

# **Radio-Television-Electronic Dictionary**

**IX-2**



**NATIONAL RADIO INSTITUTE  
WASHINGTON, D. C.**

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You will find this Radio and Electronic Dictionary a valuable reference text. Keep it handy. As you advance in your Course and come across a term that you know was explained in an earlier book but whose meaning has begun to fade, just look it up. In reading magazine or other radio articles or in discussions when you find new, strange expressions, look them up, too.

Do not be concerned, as you glance through this reference book for the first time, if you find many new and strange words and expressions. Later on, they will have greater meaning. Do not try to memorize the definitions given, nor try to read this book as a regular text. This would lead only to confusion.

Remember, a technical dictionary is not an encyclopedia, so don't look for complete explanations which belong in the Course itself. Nor will you expect to find definitions of non-technical words for which you should turn to an ordinary dictionary.

Properly used, your Radio Dictionary will save you time and prove its value many times over.

COMPLETELY NEW AND ORIGINAL DICTIONARY  
COVERING RADIO, TELEVISION, FREQUENCY  
MODULATION, RADIONICS AND ELECTRONICS.  
SIMPLIFIED DEFINITIONS AND EXPLANATIONS  
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**RADIOTRICIAN** and **TELETRICIAN**  
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# Radio-Television-Electronic Dictionary

## A

**a**—*Ampere*.

**A**—Notation used to identify the filament circuit or filament voltage supply of a vacuum tube. Abbreviation for *antenna*, *ammeter*, *ampere* or *area*.

**A**—Notation used to designate the negative filament supply terminal of a vacuum tube circuit or the negative terminal of an A battery or other filament voltage source. Pronounced "A minus."

**A+**—Notation used to designate the positive filament supply terminal of a vacuum tube or the positive terminal of an A battery or other filament voltage source. Pronounced "A plus."

**abampere**—The unit of current flow in the absolute system of electromagnetic units (e.m.u.). One abampere is equal to 10 amperes.

**A battery**—The single dry cell, combination of dry cells or storage battery which furnishes filament current for the tubes in a battery-operated vacuum tube circuit.

**A.B.C., a.b.c. or ABC**—Automatic bass compensation.

**abcolomb**—The unit of quantity of electricity in the absolute system of electromagnetic units (e.m.u.). One abcolomb is equal to 10 coulombs.

**aberration**—A lens defect in which the light rays coming from a single point are not brought to the same focal point. See *chromatic aberration* and *spherical aberration*.

**abfarad**—The unit of capacity in the absolute system of electromagnetic units (e.m.u.). One abfarad is equal to  $10^9$  farads.\*

**abohm**—The unit of resistance in the absolute system of electromagnetic units (e.m.u.). One abohm is equal to  $10^{-9}$  ohms.

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

**abrasive**—The grinding material sometimes incorporated in phonograph records for the purpose of shaping the needle point to fit the groove properly.

**abscissa**—The coordinate value which specifies distance in a horizontal direction from the vertical reference line on an ordinary graph. Also, the horizontal ref-

erence line along which abscissa values are indicated on a graph.

**absolute value**—The numerical value of a number without regard for sign. Thus, the absolute values of +9 and -9 are both 9. In algebraic expressions, vertical lines on each side of a quantity are used to specify that the absolute value is to be used. Example: The absolute value of  $\lambda$  is specified as  $|\lambda|$ .

**absolute units**—Units of measurement derived from the centimeter-gram-second (C.G.S.) system of specifying length, mass and time. Seldom used in radio.

**absorption**—Dissipation or loss of electromagnetic energy (radio waves) or acoustic energy (sound waves) in the medium through which the energy travels, or dissipation of electrical energy in one circuit which is inductively coupled to another. Thus, radio waves lose energy and hence strength in traveling through the atmosphere, the earth or through objects. Sound waves lose energy due to absorption when traveling through the atmosphere, the earth and particularly through non-rigid materials like rugs and drapes.



AB POWER PACKS

**absorption coefficient**—A measure of the ability of a material to absorb sound.

**absorption modulation**—Modulation effected by absorption of signal power from the antenna or r.f. system of a transmitter by a closely coupled a.f. system.

**abvolt**—The unit of potential in the absolute system of electromagnetic units (e.m.u.). One abvolt is equal to  $10^{-8}$  volt.\*

**a.c., A.C. or AC**—Alternating current.

**accelerating anode**—In a Farnsworth disector tube, the electrode which draws electrons away from the photosensitive cathode.

**accelerating electrode**—A cathode ray tube electrode operated at a high positive potential and serving to increase the velocity of the electrons in the beam.

\*  $10^{-8}$  is the shorthand method of writing 1,000,000,000.

\*  $10^{-8}$  is the shorthand method of writing .00000001.

**acceleration**—The rate of increase of velocity.

**acceptor circuit**—A series resonant circuit which offers minimum impedance at its resonant frequency, and high impedance to all other frequencies.

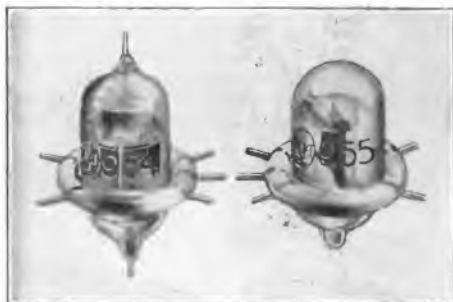
**A.C.C.W.**—Alternating-current modulated continuous waves.

**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, and is often called a *universal receiver*.

**acetate disc**—A phonograph record made of an acetate compound.

**a.c. generator**—Any device which produces an a.c. voltage, such as an oscillator or a dynamoelectric generator.

**acorn tube**—Name applied to the small tubes used for ultra-high frequency applications, up to about 400 megacycles. Their shape and size are similar to that of an acorn.



Courtesy RCA

ACORN TUBES, SHOWN ABOUT THREE-QUARTERS FULL SIZE.

**acoustic**—Pertaining to sound and hearing.

**acoustimeter**—A device for the electrical measurement of sound, having an output indicator calibrated in db or directly in units of sound intensity. More often called a *sound level meter*.

**Acoustical Labyrinth**—Trade name used by Stromberg-Carlson to describe the method by which they prevent cavity resonance, prevent standing waves, produce a low cut-off frequency and reinforce bass response in loudspeaker systems.

**Acoustic Clarifier**—Trade name used by Philco to describe free mounted cones attached to a regular loudspeaker baffle. These cones vibrate on sudden loud sounds and absorb undesired peaks in the response.

**acoustics**—The science of sound. The study of the cause and effect of audible vibrations. The characteristics of a room or space which affect sound propagation and sound travel.

**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.

**Acoustimator**—Trade name for a special tone control circuit used in some Motorola receivers.

**a.c. plate resistance**—The opposition offered by the plate-cathode path of a tube to the flow of alternating current. The a.c. plate resistance is equal to the change in plate voltage divided by the resulting change in plate current, or is equal to the a.c. plate voltage divided by the a.c. plate current.

**a.c. receiver**—A receiver designed to operate only from an a.c. power source.

**acute angle**—An angle that is less than a right angle (less than  $90^\circ$ ).

**adapter**—Any device used for changing temporarily or permanently the terminal connections of a circuit or part, for test purposes or to permit use of auxiliary apparatus.

**addition**—The process of finding the numerical sum of two or more quantities or numbers.

**adjacent-channel selectivity**—The ability of a receiver to reject the signals of stations on either side of the channel carrying the desired station signal.

**adjustable resistor**—A wire-wound fixed resistor which has the resistance wire partly exposed, so the amount of resistance in use can be adjusted *occasionally* by loosening a screw, moving a contact lug, and retightening the screw.

**adjustable voltage divider**—A wire-wound fixed resistor having one or more movable extra terminals which can be clamped at desired points along the length of the resistor. Used in voltage divider applications.

**admittance**—The reciprocal of impedance, measured in *mhos*. A measure of the ease with which an alternating current flows in a circuit. The word mho is ohm spelled backwards, indicating it is a reciprocal.

**advance ball**—The rounded support (often sapphire) which rides on the disc adjacent to the recording stylus of a sound recorder. It maintains even depth of cut by correcting for small irregularities in the surface of the disc.

**aerial**—An antenna.

**a.f.**—Audio frequency.

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

**a.h.**—Ampere hour.

**A.I.E.E.**—American Institute of Electrical Engineers.

**air-cell battery**—A non-rechargeable wet-cell battery which delivers about 2.5 volts when new, for use chiefly in 2-volt 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.

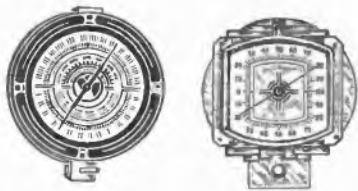
**air condenser**—A condenser having air as its dielectric material.

**air core**—A term used to describe a magnetic circuit which consists only of air and other non-magnetic materials (no iron). Air-core construction is used chiefly in r.f. circuits.

**air-core transformer**—A transformer having a core (magnetic circuit) consisting only of air or other non-magnetic materials, so that the magnetic lines of force travel only through these non-magnetic materials.

**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.



AIRPLANE DIALS

**airport runway beacon**—A radio beacon used for marking the location of one or more approaches to an airport.

**Alexanderson alternator**—A high frequency high-power a.c. dynamoelectric generator used in the early days of radio to produce radio waves.

**algebra**—A continuation of arithmetic in which letters and symbols are used to represent definite quantities whose actual values may or may not be known.

**algebraic expression**—An expression which states a number in terms of the signs and symbols of algebra. A numerical algebraic expression consists entirely of numbers and signs. Example:  $75 - (6 + 2)^2$  represents the number 11. A literal algebraic expression also contains general numbers or letters. Examples:  $2\pi fL$  represents the number of ohms of inductive reactance;  $I^2R$  represents the number of watts of power.

**algebraic subtraction**—To subtract one number from another algebraically, change the sign of the number subtracted (the *subtrahend*), then add algebraically. Examples: To subtract 7 from 10, change 7 to  $-7$  and add algebraically to get 3. To subtract 14 from  $-20$ , change 14 to  $-14$ , then add  $-14$  and  $-20$  algebraically to get  $-34$ . To subtract  $-7$  from 40, change  $-7$  to 7 and add, getting 47.

**algebraic sum**—The sum obtained by adding numbers with regard for their signs, according to the rules of addition in algebra. These rules are: To add numbers having like signs, find the sum of their absolute values and place the common sign in front of the result. Example: The algebraic sum of  $-3$ ,  $-5$ ,  $-1$  and  $-10$  is  $-19$ . To add two numbers having unlike signs, find the difference of their absolute values, and place the sign of the larger absolute value in front of the result. Example: The algebraic sum of 7 and  $-3$  is 4; the algebraic sum of  $-33$  and 11 is  $-22$ . When three or more numbers, some having different signs, are to be added algebraically, find the sum of the positive numbers first, then find the sum of the negative numbers. Finally, add the partial sums algebraically to get the total algebraic sum. Example: The algebraic sum of 17,  $-3$ ,  $-10$  and  $+4$  is the algebraic sum of 21 and  $-13$ , which is 8.

**align**—To bring into line, such as to align tuning circuits so they all respond to the same frequency. Also, to align holes in two or more parts so a bolt can be passed through the holes, or align parts by positioning so all are in a straight line.

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



ALIGNING TOOLS

**alignment**—The process of adjusting the tuning circuits in a radio receiver or transmitter so all respond to the same frequency.

**alignment chart**—A chart giving manufacturer's alignment instructions. Also, a chart on which equations can be solved graphically by placing a ruler on the two known values and reading the answer where the ruler intersects the scale for

the unknown value. Also called *nomogram* or *nomograph*.

**alive**—A term used to describe a wire or circuit which is energized and therefore has a voltage.

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

**all-metal 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. Usually called a metal tube.

**alloy**—A mixture of two or more metals. Thus, copper and zinc are mixed together to form a brass alloy.

**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.

**all-wave oscillator**—An all-wave signal generator. A test instrument.

**all-wave receiver**—A receiver capable of tuning from 550 kilocycles to at least 20,000 kilocycles.

**all-wave signal generator**—A test instrument capable of generating with satisfactory accuracy any of the radio frequency signals which may be needed during aligning or servicing of all-wave receivers (from about 100 kc. to 20,000 kc. or higher).

**Alnico**—An alloy consisting chiefly of aluminum, nickel and cobalt, used to make powerful small-size permanent magnets because it can be strongly magnetized and will hold its magnetism indefinitely.

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

**alternation**—One half of a cycle, consisting of a complete rise and fall of current in one direction. Thus, 60-cycle alternating current has 120 alternations per second.

**alternator**—A dynamoelectric generator for generating alternating current voltages.

**aluminum**—A metal extensively used in radio for shielding purposes, for making the foil plates and housings of electrolytic condensers, for making the plates of gang tuning condensers, for chassis and panel construction, etc.

**a.m. a-m, A-M, A.M. or AM**—Amplitude modulation.

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

**amateur bands**—Bands of frequencies assigned exclusively to radio amateurs by

the Federal Communications Commission. Amateur band limits are changed from time to time by government order.

**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 for U. S., and K for U. S. possessions), followed by a location-indicating numeral and two or more additional letters.

**ambient temperature**—The temperature of the air immediately surrounding a radio part.

**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.



ALLIGATOR CLIP

**American wire gauge**—The wire gauge in common use in this country for designating wire sizes (diameters). It has numbers ranging from 0000 as the largest size to 40 and higher for the smallest sizes. Formerly called Brown and Sharpe gauge (B. & S. gauge).

**ammeter**—An instrument used for measuring the current flow in a circuit in amperes. An instrument which measures current flow in milliamperes is a *milliammeter*. An ammeter is always connected in series 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. A current of exactly one ampere will flow when a one-ohm resistance is connected to a one-volt source.

**Ampère, André Marie**—French scientist (1775-1836) after whom the unit of electric current (ampere) was named.

**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.

**ampere-hour meter**—An instrument which indicates or records the number of ampere-hours of energy drawn from a storage battery.



**ampere-turn**—A unit of *magnetomotive* force, which in turn is a measure of the strength of the magnetic field produced by a coil. The number of ampere-turns is equal to the coil current in amperes multiplied by the number of turns in the coil. One ampere-turn is equal to 1.257 gilberts.

**ampere-turns**—The product of the number of turns of, and the number of amperes flowing through the coils of an electromagnet. Thus one ampere-turn would be one ampere flowing through one turn.

**amplification**—The process of increasing the strength (current, voltage or power) of a signal. Amplification can be provided by transformers and tuned circuits as well as vacuum tubes. In general, amplification is the ratio of signal output amplitude to signal input amplitude.

**amplification factor**—A vacuum tube rating indicating the theoretical maximum increase in signal strength which can be provided by a given tube. It is equal to the ratio of the plate voltage change to the grid voltage change needed to produce the same change in plate current when a tube has no load.

**amplifier**—A device which produces an amplified reproduction of its input signal by drawing power from a source other than the input signal. An amplifier usually consists of one or more vacuum tubes with associated parts, used to increase the strength of a signal. Several different basic types of amplifiers are in use; see *class A, AB, B and C amplifiers*.

**amplify**—To increase in strength, as in *amplification* of radio signals.

**amplitude**—The amount of vertical displacement above or below a horizontal reference line on a graph, or the amount of variation of a quantity from a reference value, usually zero. Also, the displacement of a phonograph record groove from its average or unmodulated position.

**amplitude distortion**—A type of distortion which occurs when the changes in the current or voltage output of a radio circuit or device are not exactly proportional, at every instant of time, to the input current or voltage changes. Amplitude distortion definitely results in the production of harmonics which were not present in the original signal. When the input signal has a pure sine wave form, a distorted output wave form is a sign of amplitude distortion.

**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, and 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, AM, etc.

**amplitude separator**—The *clipper* or *synchronizing separator* stage in a television receiver.

**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 terminal to the instrument for convenience in making measurements.

**angle**—Formed when two straight lines meet at a point. The lines are called the sides of the angle, and the point is called the vertex. An acute angle is less than  $90^\circ$ . A right angle is  $90^\circ$ . An obtuse angle is more than  $90^\circ$ . Two angles whose sum is  $90^\circ$  are called complementary angles, and either is said to be the complement of the other.

**angle of beam**—The angle enclosing the greater part of the energy transmitted from a directional antenna.

**angle, electrical**—A unit used in specifying a particular instant in an alternating current cycle for comparison purposes. One cycle is considered as having a total angle of  $360^\circ$ . Thus, if one voltage reaches a peak value an eighth of a cycle after another voltage reaches its peak, the angle between the voltages (the phase difference) is one-eighth of  $360^\circ$  or  $45^\circ$ .

**angle of incidence**—The angle between a ray of light falling on a surface and the perpendicular (normal) of the surface at that point.

**angle of lag**—The angle that a current or voltage lags behind another current or voltage, expressed in degrees (one cycle =  $360^\circ$ ).

**angle of lead**—The angle that a current or voltage leads another current or voltage, expressed in degrees.

**angle of radiation**—the angle between the earth and the strongest portion of the radiated wave from a transmitting antenna.

**angle of refraction**—The angle with respect to the normal which a ray of light takes when it passes from one medium to another.

