers to expose sufficient bare wire for a connection. Radio men use this type of wire almost exclusively for experimental and repair work.

**push-button tuner.** A tuning unit which automatically tunes a radio receiver to a station when the button assigned to that station is pressed. In electrical automatic push-button tuning, the button actuates switches which connect a set of pre-adjusted trimmer condensers into the receiver tuning circuits. In electromechanical automatic push-button tuning, the button controls the starting and stopping circuits of a small motor which rotates the regular gang tuning condenser of the receiver. In mechanical automatic push-button tuning, pressure on the button is transferred by a lever or cam system into a force which rotates the gang tuning condenser to the correct position for the desired station.

**push-pull circuit.** A two-tube audio output circuit so arranged that both tubes operate simultaneously and their individual a.f. plate currents add in the common load to give twice the output of a single tube. This circuit arrangement has the added



advantage that it balances out all even harmonics which would otherwise cause distortion.

**push-pull transformer.** An iron-core a.f. transformer designed for use in a push-pull amplifier circuit. If it is the input transformer, it will have a center-tapped

secondary winding. If it is the output transformer, it will have a center tapped primary winding.

**push-push circuit.** A two-tube audio output circuit so arranged that the tubes operate alternately into a common load.

**Q factor.** A rating used to express merit characteristics of coils and resonant circuits. It is obtained by dividing reactance by ohmic resistance.

**Q signal.** One of the three-letter abbreviations in the International List of Abbreviations, used to represent complete sentences in radio telegraphy. When the question form of the sentence is intended, the code signal for an interrogation mark is sent after the abbreviation. Thus QRM means

"I am being interfered with," and QRM? means "Are you being interfered with?"

**quartz-crystal.** A thin slab about the size of a half-dollar, cut from a natural crystal of the mineral quartz and carefully ground to a thickness which will make it vibrate at the desired natural frequency when supplied with energy. It is used as the master carrier frequency source in the crystal oscillator stage of a radio transmitter.

**R. Resistance.**

**radar.** A general term applied by U. S. armed forces to secret ultra-high-frequency equipment used for locating nearby or distant enemy ships and planes otherwise obscured from view. Used also as a means of automatically controlling range and lead-angle of gun-fire.

**radiation.** The process wherein the transmitting antenna system of a radio station converts the modulated r.f. output of the transmitter into radio waves which travel away from the station through space.

**radiation pattern.** A diagram showing how well an antenna system radiates in various directions or locations.

**radio.** Communication by means of radio waves. Also, a receiving set capable of picking up radio waves and reproducing the intelligence they convey. This intelligence may consist of speech, music, code signals, writing, printed matter, diagrams, photographs, motion pictures, actual scenes, etc. In space radio, which is the conventional form, radio waves are transmitted through space. In wired radio, the radio waves are guided by conductors.

**radio beacon.** A stationary radio transmitter which sends out special identifying signals continuously. Radio receivers on ships at sea and on aircraft in flight can tune to a radio beacon to determine their direction and position with respect to the beacon location.

**radio broadcasting.** A one-way transmission of voice and music to anyone within receiving range of the radio station.

**radio compass.** A radio direction finder used chiefly in marine and aircraft radio stations for navigational purposes.

**radio frequency.** Any frequency in the radio spectrum above the highest audible frequency, which is about 20,000 cycles. This term is also used in connection with radio parts designed for use at frequencies higher than the audio frequency range. Abbreviated r.f.

**radio frequency amplifier.** A vacuum tube amplifier stage to provide amplification

at radio frequencies. In a t.r.f. receiver, all stages ahead of the detector are r.f. amplifier stages. In a superheterodyne receiver, the amplifier stage sometimes used ahead of the first detector (in the pre-selector) is an r.f. amplifier stage.

**radio frequency choke.** A choke coil designed to have high impedance at radio frequencies, so that it limits or blocks the flow of r.f. currents.

**radio frequency transformer.**

An air-core or pulverized iron-core transformer used in r.f. circuits.

**radio metal locator.** A radio instrument which indicates the presence of metal within its operating range by a change in meter reading or a change in a tone signal heard in headphones. Used for determining positions of buried pipe lines, buried metal objects, metal objects concealed in the clothes of prisoners, metal objects imbedded in logs about to be sawed, deposits of metallic minerals, etc.

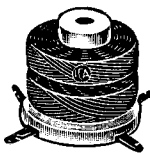
**radio meteorograph.** A combination meteorograph and radio transmitter carried aloft by an unmanned gas-filled rubber balloon and so designed that it will transmit back to earth radio signals which can be interpreted in terms of the pressure, temperature and humidity at regular intervals during the ascent of the balloon into the stratosphere. When the balloon bursts, the instrument is lowered to earth by a parachute.

**radio prospecting.** Use of radio equipment to locate mineral or oil deposits.

**radio receiver.** An instrument which amplifies radio frequency signals, separates the r.f. carrier from the intelligence signal, amplifies the intelligence signal additionally in most cases, then converts the intelligence signal back into the original sound waves.

**radiosonde.** A radio meteorograph.

**radio telegraphy.** Radio communication by means of the International Morse Code.



**radio telephone transmitter.** A transmitter capable of sending voice and music, as contrasted to a radiotelegraph transmitter which can send only code.

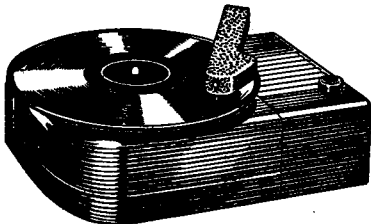
**radio telephony.** Two-way voice communication between two or more stations by means of radio waves.

**Radiotrician.** A trained radio serviceman.

**radio wave.** A combination of electric and magnetic fields varying at a radio frequency, and capable of traveling through space at the speed of light. It is produced by feeding the output of a radio transmitter to the transmitting antenna, and may carry modulation.

**R.C.A. licensed.** Manufactured under a licensing agreement which permits use of patents controlled by the Radio Corporation of America.

**reactance.** Opposition offered to the flow of alternating current by the inductance or capacity of a part. Reactance is measured in ohms, and depends upon the frequency of the alternating current as well as upon the electrical value of inductance or capacity. A condenser has capacitive reactance, and a coil has inductive reactance. The letter X is used to designate reactance.



**record player.** A motor-driven turntable and a crystal or magnetic phono pick-up used for converting a phonograph record into audio frequency signals. These signals must be fed into the audio section of a radio receiver or into a separate audio amplifier for additional amplification before they can be reproduced as sound waves by a loudspeaker. When the amplifier and loudspeaker are built into the same cabinet with the record player, the combination is generally called an electric phonograph.

**recorder.** An instrument which makes a permanent record of a varying electrical signal. Thus, code messages are recorded on paper tape by a code recorder. Music and voice are recorded on discs or other materials by a sound recorder. Pictures and printed matter transmitted by radio are reproduced on paper by a facsimile recorder.

**rectifier.** A device which changes an alternating current into a pulsating direct current. It may be a vacuum tube, gaseous tube, crystal, vibrator or copper-oxide device.

**regeneration.** A method of securing increased output from an amplifier by feeding a part of the amplifier output back to the amplifier input in such a way that reinforcement of the input signal is obtained. With this arrangement, a signal may pass through the same amplifier over

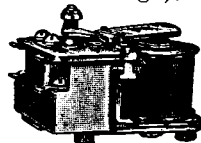
and over again, with a resultant increase in amplitude.

**regeneration control.** A rheostat, potentiometer, or variable condenser which is used in a regenerative receiver to control the amount of signal which is fed back from output to input in the regenerative detector stage.

**regenerative detector.** A vacuum tube detector in which intentional feedback of r.f. energy from the plate circuit to the control grid circuit produces regeneration.

**regenerative receiver.** A radio receiver which employs controlled regeneration to increase the amplification provided by a vacuum tube stage (usually the detector stage).

**relay.** An electromagnetic device which permits control of current in one circuit by a much smaller current flowing in another circuit.



**remote control.** Operation of radio transmitting or receiving equipment from a remote point.

**resistance.** The opposition which a device or material offers to the flow of direct or alternating current. The opposition which results in production of heat in the material carrying the current. Resistance is measured in ohms, and is usually designated by the letter R.

**resistance coupling.** A type of coupling in which a resistor and condenser provides a path for signal energy between two circuits.

**resistivity.** The resistance in ohms which a unit cube of a material offers to the flow of electric current.

**resistor.** A radio part which offers resistance to the flow of electric current. Its electrical size is specified in ohms or megohms (one megohm equals 1,000,000 ohms). A resistor also has a power-handling rating in watts, indicating the amount of power which can safely be dissipated as heat by the resistor.

**resonance.** In a circuit containing both inductance and capacity, a condition in which the inductive reactance is equal to and cancels out the capacitive reactance at a particular frequency.

**resonant frequency.** The frequency which produces resonance in a coil-condenser tuning circuit. In a series resonant circuit, the largest current flow occurs at the resonant frequency. In a parallel resonant circuit, the largest voltage is developed across the circuit at the resonant frequency.

**resting frequency.** The assigned carrier frequency of a radio station which employs the frequency modulation system of broadcasting. The resting frequency is radiated only during intervals when no sound waves are being transmitted.

**r.f.** Radio frequency.

**rheostat.** A resistance unit which can be varied in ohmic value so as to control the flow of current in the circuit of which it is a part.

**Rider's manuals.** A series of reference books

which contain servicing information and circuit diagrams of radio receivers manufactured from 1919 on. These manuals are used chiefly by radio servicemen.

**rim-drive.** A method of driving a phonograph or sound recorder turntable with a rubber-covered wheel which is in contact with the rim of the turntable. The wheel is powered by an electric motor.

**ripple.** An alternating current component which is present in the output of a d.c. voltage supply such as a power pack or d.c. generator.

**R.M.A.** Radio Manufacturers Association, an organization of leading manufacturers in the radio industry. Its work involves standardizing sizes and designs of radio parts, standardizing of color markings on parts (such as the R.M.A. color code for resistors and condensers) and standardizing of radio terms and definitions.

**R.M.A. color code.** A standard method of designating resistor values by colored markings. The code is given at the back of this book.

**r.m.s.** Root mean square value, which is the

effective value of an alternating current. It corresponds to the equivalent direct current value which will produce the same heating effect. Unless otherwise specified, alternating current values are always r.m.s. values.

**rosin-core solder.** Solder which has as its core the correct amount of rosin flux for effective radio soldering work. The rosin is released automatically as the solder is applied to the heated joint.

**rotor plates.** The movable plates of a variable condenser. They are usually connected directly to the metal frame of the condenser.

**rotary beam antenna.** A highly directional short wave receiving or transmitting antenna system mounted on a high pole or mast in such a way that it can be rotated to any desired positions either manually or by an electric motor drive.

**rotary switch.** Any switch which is operated by rotating its control knob.

**r.p.m.** Revolutions per minute.



## S

**S.** A letter sometimes used to designate the secondary winding of a transformer.

**sapphire.** A gem used in the tips of high-grade phonograph needles and in cutting needles used with sound recorder.

**scale.** A series of marks printed on a flat surface over which the pointer of a meter moves. The value of the mark directly behind the pointer corresponds to the meter reading.

**scanning.** The process of analyzing successively the amount of light present in each of the picture elements which make up the total area of a picture or scene being converted into electrical signals for television or facsimile transmission.

**s.c.c.** Single cotton covered insulation on a wire.

**s.c.e.** Single cotton covering over an enamel insulating layer on a wire.

**schematic diagram.** A diagram which shows electrical connections of a radio device by means of symbols which are used to represent the radio parts.

**scratch filter.** A filter circuit used in connection with a phonograph pick-up to block those frequencies at the higher end of the audio range at which needle scratch is most prominent.

**screen grid.** An electrode mounted between the control grid and plate of a vacuum tube for the purpose of reducing the capacity between these two electrodes.

**screen grid tube.** A vacuum tube having a screen grid. It may be a tetrode (four-element tube) or a pentode (five-element tube). In the latter case, it is more often called a screen grid pentode.