**angstrom unit**—An extremely small unit of length, used in expressing wavelengths of light waves. One angstrom unit is equal to one hundred-millionth of a centimeter.

**angular velocity**—The speed of a rotating body when measured by the angle through which any point of it moves relative to the axis of rotation. In electrical circuits, the angular velocity of a current or voltage is equal to  $2\pi \times$  frequency, or  $6.28 \times$  frequency.

**anion**—A term sometimes used to describe a negative ion which moves toward the anode. An electro-chemical term.

**annealing**—A process of softening metals by first heating and then allowing to cool gradually.

**announcer**—One who introduces performers and programs at a radio broadcasting station, provides continuity between portions of a program, and identifies the station.

**annular**—Ring-shaped.

**anode**—The radio tube electrode to which the main electron stream flows. The anode is more commonly 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 array**—A system of antennas coupled together to obtain directional characteristics.

**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.

**antenna coupler**.—A device for transferring r.f. energy from the final plate tank to the antenna. It may also serve to match the plate tank impedance to the impedance of the transmission line.

**antenna effect**—The error or spurious effect due to capacity between a loop antenna and ground. In radio direction-finders, the antenna effect is cancelled out by the *balancer*.

**antenna form factor**—The ratio of the effective height of an antenna to its actual physical height.

**antenna gain**—The effectiveness of an antenna in a particular direction as compared to some standard antenna. Antenna gain is usually considered as the ratio of the power which must be supplied to some standard antenna to the power which must be supplied to the given antenna to produce the same field strength in a desired direction. Antenna gain in db is equal to 10 times the log of this power ratio.

**antenna resistance**—The total resistance of the transmitting antenna system at the operating frequency and at the point at which the antenna current is measured.

**antenna resistance**—A transmitting antenna rating.  $R_a = P \div I^2$  where  $R_a$  is the antenna resistance in ohms,  $P$  is the power in watts supplied to the entire antenna circuit, and  $I$  is the effective antenna

current in amperes measured at the point where power is supplied to the antenna.

**anti-capacity switch**—A switch designed so that there will be a minimum of capacity between the switch contacts or terminals.

**antilog**—Antilogarithm.

**antilogarithm**—The number corresponding to a given logarithm. Usually written *antilog*. Example: If  $\log 87.9 = 1.940$ , then 87.9 is the antilog of 1.940.

**antinode**—Any point, line or surface which has maximum amplitude in a stationary-wave system. The type of antinode is usually specified, since there can be antinodes of voltage, current, pressure, velocity, etc.

**aperiodic**—This term is applied to a circuit which has no definite time period of oscillation. Either its resistance is large enough to prevent natural oscillations, or it has no capacity or inductance by which it can be tuned. A circuit which will not resonate in the tuning range is often called aperiodic.

**aperiodic antenna**—An antenna which has a constant impedance over a wide range of frequencies due to suppression of reflections within the antenna system. Terminated wave antennas and terminated rhombics are examples.

**aperture**—An opening in an opaque plate which limits the cross section of the light beam passing through it.

**A power supply**—Any power supply device which provides power for heating the cathode of a vacuum tube, such as a battery, power line or generator.

**apparent power**—In an alternating current circuit, the apparent power in watts is obtained by multiplying the voltage in volts by the current in amperes, without considering phase relations. The apparent power is therefore not the true power if the circuit contains any reactance.

**arc**—A luminous glow sometimes having the appearance of an arch or arc of light, formed by the flow of electric current through air, gas or vapor. Conduction in an arc is due mainly to ionization of the gas or vapor.

**arc converter**—A type of r.f. oscillator which utilizes an electric arc for the generation of a pulsating or alternating current. In effect, an arc converter changes d.c. to a.c.

**argon**—A gas used in some rectifier tubes and electric lamps. It gives off a purple glow when ionized.

**arithmetic**—The addition, subtraction, multiplication and division of ordinary numbers, decimals and fractions.

**armature**—That part of a motor, generator or other device which carries the conductors in which a voltage is generated (the generated e.m.f. if a generator, and the back e.m.f. if a motor). The armature is



- usually the rotating part of a dynamo-electric machine. The armature is the pivoted or spring-mounted iron portion of a magnetic loudspeaker, buzzer, relay, magnetic phono pickup or similar magnetic device.
- armature reaction**—The reaction between armature flux and field flux which causes a redistribution of flux lines in a dynamo-electric motor or generator.
- arrester**—*Lightning arrester.*
- A.R.R.L.**—American Radio Relay League, an association of amateur radio operators and other persons interested in amateur radio activities.
- artificial antenna**—A device having all the essential characteristics of a particular antenna except that it converts the transmitter output power into heat instead of radio waves. Used chiefly for testing and adjusting transmitters. Also called *dummy antenna.*
- artificial line**—A filter circuit having characteristics similar to a transmission line of given length.
- asbestos**—A non-inflammable mineral of fibrous texture, available in flake or pressed form, and used for heat-insulating and fire-proofing purposes. The resistance wire in a Cordohm line cord is wrapped in asbestos.
- aspect ratio**—The ratio of the width of a television image to its height.
- astatic**—Without magnetic polarity. Also (when capitalized), trade name for crystal microphones and phono pickups made by Astatic Microphone Laboratories.
- A supply**—Filament voltage supply of a vacuum tube circuit, such as an A battery or a filament winding on a power transformer.
- asynchronous**—Not synchronous.
- a.t., AT or A.T.**—Ampere-turns.
- AT cut crystal**—A crystal cut at a  $35^\circ$  angle to the Z axis. It has low temperature drift.
- atmosphere**—A complex mixture of gases which surround the earth. The principal gases are oxygen and nitrogen. Atmosphere is supposed to exist for a distance of about 100 miles from the earth's surface. Atmospheric pressure at the surface of the earth is approximately 15 pounds per square inch; hence this value is often used as a unit of pressure called one atmosphere.
- atmospheric interference**—Crackling and hissing noises reproduced in the radio loudspeaker due to electrical disturbances occurring in the atmosphere surrounding the earth. These disturbances radiate electromagnetic waves which are picked up by antenna systems of receivers. Also called atmospheric disturbance, atmospheric noise, atmospherics, static or QRM, and particularly noticeable during thunderstorms.
- atmospheric radio wave**—A radio wave of short length reaching its destination after reflection in the upper layers of the atmosphere.
- 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.
- atomic weight**—The weight of any atom as compared to the weight of the hydrogen atom, which is accepted as unity (one).
- attenuation**—The decrease in the strength of a radio wave as it travels away from the transmitter. Also any decrease in the strength of a signal.
- attenuation equalizer**—A network of resistors, coils and condensers which changes the transmission loss of a circuit at certain frequencies in order to make the total transmission loss essentially constant over a range of frequencies.
- attenuator**—A device, usually an arrangement of variable resistances, which permits reducing the strength of a radio signal a desired amount without appreciably distorting the signal.
- audibility**—The strength of a sound or signal as compared to the strength required to produce a sound which can just barely be heard.
- audible**—Capable of being heard by the human ear. The range of human hearing is usually within the limits of 20 cycles and 20,000 cycles, but the actual limits vary greatly for different persons.
- 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. Abbreviated a.f., A.F., etc.
- audio frequency transformer**—An iron-core transformer used for coupling together two audio amplifier circuits, and sometimes also for changing the value of an audio signal.
- audio oscillator**—An oscillator which generates audio frequency voltages.
- audiometer**—An audibility meter.
- audion**—Name used by Dr. Lee DeForest for the three-electrode vacuum tube which he invented.

**audio signal**—The electrical equivalent of sound.

**audio transformer**—Audio frequency transformer.

**aural**—Pertaining to hearing.

**autodyne reception**—A system of heterodyne reception in which one tube acts as both an oscillator and a detector.

**Auto-Expressionator**—Trade name for the volume expander circuit used in some Crosley receivers.

**automatic**—Self-acting.

**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.

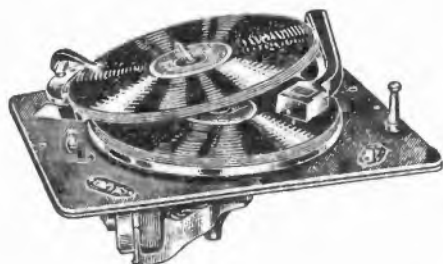
**automatic brightness control**—A circuit which automatically keeps the average brightness of the reproduced image constant in a television receiver.

**automatic circuit-breaker**—A device which automatically opens a circuit when the current becomes excessive.

**automatic frequency control**—A special radio circuit which keeps a superheterodyne receiver tuned accurately to a given station. It is found chiefly on push-button tuned receivers, where it corrects slight inaccuracies in the operation of the automatic tuning system.

**automatic gain control**—Same as *automatic volume control*.

**automatic grid bias**—A circuit arrangement in which the voltage drop across a resistor in the cathode lead of a tube serves as the C bias voltage for the grid of the tube, eliminating the need for a separate C bias voltage source.



AUTOMATIC RECORD CHANGER

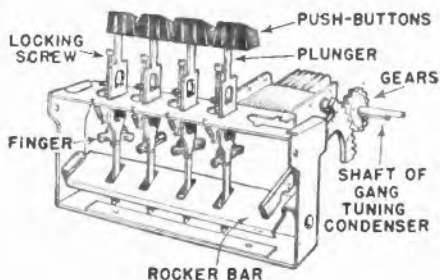
**automatic record changer**—An electric phonograph which automatically plays a number of records one after another. Some types play only one side of each record; some play both sides without turning over the record, by using two

pickups; some are arranged to turn each record over and play both sides.

**automatic regulator**—An automatic regulator is a device for regulating a system in such a manner that changes in its functioning are initiated by changed conditions and carried out without the intervention of an attendant.

**automatic starter**—An automatic starter is a device for starting a system without the intervention of an attendant.

**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.



Courtesy Radiocraft

AUTOMATIC TUNING SYSTEM OF THE MECHANICAL TYPE. WHEN A BUTTON IS DEPRESSED, THE TUNING CONDENSER IS MECHANICALLY MOVED TO THE DESIRED POSITION.

**automatic volume control**—A radio circuit which automatically maintains the output volume of a radio receiver constant within limits while the carrier signal picked up by the antenna is varying in amplitude over a wide range, or while the receiver is being tuned to signals which differ in strength. 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 making loud passages louder.

**automobile receiver**—A receiver designed for installation in an automobile, usually underneath the dashboard. Filament voltages are obtained directly from the 6-volt automobile storage battery, and the required higher d.c. voltages are usually obtained from a vibrator power pack in the receiver. Also called *auto radio*.

**auto radio**—An *automobile receiver*.

**auto-transformer**—A transformer having one continuous winding. Usually all of the winding serves as the secondary, and

a part of the winding also serves as the primary.

**a.v.c., A.V.C. or AVC**—Automatic volume control.

**a.v.e.**—Automatic volume expansion.

**average**—The average of a number of quantities is obtained by dividing the sum of the quantities by the number of quantities represented.

**average value**—The average of many instantaneous amplitude values taken at equal intervals during an alternation (half-cycle) of alternating current. The average value of a pure sine wave is 0.637 times its maximum or peak amplitude value.

**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.

**A.W.G.**—American wire gauge, formerly known as the Brown and Sharpe wire gauge (B. & S. gauge).

## B

**B**—Notation used to identify the plate circuit or plate voltage supply of a vacuum tube. Also used to represent magnetic flux density.

**B**— —Notation used to designate the negative plate supply terminal of a vacuum tube circuit or the negative terminal of the B battery or other plate voltage source. Pronounced "B minus."

**B+** —Notation used to designate the positive plate supply terminal of a vacuum tube circuit or the positive terminal of a B battery or other plate voltage source. Pronounced "B plus."

**back e.m.f.**—Back electromotive force.

**back electromotive force**—A voltage developed in an inductive circuit by a changing or alternating current, the polarity of which is at every instant opposite to that of the applied voltage. Also called *counter electromotive force*. It can never be greater than the applied voltage.

**background**—Music or sound effects produced at low volume level along with a regular radio program.

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

**background voltage**—In a radio direction finder, any voltage induced in the loop other than the desired signal voltage.

**back-lash**—Movement or play in the gears or parts of a tuning mechanism or other system, allowing one gear to be moved

a certain amount without causing motion of connected gears or parts.

**back-shunt signalling**—A signalling system where energy is delivered to the antenna when a telegraph key is closed and to a "back shunt" non-radiating circuit when the key is open.

**back-wave**—A back-wave is a signal which is heard from a telegraph transmitter with the key open. The wave is heard due to improper neutralization of the transmitter amplifier.

**baffle**—A wood, metal or composition horn or flat surface used with a loud-speaker to increase the effective 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.

**Baird, John Logie**—A pioneer of British Television, who developed a mechanical television system using the Nipkow scanning disc.

**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.

**balanced circuit**—A vacuum tube circuit in which the tube capacity is balanced or compensated for by an external capacity. More generally, any circuit which is adjusted so that two factors balance each other.

**balancer**—The portion of a radio direction finder used to balance out the antenna effect which is due to loop-ground capacity.

**ballast resistor**—A resistor which has the special characteristic of greatly decreasing its resistance when current flow tends to decrease, and increasing its resistance when current increases, thereby maintaining essentially constant current over a considerable range of voltage variation. The resistor is usually in a glass or metal envelope like a radio tube, and is used in some radio receivers to compensate for variations in line voltage.

- ballast tube**—A ballast resistor mounted in an evacuated glass or metal envelope like that of a radio tube. This construction improves the automatic voltage regulating action by reducing radiation of heat from the resistor element.
- ballistic galvanometer**—A laboratory instrument for precise measurements. It is a microammeter having no retarding spring. The meter movement rotates through an angle dependent on the quantity of electricity fed to its coil.
- band**—In radio, the frequencies which are within two definite limits are used for a definite purpose. Thus, the standard broadcast band extends from 550 kc. to 1600 kc.
- band-pass filter**—A filter network designed to pass a certain band of frequencies while attenuating or rejecting both higher and lower frequencies.
- band selector**—A *band switch*, which permits selecting any one of the bands in which a receiver or transmitter is designed to operate.
- bandspread tuning control**—A small variable condenser connected in parallel with each main tuning condenser of a short-wave receiver, to provide more accurate tuning by spreading a single band over the entire tuning dial.
- band switch**—A switch which simultaneously changes all tuning circuits of a radio receiver or transmitter to a desired band of frequencies.
- band width**—The width in cycles covered by a radio signal; also a particular group of station channel assignments (such as an amateur band width). The frequency limits of a tuned circuit or a combination of circuits.
- bank winding**—A method of winding coils in which successive turns are placed in two or more layers so that a multi-layer coil is completed without going back to the starting point. This procedure reduces the distributed capacity of the coil.
- bantam jr. tube**—An extremely small glass vacuum tube with a special bantam jr. base, used chiefly in hearing aid units.
- 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. They are designated by the letters GT following the tube type number.
- bar**—A term formerly used to mean a sound pressure of one dyne per square centimeter. Radio engineers now use the full term "dynes per square centimeter" to avoid confusion, because in all fields except acoustics the bar was originally equal to 1,000,000 dynes per square centimeter.
- barium**—A chemical element used in photoelectric cells.
- Barkhausen-Kurz oscillator**—A micro-wave oscillator circuit in which the plate is at cathode potential or even slightly negative, and the grid is positive with respect to the cathode. The frequency of the oscillator is determined by the speed of electrons and the distance between the grid and plate.
- bar magnet**—A magnetized straight bar of steel serving as a permanent magnet.
- barometer**—An instrument for measuring the pressure of the atmosphere, used chiefly for weather forecasting purposes.
- base**—The number upon which a system of logarithms is constructed. The base of the common system of logarithms is 10. Example:  $\log_{10} 10,000=4$ , which means that  $10^4=10,000$ ;  $\log_{10} 351=2.545$ , which means that  $10^{2.545}=351$ .  $\text{Log } \epsilon 453=6.116$ , which means that  $\epsilon^{6.116}$  or  $2.718^{6.116}$  equals 453. The base is designated to the right of and below the abbreviation "log": when no base is specified in ordinary problems of computation, the base 10 is always assumed.
- basket winding**—A criss-cross coil winding in which each turn is so placed that adjacent turns are separated by a considerable space except at the points of crossing, so as to reduce the distributed capacity of the coil.
- bass**—Low audio frequencies.
- bass-boost circuit**—A circuit designed to emphasize low audio frequencies.
- bass compensation**—Any means for offsetting the natural drop in the response of the human ear to low audio frequencies at low volume levels.
- 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 response**—The ability of a loudspeaker or amplifier 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 source of power.
- bay**—One complete vertical section of a number of amplifiers or other transmitter units mounted on racks.
- bayonet base**—A type of tube and lamp base having two projecting pins on opposite sides of the smooth cylindrical base. These pins engage in corresponding slots in the bayonet-shell socket, thus holding the tube or lamp in the socket. Electrical contact is made by means of pins or rings on the bottom of the base.

**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.

**B.B.C.**—British Broadcasting Corporation.

**b.c. or BC**—Broadcast band.

**BCL**—Amateur radio abbreviation for broadcast listener.

**beacon course**—The equisignal zone or beam of an aircraft radio beacon, designating a course through the sky.

**beam**—In aviation, a constant unidirectional radio signal transmitted for guidance of pilots. A plane flying exactly on the course indicated by a beam is said to be "flying the beam."