**screen grid voltage.** The d.c. voltage which is applied between the screen grid and the cathode of a vacuum tube to make the screen grid highly positive with respect to the cathode.

**sec.** Secondary.

**secondary winding.** Any of the output windings in a transformer.

**secondary cell.** A d.c. voltage source which is capable of storing electrical energy. When exhausted, it can be recharged by sending direct current through it in the reverse direction. Each cell of an ordinary storage battery is a secondary cell.

**secondary emission.** Emission of electrons from a cold electrode when it is hit or bombarded by high-speed electrons.

**selectivity.** The degree to which a radio receiver is capable of reproducing signals of one station while rejecting signals from all other stations.

**self-bias.** Referring to a vacuum tube stage which produces its own grid bias voltage. Plate current flowing through a resistor in series with the cathode lead produces across this resistor the voltage drop used for grid bias purposes. Also called automatic C bias.

**sensitivity.** The minimum strength of signal input which is capable of producing a desired value of signal output. A measure of the ability of a radio receiver to reproduce weak signals with satisfactory volume.

**series connection.** A connection in which the same current must flow through all of the series-connected parts. When dry cells or batteries are connected in series so that their voltages add, the minus terminal of one cell must be connected to the plus terminal of the next cell.

**series resonant circuit.** A circuit in which a coil and condenser are connected in series, and have values such that the inductive reactance of the coil will be equal to the capacitive reactance of the condenser at the desired resonant frequency. At resonance, the current through a series resonant circuit is a maximum.

**service area.** The region around a broadcast

station in which its signal strength is strong enough to insure satisfactory reception at all times.

**SG.** Letters used to designate the screen grid electrode of a vacuum tube.

**shadow tuning indicator.** A tuning meter which has a small piece of cardboard attached to its pointer, with a pilot lamp mounted behind the pointer so that a shadow is thrown upon a glass screen. The meter is so constructed and connected into a radio receiver circuit that the shadow will be narrowest when the receiver is accurately tuned to a station.

**shield.** A metal can or housing placed around a radio part to prevent its electric and magnetic fields from affecting nearby parts or to prevent other fields from affecting it.

**shielded wire.** Insulated wire having around it a shield of tinned braided copper wire.

**short circuit.** A low-resistance connection, usually accidental, occurring between the two sides of a circuit or between any two circuit terminals; it often results in excessive current flow and damage to some parts.

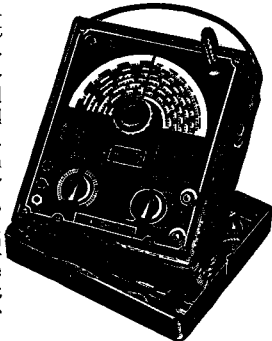
**short waves.** Wavelengths shorter than those included in the broadcast band, hence waves shorter than 200 meters. Short waves correspond to frequencies higher than the highest broadcast band frequency of 1600 kilocycles.

**short-wave converter.** A radio device which can be connected between a broadcast receiver and its antenna system to permit reception of higher-frequency stations which the receiver could not otherwise receive. It consists essentially of an oscillator-mixer first-detector arrangement like that used in a superheterodyne receiver, and serves to convert the high-frequency signals to a broadcast band frequency which can be handled by the regular receiver.

**shunt.** A resistor placed across the terminals of an ammeter to increase the full-scale current measuring range of the meter. Any parallel-connected part, or the act of placing one part in parallel with another.

**signal.** A radio wave or alternating current which carries intelligence of any form. More generally, any alternating current having other than an a.c. power line frequency.

**signal generator.** A test instrument used by radio servicemen to produce a modulated or unmodulated r.f. carrier signal having a known radio frequency value, sometimes also at a known voltage. It is used as a signal source during alignment of a radio receiver and when hunting for the defective part in an improperly operating receiver. An all-wave signal



generator has several ranges, and hence can be set to any carrier frequency which an all-wave receiver can receive.

**signal-to-noise ratio.** The ratio of the intensity of a desired signal at any point to the intensity of noise signals at that same point. The higher the signal-to-noise ratio, the less noise there is to interfere with reception.

**signal tracing.** A radio receiver servicing technique which involves tracing the progress of a radio signal through an entire receiver, stage by stage, while the receiver is in operation. Measurements which are made during this procedure by a special signal-tracing test instrument indicate when the defective part or stage has been reached.

**sine wave.** The wave form of a pure alternating current such as that produced by a.c. power systems. It reaches a peak or maximum in one direction, drops to zero, reverses its direction and reaches a peak in the opposite direction, then returns to zero again during one complete cycle.

**single-button carbon microphone.** A microphone having a carbon-filled button on only one side of its diaphragm.

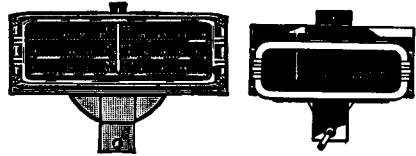
**single-pole switch.** A toggle or knife switch with a single blade and a single contact.

**single-throw switch.** A toggle or knife switch in which each movable contact arm or blade always touches the same contact when closed.

**skip distance.** The distance between the farthest point reached by the ground wave of a radio station and the nearest point at which the reflected skip wave comes back to earth. This skip effect usually occurs only during high-frequency transmissions (short-wave transmissions).

**sky waves.** Radio waves which travel up into the sky from the transmitting antenna and are reflected back to earth by the Kennelly-Heaviside ionized layer.

**slide rule dial.** A type of tuning dial used on radio receivers, in which a vertical marker moves horizontally over long straight scales resembling the scales of a slide rule.



SLIDE RULE DIALS

**socket.** A mounting device for tubes, plug-in coils, plug-in condensers, plug-in resistors and crystals, having holes with spring clips arranged to fit and grip the terminal prongs of the part being plugged in. Also, a bayonet or screw type socket for pilot lamps.

**solder.** An alloy of lead and tin which melts at a fairly low temperature and is used in radio for making permanent electrical connections between parts and wires.