**beam angle**—The angle enclosing the greater part of the energy transmitted from a directional antenna.

**beam antenna**—An antenna so designed that its radiation is practically confined to a narrow beam extending in a definite direction.

**Beam-a-Scope**—Trade name for a built-in shielded loop antenna used in some General Electric receivers.



BAYONET BASE SOCKETS AND BULB

**beam, convergent**—A beam of light whose rays begin at different distant points and meet (converge) at a single point.

**beam, divergent**—A beam whose rays start at a single point and spread out.

**beam of light**—A group or pencil of light rays having an essentially constant cross-sectional area.

**beam, parallel**—A beam of light whose rays are exactly parallel to one another.

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

**bearing**—A term used in navigation to designate the direction of one point with respect to another in terms of compass readings. Thus, a bearing can specify the angle on which a ship or aircraft lies from a given point with respect to a straight line running north and south.

**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.

**beat-frequency receiver**—Early name for a superheterodyne receiver.

**beating**—Combining of two different frequencies to produce a new signal having pulsations in amplitude at the difference or beat frequency value.

**beat note**—An audible frequency produced by the beating of two higher frequencies.

**beats**—A periodic variation in the amplitude of the pressure or velocity at a point due to the interaction of two waves which differ in frequency. Beats can occur between radio signals as well as between sound waves or mechanical vibrations.

**bel**—The unit for logarithmic expression of ratios of power, voltage or current, named after Alexander Graham Bell, inventor of the telephone. The number of bels is the common logarithm of the power ratio. In radio work, a smaller unit called the *decibel* is used instead of the bel; a decibel is one-tenth of a bel.

**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, Alexander Graham**—American inventor of the telephone and microphone.

**Bellini-Tosi direction finder**—An early type of radio compass.

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

**beta rays**—Rays consisting of negatively-charged particles or electrons. Also called cathode rays.

**Beverage antenna**—A directional antenna of low height having a length which is some multiple of the received wavelength.

**b.f.o.**—Beat frequency oscillator.

**B-H curve**—A curve showing the relationship between magnetic flux density (B) produced in a magnetic path and the magnetic force per unit length (H) in that path.

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

- bias cell**—A tiny 1-volt or  $1\frac{1}{4}$ -volt cell used singly or in series combinations to provide a negative C bias voltage for a vacuum tube amplifier circuit. It will last indefinitely if no current is drawn from it.
- bias resistor**—The cathode resistor which provides an *automatic C bias* voltage for a tube.
- bidirectional**—In two directions, one opposite the other, an ordinary loop antenna is bidirectional, as it picks up energy from two directions, one exactly opposite the other.
- bilateral**—Having two sides.
- bilateral antenna**—An antenna having the property of radiating or receiving radio waves best in directions  $180^\circ$  apart (exactly opposite).
- bimorph cell**—A cell consisting of two crystal elements cemented together, used in crystal headphones, microphones, pickups and loudspeakers.
- binaural**—Having two ears, or the effect of hearing with both ears. Also, sound radiated from two sources, creating the sensation of sound position.
- binaural effect**—The effect of sound on both ears. The different sound path lengths make it possible for a person to determine the direction from which a sound is coming.
- binder**—A resinous material which causes the various materials of a phonograph record compound to adhere to one another. Also, the cement-like material used in carbon resistors to provide mechanical strength.
- binding post**—A small screw or clamping device for making quick electrical connections.
- bipolar**—Possessing two poles.
- bipolar magnetic driving unit**—A headphone unit having two magnetic poles.
- birdie**—A high-pitched whistle heard while tuning a receiver. It actually is a beat note having a high audio frequency.
- blacker-than-black level**—In television, the d.c. voltage value which is greater than the value representing the color black, used for control impulses.
- black level**—In television, the positive d.c. voltage representing the color black. Usually it is not greater than 80% of the maximum television signal amplitude.
- blanking pulse**—In television, the pulse used to blank out the lines that would otherwise be traced on the screen by the electron beam as it returns to the left of the tube to start another line, and as it returns from the bottom of the screen to the top to start another frame.
- blanking signal**—The signal introduced into the complex video signal at or above the black level, used to blank out all video signals during the transmission of synchronizing signals.
- blasting**—A distortion of sound caused by overloading the microphone, loudspeaker or other part of a transmitting system or public address amplifier.
- bleeder current**—A current drawn continuously from a power pack or other voltage source to improve its voltage regulation or to increase the voltage drop across a particular resistor.
- bleeder resistor**—A resistor which is used to draw a fixed bleeder current value from a power pack.
- blocked-grid keying**—Method of keying a telegraph transmitter by applying sufficient bias to block tubes when the key is open. Closing the key removes the bias, allowing plate current to flow.
- blocked resistance**—A term used in measuring loudspeaker efficiency. It represents the resistance due to electrical losses when the moving elements are blocked so they cannot move.
- blocking**—Stopping of operation, as by applying a high negative bias to the grid of a tube to cut off plate current.
- blocking condenser**—Any condenser used in a radio circuit to block the flow of direct current while allowing a.c. signal currents to pass.
- blooper**—Slang term applied to a regenerative receiver which radiates a signal when improperly tuned.
- blow-out magnet**—A permanent magnet or electromagnet used to extinguish the electric arc formed in an arc transmitter or when a switch or relay contact carrying heavy current is opened.
- B supply**—Plate voltage supply of a vacuum tube circuit, such as a B battery, an a.c. or universal power pack, a vibrator power pack, a d.c. generator, etc.
- B. & S.**—Brown & Sharpe (wire gauge), now known as American Wire Gauge (A.W.G.).
- bobbin**—A coil of wire wound on a form, or the form itself. A magnetic coil in a headphone unit is an example.
- body**—A definite portion of matter by itself.
- body capacity**—The capacity existing between the human body and a piece of radio apparatus.
- bombardment**—The impact of high-speed electrons on an electrode or other surface, usually causing secondary emission of electrons.
- 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).



- book condenser**—A two-plate condenser hinged like the pages of a book. Capacity variation is obtained by changing the angle between the plates. Usually called a *trimmer condenser*.
- B power supply**—Any power supply device which is connected in the plate circuit of a vacuum tube, such as a B battery, a.c. power pack, vibrator power pack or generator.
- breadboard construction**—Layout of all radio parts and wiring on one side of a wood board, so parts may be fastened by wood screws and easily moved during experimental work.
- break-in keying**—Method of keying a telegraph transmitter in which the receiver is inoperative only during the interval the transmitting key is held down. This enables the operator to listen continuously to other signals on the air. The station he is working can then stop him for a repeat at any time, rather than at the end of the message.
- breakdown voltage**—The voltage at which the insulation between two conductors will break down and become conductive.
- bridge**—An arrangement of resistances, inductances, or capacities, for the comparison of values of any unit with standards of the same kind.
- bridge circuit**—A circuit consisting of four resistances or impedances connected in series to form a square, with a voltage source connected between one pair of opposite junctions and an indicating meter (usually a galvanometer) between the other pair of junctions. One or more resistors are adjustable. The bridge is said to be balanced when these are adjusted so no current flows through the indicating meter. Example: *Wheatstone bridge*.
- bridge rectifier**—A four-element rectifier circuit connected in the characteristic four-cornered arrangement of a bridge circuit. A.C. voltage is applied to one pair of opposite junctions or corners, and d.c. voltage is obtained from the opposite pair.
- bright level**—The zero-voltage line of the pulsating d.c. voltage which constitutes a television video signal. The bright level represents white, the brightest part of an image.
- brightness**—The amount of light flux per unit area. Brightness is measured in lamberts, candle-power per square foot, or lumens per unit area.
- brightness control**—In a television receiver, the control which varies the average illumination of the reproduced image.
- brilliance**—In radio, good reproduction of the higher audio sound frequencies, making the reproduced program sound like the original.
- brilliance control**—Same as *brightness control*.
- broad**—A term often used to describe a circuit which will respond to a wide range of frequencies.
- broadcast**—A radio transmission intended for reception by the general public.
- 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.
- broadcasting**—A general term applying to the radiation of radio waves carrying programs intended for public interest, education, or entertainment.
- broadcast station**—A radio station used for transmitting programs to the general public.
- broadside directional antenna**—An antenna array whose radiation is substantially at right angles to the line along which its elements are arrayed.
- 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.
- bronze**—An alloy of copper and tin.
- Brown and Sharpe Gauge**—Former name of the American Wire Gauge (A.W.G.), commonly used in this country for specifying sizes of conductors. It uses a system of numbers ranging from 0000 for the largest diameter to 40 and beyond for the smallest diameters.
- brush**—A metal or carbon block used to make contact with a rotating or otherwise moving part in an electrical circuit.
- brush discharge**—Visual ionization occurring on the surfaces of conductors charged to high potentials. Also called corona discharge.
- brute-force filter**—A low-pass filter depending on large values of capacity and inductance rather than on resonant effects to filter out or block a.c. components while passing direct current.
- b.t.u.**—British thermal unit, an English unit of measure of heat energy. It is comparable to the calorie in the metric system.
- buck**—To oppose.
- bucking coil**—A coil whose magnetic field opposes the magnetic field of another coil, such as the hum-bucking coil in an electrodynamic loudspeaker.
- buffer**—Any part or circuit used to reduce undesirable interaction between radio circuits.
- buffer condenser**—A condenser connected between the anode and cathode of a rectifier tube to reduce voltage surges which might affect following parts in the apparatus.

**buffer stage**—An amplifier stage used to prevent feedback 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.



BUG OR SEMI-AUTOMATIC CODE KEY

**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.

**bus bars**—The heavy copper bars used on switchboards to carry current.

**bushing**—A tube or washer used for lining or insulating a hole in a radio chassis or as a bearing.

**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 cable**—Flexible metal conduit used to protect power line wiring in buildings and in high-power radio apparatus. Often called simply BX.



BX CABLE

**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**—Notation used to identify the grid circuit or grid voltage supply of a vacuum tube. Abbreviation for *capacity*, *condenser*, *center tap*, and *Centigrade*.

**°C**—Degrees Centigrade.

**C** —Notation used to designate the negative grid bias terminal of a vacuum tube circuit or the negative terminal of a C battery or other grid voltage source.

**C+** —Notation used to designate the positive grid bias terminal of a vacuum tube circuit or the positive terminal of a C battery or other grid voltage source.

**cabinet**—The ornamental, artistically designed wood, metal or plastic housing in which a radio receiver chassis and loud-speaker are mounted.

**cable**—A general term applied to larger sizes of wire, either solid or stranded, used singly or in combination; a cable is usually heavily insulated, and often is also lead-covered or shielded with metal braid.

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

**caesium**—An alkali metal used in certain types of photo-cells.

**cage antenna**—An antenna having conductors which consist of groups of parallel wires in a cylindrical arrangement.

**calibrate**—To determine by measurement or comparison the true values corresponding to each scale reading of a meter or other instrument. To determine and record the settings of a control which correspond to particular values of frequency, voltage, current or some other characteristic.

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

**calorie**—The unit of heat energy in the metric system. One calorie is the amount of heat energy required to raise the temperature of one gram of water one degree Centigrade. There are 252 calories in a British thermal unit (b.t.u.).

**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.

**cambric, varnished**—A fine white linen or cotton fabric, varnish impregnated and baked, and used as an insulating material in constructing coils and other radio parts. When made in the form of tubing, it is referred to as spaghetti.

**camera**—The part of a television transmitting apparatus in which the image of the scene to be televised is formed for a conversion into equivalent electrical impulses.

**camera tube**—In a television camera, the cathode ray tube which breaks up pictures or scenes into elemental areas and converts these into electrical impulses in definite sequence.

**candlepower**—Unit of measure of light intensity.

**candohm**—Trade name for the particular type of wire-wound resistor, usually tapped, which is wrapped in heavy fiber in-

- ulating paper and then encased in metal. Widely used for bleeder resistors and voltage divider applications.
- capacitance**—Capacity.
- capacitor**—Condenser.
- capacitor split-phase motor**—An induction motor using a series condenser to produce the rotating magnetic field required to bring an induction motor up to synchronous speed when operated from a single-phase a.c. source.
- capacity**—The electrical size of a condenser, determining the amount of electrical energy which can be stored in a condenser by a given voltage. The unit of capacity is the *farad*; a condenser or circuit has a capacity of 1 farad when a change of 1 volt per second produces a current of 1 ampere. In radio work, capacity is measured in microfarads (mfd.) and micro-microfarads (mmfd.); 1 mfd. is equal to 1,000,000 mmfd. Capacity exists wherever two conductors are separated by an insulating material.
- capacity bridge**—A wheatstone bridge formed of capacitive elements, for precise measurements of unknown capacity. It must be used with an a.c. source.
- 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 granules**—Small particles of carbon used in microphone buttons.
- carbon microphone**—A microphone in which the diaphragm applies a varying pressure to a container filled with carbon granules, thereby causing the resistance of the microphone to vary in accordance with the varying pressure of sound waves on the diaphragm.
- carbon-pressure recording**—That type of electromechanical facsimile recording in which a pressure device acts upon carbon paper to register upon the record sheet.
- 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 which can be used in crystal form to rectify or detect radio waves, as in a crystal detector.
- cardioid pattern**—A heart-shaped pattern representing the response or radiation characteristics of an antenna or the response characteristics of a microphone.
- carrier**—A current or voltage having the assigned frequency of a radio station, or the corresponding radio wave which is capable of traveling out into space from the transmitting antenna. 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 current**—The alternating current which is associated with a carrier, and which may be modulated with an intelligence signal. Also, the r.f. carrier current sent over power lines for communication purposes.
- 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.
- carrier level**—The strength of a carrier, expressed as power or voltage, and usually applying to the level of an unmodulated carrier.
- carrier suppression**—A method of radio transmission in which the carrier wave is not transmitted.
- carrier wave**—The unmodulated component of a signal wave, usually called simply the *carrier*. It carries the sound, picture, code or facsimile signals from the transmitting station through space to receivers.
- carrying capacity**—The maximum current strength that a conductor can safely transmit without getting too hot and damaging its insulation.
- cartridge fuse**—A fuse enclosed in a cartridge having the shape of a rod or cylinder, with contacts at the ends.
- cascade**—In series, such as tuning circuits or amplifier stages used one after another.
- cascade limiter**—An f.m. limiter system which uses two limiter tubes in series or cascade to improve operation for both weak and strong signals and give considerably higher gain than a single-stage limiter.
- catcher**—A part of a *Klystron*, a tube used for generating microwaves.
- 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 current**—The total current passing from the cathode through space to the other electrodes in a vacuum tube.

**cathode heating time**—The time in seconds required for the cathode of a tube to reach normal operating temperature after normal voltage is applied to the heater. For convenience and accuracy in measuring this time, the cathode is usually assumed to be at normal temperature when the plate current has reached 90% of its final value.

**cathode modulation**—A system of amplitude modulation in which the grid bias and plate voltage are varied simultaneously, thereby varying the cathode current.

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

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

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

**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.

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

**cathode sputtering**—A process sometimes used in the production of the metal master of a phonograph record, wherein the wax or lacquer original is coated with a conducting layer by means of an electrical discharge in a vacuum.

**cation**—A positive ion.

**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 voltage 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.

**C bias detector**—A vacuum tube operated with almost enough negative bias to cut off plate current. The tube operates on the lower bend of the characteristic curve, and detection takes place in the plate circuit.

**CBS**—Columbia Broadcasting System.

**c.c.**—Cubic centimeter.

**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 by passing a current through it in the reverse direction. The term cell is also used to designate light-sensitive tubes (*photoelectric cells* and *selenium cells*), probably because these tubes permit increased current flow when illuminated.

**cellulose nitrate disc**—A phonograph record made of cellulose nitrate.

**celotex**—Trade name for a fiber wallboard often used to form loudspeaker baffles due to its sound-absorbing qualities. Also used in radio and sound picture studios to control the amount of reverberation.

**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. Centering controls are also provided on cathode ray oscilloscopes.

**center-tap keying**—Keying a telegraph transmitter stage by interrupting the current flowing to the filament center-tap connection through the plate return lead.

**centi**—A prefix denoting a hundredth of.

**Centigrade**—The metric scale of temperature, in which 0 is the freezing point and 100 is the boiling point of 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.

**c.g.s.**—Centimeter-gram-second system, which is the metric system of specifying length, mass and time.

**CH**—Choke coil.

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

**changeover switch**—A special switch arranged to shift the antenna connection from sending to receiving apparatus and vice versa.

**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 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.

**characteristic**—The first part of a logarithm (to the left of the decimal point). Example: In  $\log 461 = 2.6637$ , the characteristic is 2. The characteristic of a number greater than 1 is positive and is one less than the number of digits to the left of the decimal point. The characteristic of a number less than 1 is negative, and is one more than the number of zeros immediately to the right of the decimal point.

**characteristic curve**—A curve plotted on graph paper to show the relation of changing values. For example, a curve showing how the plate current in a vacuum tube changes with respect to a change in grid voltage.