**soldering iron.** A device used to apply heat to a joint which is to be made permanent by soldering.

**sound.** A vibration of a body at a rate which can be heard by human ears. The extreme limits of human hearing are about 20 cycles and 20,000 cycles. Sound can travel through any medium which possesses the ability to vibrate; the resulting traveling vibrations are called sound waves.

**source.** A term sometimes used to describe the part which is supplying electrical energy or radio signals to a circuit.

**space charge.** A gathering of electrons near the cathode of a vacuum tube. Being negative, it tends to limit the number of electrons which can reach the plate, and hence limits the plate current.

**spaghetti.** Heavily varnished cloth tubing sometimes used to provide additional insulation for radio circuit wiring.

**s.p.d.t. switch.** Single pole, double throw switch.

**spider.** A highly flexible fiber ring which serves to center the voice coil of a dynamic loudspeaker without appreciably hindering the in-and-out motion of the voice coil and its attached diaphragm.

**splice.** A joint between two wires which possesses mechanical strength as well as good electrical conductivity.

**s.p.s.t. switch.** Single pole, single throw switch.

**squealing.** A condition in which a high-pitched note is heard along with the desired radio program. It can be due to interference between stations or to a number of other causes.

**s.s.c.** Single silk covered wire.

**stand-off insulator.** An insulator used to support a wire at a desired distance away from the building or other support on which the insulator is mounted.

**static.** Interfering noises heard in a radio receiver due to radio waves created by atmospheric electrical disturbances such as discharges of lightning.

**stator.** The fixed set of plates in a variable condenser.

**step-down transformer.** A transformer in which the secondary winding has fewer turns than the primary, so that the secondary delivers a lower voltage than is applied to the primary.

**step-up transformer.** A transformer in which the secondary winding has more turns than the primary, so that the secondary delivers a higher voltage than is applied to the primary.

**table model receiver.** A radio receiver having a cabinet of suitable shape and size to permit placing on a table.

**television.** The transmission and reception of a rapid succession of images by means of radio waves travelling through space or over wires.

**television connection.** Terminals which permit the use of an ordinary radio receiver in amplifying and reproducing the audio signals associated with a television program. These terminals simply connect to the input of the audio amplifier in the receiver, just as do the phonograph con-

nection terminals.

**storage battery.** One or more secondary or storage cells connected together, usually in series.

**storage cell.** A secondary cell. More specifically, one of the cells of the ordinary automotive storage battery, delivering a voltage slightly higher than two volts and capable of being recharged.

**stranded wire.** A wire which consists of a number of finer wires twisted together.

**superheterodyne receiver.** A type of radio receiver in which the incoming modulated r.f. signals are amplified a small amount in the preselector, then fed into the frequency converter section (consisting of the oscillator, mixer and first detector) for conversion into a fixed, lower carrier frequency called the i.f. value of the receiver. The modulated i.f. signals are given very high amplification in the i.f. amplifier stages, then fed into the second detector for demodulation. The resulting audio signals are amplified in the conventional manner by the audio amplifier, then reproduced as sound waves by the loudspeaker.

**suppressor.** A resistor inserted in series with the spark plug lead or the distributor lead of an automobile engine to suppress spark interference which might otherwise interfere with reception of radio programs in the auto radio set.



**sweep circuit.** A special oscillator circuit which generates a voltage having a sawtooth wave form suitable for making the electron beam of a cathode ray tube sweep back and forth across the fluorescent screen.

**switch.** A mechanical device for opening and closing an electrical circuit, or for changing the connections between parts or circuits.

**symbol.** A simple design used to represent a radio part in a schematic circuit diagram. A letter used in formulas to represent a particular quantity.

**synchronous vibrator.** A vibrator which serves the dual function of converting a low d.c. voltage to a low a.c. voltage and at the same time rectifying a high a.c. voltage. When used in an auto radio power pack, it eliminates the need for a rectifier tube.

## T

**terminal.** A point to which electrical connections are made.

**test lead.** A flexible insulated lead used chiefly for connecting meters and test instruments to a circuit under test.



**test prod.** A sharp metal point provided with an insulated handle and means for connecting the point to a test lead. It is used for making a touch connection to a circuit terminal.

**tetrode.** A four-electrode vacuum tube. Or-

dinarily, these electrodes will be the cathode, control grid, screen grid, and anode.

**three-band receiver.** A radio receiver having three different tuning ranges. One range will always include the broadcast band, and may also include police stations operating on frequencies just above the broadcast band. The other two ranges will usually be from about 2.2 mc. to about 7.5 mc., and from about 7.25 mc. to about 24 mc.

**tickler.** A coil connected in series with the plate circuit for the purpose of feeding a portion of the amplified signal current back into the grid circuit by induction for repeated amplification. The tickler is used chiefly in regenerative detector circuits.

**time signals.** Naval Observatory time signals which are broadcast regularly each day by government radio station NAA in Arlington, Virginia on a number of different frequencies. They can generally be picked up during the final minute of each hour on 9,425 kc. by a good all-wave receiver. These signals are used by army and navy stations, ships at sea, jewelers, and other persons throughout the entire country for setting timepieces. NAA signals are re-broadcast by some broadcasting networks at certain hours.

**toggle switch.** A small snap-action switch operated by means of a lever.

**tolerance.** The permissible variation from a rated or assigned value.

**tone.** The general character of a reproduced radio program as it affects the human ear.

**tone control.** A circuit control sometimes provided on a radio receiver to permit strengthening the response at either low or at high audio frequencies at will, so as to make the reproduced radio program more pleasing to a particular audience.

**top cap.** A metal cap sometimes placed on the top of a vacuum tube and connected to one of the electrodes, usually the control grid.

**tracking.** A term used to indicate that all of the tuned circuits in a receiver follow the frequency indicated by the tuning dial pointer as the receiver is tuned over its entire tuning range.

**transcription.** An electrical transcription, in which a complete radio program is recorded for future use.

**transformer.** Two or more coils mounted on a common support in such a way that the magnetic lines of force produced by the flow of alternating or pulsating direct current through one coil will pass through the other coil and induce in it a resultant a.c. voltage.

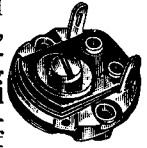
**transmission line.** Any set of conductors used to carry r.f. or a.f. signals or energy from one location to another.

**transmitter.** A comprehensive term applying to all of the equipment used for generating and amplifying an r.f. carrier signal, modulating this carrier with intelligence, and radiating the modulated r.f. carrier into space after it is amplified additionally and fed to the transmitting antenna.

**treble.** A term sometimes used to designate high audio frequencies.

**t.r.f.** Tuned radio frequency.

**trimmer condenser.** A small semi-adjustable condenser, usually adjusted with a screwdriver, and used in the tuning circuits of radio receivers and other radio apparatus to permit accurate alignment of these circuits.



**triode.** A three-electrode vacuum tube, usually having a cathode, control grid and anode.

**tube.** A vacuum tube, gaseous tube or photoelectric cell used in any radio or electronic circuit or apparatus.

**tube tester.** A test instrument used to test the condition of radio tubes.

**tubular condenser.** A paper or electrolytic condenser having as its plates long strips of foil which have been rolled into a compact tubular shape.



**tuned circuit.** A resonant circuit, consisting of a coil and condenser which are preset or can be adjusted to give resonance at a desired frequency.

**tuned radio frequency receiver.** A receiver in which r.f. amplification is provided by a number of vacuum tube amplifier stages, each of which has one or more circuits which are tuned to resonance at the incoming signal frequency by a section of the gang tuning condenser. The amplified r.f. signals are fed directly into the detector for demodulation.

**tungar bulb.** A gaseous diode rectifier tube employed in battery chargers.

**tungsten.** A pure metal used in radio chiefly for the filaments and other elements of radio tubes.

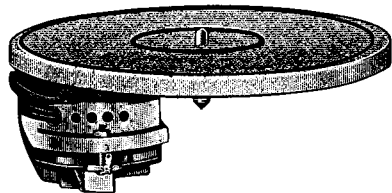
**tuning.** The process of varying the inductance or capacity in a coil-condenser circuit to provide resonance at a desired frequency. Also, the process of setting all of the tuning circuits in a radio receiver simultaneously to a desired frequency by rotating the tuning dial or pressing a button of a push-button tuner.

**tuning eye.** A cathode ray tuning indicator tube.

**tuning indicator.** A device which indicates when a radio receiver is tuned accurately to a radio station.

**tuning meter.** An ordinary meter connected into a radio receiver circuit for use as a tuning indicator.

**turn.** In a coil, one complete loop of wire around the coil form.



**turntable.** In a record player or electric

phonograph, the motor-driven disc on which the phonograph record is placed. In a sound recorder, the motor-driven disc on which is placed the disc to be cut.

**two-band receiver.** A radio receiver having

## U

**ultra-high frequency.** A term usually used to indicate a frequency higher than about 30 megacycles. Abbreviated u.h.f.

**universal output transformer.** An iron-core a.f. output transformer having a number of taps on its windings to permit its use

## V

**V. Voltage.** Volts.

**vacuum.** A space from which practically all air has been removed.

**vacuum tube.** A device consisting of a number of electrodes mounted in an envelope or housing from which practically all air has been removed. Also called an electron tube or radio tube.

**vacuum tube voltmeter.** A test instrument which utilizes the rectification characteristic of a vacuum tube for measuring voltages without affecting the circuit to which the instrument is connected.

**valve.** The term used in Great Britain to designate a radio tube.

**variable condenser.** A condenser whose capacity may be changed either by varying the space between plates (as in a trimmer condenser) or by varying the amount of meshing between the two sets of plates (as in a tuning condenser).

**variable resistance.** A resistance which can be changed in value while in use.

**vernier condenser.** A small variable tuning condenser which is placed in parallel with a larger tuning condenser for the purpose of providing a finer adjustment after the large condenser has been set roughly to the desired position.

**vernier dial.** A type of tuning dial in which a complete rotation of the control knob makes the tuning condenser shaft rotate only a small fraction of a revolution, thereby permitting fine and accurate tuning.

**vertical antenna.** A single vertical metal rod, suspended wire or metal tower used as an antenna.

**vibrator.** An electromagnetic device which converts a d.c. voltage to pulsating d.c. or a.c. It is used in the power packs of auto radios and some public address amplifiers to convert the 6-volt auto storage battery voltage to a low a.c. voltage. The a.c. voltage is then stepped up by a power transformer, and converted into a high d.c. voltage either by a conventional rectifier tube circuit or by an extra set of contacts on the vibrator itself.

**video.** A latin word meaning "I see," applied to television parts and circuits which handle picture signals, and applied also to signals associated with the picture being transmitted.

**video frequency.** One of the frequencies present in the output of a television cam-

two reception ranges. One will generally cover from 535 kc. to 1720 kc, which includes the broadcast band and some police calls, and the other will generally be between 5.65 mc. and 18.1 mc.

in practically any average radio receiver.

**universal receiver.** A receiver capable of operating from either a.c. or d.c. power.

**unmodulated.** Without modulation. The r.f. carrier signal alone, as it exists during pauses between station programs.

era as a result of scanning the image being transmitted. It may be any value from almost zero to well over 4,000,000 cycles.

**voice coil.** The moving coil which activates the diaphragm of a dynamic speaker.

**volt.** The practical unit of voltage. One volt will send a current of one ampere through a resistance of one ohm.

**volt-ohm-milliammeter.** A test instrument having provisions for measuring voltage, resistance and current. It consists essentially of a single meter having the necessary number of scales, and a switch which places the meter in the correct circuit for a particular measurement.

**voltage amplification.** Amplification which increases the voltage of a signal rather than its power. Also, a rating obtained by dividing the a.c. output voltage of an amplifier stage by the a.c. input voltage.

**voltage divider.** A resistor having one or more fixed or adjustable contacts along the length of its resistance element, in addition to the customary two end terminal. The total available voltage is applied between the two end terminals, and desired portions of this voltage are obtained from any two terminals on the voltage divider.

**voltage drop.** The voltage developed across the terminals of a radio part by the flow of current through the part.

**voltage regulator tube.** A two-element gaseous tube used in a.c. radio receivers to keep the input a.c. voltage to the receiver power pack essentially constant despite wide variations in the line voltage. Also used to maintain a constant d.c. potential across a circuit.