**characteristic impedance**—The impedance in ohms as measured between the terminals of a transmission line at the operating frequency. Also called surge impedance and designated by the notation  $Z_0$ .

**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 assembled parts on the metal frame or chassis base of a radio receiver, not including the housing or cabinet, or the metal frame itself.

**chassis base**—The metal framework on which the parts of a radio receiver or a section of a transmitter are mounted. More often called simply the *chassis*.

**clip**—The material removed from the phonograph disc by the recording stylus in cutting the groove during sound recording.

**choke coil**—A coil used to limit the flow of alternating current while allowing direct current to pass. A choke coil presents a high impedance to the alternating current which it is to block, without appreciably hindering the flow of direct current. R.F. choke coils have air or pulverized iron cores, while a.f. choke coils and filter chokes have iron cores.

**chopper**—A device for continuously breaking up a current or a ray of light.

**Christmas tree pattern**—The optical pattern observed when the surface of a phonograph record is illuminated by a beam of parallel light.

**Chromatic aberration**—A lens defect in which the different colors of light rays coming from a single point are not brought to the same focal point. The cause is failure of the lens to bend all colors of light the same amount; the effect is colored fringes around the image produced by the lens, and the remedy involves making the lens from suitable combinations of glass, such as from crown and flint glass. Television lenses must be corrected for chromatic aberration in this way.

**cipher**—A zero. A secret code.

**circuit**—A complete path over which electrons can flow from the negative terminal of a voltage source through connecting wires and parts to the positive terminal of the same voltage source.

**circuit breaker**—An electromagnetic device which opens or breaks a circuit automatically when the current rises above a predetermined value.

**circuit disturbance test**—A professional radio servicing technique which is widely used for isolating the defective stage in a dead receiver. It depends on the fact that a disturbance introduced in any receiver stage will reach the loudspeaker only if all stages between the point of disturbance and the loudspeaker are good. The disturbance is introduced in each stage in turn, working from the loudspeaker toward the antenna; the first stage at which no loudspeaker indication is obtained is then the defective stage. The disturbance may be introduced by removing and replacing the tube (not for universal receivers), touching the top cap, removing and replacing the top

## CHOKE COILS



UNSHIELDED  
R.F. CHOKE



SHIELDED  
R.F. CHOKE



BAKELITE  
CASE R.F.C.



SECTION-WOUND  
R.F. CHOKE



IRON-CORE  
CHOKE COIL

cap clip, or shorting the grid momentarily to the cathode or the chassis.

**circularly polarized wave**—A polarized wave in which the direction of displacement at a point rotates with constant angular velocity about an axis in the direction of propagation, and the magnitude of displacement is independent of its direction.

**circular mil**—A unit of area used chiefly in specifying the cross-sectional areas of round conductors. A circular mil is the area of a circle whose diameter is one mil (.001 inch).

**circular-mil-foot**—A unit conductor having a cross-sectional area of 1 circular mil and a length of one foot, sometimes used for comparing resistance of wires made from different materials. Thus, the specific resistance of a wire or material is the resistance in ohms of 1 circular-mil-foot of the wire.

**clamp**—A device for compressing or holding together two or more parts.

**class A amplifier**—An amplifier in which plate current flows at all times. Operating values are such that the input signal voltage swings over a straight portion of the tube characteristic curve at all times, but never swings positive and never swings down to the curved cut-off position.

**class AB amplifier**—An amplifier in which plate current flows for appreciably more than half of each input cycle but not for the full cycle. The operating point is essentially the same as for class A, but the input signal voltage is allowed to swing a certain amount positive and beyond cut-off so as to improve the efficiency of operation, and input circuits are specially designed to eliminate the resulting distortion.

**class B amplifier**—An amplifier in which the grid bias is approximately equal to the cut-off value of the tube, so that plate current is essentially zero when no signal is applied. Plate current then flows for approximately half of each input cycle when a signal is applied. The grid may be allowed to swing positive on peaks. Used both in r.f. and a.f. amplifiers. When used as an audio amplifier, class B operation requires the use of the push-pull circuit (push-push stage) to minimize distortion.

**class C amplifier**—An amplifier in which the grid bias is greater than the cut-off bias, so that plate current is zero when no signal is applied, and plate current flows for appreciably less than half of each input cycle when a signal is applied. The grid may swing positive far beyond saturation. Class C operation is used chiefly for unmodulated r.f. stages in transmitters.

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

making a readily removable connection to a terminal.

**clipper**—In a television receiver, the circuit which separates the control impulses from the video signals. Also called *synchroizing separator* or *amplitude separator*.

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

**close coupling**—The coupling provided by an r.f. or i.f. transformer when the primary and secondary windings are as close together as possible.

**cm.**—Centimeter.

**coaxial cable**—A tube or pipe of conductive material, usually less than an inch in diameter, through the middle of which runs a conductive wire held in position by insulators. Used to transmit radio or television signals or to transmit a number of telephone or telegraph messages simultaneously. Also called coaxial line, concentric line, pile line, etc.

**cobalt**—A metallic element often combined with iron and steel to make special alloys used in permanent magnets. It is less magnetic than iron, but retains its magnetism at temperatures as high as 1,100 degrees Centigrade.



SEVERAL TYPES OF CLIPS

**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. Also a system of sending secret messages.

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

**coefficient**—Any factor of a product can be called the coefficient of the product of the remaining factors. Examples: In  $2xy$ , 2 is the coefficient of  $xy$ ;  $x$  is the coefficient of  $2y$ ;  $y$  is the coefficient of  $2x$ . Usually, however, only the numerical part of an expression is called the coefficient. If there are no numbers in the expression, the coefficient is assumed to be 1.

**coercive force**—The amount of opposite magnetomotive force necessary to eliminate residual magnetism.



**colherer**—A device used in the early days of radio communication for detecting the presence of electromagnetic waves. It usually consisted of a glass tube containing metallic filings which completed the circuit between two electrodes while allowing current to flow only in one direction.

**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, glass or wood.

**coincidence counter**—A device for counting pulses which occur in separate circuits at precisely the same time.

**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.

**collector**—In a cathode ray television camera tube, a conductive coating or ring on the inside of the glass envelope midway between the mosaic and the window end of the tube, which collects the electrons which leave the light-sensitive mosaic surface.

**collector rings**—The rings of an A.C. generator, corresponding to the commutator of a D.C. generator, from which the brushes collect the electrical energy. Sometimes called *slip rings*.

**Colorana tuning indicator**—Trade name used by General Electric for a system using colored lights and a saturable-core transformer to indicate when the receiver is accurately tuned to a station. Green dial lights glow when tuning is correct, and red lamps glow when the set is tuned off a station.

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

**color response**—The relative sensitivity of photoelectric cells and of the human eye to light of various colors.

**Colpitts oscillator**—A tube circuit arranged so that the cathode is connected to the junction of two condensers which are in series across the coil.

**communication band**—The active band of frequencies produced by modulation or keying of a particular transmitter. A communication band is always narrower

than a channel, to prevent interference between stations having adjacent frequency assignments.

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

**communication system**—A means of exchanging intelligence between two or more separate locations.

**commutating poles**—Small poles set between the main poles of a generator or motor to produce sparkless commutation.

**commutation**—In a d.c. generator, the process of changing the generated a.c. voltage to a pulsating d.c. voltage by means of a commutator and brushes. In a high-power multitube rectifier system, the process of shifting the load current from one rectifier tube to another.



Courtesy Hallicrafters

#### COMMUNICATION RECEIVER

**commutator**—A set of copper segments radially mounted on the armature shaft and connected to the armature coils, with fixed brushes pressing against the commutator segments at the correct positions to give mechanical rectification of the a.c. voltage generated in the armature coils.

**compass**—A small permanent magnet mounted so it can freely rotate. It will line itself up with the direction of the earth's magnetic lines of force, and point toward the north and south magnetic poles. Used to determine direction in air and sea navigation.

**compensator**—The portion of a radio direction finder which automatically applies part or all of the necessary correction to the directional indication.

**complementary angle**—One of two angles whose sum is  $90^\circ$ .

**complex number**—An expression consisting of a "real number" plus or minus an "imaginary" number. Examples:  $R + jx$ ;  $7 - j16$ . The value following  $j$  is the imaginary component.

- compliance**—Compliance in a mechanical system is equivalent to capacity in an electrical system, and is a measure of the ability of an object to give or stretch when a force is applied. Usually used in referring to the springiness of a loud-speaker moving system.
- component**—Any part of a whole (current, force, voltage, etc.) which may be considered by itself. Example: the a.c. component of a pulsating current.
- components of a vector**—The distances which determine the position of a vector with respect to reference lines. The *horizontal component* is the projection of the vector upon a horizontal line, and is equal to the magnitude of the vector multiplied by the cosine of the angle which the vector makes with the horizontal. The *vertical component* is the projection of the vector upon a vertical line, and is equal to the magnitude of the vector multiplied by the sine of the angle which the vector makes with the horizontal.
- compound**—A combination of two or more elements.
- compound winding**—A two section field winding for a motor or generator, one section being in series with the armature and the other in parallel with the armature.
- compression**—Squeezing together, as in limiting the audio frequency response of a device to a certain portion of normal frequency range. Also, a dense region of air caused by a vibrating body.
- concave lens**—A lens which is curved inward on one side and flat on the other side.
- concave mirror**—A polished reflecting surface curving inward like the inside surface of a sphere or ball.
- concavo-convex lens**—A lens which is concave on one side and convex on the other side.
- concentric**—Having a common center.
- concentric cable**—Coaxial cable.
- concentric line**—A shielded transmission line consisting of coaxial cylinders (a wire supported by insulators in the center of a hollow metal tube). Also called coaxial line, coaxial cable, pile line, etc.
- concentric-line oscillator**—An oscillator whose grid and/or plate tank inductances are formed by the elements of a concentric line. Used in ultra-high frequency work.
- 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.
- condenser bank**—A number of paper by-pass or filter condensers in a single container.
- condenser gang**—A number of variable condensers operated from the same shaft.
- condenser loudspeaker**—A loudspeaker in which the mechanical forces acting in the diaphragm result from electrostatic interactions of two large, closely spaced plates when a varying signal voltage is applied to the plates. Not in common use.
- condenser microphone**—A microphone consisting essentially of a flexible metal diaphragm and a rigid metal plate arranged to form a two-plate condenser. Sound waves set the diaphragm in vibration, causing the capacity to vary accordingly, and these capacity variations cause a varying current flow from the source of charging voltage.
- condenser plates**—The half-round metal plates of a tuning condenser, or the metal plates of any other condenser.
- condenser shaft**—The metal rod to which the rotor plates of a variable tuning condenser are attached.
- condenser, voltage-regulating**—A condenser, usually of the wet electrolytic type, used in a circuit to maintain a constant voltage by placing a load on the circuit if the voltage goes too high.
- conductance**—The ability of a body to conduct electricity. The unit of conductance is the *mho*, which is reciprocal of the ohm.
- conduction current**—A current formed by movements of electrons only (not ions).
- conductivity**—The ability of a material to carry electric current.
- conductor**—A wire or 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.
- conduit**—A metal pipe through which electrical conductors are run.
- cone**—The conical-shaped paper or fiber diaphragm of a magnetic or dynamic loudspeaker.
- cone of silence**—The area directly over the antenna of a radio beacon transmitting antenna, in which no signal can be picked up.
- conical horn**—A cone-shaped horn, having a radius which increases uniformly along the axis of the horn.
- connector**—Any device that joins or couples two or more parts.
- console**—A large radio receiver cabinet designed to rest on the floor rather than on a table.
- console receiver**—A radio set placed in a console cabinet.

- constant**—An unvarying quantity included as a factor in many formulas, for the purpose of bringing theoretical calculations into agreement with experience.
- constant-amplitude recording**—A recording in which all frequencies of the same intensity are inscribed at the same amplitude. If the entire frequency range is recorded by the constant amplitude method, surface noise on the record will be reduced, due to a better frequency-to-noise ratio.
- constantan**—An alloy of approximately 60% copper and 40% nickel, used in the construction of precision resistors, rheostats and measuring instruments.
- constant-current generator**—A tube circuit in which the a.c. plate resistance is high compared to the plate load resistance, with the result that the current is practically independent of load variations. A pentode tube acts in this way.
- constant-velocity recording**—A recording in which the amplitude of the cut in the record is inversely proportional to the frequency in order to hold the vibrational velocity constant. Since lower frequencies would require extremely large amplitudes of cutting, the usual practice is to record at constant amplitude up to about 350 cycles, then change to constant velocity above this point.
- contact**—A terminal to which a connection can be made. A joining of bodies to permit the flow of electrical current.
- 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.
- contact potential**—A voltage difference which exists between different metals when in contact with each other.
- Continental Code**—Same as the International Morse Code. Used universally for radio telegraphy.
- continuity**—The property of having a continuous or complete d.c. electrical path.
- continuous wave**—A radio wave in which successive cycles are identical (constant in amplitude) under steady-state conditions. Abbreviated c.w.
- contrast control**—In a television receiver the manual control which changes gain. The most noticeable effect is a variation or change in the amount of contrast between bright and dark areas of the reproduced image. In effect, it changes the range of brightness between highlights and shadows in the image.
- control electrode**—An electrode to which a varying voltage is applied for the purpose of varying the current flowing between two or more other electrodes in a vacuum tube.
- 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.
- control room**—A small room in a broadcast station, partly or completely inclosed in glass and located next to the main studio, from which the engineers and production men control a radio program.
- converge**—To bring together, as to focus light rays or radio waves to a single point.
- convergent beam**—A beam of light whose rays begin at different distant points and meet (converge) at a single point.
- 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, for changing electrical energy from one form to another, as a.c. to d.c.
- converter noise**—Noise generated in the oscillator and mixer-first detector sections of a superheterodyne receiver due to electrons arriving at the plate in spurts or "shots," so that the plate current varies from instant to instant.
- convex mirror**—A polished reflecting surface curving outward like the outside of a ball or sphere.
- convex lens**—A lens which is curved outward on one side and flat on the other side.
- coordinate**—Any of two or more magnitudes which determine the position of a point with respect to reference lines. Ordinary graphs use *rectangular coordinates*, in which the horizontal reference line is called the X axis or the axis of abscissa, and the vertical reference line is called the Y axis or the axis of ordinates. In *polar coordinates*, position is determined with one vector magnitude and the angle which the vector makes with the horizontal reference line or X axis.
- copper**—A metallic element widely used in radio. It is one of the best conductors of both electricity and heat.
- copper-oxide rectifier**—A rectifier made up of discs of copper coated on one side with cuprous oxide. The discs allow current to flow in one direction but allow very little current flow in the reverse direction.
- copper-oxide rectifier-type meter**—An instrument used to measure a.c. voltages and currents. The current to be measured is passed through a full-wave copper-oxide rectifier, and the resulting direct current is indicated by a d.c. milliammeter.

- cord**—A small flexible wire, usually stranded, and substantially insulated to withstand wear.
- core**—The center of a coil.
- core losses**—The losses in an iron core coil or transformer due to eddy currents and hysteresis in the iron core.
- corona**—The discharge of electricity which appears on the surface of a conductor as a glow of colored light when the potential gradient (voltage per unit length) exceeds a certain value. It is due to ionization of surrounding air by the high voltage.
- corrosion**—A chemical action, oxidation or rusting, which causes a gradual wearing away of the original metals.
- corrugated**—Formed with a surface having the appearance of alternate valleys and ridges.
- cos**—Cosine.
- cosecant**—The cosecant of an acute angle of a right triangle (written  $\csc \theta$ ) is equal to the hypotenuse divided by the opposite side. Cosecant is the reciprocal of sine. See *trigonometric function*.
- cosine**—The cosine of an acute angle of a right triangle (written  $\cos \theta$ ) is equal to the adjacent side divided by the hypotenuse. See *trigonometric function*.
- cosmic rays**—Rays originating outside the earth's atmosphere, having extremely high frequency and penetrating power. They can penetrate 18 inches of solid lead or 200 feet of water.
- cot**—Cotangent.
- cotangent**—The cotangent of an acute angle of a right triangle (written  $\cot \theta$ ) is equal to the adjacent side divided by the opposite side. Cotangent is the reciprocal of tangent. See *trigonometric function*.
- Coulomb, Charles Augustin**—A French scientist (1736-1806) noted for his study of electricity. The unit of quantity of electricity was named after him.
- coulomb**—A measure of the quantity of electricity which passes a given point in a given time. A coulomb is equal to a current of one ampere flowing for one second, which involves a movement of 6.3 million million electrons past a point in the circuit.
- counter-clockwise**—In a direction opposite that in which the hands of a clock rotate.
- counter e.m.f.**—An electromotive force induced in the armature of a motor, of opposite polarity to the applied voltage. Also known as *back e.m.f.*
- counterpoise**—A system of wires directly below an antenna, elevated above and insulated from the ground, forming a lower system of conductors for an antenna.
- 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.
- coupled circuits**—Separate circuits which are made to influence one another.
- coupler**—A device employed to transfer electric power from one circuit to another. May be inductive, capacitive or resistive.
- 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. *Optimum coupling* or *critical coupling* is that which gives maximum transfer of signal energy. *Tight coupling* is the closest possible coupling under a given set of conditions. *Loose* or *poor coupling* gives little transfer of signal energy. Also, a device for connecting two shafts together end to end.
- coupling coefficient**—A numerical rating between 0 and 1, specifying the degree of coupling between two circuits. Perfect coupling is 1, and no coupling is 0. For inductive coupling, the coupling coefficient is equal to  $M \div \sqrt{L_1 L_2}$ , where  $M$  is the mutual inductance in henrys, and  $L_1$  and  $L_2$  are the inductance values in henrys of the individual coils.
- coupling condenser**—A condenser used to couple two circuits together.
- coupling transformer**—A transformer used to couple two circuits together by means of mutual induction.
- coverage**—The portion of a community or populated region which is effectively served by a broadcast station from an advertising standpoint.
- c.p.**—Candlepower.
- C power supply**—Any power supply device which is connected between the cathode and grid of a vacuum tube so as to apply a grid bias, such as a C battery or grid bias cell.
- c.p.s.**—Cycles per second.
- crater**—The cavity formed in the positive carbon electrode of an electric arc. The highest light intensity is emitted in the region of the crater.
- crater lamp**—A neon lamp having a cup-shaped light source, providing a spot source of light.
- critical angle**—The angle of incidence beyond which rays of light are no longer refracted (bent) into a transparent medium, but are totally reflected from its surface.
- critical coupling**—Coupling which produces maximum transfer of energy.
- c.r.o.**—Cathode ray oscilloscope.
- cross modulation**—A type of station interference (intermodulation) in which the

carrier of a desired signal becomes modulated with an undesired signal, so that the program of the undesired station is heard in the background of the desired program.