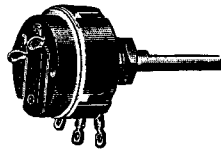
**voltage rating of a condenser.** The maximum sustained voltage which can safely be applied across the terminals of a condenser without causing breakdown of the insulation between condenser plates.

**voltmeter.** A meter used to measure electrical pressure in volts.

**volume.** The intensity of the sound produced by a radio loudspeaker.

**volume control.** A device which varies the a.f. output of a receiver or p.a. amplifier, thereby changing the volume of the sound produced by the loudspeaker.

**volume expander.** A special manually-ad-



justed audio circuit which can be set to increase the volume range of a radio program or phonograph record by making the weak passages weaker and the loud portions of the program louder. Volume expanders are also made as self-contained, self-powered units which can be inserted

## W

**wafer socket.** A type of socket in which the clips for gripping the tube prongs are mounted between two wafers or sheets of insulating material.

**watt.** The practical unit of electrical power. In a d.c. circuit, the power in watts consumed by a device is equal to the applied voltage multiplied by the current in amperes. In an a.c. circuit, however, the power value obtained in this manner must also be multiplied by the power factor of the part. The power factor is always essentially 1 for a resistor.

**wattage rating.** A rating expressing the maximum power which a device can safely absorb or handle. To determine how high a wattage rating is required for a particular resistor, multiply the value in ohms of the resistor by the square of the current which is to flow through the resistor (resistance  $\times$  current  $\times$  current), and choose a resistor having a wattage rating approximately twice the computed value so as to give ample margin of safety in operation.

**wattmeter.** A meter used to measure the power in watts or kilowatts which is being consumed by a device, chiefly in a.c. circuits.

**wave.** Any continually varying quantity, such as an alternating current sound wave, or radio wave.

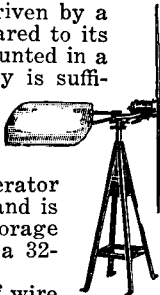
**wavelength.** The distance travelled in a time of one cycle by an alternating current, sound wave or radio wave. This is the same as the distance between successive peaks having the same polarity in the wave. For wave motion in ether, the wavelength in meters is equal to the number 299,820,000 divided by the frequency in cycles per second.

**wave trap.** A device sometimes connected to the aerial system of a radio receiver to reduce the strength of signals at a particular frequency, such as at the frequency of a strong local station which is interfering with reception of other stations.

**wind charger.** A generator driven by a propeller mounted on or geared to its shaft. The unit must be mounted in a location where wind velocity is sufficient to rotate the propeller; this means it should be on a mast or tower extending well above surrounding trees and buildings. The generator is usually of the d.c. type, and is used for charging a radio storage battery or the batteries of a 32-volt farm lighting plant.

**winding.** One or more turns of wire which make up a continuous coil. Used chiefly in coils, transformers and electromagnetic devices.

**wire.** A metallic conductor having essentially



between a phono pick-up and the input terminals of an audio amplifier.

**volume unit.** A recently developed method of expressing the power level in broadcast equipment with reference to a fixed power level of .001 watt.

**vu.** Volume unit.

uniform thickness, used in radio chiefly to provide a path for electric currents between two points. It may be bare or covered with an insulating material such as enamel, cotton, linen or silk.

**wired radio.** Communication by means of radio waves by wires.

**wireless.** Radio.

**wireless record player.** A motor-driven turntable and phono pick-up mounted in the same cabinet with an r.f. oscillator. The phono pick-up converts a recording into a.f. signals which modulate the r.f. carrier of the oscillator. The resulting signal is radiated through space, as a miniature broadcast signal, and can be picked up by any radio receiver in the same house merely by tuning that receiver to the broadcast band frequency on which the wireless record player is operating.

**wire-wound resistor.** A resistor which is constructed by winding a high-resistance wire on an insulating form. The resulting element may or may not be covered with a ceramic insulating layer.

## X

**X.** A letter used in formulas to designate reactance.

**Xc.** A symbol used for capacitive reactance in ohms.

**x-cut.** A piezo-electric crystal or quartz plate cut in such a manner that X-axis is perpendicular to its faces. Also sometimes called Currie cut and a zero-angle cut.

**x-rays.** Rays which have frequencies between the higher ultra-violet frequencies and the lower gamma rays. They are produced by the striking of cathode rays on a solid and are capable of penetrating opaque objects.

**x's.** Disturbances caused by static.

## Y

**y.** Symbol used for the admittance in ohms.

**y-axis.** In a quartz crystal, a line perpendicular to the two diametrically opposite parallel faces. It lies in a plane which is at right angles to the x-axis.

**y-cut.** A piezo-electric crystal cut in such a manner that the y-axis is perpendicular to its faces. Also sometimes called a face-parallel cut or thirty-degree cut.

## Z

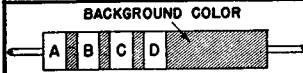
**Z.** A letter used to designate impedance.

**zero-beat.** A condition where two signals of equal frequency are working in a common circuit.

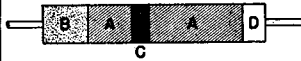
**zero bias.** Zero voltage between the control grid and cathode of a vacuum tube, so that these two electrodes are at the same potential.



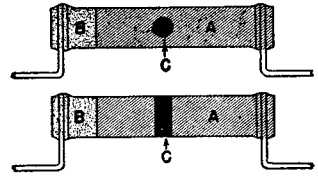
## RMA COLOR CODE FOR RESISTORS



**METHOD I**  
 COLOR BANDS A, B, AND C GIVE VALUE.  
 GOLD OR SILVER BAND D, USUALLY  
 OMITTED, INDICATES TOLERANCE.  
 BLACK BACKGROUND — UNINSULATED.  
 TAN BACKGROUND — INSULATED.



**METHOD II**  
 BODY COLOR (A), END COLOR (B), AND DOT  
 OR BAND COLOR (C) GIVE VALUE.  
 GOLD OR SILVER BAND D, USUALLY  
 OMITTED, INDICATES TOLERANCE.