**cross-over frequency**—The frequency where the output from a low-frequency speaker and a high-frequency speaker are equal. Below this point, the output is primarily from the low-frequency speaker, while above this point the output is from the high-frequency speaker.

**cross-over point**—The point at which converging light rays or electron beams cross and begin to diverge.

**cross-section**—The total area at right angles to the length of an object.

**cross-talk**—Interfering conversation originating at a point other than that of program origin.

**cruciform core**—A type of transformer core having the primary and secondary windings on a central core, with four separate magnetic return paths.



*Courtesy General Electric*

CRYSTAL HELD IN TWEEZERS IS READY FOR USE IN A TRANSMITTER. THESE CRYSTALS ARE CUT FROM NATURAL QUARTZ SUCH AS THE PIECE AT THE RIGHT.

**crystal**—A piece of natural quartz or similar piezoelectric 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 also 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.

**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 holder**—A device to hold a quartz crystal in a definite position and provide proper electrical contacts for it. Some holders have a variable air gap so the frequency of oscillation may be varied over a limited range.

**crystal loudspeaker**—A loudspeaker in which the mechanical forces acting on the diaphragm result from deformation of a crystal element. Not in common use.

**crystal microphone**—A microphone in which deformation of a piezoelectric crystal by sound waves or vibrations generates the output voltage. Widely used in radio.

**crystal oscillator**—A vacuum tube oscillator stage whose frequency is determined by a piezoelectric (quartz) crystal.

**crystal oven**—A small electrically-heated oven in which the quartz crystal of a transmitter is mounted. The oven and crystal are kept at essentially constant temperature by automatic temperature controls.

**crystal pickup**—A phonograph pickup in which deformation of a piezoelectric crystal by movements of the phonograph needle generates the output voltage.

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

**csc**—Cosecant.

**C.S.T.**—Central Standard Time.

**C supply**—Grid voltage supply.

**cube**—The third power of a number, obtained by using a number as a factor three times. Example:  $3 \times 3 \times 3 = 27$ , which is the cube or third power of 3.

**cube root**—A number which, when multiplied by itself three times, equals the given number. Examples: 3 is the cube root of 27; 5 is the cube root of 125. Cube root is indicated by a radical sign with 3 as the index number. Example:  $\sqrt[3]{343}$ .

**cue**—A signal, given verbally by a recognized sound or by sign during a radio broadcast. Thus, a phrase like "This is the National Broadcasting Company" could be a cue signal for radio and telephone operators to switch channels and lines in preparation for the next network program.

**current**—The movement of electrons through

- a conductor. Current is measured in amperes, in milliamperes and in microamperes.
- current amplification**—The ratio of the signal output current to the signal input current.
- current anti-node**—A point along a transmission line or antenna at which current is a maximum.
- current density**—The strength of an electric current per unit cross-sectional area of a conductor.
- current feed**—A method of exciting a transmitting antenna by feeding current to it at a point of maximum current flow.
- current loop**—A point of maximum current flow, usually on an antenna. Also called a *current anti-node*.
- current node**—Any point which has zero current in a transmission line, antenna or other stationary wave system. Thus, current nodes exist at the ends of a half-wave doublet antenna.
- current transformer**—A transformer connected into a high current circuit for measuring purposes. A meter is connected across the secondary winding, and is calibrated or read in terms of current flowing in the primary.
- curve**—The line on a graph which connects plotted points and shows the relationship of one variable to another.
- curvilinear cone**—A curved cone having the general form of a parabola, used to secure pure piston action. Often called a *paracurve*.
- cushion socket**—A tube socket mounted on soft rubber or a spring, so that vibration will not injure or affect the tube.
- cut**—Removal of spoken or musical material from a radio program script in order to fit the prescribed time. Also, a command telling the studio engineer to disconnect all microphones, so nothing more can go out on the air.
- cut-off**—In a vacuum tube, the grid bias voltage value at which plate current ceases to flow. In a selective circuit, the frequency above or below which an amplifier or circuit fails to respond.
- cutout**—Any arrangement by which a circuit is automatically opened when the current flowing through it exceeds or drops below a certain set value. Usually an electromagnetic device like a relay.
- cutter**—The device which transforms electric energy into mechanical motion which is inscribed into the record by the cutting stylus during recording.
- 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.
- cutting stylus**—The cutting tool which cuts the groove into a record during recording.
- c.w. or CW**—Continuous waves.
- 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. Cycle is often designated by the symbol  $\sim$ .
- cyclotron**—An apparatus which uses electromagnetic and electrostatic means for imparting tremendously high speeds to electrified particles. Cyclotrons are used to bombard the nuclei of atoms so as to change atomic structure or artificially produce radioactivity.
- cylindrical concave mirror**—A curved reflecting surface like the inside of one half of a cylinder, used to focus light rays to a line.
- cylindrical convex lens**—A long lens having surfaces spherically curved in one direction and straight in the perpendicular to this direction, used to focus light rays to a line.
- cylindrical wave**—A wave whose wave front is a cylindrical surface.

## D

**d.**—Distance. Diameter.

**damped waves**—Radio waves which progressively decrease in amplitude during successive cycles.

**dampen the studio**—To increase the absorption of sound in a studio by bringing in portable sound-absorbing equipment such as monk's cloth screens, drapes or rugs, or by bringing more people into the studio.

**damping**—Elimination of vibration or oscillation in a meter movement by introducing friction or some other type of loss.

**dark spot defect**—Dark spots in the reproduced television image caused by electron clouds which form in front of the mosaic screen in the camera tube at the transmitter.

**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.



**db**—Decibel; always written without a period between the letters.

**db meter**—A copper-oxide rectifier-type meter whose scale is calibrated to read decibel values. Used with audio amplifiers to indicate volume level (particularly in broadcast and p.a. work).

**d.c., D.C. or DC**—Direct current.

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

**d.c. inserter stage**—A television transmitter stage which introduces a d.c. component (the pedestal level) into the television signal. Synchronizing impulses will then swing the signal in one direction from the pedestal level, while picture signal elements swing the signal in the other direction, with the swing away from the pedestal level increasing with brightness in the latter case.

**d.c. plate resistance**—The average or d.c. plate voltage divided by the average or d.c. plate current in a vacuum tube.

**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.c. transmission**—In television, the transmission of a television signal with the direct current component represented in the picture signal.

**d.c. voltage**—A voltage which sends a direct current through a circuit, and hence forces electrons around a circuit in the same direction all the time.

**deadbeat**—A descriptive term applied to instruments whose pointers move to a position without undue oscillation and come to a "dead" stop. A highly damped meter movement.

**dead-center position**—The position in which a brush would be placed on the commutator of a d.c. motor or generator if there were no distortion of field flux by armature reaction.

**dead end**—The part of a radio studio which has the greatest sound absorption.

**dead end**—The portion of a tapped coil through which no current is flowing.

**dead receiver**—A receiver which will not play.

**dead spot**—A region in which signals from certain radio stations are received poorly or not at all, such as under a steel railroad bridge.

**decade box**—A system of resistors or other units whose values are arranged in multiples of 10 so that any desired value of the unit may be obtained.

**deci**—A prefix indicating one-tenth of a unit.

**decibel**—A unit used for expressing a *change* in signal level in an a.f. circuit or a *change* in sound level. The power level change in decibels is equal to 10 times the

common logarithm of the power ratio. One decibel (db) is the amount by which the pressure of a pure sine wave sound must be changed in order for the change to be just barely noticeable by the average human ear. A decibel can express an actual level only when some definite reference level is assumed to be zero db. With sound, the threshold of audibility is generally assumed to be zero db, while in a.f. work a power of 0.006 watt is most generally used as the reference level of zero db.

**decimal point**—A period separating a decimal fraction from a whole number.

**decoupling**—Means taken to prevent coupling between stages or sections of a stage.

**definition**—Clarity or degree of perfection of transmission and reception. The characteristic which enables radio listeners to distinguish between actors in a drama or to identify various musical units in an orchestra, and enables television viewers to distinguish fine detail in the reproduced image.

**deflecting coil**—A coil of wire used to control by electromagnetic means the movement of the electron beam in a cathode ray tube in an oscilloscope, television camera or television receiver. Also called a deflecting yoke.

**deflecting electrode**—An electrode in a cathode ray tube to which a potential is applied for the purpose of moving the beam in a horizontal or vertical direction.

**deflection**—A movement of an object away from its resting (normal) position, such as deflection of a meter pointer, an electron beam in a cathode ray tube or the vane in a shadow-type tuning indicator.

**deflection sensitivity**—The beam deflection in a cathode ray tube caused by a given change in the field intensity. For electrostatic deflection this is usually given as volts per inch of deflection.

**De Forest, Lee**—An American, inventor of the three-element (triode) vacuum tube.

**degaussing**—Neutralizing the magnetic field of a ship so that if it passes over a magnetic mine, the magnetic striker on the mine will not act and the mine will not explode.

**degeneration**—Negative feedback, which decreases the amplification. Also called *inverse feedback* or *stabilizing feedback*.

**deionization time**—The time required for the grid of a gas tube to regain control after plate current has been interrupted.

**delayed a.v.c.**—An automatic volume control circuit which does not begin to act until signals reach a certain strength. It permits reception of weak signals even though they are fading at times, whereas normal a.v.c. tends to make weak signals weaker.

- delta circuit**—A network of three resistors or impedances connected so they appear to be arranged in the form of a triangle like the Greek letter delta ( $\Delta$ ).
- 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.
- denominator**—The part of a common fraction which is written below the line. Example: In  $\frac{9}{16}$ , the denominator is 16; in  $\frac{\omega L}{R}$ , the denominator is R.
- densitometer**—An instrument used to measure the density or opacity of a material. The electronic version employs a light beam, a photoelectric cell and an indicating meter.
- density**—A measure of the light-reflecting or transmitting properties of an area. A measure of the concentration of matter in a material, in which case density is equal to weight divided by volume. Current density is the total current divided by the cross-sectional area of the conductor.
- depolarizer**—The chemical used in a primary cell to prevent polarization due to excess hydrogen formation at the carbon electrode.
- DET.**—Detector tube or stage.
- detector**—That stage in a receiver at which demodulation takes place. In the detector stage of a t.r.f. receiver, the desired audio signal is separated from the r.f. carrier. In the second detector of a superheterodyne receiver, the desired audio signal is separated from the i.f. carrier.
- detune**—To change slightly either the capacity, the inductance or both in a tuned circuit, so that it no longer is in exact resonance at the applied frequency.
- d.f. station**—A radio direction-finding station.
- diagram**—A plan or layout for a receiver, transmitter or other apparatus. In a schematic circuit diagram, schematic symbols represent radio parts. In a pictorial circuit diagram, actual sketches of radio parts are used. In a block diagram, entire circuits, stages or sections are represented by labelled blocks. In all diagrams, lines are used to represent circuit connections.
- 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 wave-length in meters will also be indicated. Tuning dials of all-wave receivers may indicate frequencies in kilocycles and megacycles as well as in meters.
- 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.
- diameter**—A line passing through the center of a circle and ending at opposite points on the circle. The distance across, or width of the circle.
- diaphragm**—A thin, flexible sheet which can produce sound vibrations (as in a loud-speaker) or can be moved by sound waves (as in a microphone). In photography and in television cameras, an adjustable device used to reduce the effective area of a lens so as to increase the depth of focus.
- diathermy**—Therapeutic use of a high-frequency current to generate heat within some part of a person. Diathermy machines are actually short-wave transmitters, and often cause serious radio interference.
- dielectric**—The insulating material between the plates of a condenser.
- dielectric constant**—The ratio of the capacity of a condenser using a given substance for a dielectric to the capacity of the same condenser with air for a dielectric. Air has a dielectric constant of 1, glass a dielectric constant of 4 to 8, etc.
- dielectric strength**—The voltage a dielectric of unit thickness can withstand without breaking down.
- diffraction**—The bending of a radio wave or light ray around an obstacle.
- diffusion**—Scattering of light.
- dimmer**—An adjustable resistance by means of which lights may be gradually dimmed or brightened.
- 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.
- diode-pentode**—A vacuum tube having a diode and a pentode in the same envelope.
- diopter**—A unit equal to the reciprocal of focal length in meters.
- dipole antenna**—To the radio physicist, an elemental (very small) length of radiating antenna, having opposite charges at the ends and having uniform current distribution. The term is used to describe any short antenna, not necessarily resonant at the transmitting frequency. Also, sometimes loosely used to describe a *doublet antenna*.
- 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.

**direct-current amplifier**—An amplifier which is capable of amplifying small variations in direct current.

**direct inductive coupling**—A method of coupling in which one circuit is connected directly to a tap on the inductance element of another circuit.

**directional antenna**—An antenna which radiates or receives radio waves better in some directions than others.

**directional pattern of an antenna**—A special graph (polar characteristic) which indicates the intensity of the radiation field of a transmitting antenna at a fixed distance in different directions in space. In the case of a receiving antenna, it indicates the response of the antenna from different directions to a signal having unit field intensity.

**direction finder**—A radio receiving device which can be used to determine the line of travel of radio waves. It usually employs a highly directional loop antenna.

**direction-finder deviation**—The difference between the observed radio bearing and the true (corrected) radio bearing of a direction finder.

**direction of polarization**—The direction of the displacement vector in a linearly polarized wave. In an electromagnetic wave, however, the direction of polarization is the direction of the electric displacement. Thus, a vertically polarized wave is one having the electric field component in a vertical (up and down) plane with respect to the earth's surface.

**director**—In a directional antenna system, the director is the front portion which is not connected to the transmitter or receiver. The purpose of the director is to increase the effectiveness of the antenna in the forward direction.

**directly proportional**—Varying uniformly as some other value varies.

**direct resistance-coupled amplifier**—An amplifier stage coupled to a following stage by directly connecting the plate element of the first stage to the control grid element of the second stage. The plate load for the first stage is a resistor which is common to both stages.

**direct scanning**—A method of scanning in which the entire subject is simultaneously illuminated, and a device is used to view a limited area of the scene at a time.

**direct wave**—A wave that is propagated directly through space, without being reflected.

**directivity**—The antenna characteristic which causes it to radiate or receive more power in certain directions than in others.

**disc**—A phonograph record or blank. Also the rotating element of a mechanical television scanning system.

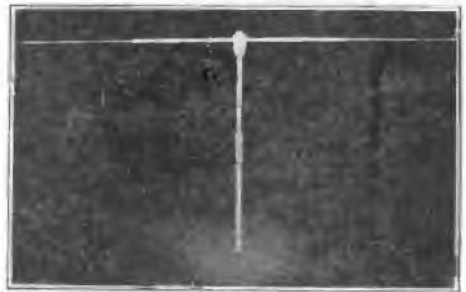
**discharge**—A release of energy which has been stored up, as in the case of a discharge from a condenser.

**discriminator**—That stage of an f.m. receiver which converts f.m. signals directly into audio signals. Also, a similar stage in an a.f.c. system.

**dissector tube**—Trade name for the cathode ray television camera tube developed and used by Farnsworth.

**distortion**—Improper reproduction of a sound or television radio program due to changes occurring in the wave form of the intelligence signal somewhere in the path it takes through the transmitting and receiving system or through an amplifier system.

**distributed capacity**—Capacity distributed between conducting elements such as wires, as distinguished from capacity concentrated in a condenser. Usually



DIPOLE ANTENNA

used to specify the small capacity existing between the turns of wire in a coil.

**distributed constants**—Constants which exist along the entire length or area of a circuit, such as distributed capacity between each pair of adjacent turns in a coil, or the distributed inductance which exists in each elemental length of a conductor.

**distributed inductance**—The inductance which exists along the entire length of a conductor, as distinguished from self-inductance concentrated in coils.

**distribution control**—The control which varies the amount of correction applied to the saw-tooth wave in a television receiver so as to give the desired linear scanning of lines.

**divergent**—Spreading out from a point of origin, as of light rays or radio waves.

**divergent beam**—A beam of light whose rays start at a single point and spread out.

**dividend**—A number or quantity that is to be divided. Example: In the expression  $1400 \div 70 = 20$ , the dividend is 1400. (The *divisor* here is 70, and the *quotient* is 20.)

**division**—The process of finding how many times one number is contained in another. The standard sign which indicates division is  $\div$ . In algebra, a horizontal line (or sometimes a fraction bar) is used instead of the conventional division

E  
 $\div$   
R

sign. Example:  $E \div R$ ,  $\frac{E}{R}$  and  $E/R$  all

mean that E is to be divided by R. In dividing positive and negative numbers, the quotient is positive if both numbers have like signs, and the quotient is negative if the numbers have unlike signs.

**divisor**—The number by which a number or quantity is to be divided. Example: In  $1400 \div 70 = 20$ , the divisor is 70. (The *dividend* here is 1400, and the *quotient* is 20.)

**dog house**—The structure at the base of a transmitting antenna tower which houses the antenna tuning equipment and meters.

**Doherty amplifier**—An amplifier circuit in which one tube supplies unmodulated carrier power and a second tube, feeding the same load as the first, is biased so no plate current flows until the r.f. grid voltage (modulated carrier signal) exceeds the bias on the tube. When this happens, power is fed to the load, and the effective impedance of the load is lowered. This results in an increase in power from the first tube.

**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-concave lens**—A lens with both sides curved inward, so the center is the thinnest section. It causes light rays to diverge.

**double-convex lens**—A lens with both sides curved outward, so that the center of the lens is the thickest portion.

**double modulation**—The process of modulation in which a carrier wave of one frequency is first modulated by the signal wave, and is then made to modulate a second carrier wave of higher frequency.

**double-pole switch**—A switch which simultaneously changes connections in two separate circuits or in both sides of the same circuit.

**double superheterodyne**—A superhet using two first detector stages. The local oscillator signal combines with the desired signal in the first tube to produce a preliminary i.f. value, and this combines in

the second tube with the same local oscillator signal to produce the final i.f. value. Used in some f.m. sets to get more gain and to stabilize operation at high frequencies.

**double-throw switch**—A switch which connects one circuit terminal to either of two other circuit terminals.

**doublet antenna**—A Hertzian antenna system, independent of the earth, usually a half wavelength long or some multiple of this length. The term is also used to describe a shorter antenna which should be called a *dipole antenna*.

**down lead**—The wire connecting the antenna proper with the receiver. More often called a *lead-in*.

**Dow oscillator**—An electron-coupled oscillator circuit originated by Dow.

**d.p.d.t.**—Double-pole, double-throw. A type of switch.

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

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

**drive pin**—A pin similar to the center pin on a phonograph turntable, but located to one side of center, sometimes used to prevent the record from slipping on the turntable during recording.

**driver stage**—The amplifier stage preceding the high-power audio output stage in a transmitter. It is called a driver stage because it delivers power as well as voltage for excitation of the output stage.

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

**drop-out current**—That value to which the current through a relay coil must be reduced before the armature will be released (will drop away from the core).

**drum speed**—The number of scanning lines per minute in a facsimile system.

**drum switch**—A series of contacts on a rotating drum which make contact with fingers fastened to an insulated support. Used for complex circuit changes.

**dry battery**—A group of dry cells connected in various series, parallel or series-parallel arrangements to get desired voltage and current values.

**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.

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

**d.t.**—Double-throw. A type of switch.

**dual modulation**—The process of modulating a common carrier wave or sub-carrier by two different types of modulation, such as both amplitude and frequency modulation, each conveying separate information.

**dummy antenna**—A resistor or other device which duplicates the electrical characteristics of a transmitting antenna without radiating radio waves. Used for testing and adjusting transmitters.

**duodiode**—A vacuum tube having two diodes in the same envelope. Also called double diode.

**duodiode-pentode**—A vacuum tube having two diodes and a pentode in the same envelope. Also called double-diode-pentode.

**duodiode-triode**—A vacuum tube having two diodes and a triode in the same envelope. Also called duplex diode-triode.

**duotriode**—A vacuum tube having two triodes in the same envelope. Also called double triode.

**duplex operation**—Simultaneous transmission and reception of radio signals between two stations.

**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.



DRY ELECTROLYTIC CONDENSERS

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

**dynamic characteristic**—A graph plotted for operating conditions of a tube, with a.c. applied to the grid.

**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 (field coil) in electrodynamic loudspeakers.

**dynamic microphone**—A microphone operating on the same moving coil principle as a dynamic loudspeaker. Sound waves move the diaphragm, causing the attached voice coil to move in and out of a fixed magnetic field produced by a permanent magnet. The a.f. output voltage is thus induced in the moving coil.

**dynamic pickup**—A phonograph pickup in which the electrical output is due to motion of a conductor or coil in a magnetic field.

**dynamo**—A term sometimes used to describe an electric motor or generator.

**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.

**dynatron**—A tube circuit arranged so that secondary emission from the plate causes plate current to decrease as plate voltage is increased. The resulting negative resistance characteristic makes a dynatron useful in radio for oscillator circuits.

**dynatron oscillation**—Oscillation produced by negative resistance due to secondary emission from the plate of a vacuum tube.

**dyne**—The c.g.s. unit of physical force. A dyne is equal to 1/980th gram.

**dyne per square centimeter**—The unit of sound pressure. The term *bar* was formerly used to mean a sound pressure of one dyne per square centimeter, but the term is being dropped in acoustics. A bar was originally a pressure of 1,000,000 dynes per square centimeter in all fields except acoustics, hence the confusion.

**dynode**—One of the "plate" elements in a multiplier type tube.

## E

**E**—Voltage (d.c. value or effective a.c. value).

**e**—Instantaneous value of voltage.

**E** or **e**—Notation commonly used for electromotive force or voltage.

**eccentric circle**—A blank endless groove whose center is other than that of the record, provided on some records to actuate the tripping mechanism of an automatic record changer after the record has been played.

**eccentric spiral**—The blank spiral groove leading from the end of a record to the eccentric circle.

**echo**—A radio wave which has been reflected at one or more points in the transmission medium, so that it is received

- separately from the main transmission. Also, a sound wave heard after reflection from one or more surfaces.
- echo chamber**—A reverberant room used to add hollow effects and actual echoes to radio programs. These effects may also be produced electrically.
- 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.
- Edison cell**—A type of storage battery employing an alkali electrolyte. Not used much in radio.
- effective antenna length**—The length which, when multiplied by the current at the point of maximum current, will give the same product as the length and uniform current of an elementary dipole antenna at the same location, and give the same radio field intensity in the direction of maximum radiation.
- 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. Also called the r.m.s. value.
- effective height**—An antenna rating. It is equal to the height of a perfect antenna giving the same field strength.
- effective value**—The alternating current value which will produce as much heat as the corresponding direct current value. Thus, an alternating current with an effective value of 1 ampere will produce the same heat as a direct current of 1 ampere. The effective value is also called the root-mean-square (r.m.s.) value, because it is equal to the square root of the average (mean) of the squared instantaneous values equally spaced in an alternation or half-cycle. All a.c. meters, unless definitely marked otherwise, read effective values of voltage and current.
- efficiency**—The ratio of energy output to energy input, usually expressed as a percentage. A perfect electrical device would have an efficiency of 100%.
- E<sub>c</sub>**—Grid voltage of a tube.
- elasticity**—The ability of a substance to return to shape after being stretched or otherwise deformed.
- E layer**—An ionized layer in the atmosphere, capable of reflecting or bending radio waves back to earth. The E region extends between about 55 and 85 miles above the earth's surface.
- electralloy**—A soft iron alloy used for radio chassis construction.
- electrical handsread**—The use of a small variable condenser in parallel with each main tuning condenser in a short-wave receiver, to provide more accurate tuning by spreading the stations in a single band over the entire tuning dial.
- electrical interference**—Interference caused by the operation of electrical apparatus other than radio stations.
- electrical transcription**—A 16-inch diameter recording of sound or music, designed for playing at a speed of 33-1/3 revolutions per minute, having high fidelity and made especially for broadcast purposes. Transcriptions permit broadcasting of a 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. It consists of a fluorescent screen with a dark sector which varies in direct proportion to the strength of the incoming signal. Also, a popular name for a photoelectric cell.
- 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.
- electric organ**—A musical instrument which employs electrical circuits and electrical devices instead of wind to produce tones similar to those of a pipe organ.
- electrochemical recording**—Recording by means of a chemical reaction brought about by the passage of signal-controlled current through the sensitized portion of the record sheet of a facsimile receiver.
- electrode**—An essential part inside a vacuum tube, such as the cathode, the various grids and the plate. Also, the plates of a primary cell, secondary cell or electrolytic condenser, or the carbons of an arc.
- electrode current**—The current passing to or from an electrode through the space inside a vacuum tube.
- electrode dissipation**—Power dissipated as heat by a vacuum tube electrode as a result of electron and/or ion bombardment.
- electrode voltage**—The voltage applied between an electrode and the cathode in a vacuum tube.



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

**electrolysis**—To the radio man, electrolysis is the action which occurs whenever electric currents cause corrosion by flowing in and out of the surface of a conductor, due to resistance developing in a joint or conductivity in adjoining insulation. The resulting corrosion causes characteristic green spots to develop on copper wire and will eventually break the circuit. To the chemist, electrolysis is the decomposing of a compound into its elements by electricity.

**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 formed on the surface of one aluminum electrode by a liquid or paste electrolyte. Also see *dry electrolytic condenser*.

**electrolytic rectifier**—An electrolytic cell which allows current to pass in only one direction. Little used today.

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

**electromagnetic field**—The electric and magnetic fields produced by the flow of electrons through a wire or coil.

**electromagnetic induction**—The action which causes a voltage to be induced in a closed loop when the number of magnetic lines of force passing through the loop is changed in any way.

**electromagnetic unit**—A unit of measurement of magnetic force, derived from basic c.g.s. units.

**electromagnetic wave**—A wave in which there are both electric and magnetic fields, at right angles to each other. Electromagnetic waves are known as radio waves, heat rays, light, X rays, etc., depending on the frequency.

**electromechanical**—A combination of mechanical and electrical forces.

**electromechanical recording**—Facsimile recording by means of a signal-actuated mechanical device.

**electromotive force**—The force that causes motion of electrons. More often called *voltage* or *potential*.

**electron**—The elementary 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 con-

ductor which constitutes an electric current.

**electron coupling**—A method of coupling in which an electron stream transfers energy from the anode grid of the oscillator to the plate in the load circuit. Electron coupling is used principally with multi-grid tubes. It was first introduced by Dow, and is sometimes called a Dow oscillator.

**electron drift**—The actual movement of electrons when a current flows.

**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.

**electron gun**—That part of a cathode ray tube which includes the electron-emitting cathode and the associated parts which concentrate, control and focus the stream



ELECTROLYTIC CONDENSERS

of electrons to a spot of the desired size on the fluorescent screen at the end of the tube.

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

**electronic lens**—An arrangement of electrodes and/or magnetic deflecting and focusing coils which is used to control the direction and size of a beam of electrons, much as a glass lens controls light rays.

**electronics**—That branch of science which relates to the conduction of electricity through gases or in a vacuum. Electronics is thus a broad field of electricity which deals with all types of applications for electron tubes, including radio, television, photoelectric applications, facsimile, diathermy, industrial control, etc.

**electronic optics**—That branch of electronics dealing with the control of the movements of electrons by the application of electrostatic and electromagnetic forces.

**electronic scanning**—Scanning by means of a cathode ray tube, as opposed to mechanical scanning by means of a disc or drum.

**electronic television**—A television system in which the scene to be transmitted is scanned and reconstructed by electron beams in cathode ray tubes. The process is entirely electrical, with no mechanical moving parts.

**electron microscope**—A device which directs a beam of electrons on the object being examined, magnifies the resulting shadow, and makes this shadow visible on a fluorescent screen or records it on photographic film. Magnification as high as 30,000 diameters has been obtained, far greater than can be obtained with the best optical microscopes.

**electron-multiplier tube**—A vacuum tube so designed that the initial electron current produced by a thermionic or light-sensitive cathode causes secondary emission from a number of anodes to take place and contribute to the total electron current. Each time an anode is struck by an electron stream, the secondary electrons combine with the electron stream to form a larger electron stream, which in turn produces more secondary emission from the next anode in line. The final electron current arriving at the collector anode is the sum of the individual secondary emission currents and the initial cathode current.

**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.

**electroplating**—A process for applying a thin coating of metal to a metallic surface by means of an electric current.

**electroscope**—An instrument for detecting static charges of electricity.

**electrostatic**—Pertaining to static electricity.

**electrostatic coupling**—The coupling of two circuits by a capacity, so that one circuit influences the other through condenser charges and discharges.

**electrostatic field**—The influence (often called electric lines of force) which exists in space near an electrically charged body and is capable of acting on another charged body.

**electrostatic focusing**—Focusing of an electron beam in a cathode ray tube by the action of an electric field.

**electrostatic shield**—A grounded piece of metal used to prevent the interaction of electric fields. It is used between primary and secondary windings of some transformers.

**electrostatic voltmeter**—A voltmeter which operates on the principle that two like charged bodies will repel each other. Such a voltmeter has two plates opposite each other, one free to move. As the

voltage applied to the plates is increased, the movement increases and a pointer connected to the movable plate indicates the degree of voltage applied.

**electrothermal recording**—That type of electrochemical facsimile recording in which the chemical change is produced principally by heat.

**element**—One of the ninety-two 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.

**elemental area**—In television and facsimile, any segment of a scanning line, the dimension of which along the line is exactly equal to the nominal line width.

**elliptically polarized wave**—A wave in which the direction of displacement at a point rotates about a point in a plane and the magnitude of displacement varies as the radius of an ellipse.

**e.m.f.**—Electromotive force.

**emission characteristic**—A relation, usually in the form of a graph, between the emission of a vacuum tube electrode and the cause of the electron emission (such as the temperature, voltage or current of the filament or heater).

**emitron**—Term applied to one British version of a television camera tube.

**empirical**—Based on experience or observation.

**e.m.u.**—Electromagnetic unit.

**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**—A curve which is drawn to pass through the peaks of a graph showing the wave form of a modulated r.f. carrier signal. Also, the glass or metal housing of a radio tube.

**$E_p$** —Plate voltage of a tube, measured with respect to the cathode.

**equalizer**—A coil or condenser used alone, in combination with each other or with resistors, inserted in a radio circuit for the purpose of producing a flat electrical or acoustical frequency response over a desired frequency range, or for changing the response to satisfy particular requirements.

**equation**—A mathematical statement that two numbers, quantities or expressions are equal. The equality sign ( $=$ ) is used to separate the two equal quantities. Examples:  $P = EI$ ;  $7^2 = 49$ ;  $(a + b)^2 = a^2 + 2ab + b^2$ . A formula is an equation because it involves equality, but an equa-

tion is a formula only when it expresses a scientific fact, law or principle.

**equipotential line**—An imaginary line in space along which no potential difference exists between any two points of the line. This same definition applies to equipotential surface and equipotential space.

**equisignal radio range beacon**—A radio beacon station which transmits two distinctive signals, these being received with equal intensity only in certain directions which constitute the route in air for planes.

**equisignal sector**—The on-course region in which the two different signals from an equisignal radio range beacon are received with equal intensity.

**equivalent circuit**—An arrangement of resistors, coils and condensers to simulate or electrically replace a more complicated circuit, to permit easier analysis.

**equivalent loudness level**—The intensity level in decibels of a 1000-cycle pure tone which seems equivalent in loudness to the sound under consideration. The threshold of hearing for a 1000-cycle pure tone is usually used as the reference level.

**equivalent resistance**—A lumped or concentrated resistance which would cause the same loss as smaller resistance values distributed throughout an entire part or circuit. Used chiefly for convenience in computations or for determining circuit actions.

**E region**—The region of the ionosphere between about 55 and 85 miles above the earth's surface.

**erg**—The basic unit of work in the c.g.s. system. The work done by a force of one dyne acting through a distance of one centimeter.

**E<sub>sg</sub>**—Screen grid voltage, measured from screen grid to cathode.

**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.

**E.S.T.**—Eastern Standard Time.

**e.s.u.**—Electrostatic unit, used in the c.g.s. system for specifying the strength of an electric field.

**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.

**excitation**—Application of a signal to the input of an amplifier stage. Application of signal power to a transmitting antenna. Application of voltage to the field coils of a motor or generator, or to the field coil of an electrodynamic loudspeaker.

**exciter**—In a directional transmitting antenna system of the type which includes

a reflector, the exciter is the portion which is directly connected to the source of power (to the transmitter). In a transmitter, the exciter is the crystal oscillator or self-excited oscillator which generates the carrier frequency. Also, the small auxiliary generator used to provide field excitation for some large generators.