Color	Figure
BLACK	0
BROWN	1
RED	2
ORANGE	3
YELLOW	4
GREEN	5
BLUE	6
VIOLET	7
GRAY	8
WHITE	9

COLOR A GIVES FIRST FIGURE OF RESISTOR VALUE.

COLOR B GIVES SECOND FIGURE OF RESISTOR VALUE.

COLOR C GIVES NUMBER OF CIPHERS FOLLOWING THE FIRST TWO FIGURES.

COLOR D: GOLD BAND INDICATES  $\pm 5\%$  TOLERANCE.  
 SILVER BAND INDICATES  $\pm 10\%$  TOLERANCE.  
 NO BAND INDICATES STANDARD  $\pm 20\%$  TOLERANCE.

*Courtesy National Radio Institute*

### EXAMPLES—METHOD I

BAND A	BAND B	BAND C	BAND D	BACKGROUND	RESISTOR VALUE
Green (5)	Black (0)	Black ( )	None	Black	50 ohms $\pm 20\%$ , uninsulated.
Red (2)	Green (5)	Brown (0)	Silver	Brown	250 ohms $\pm 10\%$ , insulated.
Green (5)	Black (0)	Yellow (0000)	None	Black	500,000 ohms $\pm 20\%$ , uninsulated.
Orange (3)	Green (5)	Green (00000)	Gold	Brown	3,500,000 ohms $\pm 5\%$ , insulated.

### EXAMPLES—METHOD II

BODY (A)	END (B)	DOT OR (C)	RESISTOR
Green	Black	Black	50 ohms
Red	Green	Brown	250 ohms
Green	Black	Yellow	500,000 ohms
Orange	Green	Green	3,500,000 ohms

### EXAMPLES—MICA CONDENSERS

1ST DOT	2ND DOT	3RD DOT	CONDENSER VALUE
Green	Black	Black	50 mmfd. (.00005 mfd.)
Brown	Black	Brown	100 mmfd. (.0001 mfd.)
Red	Green	Brown	250 mmfd. (.00025 mfd.)
Green	Black	Red	5000 mmfd. (.005 mfd.)

The standard color code for resistors was developed by the Radio Manufacturers Association for marking ohmic values on fixed carbon and metallized resistors. Two marking methods are in common use.

Method 1 markings are used chiefly on resistors having leads coming straight out from the ends; with this method, all color bands are equal in width, and may or may not be touching each other.

Method II markings are identified by the fact that the color bands or colored areas are of different widths. This method is invariably used on resistors having leads coming out from the sides, and sometimes also on end-lead resistors.

The tolerance marking, when present, indicates the amount by which the resistor may deviate from its rated value. Thus, a 100-ohm resistor with  $\pm 5\%$  (plus or minus five percent) tolerance may have an actual value up to 5 ohms higher or lower than 100 ohms (between 95 and 105 ohms).

Uninsulated resistors marked according to Method I have a black background color, while insulated resistors have a tan background color.

Missing color bands in Method I markings are assumed to be the background color (brown or black). A missing end color (B) or dot color (C) in Method II markings are assumed to be the same as the body color (A).

With Method I, band A is never black, for a resistor value cannot start with zero. When you encounter a resistor with a black band at the left end, it is either an uninsulated Method I resistor which you are trying to read backward, or it is a Method II resistor with the black band serving as end color B.

**Condenser Color Code.** The basic scheme of the RMA Color Code is also used for designating values of fixed mica condensers. Three colored dots will usually be placed on the bakelite body of the condenser, along with an arrow or other markings which indicate the direction in which the dots are to be read. The value of the condenser in **micro-microfarads** is read in exactly the same way as for resistors; the first color dot gives the first figure in the condenser value; the second color dot gives the second figure; the third color dot gives the number of ciphers to be added to the first two figures.

TWO RESISTORS IN SERIES: TOTAL  $R = R_1 + R_2$

TWO RESISTORS IN PARALLEL: TOTAL  $R = \frac{R_1 \times R_2}{R_1 + R_2}$

TWO CONDENSERS IN SERIES: TOTAL  $C = \frac{C_1 \times C_2}{C_1 + C_2}$

TWO CONDENSERS IN PARALLEL: TOTAL  $C = C_1 + C_2$

OHMS LAW FOR D.C. WHERE R IS RESISTANCE IN OHMS, E IS VOLTAGE IN VOLTS, I IS CURRENT IN AMPERES, AND P IS POWER IN WATTS:

$$E = I \times R \quad P = E \times I$$

$$R = E \div I \quad P = I^2 \times R$$

$$I = E \div R \quad P = E^2 \div R$$

## HOW TO READ SCHEMATIC DIAGRAMS

A SCHEMATIC circuit diagram is a symbolic means of showing electrical connections in radio apparatus. It tells very little about how the various parts look, how they are constructed, or where they are located on the chassis, but it does tell how the parts must be connected together electrically to make the set operate. The schematic diagram also provides a quick means for checking connections during construction work and when hunting for defects in improperly operating apparatus.

A circuit diagram is read from left to right when tracing intelligence signals from the antenna to the loudspeaker. Look for the antenna or input terminals at the upper left, then move across the diagram one stage at a time. Usually the stages will be labelled to indicate their functions, so the tube line-up of a receiver can be determined almost at a glance once a bit of experience is secured with these diagrams.

The power pack is always placed near the bottom of the diagram. It can readily be identified by the fact that it will have an input connection to a power line or storage battery. In battery-operated equipment, the circuit will usually show only the terminals to which the A, B, and C batteries are to be connected.

The preliminary scanning of a complete diagram to "get your bearings" is about the only time when a schematic circuit diagram need be read completely all at once. The radio man is usually interested only in one particular section of the diagram, for he works on only one section of a receiver at a time.

One important fact to realize is that junctions of wires on a schematic may be arranged differently from corresponding terminals on actual apparatus. Thus, there may be two resistors and two condensers connected to a particular tube socket terminal on the chassis, but only a single line going to that same terminal on the schematic diagram; somewhere along the line, however, you will come to the symbols for these same resistors and condensers. A schematic diagram is drawn so it will be easy to trace through, while parts are arranged on a chassis so connections will be easy to make, leads will be as short as possible, and parts which might interfere with each other are kept far apart.