**exciting current**—The current which flows through the primary winding of a power transformer when there is no load connected to any secondary winding.

**exponent**—A number written at the right of and slightly above another number to indicate how many times the number is to be multiplied by itself. The result is the power of the number. Examples: 5<sup>4</sup> means 5×5×5×5, and is pronounced "5 fourth power." The result, 625, is the fourth power of 5. 1<sup>2</sup> means 1×1, and is pronounced "1 square" or "1 second power." A negative exponent means to find the reciprocal of the number with a positive exponent. Example:

$$b^{-} = \frac{1}{b^{\cdot}}; \frac{1}{x^{-4}} = x^4.$$

A fractional exponent indicates the root of a quantity. Example:

$x^{\frac{1}{2}}$  means  $\sqrt{x}$ ;  $x^{\frac{1}{3}}$  means  $\sqrt[3]{x}$ ;  $x^{\frac{2}{3}}$  means  $\sqrt[3]{x^2}$

**exponential horn**—A loudspeaker horn whose cross-sectional area varies exponentially with its length.

**extinction potential**—The lowest value to which the plate voltage of a gaseous triode can be reduced, with a certain grid bias (if used), without stopping the flow of plate current.

**extraordinary wave**—One of two components into which a radio wave is split in the ionosphere by the earth's magnetic field. This wave is sometimes called the X wave. The other component is the ordinary wave.

## F

f—Frequency.

F—Filament.

°F—Degrees Fahrenheit, the English scale of temperature.

**facsimile**—The process of transmitting and reproducing photographs, drawings, handwriting, sketches and printed matter of any kind for permanent record reception by means of a radio or wire communication system. "Type A facsimile" is a system of facsimile communication in which images are built up of lines or dots of constant intensity. "Type B facsimile" (telephotography, photoradio, etc.) is a system of facsimile communication in

which images are built up of lines or dots of varying intensity.

**facsimile receiver**—The apparatus employed to translate the signal from the facsimile communication channel into a facsimile record of the subject copy.

**facsimile recorder**—The part of a facsimile receiver in which the picture signal in its final form is systematically registered upon a paper record sheet.

**facsimile transmission**—The transmission of signal waves produced by scanning fixed graphic material, including pictures, for permanent reproduction on paper or film.

**facsimile transmitter**—The apparatus used to translate pictures and other subject copy into signals which can be transmitted by radio.

**factor**—If two or more numbers are multiplied together, each of them or the product of any combination of them is a factor of the product. Example: 2, x, y, 2x, 2y and xy are all factors of 2xy.

**fade**—To change gradually in loudness. A program is faded in by making it gradually louder, and is faded out by diminishing its volume gradually to zero.

**fadeout**—Intentional, gradual disappearance of a movie or television scene prior to viewing a different scene. Also, the failure of radio waves to arrive at a location due to magnetic storms or atmospheric disturbances.

**fader**—A device for electrically diminishing or increasing volume in an audio amplifier system. Also, a type of volume control which gradually reduces the volume of one audio signal while gradually increasing the volume of another signal.

**fading**—A variation in the intensity of received radio signals to changes in atmospheric conditions along the path taken by radio waves between the transmitter and receiver.

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



FAHNESTOCK CLIPS

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

**farad**—The basic unit of capacity. A condenser is said to have a capacity of 1 farad when a change of 1 volt per second across it produces a current of 1 ampere.

The farad is too large a unit for practical radio work, hence smaller units are usually employed. The microfarad, equal to one millionth of a farad, is widely used. An even smaller unit, the micro-microfarad, is also used in radio; it is equal to one millionth of a microfarad.

**Faraday, Michael**—English scientist (1791-1867) who discovered electromagnetic induction.

**Faraday shield**—A network of parallel wires all interconnected at the same end like a comb to provide electrostatic shielding. The end which connects to all conductors is grounded, and the entire assembly placed between two coils to eliminate stray capacity, or is placed around a loop aerial to eliminate electrostatic pickup of signals. Also called a Faraday screen.

**FCC**—Federal Communications Commission.

**Federal Communications Commission**—A board of commissioners appointed by the President under the Communications Act of 1934, having the power to regulate all U. S. communication systems, including radio, television, telegraph, cable and telephone.

**feed**—To transmit a program over telephone lines to stations or groups of stations or to any listening point.

**feedback**—The returning of a fraction of the output of a stage to the input either electrically or acoustically. When the feedback signal is *in phase* with the input signal, *positive feedback* or *regeneration* exists and *increases* the amplification. This may produce squealing or howling. When the feedback signal is *out of phase* with the input signal, *negative feedback* or *degeneration* exists and *decreases* the amplification.

**feedback cutter**—In sound recording, a cutter in which a voltage generated by movement of the cutting stylus is fed back into the amplifier system, usually for the purpose of reducing distortion or stabilizing frequency characteristics.

**feeder**—A main wire or set of wires supplying energy from a source to a useful load.

**fiber**—A hard, tough material made of paper and cellulose, compressed into sheets, rods or tubes and used in radio for insulating and supporting purposes.

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

**field**—In television, the area covered during one vertical sweep of the scene. In normal scanning, the field is the entire scene. In double interlaced scanning the field is one-half the area of the scene. Also, a general term describing the effect produced in surrounding space by an electrically charged object, by electrons in

motion or by a magnet. See *electric field* and *magnetic field*.

**field coil**—In an electrodynamic loudspeaker, electric motor or generator, the coil or coils which produce 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 by a downward sweep of the electron beam.

**field intensity**—In radio, this is the effective (r.m.s.) value of the electric or magnetic field produced at a point by radio waves from a particular station. It is usually expressed as electric field intensity in microvolts per meter or millivolts per meter. Unless otherwise specified, it is assumed that the measurement is made in the direction of maximum field intensity. Also, the amount of magnetic flux produced by an electromagnet or permanent magnet.

**field poles**—The projecting iron ends of the field coils of a motor or generator.

**field rheostat**—A variable resistance used to regulate the current flowing through the field coils of a motor or generator.

**field strength**—Same as *field intensity*.

**figure**—A written or printed character representing a number. A numeral. A digit. Examples: 1, 5, 6, etc.

**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 also serves as the cathode. In a heater-type or indirectly-heated tube, the filament supplies heat to a separate cathode electrode.

**filament circuit**—The complete circuit through which filament current flows from the filament voltage source to the filaments of radio tubes.

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

**filament emission**—The process by which electrons are given off from a heated filament in a vacuum tube.

**filament rheostat**—A variable resistance used to limit the flow of current through the filaments of older types of vacuum tubes.

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

**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 selective circuit network designed to pass currents within a certain range of frequencies or to pass direct current, while reducing considerably the amplitudes of currents at undesired frequencies. A *low-pass filter* passes all frequencies below its cut-off value. A *high-pass filter* passes all frequencies above its cut-off value. A *band-pass filter* passes all frequencies between its two cut-off values. A *band elimination filter* passes frequencies outside its two cut-off values, eliminating frequencies between. A filter usually consists of a resistor, coil, condenser or any combinations of these parts, sometimes also with a crystal. 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. A filter may be used in an a.f. circuit to change or correct tone characteristics by attenuating certain audio frequencies. The term filter also applies to a pane of glass which absorbs or blocks certain colors of light while allowing others to pass.

**filter choke**—An iron-core 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. Thus, a power pack filter condenser passes hum ripple currents while blocking direct current.

**final radio stage**—The stage which supplies power to the transmitting antenna.

**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.

**fishbone antenna**—A directional antenna consisting of a number of doublets arranged on both sides of a transmission line, with all doublets making the same angle with the line as in the skeleton of a fish or a so-called herringbone pattern.

**fishpaper**—A specially-treated fiber paper used to insulate transformer windings from the transformer core. Also used for other applications where an insulating paper with high mechanical strength is required.

- 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. A fixed resistor with intermediate connections or taps is known as a tapped resistor.
- flare factor**—The outward curvature of a loudspeaker horn, expressed as a number.
- flat top**—The horizontal portion of an antenna.
- flat-top response**—A broad frequency response such as that obtained by tuning primary and secondary trimmers of an i.f. transformer to slightly different frequencies.
- F layer**—An ionized layer in the F region of the atmosphere, existing chiefly at night. In bright daylight, two layers exist, the  $F_1$  layer and the  $F_2$  layer.
- $F_1$  layer**—The lower of the two ionized layers normally existing in the F region in bright daylight.
- $F_2$  layer**—The higher of the two ionized layers normally existing in the F region in broad daylight.
- flicker**—The erratic movement of an entire televised image or projected motion pictures.
- floating charge**—Continuous charging of a storage battery, usually at a low current, for the purpose of keeping the battery fully charged, particularly when it must stand idle for periods of time. Also called *trickle charging*.
- floating grid**—A vacuum tube grid which is not connected to any circuit.
- flood projection**—In facsimile systems, the optical method in which the subject copy is illuminated and the scanning spot is created by an aperture between the subject copy and the light-sensitive device.
- fluorescence**—Light emitted as a result of electron bombardment or as a result of absorption of radiation from some other source.
- 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.
- flux**—Magnetic lines of force.
- flux density**—The total number of magnetic lines of force per unit of area.
- flux-meter**—An instrument used to measure the number of magnetic lines of force passing through a given area.
- flying spot**—The spot of light which moves across or scans the picture or object being televised by a mechanical television system using a scanning disc.
- f.m., f-m, FM or F.M.**—Frequency modulation.
- f number**—A number obtained by dividing the focal length of a lens by the effective diameter of the lens. A lens having a focal length of 8 inches and a useful diameter of  $\frac{1}{2}$  inch would have an *f* number of 16, written as f16, *f*/16, *f*:16, f.16, *F*/16, *F* 16, etc. The lower the *f* number, the brighter the image and hence the shorter the exposure required by an ordinary camera, movie camera or television camera.
- focal length**—The distance between the optical center of a lens and its principal focus at which light rays coming from an infinite distance would meet.
- focusing coil**—An electromagnetic coil placed around a cathode ray tube or television camera tube for the purpose of controlling the cross-sectional area of the beam at the fluorescent screen.
- 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.
- focusing electrode**—An electrode in a cathode ray tube to which a potential is applied for the purpose of controlling the cross-sectional area of the beam at the fluorescent screen.
- focusing, electromagnetic**—Control of the cross-sectional area of the electron beam in a cathode ray tube by means of a magnetic field produced by a *focusing coil*.
- focusing, electrostatic**—Control of the cross-sectional area of the electron beam in a cathode ray tube by means of a high d.c. voltage applied to a focusing electrode.
- foil**—Very thin, pliable metal sheets of aluminum, lead, tin or other metals, used extensively in radio for plates of fixed condensers and sometimes for shielding.
- foot-candle**—The intensity of illumination on a surface one foot from a standard candle.
- foot-pound**—A unit of energy equal to the work done in raising a mass of one pound a distance of one foot.
- force**—Any physical cause which can produce motion or change the motion of a body.
- forming**—The process of preparing the thin film on the surface of the positive electrode of an electrolytic condenser, so as to give it the characteristics of a condenser. Also, the processing of lead plates for use in storage batteries.
- formula**—A scientific fact, law or principle which is expressed as an equation by means of letters, symbols and constant terms. Examples:  $Z^2 = R^2 + X^2$ ,  $E = IR$ . A formula is an equation because it involves equality, but an equation is not always a formula.

**frame**—In television, one complete scanning of every part of the field of view being transmitted. In facsimile, a rectangular area, the width of which is the available line and the length of which is determined by the nature of the facsimile service.

**frame frequency**—In television, the number of times per second the frame area is completely scanned. In double interlaced scanning, the frame frequency is one-half the field frequency, since it takes two downward sweeps to scan every element of the frame.

**framer**—A device for adjusting facsimile equipment so that the recorded elemental area bears the same relation to the record sheet as the corresponding transmitted elemental area bears to the subject copy in the direction of line progression.

**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. In facsimile, the control which shifts the picture sideways.

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

**free-point tester**—A type of test instrument for radio servicing which permits transferring any tube in a receiver to a socket on a test panel. The test panel is connected to the receiver socket by means of a cord and plug. Voltage and current measurements for each tube electrode are then made quickly by plugging a meter into appropriate jacks on the test panel.

**free-space radiation pattern**—The radiation pattern an antenna would have if out in free space where there is nothing to reflect, refract or absorb the radiated waves.

**freezing point**—The temperature at which any particular liquid freezes and changes from the liquid to the solid state.

**F region**—The region of the ionosphere between about 85 and 250 miles above the earth's surface.

**frequency**—The number of complete cycles per second which an alternating electric current, a sound wave or a vibrating object undergoes. A cycle consists of a current rise from zero to maximum, a return to zero, a rise to a maximum in the opposite direction, and a return to zero again. When speaking of an electric current or radio wave, the frequency in cycles is approximately equal to 300,000,000 divided by the wavelength in meters.

**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 deviation**—In frequency modulation, the amount by which the instantaneous carrier frequency of the signal differs from the resting frequency.

**frequency deviation meter**—A meter (usually a complex circuit of which the indicating meter is only a small part) which measures the number of cycles drift from a specified reference frequency. It is required by the FCC for all broadcast transmitters.

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

**frequency doubler**—A class C amplifier adjusted so the plate circuit will have strong harmonics of the input signal. The plate tank circuit is tuned to the second harmonic, hence the output frequency of the circuit is twice the input frequency.

**frequency drift**—A slow change in the frequency of an oscillator or transmitter, usually due to temperature changes in oscillator circuit parts.

**frequency meter**—An instrument for measuring frequency. Sometimes called a wavemeter.

**frequency modulation**—A relatively new system of 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, and 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 multiplier**—A radio stage or section used to multiply the frequency value of a signal a whole number of times.

**frequency record**—A phonograph record upon which various frequencies throughout the desired audio frequency spectrum have been recorded.

**frequency response**—A rating or graph which expresses the manner in which a

# G

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.

**frequency response curve**—A graph showing the frequency response of a radio part, circuit or system.

**frequency separator**—The television receiver circuit which separates the horizontal synchronizing impulses from the vertical synchronizing impulses.

**frequency shift**—A change in the frequency of an oscillator or transmitter.

**frequency stability**—The ability of a radio transmitter to maintain a given carrier frequency. It is usually expressed as a percentage deviation within which the carrier frequency is maintained.

**frequency standard**—A highly stable low-frequency oscillator, usually operated at 50 kc. or 100 kc. The harmonics of the fundamental frequency are used to provide reference points every 50 or 100 kc. throughout the radio spectrum.

**frequency tolerance**—The maximum permissible amount of variation in either direction from the assigned carrier frequency.

**frictional loss**—Energy expended in overcoming friction between moving parts.

**front-to-back ratio**—In a multi-element directional antenna, the ratio between the signal radiated in the desired front direction and the signal radiated in the opposite or rear direction. Also called front-to-rear ratio.

**ft.**—Feet.

**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.

**fundamental frequency**—The lowest frequency in a complex signal having harmonics. The lowest or natural resonant frequency of a part or circuit, such as an antenna.

**fundamental wavelength**—The wavelength corresponding to the fundamental frequency.

**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.

**fuse link**—The metal portion inside a fuse, which melts at the rated current value.

**G**—Grid of a tube. Generator. Conductance.

**gage**—Alternate spelling of *gauge*, and equally correct.

**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. Increasing the gain means increasing the volume of sound which is produced by an audio amplifier.

**gain of an antenna**—A rating expressing how much better one transmitting or receiving antenna is than another. For constant transmitted power level, the measured gain is the ratio of the signal powers produced at the input terminals of a receiver by the two antennas under comparison.

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

**galvanometer**—A fundamental current-indicating meter. Usually having a scale indicating relative deflection or degrees of deflection, from which the amount of current can be calculated. When the meter has a current scale indicating milliamperes or amperes directly, it is called a milliammeter or ammeter.

**gamma ray**—An electromagnetic radiation, similar to X-rays but of shorter wavelength.

**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.

**gas current**—A current consisting of positive ions produced by gas ionization in a tube, flowing to an electrode.

**gaseous conduction**—The conduction of electricity through a gas due to ionization of the gas by collision of electrons with gas molecules, when a suitably high voltage is applied between electrodes.

**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.

**gas focusing**—Focusing of the electron beam in a cathode ray tube by the action of ionized gas.

**gasket**—A ring or washer used for packing or insulating.

**gas magnification**—A term sometimes used to describe the increased electron flow



in a gas-filled photocell due to ionization of gas.

**gasoline-driven generator**—An electric generator, either a.c. or d.c., which is driven by a small gasoline engine.

**gas tube**—A tube in which a small amount of gas has been admitted after evacuation, to give to the tube special electrical characteristics.

**gauge**—A standard of measurement or a device for measuring by comparing with a standard.

**gauss**—The unit of flux density equal to one magnetic line of force per square centimeter.

**Gauss, Karl Friedrich**—The German mathematician (1777-1855) after whom the unit of flux density was named.

**G-E**—General Electric Co.

**Geissler tube**—A long gaseous tube which gives off colored light when a suitable voltage is applied to the electrodes which



GASOLINE-DRIVEN GENERATOR

are at opposite ends of the tube. A Geissler tube is the early laboratory version of modern neon tubing used in signs.