The symbols used on schematic circuit diagrams to represent various radio parts are shown in the accompanying chart. When several different symbols for a particular part are in common use, these are shown. Variation in symbols are most evident in the case of radio tubes, but will give no difficulty once you learn that a dotted or zig-zag line always represents a grid, and a solid line, solid box or hollow box represents an anode.

In battery symbols, the short line is always negative or minus and the long line is positive or plus.

Several methods of showing cross-overs of wires are in common use, but there should be no confusion if you first look over a new diagram to see which method is employed. If a half-circle is used to bring one wire over another when there is no connection, you can be sure that a connection is intended when wires cross without having this half-circle symbol. If there are no half circles anywhere on the diagram at cross-over points, and there are solid dots at some cross-overs but not all, then the solid dot indicates a connection and the plain cross-over indicates no connection. In any event, a solid dot at a junction will always indicate a connection.

Filament circuit connections are so standardized that a radio man seldom bothers to draw them in. Instead, he brings the two filament leads out of the tube symbol a short distance, labels one X, and labels the other Y. Corresponding letters will be found on the two leads of the filament winding in the power pack. This system of marking indicates that all points marked X are to be connected together and to the X terminal of the filament winding, and all points marked Y are to be connected to the Y terminal of the filament winding. The tube filaments are then connected in parallel, as is always done in a.c. receivers, and almost always in battery-operated sets.

Sometimes a ground symbol will be used in place of Y, indicating that those terminals are simply connected to the nearest convenient chassis lug. Then again, the letter H will be used on all filament leads, indicating that all tube filaments and the filament transformer are to be connected in parallel, with polarity being unimportant.

In universal a.c.-d.c. receivers, the filaments are invariably connected in series. Sometimes the connections are shown right on the schematic diagram, but usually the filament symbols will be omitted from the tube circles, and will be shown instead near the bottom of the diagram, all connected together as they should be. When you encounter this type of connection, be sure to follow the exact order of connections shown on the diagram. The filament of the power output tube and rectifier tube must often have particular positions in the line-up to give satisfactory operation.


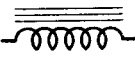


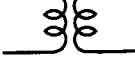



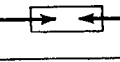

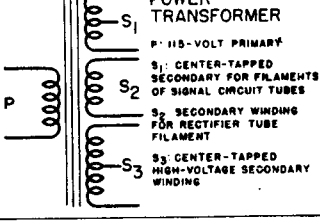

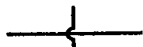







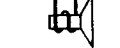
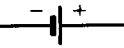

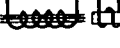

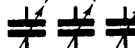





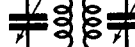


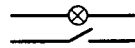
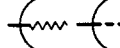





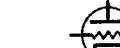
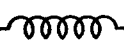
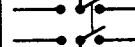

Other methods of showing series filament connections are generally self-explanatory once they are studied for a few minutes while keeping the above basic facts in mind.

Connections to the chassis are usually indicated by a ground symbol. The chassis of a universal a.c.-d.c. receiver is seldom connected directly to an external ground.

# HOW TO READ SCHEMATIC DIAGRAMS

Bottom views of tube sockets, showing terminal connections, are usually given either directly on a schematic circuit diagram or on a separate diagram. However, schematically drawn tube terminal connections are not always drawn in the same rotation as the actual socket connections. If a separate diagram indicating the proper terminal number is not included, a tube chart or manual

must be referred to. Always use the aligning key as your guide for locating a particular terminal when working with octal-base tubes. With older tube bases, the spacings between prongs are unequal to permit locating a particular prong. In some cases the spacing is equal but the filaments are indicated by larger socket holes. With this as a guide the other elements may be identified.

	ANTENNA (AERIAL)		IRON-CORE CHOKE COIL		SWITCH (ROTARY OR SELECTOR)
	GROUND (OR CHASSIS CONNECTION)		R F TRANSFORMER (AIR CORE)		CRYSTAL DETECTOR
	LOOP AERIAL (USUALLY BUILT INTO CABINET OF RECEIVER)		A.F. TRANSFORMER (IRON CORE)		LIGHTNING ARRESTER
	CONNECTION		POWER TRANSFORMER P: 115-VOLT PRIMARY S <sub>1</sub> : CENTER-TAPPED SECONDARY FOR FILAMENTS OF SIGNAL CIRCUIT TUBES S <sub>2</sub> : SECONDARY WINDING FOR RECTIFIER TUBE FILAMENT S <sub>3</sub> : CENTER-TAPPED HIGH-VOLTAGE SECONDARY WINDING		FUSE
	NO CONNECTION				PILOT LAMP
	NO CONNECTION (WHEN NO-CONNECTION ARE INDICATED BY DOTS)				HEADPHONES
	CONNECTION (WHEN NO-CONNECTION CROSS-OVERS ARE INDICATED BY HALF- CIRCLES)				FIXED CONDENSER (MICA OR PAPER)
	TERMINAL		FIXED CONDENSER (ELECTROLYTIC)		LOUDSPEAKER, P.M. DYNAMIC
	ONE CELL OR 'A' BATTERY		VARIABLE CONDENSER		LOUDSPEAKER, ELECTRODYNAMIC
	MULTI-CELL OR 'B' BATTERY		GANG TUNING CONDENSER		PHONO PICK-UP
	RESISTOR		TRIMMER AND PADDER CONDENSER		FILAMENT
	POTENTIOMETER		I.F. TRANSFORMER (DOUBLE-TUNED)		CATHODE
	TAPPED RESISTOR OR VOLTAGE DIVIDER		POWER SWITCH (S.P.S.T.)		GRID
	RHEOSTAT		SWITCH (S.P.D.T.)		PLATE
	RHEOSTAT		SWITCH (D.P.S.T.)		3-ELEMENT VACUUM TUBE
	AIR-CORE CHOKE COIL		SWITCH (D.P.D.T.)		ALIGNING KEY OF OCTAL BASE

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