**genemotor**—A small motor-generator set, generally employed for plate voltage supply purposes in mobile radio installations.

**general number**—A letter or symbol used for representing quantities. Thus, R is a general number (sometimes called a literal number) when used to represent a number of ohms of resistance.

**generator**—A machine which converts mechanical energy into electrical energy. It consists essentially of a large number of conductors mounted on an armature which is rotated in a magnetic field produced by field coils. A *series* generator has the armature, field and load all in series. A *shunt* generator has the armature, field and load all in parallel. A *compound* generator has two fields, one in series with the armature and the other in parallel with the armature. 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.

**geometric mean**—The square root of the product of two quantities.

**geometry**—That branch of mathematics which deals with the relations and measurements of solids, surfaces, lines and angles in space.

**german silver**—An alloy of brass and nickel.

**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.

**gilbert**—The unit of magnetomotive force. One gilbert is equal to .796 ampere-turn.

**gimmick**—A simple capacitor formed by twisting two wires together. Also, a few turns of insulated wire wound around the secondary of an antenna transformer. One end is connected to the antenna terminal, and the other is left unconnected. It is used chiefly in universal a.c.-d.c. receivers, where it serves to make the gain more uniform over the entire tuning range.

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

**glow-discharge voltage regulator**—A special gas tube whose resistance varies between about 5000 and 30,000 ohms, depending on the amount of applied voltage: It is used to maintain a constant voltage supply to oscillator tubes in short wave u.h.f. and f.m. receivers and in transmitter exciter units.

**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.

**G<sub>m</sub>**—Mutual conductance of a tube.

**G.M.T.**—Greenwich Mean Time.

**GND., gnd.**—Ground.

**gold**—A metallic element used in some delicate electrical instruments, and used for electroplating the housings of radio parts which must withstand severe corrosive conditions, as in the tropics.

**goniometer**—A special type of r.f. transformer used with a radio compass or direction finder. It has two primaries at

right angles, connected to the two loop aerials, and a rotary secondary connected to the receiving or sending circuit.

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

**gramophone** — A phonograph (English term).

**graph**—A pictorial presentation of the relation existing between two or more quantities.

**graphite**—A soft form of carbon, used as a lubricant.

**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.

**grid bias cell**—A bias cell used in the grid circuit of a vacuum tube.

**grid characteristic**—The graph plotted with grid voltage values as abscissas and grid current values as ordinates.

**grid circuit**—The circuit connected between the grid and cathode of a tube. It forms the input circuit of the tube.

**grid 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 conductance**—The ratio of the change in grid current to the change in grid voltage producing it, under the condition of constant plate voltage.

**grid-controlled rectifier**—A triode mercury vapor tube in which the grid determines when plate current starts to flow but not how much current will flow.

**grid current**—The current passing to or from a grid through the space inside a vacuum tube.

**grid detection**—Detection taking place in the grid circuit of a vacuum tube. Also called grid leak detection or grid current detection.

**grid dip oscillator**—An oscillator with a sensitive current meter connected in its grid circuit. When the oscillator is connected to a resonant circuit, resonance between the circuit and the oscillator is indicated by a sharp change in the meter reading, indicating that power is being drawn from the oscillator and the two are in resonance.

**grid emission**—Emission of electrons or ions from a grid, usually due to the im-

pact of electrons going from cathode to plate in the vacuum tube.

**grid-glow tube**—A gaseous triode used in electronic control applications for controlling relatively large currents by means of very small grid currents.

**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 modulation**—Modulation produced by introduction of the modulating wave into any of the grid circuits of any tube in which the carrier frequency wave is present.

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



GRID CLIPS

**grid suppressor**—The resistance connected between the control grid and the tuned portion of the grid circuit of a radio frequency amplifier to prevent oscillation.

**grid swing**—The total variation of grid voltage, from positive peak to negative peak of the applied signal.

**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.

**gronnet**—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.

**groove**—The track cut in a phonograph record by the stylus during recording, or the track in which a phonograph needle rides during playback.

**ground**—The earth, to which a connection is made by means of a buried conductor

for radio purposes. Also, the chassis of a receiver when it is connected to ground and serves as the return path for signal circuits. The ground is considered to be at zero r.f. potential.

**ground absorption**—The loss of power in transmission of radio waves due to dissipation in the ground.

**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 CLAMPS

**ground potential**—When a terminal is at a potential difference of zero with respect to the ground, it is at ground potential. All grounded terminals are at ground potential. Terminals negative with respect to ground are below ground potential; terminals positive with respect to ground are above ground potential.

**ground-reflected wave**—The component of the ground wave that is reflected from the ground.

**ground resistance**—The resistance of the ground or earth portion of an antenna system.

**ground system**—That portion of an antenna system which is closely associated with the ground, including the earth itself and any wires buried in it.

**ground waves**—Radio waves which travel along the surface of the earth instead of going up into the sky, and are affected by the presence of the earth (lose strength rapidly due to dissipation of energy in the earth).

**ground wire**—A wire used to make a connection from radio apparatus to a ground clamp or other grounded object. Outward-radiating buried ground wire is commonly used with large transmitting antennas to improve the contact with the ground.

**guard band**—A .25-megacycle wide frequency band provided at the high-frequency end of each television channel to prevent interference between adjacent television channels.

**guided wave**—A wave whose propagation is concentrated in certain directions.

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

## H

**h**—Henrys.

**H**—Heater or filament of a tube. Magnetic intensity or magnetomotive force per cm.

**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.

**ham**—An amateur radio transmitter operator.

**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.

**harmonic generator**—A vacuum tube or other generator used to generate a signal having many strong harmonics.

**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.



HEADPHONES

**hash**—Characteristic electrical noise produced by vibrators which have excessive sparking at the contact points.

**Hazeltine licensed**—Radio apparatus which uses Hazeltine patents under a licensing agreement with the Hazeltine Corporation.

**headphone**—A small telephone receiver, held against an 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 vacuum tube

- only for the purpose of supplying heat to an indirectly heated cathode.
- heater current**—The current supplied to a vacuum tube filament which is used only for heating purposes.
- heater voltage**—The voltage applied between the terminals of a vacuum tube filament used only for heating purposes.
- 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.
- height control**—The control in a television receiver which adjusts the picture size in a vertical direction.
- Heising modulation**—A modulation system in which the plates of both the r.f. oscillator and the modulator tube are fed through a single common choke having high impedance at both audio and radio frequencies. This choke prevents any change in the total plate current drawn by the two tubes together. Therefore, the a.f. plate current variation in the modulator tube produces a similar but opposite a.f. variation in the plate current of the r.f. oscillator tube. This is also called constant current modulation.
- helix**—A coil wound in spiral form. The shape of a machine screw thread.
- henry**—The unit of inductance. A device has an inductance of 1 henry when an electromotive force of 1 volt is induced in it by a current changing at the rate of 1 ampere per second. Plural: henrys.
- Henry, Joseph**—An American, noted for his work with electromagnets and electromagnetic actions. The unit of inductance is named after him.
- heptode**—A vacuum tube having seven electrodes—a plate, a cathode, a control grid and four other electrodes which are usually grids.
- hermetically sealed**—Sealed so as to be airtight.
- Hertz antenna**—An antenna which is electrically independent of the ground.
- heterodyne frequency**—Same as *beat frequency*, which is the difference frequency of two signals.
- heterodyne frequency meter**—A completely shielded, accurately calibrated oscillator used for frequency measurement purposes by comparison of the unknown signal with the accurately known signal frequency of the meter.
- heterodyne interference**—Interference between two stations transmitting on nearly the same frequencies so their waves produce a beat note which causes an audible tone in receivers.
- heterodyne reception**—A process of changing the carrier frequency of an incoming radio signal by combining it with a locally-generated signal. Usually called superheterodyne reception.
- hexode**—A vacuum tube having six electrodes—a plate, a cathode, a control grid, and three other electrodes which are usually grids.
- high-fidelity receiver**—A receiver capable of reproducing audio frequencies in a range from 50 to about 8000 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 resistance**—The total effective resistance of a circuit due to all effects, including eddy current, hysteresis, dielectric, corona and ohmic losses.
- 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.
- high-level modulation**—Modulation at a point in a transmitter where the power level is approximately the same as at the output of the transmitter, such as in the final radio stage.
- high- $\mu$  tube**—A tube having a high amplification factor.
- high-pass filter**—A filter network designed to pass all frequencies *above* a cut-off frequency value while attenuating or rejecting lower frequencies.
- high Q**—High ratio of reactance to a.c. resistance for any resonant circuit or coil.
- high-resistance voltmeter**—A voltmeter having a very high resistance, so that very little current is drawn by the meter, from the circuit in which a measurement is made.
- high-tension**—A term applied to circuits where voltages of the order of thousands of volts exist.
- high-vacuum tube**—A vacuum tube which has been evacuated so thoroughly that gaseous ionization cannot occur during normal operation.
- hill and dale recording**—Another name for *vertical recording*.
- hissing**—A noise encountered in sensitive radio receivers due to feedback or to circuit and tube shot effects.
- 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.
- honeycomb coil**—A coil wound in a criss-cross manner to reduce distributed capacity. Also called lattice-wound coil.

**hookup**—A diagram giving circuit connections for a radio receiver, amplifier or transmitter.

**hop**—An excursion of a radio wave from the earth to the ionosphere and back to earth, in traveling from one point to another. It is usually used in expressions such as single-hop, double-hop, and multi-hop. The number of hops is called the order of reflection.

**horizon**—In radio wave propagation over the earth, the line which bounds that part of the earth's surface reached by the direct wave. On a spherical surface, the horizon is a circle. The distance to the horizon is affected by atmospheric refraction.

**horizontal**—Level. From side to side, not vertical.

**horizontal deflecting electrode**—One of the cathode ray tube electrodes to which voltage is applied to move the electron beam horizontally from side to side on the screen.

**horizontal flyback**—In a television system, the right-to-left return motion of the electron beam from the end of one line to the beginning of the next. Also called *horizontal retrace* or *line flyback*.

**horizontal hold control**—The hold control used to adjust the free-running time of the horizontal sweep oscillator.

**horizontal polarization**—A method of transmitting radio waves in which the plane of polarization is parallel to the surface of the earth.

**horizontal retrace**—Same as horizontal flyback.

**horizontal sweep**—The left-to-right scanning motion across a picture or scene being televised.

**horizontal synchronizing impulse**—The impulse sent at end of each line for receiver-controlling purposes. Same as *line synchronizing pulse*.

**horn**—A loudspeaker having a tapering tube (of varying cross-sectional area) in place of a baffle. The smaller end of the horn is the *throat*, and the larger end is the *mouth*.

**horsepower**—A unit of power, which is the rate of doing work. One horsepower is mechanically equivalent to 33,000 ft. lb. per minute or 550 ft. lb. per second, and is electrically equivalent to 746 watts.

**horseshoe magnet**—A magnetized steel bar bent into the shape of a horseshoe.

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

**hot-wire ammeter**—An ammeter which depends for its action on the expansion of a fine wire under the influence of the

heat produced in it by the passage of the current to be measured.

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

**h.p.**—Horsepower.

**H pad**—An attenuation network having its elements arranged in the manner of the letter H. It has a constant input and output impedance.

**h.p.f.**—High-pass filter.

**hum**—A low and constant audio frequency, usually either 60 or 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.

**hum-bucking coil**—An extra coil placed on the center pole of an electrodynamic loudspeaker to cancel hum currents which might be induced in the voice coil by the field coil.

**hum modulation**—Hum which is audible only when a station is tuned in, originating in an r.f. stage. This hum modulates an incoming signal due to some non-linearity in the stage.

**hunting**—Speed variation or oscillation about the average or synchronous speed of rotation of a motor.

**hydrometer**—A device used to measure the specific gravity of a liquid, such as the electrolyte in a storage battery. The resulting readings are an indication of the state of charge of the battery.

**hypotenuse**—The side of a right triangle opposite the right angle.

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

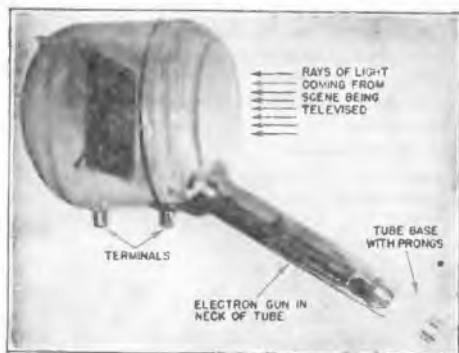
**hysteresis loop**—A graph showing the relation between magnetizing force and flux density over a complete cycle of magnetization and demagnetization.

## I

**i**—Instantaneous value of current.

**I**—The letter commonly used to designate current.

**iconoscope**—A cathode ray television pickup tube developed by the Radio Corporation of America for use in electronic television cameras. It converts each picture element of the scene being televised into a corresponding electrical impulse. Scanning of the image is accomplished by making an electron beam sweep back and



ICONOSCOPE

Courtesy ROA

forth across the mosaic many times per second.

**i.c.w. or ICW**—Interrupted continuous waves.

**idler pulley**—A pulley used to change the direction of a belt or cord. Its shaft does not rotate any other part.

**i.f. or I.F.**—Intermediate frequency.

**ignitron**—A half-wave mercury-vapor rectifier tube in which the arc (electron stream) is started at the beginning of each active cycle by a special igniter electrode immersed in the mercury-pool cathode and energized by an auxiliary circuit.

**illuminosity meter**—A device for measuring light flux or amount of illumination. It generally uses a photoelectric cell as the means of converting light energy into an electric current which can be measured.

**image**—A reproduction of a person, object or scene, such as that produced by a television receiver.

**image antenna**—An imaginary antenna which can be considered the source of reflected waves.

**image dissector**—A cathode ray television pickup tube developed by Philo T. Farnsworth for use in electronic television cameras. Its construction and operating principles are different from those of the iconoscope, but it serves essentially the same purpose of converting a scene into corresponding electrical impulses.

**image frequency**—In a standard superheterodyne receiver in which the oscillator operates above the incoming signal frequency, the image frequency is the frequency equal to the sum of oscillator frequency and the i.f. value. The image frequency is therefore above the desired signal frequency by twice the i.f. value.

**image interference**—A type of interference in which two stations are heard at the same time, one being the desired station

which is *below* the oscillator frequency of the i.f. value, and the other being an undesired station which is *above* the oscillator frequency by the i.f. value.

**image interference ratio**—A superheterodyne radio receiver rating indicating how effectively the r.f. tuned circuits ahead of the first detector can reject signals at the image frequency.

**image reconstructor**—The cathode ray tube or other device used in a television receiver to convert the received picture signals into an image of the scene originally televised.

**imaginary number**—Term used to designate the square root of a negative number.

**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.

**impedance coupling**—Coupling between stages by means of an impedance.

**inpulse**—A momentary increase in the current or voltage in a circuit.

**impulse generator**—A device which generates electric impulses for synchronizing purposes in a television system.

**impulse separator**—The television receiver circuit which separates the horizontal impulses from the vertical impulses.

**in.**—Inches.

**incident light**—Direct light falling on a surface.

**incident wave**—An oncoming wave.

**index**—The small number in the angle of a radical sign, indicating the particular root to be extracted. Examples: In  $\sqrt[4]{x}$ , the index is 4; in  $\sqrt[3]{64}$ , the index is 3.

**index of refraction**—A number indicating the amount a ray of light will be bent out of its normal path when passing through a particular material. It is equal to the speed of light in air divided by the speed of light in the particular material being considered.

**indirectly heated cathode**—A cathode which is heated by a separate filament in a thermionic vacuum tube.

**indirect scanning**—A method of scanning in which a beam of light is moved across a scene or picture, and the light reflected from the illuminated scene is picked up by a photocell or group of photocells.

**indirect wave**—Sky wave.

**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 mag-

- netic lines of force which are linking or cutting through the conductors of the circuit.
- inductance**—That property of a circuit or coil which causes an electromotive force (voltage) to be set up due to a *change* in current in the circuit or coil, or which determines how much electromotive force will be induced in one of two neighboring coils or circuits by a change in either of them. Inductance is effective only when a varying or alternating current exists, and has no effect on direct current. The basic unit of inductance is the *henry*. A circuit has an inductance of 1 henry when a change of current of 1 ampere per second induces an electromotive force of 1 volt.
- inductance bridge**—A form of Wheatstone bridge circuit used to determine inductance values. It must be supplied with an a.c. source of power.
- inductance-tube modulation**—Frequency modulation by means of an oscillator control tube which acts as a variable inductance in parallel with the tank circuit of an r.f. oscillator, causing the oscillator frequency to vary in proportion to the a.f. voltage applied to the grid of the oscillator control tube.
- 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.
- induction field**—That portion of the electromagnetic field produced by a transmitting antenna which acts as if it were permanently associated with the antenna. The *radiation field*, on the other hand, breaks away from the antenna to form radio waves.
- induction motor**—An electric motor which operates on the principle that a pivoted closed loop of wire will rotate essentially in step with a rotating magnetic field.
- 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 feedback**—Feedback of energy from the plate circuit to the grid circuit of a tube by inductive coupling.
- 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.
- inductor**—Inductance. Coil.
- inertia**—The property of matter which tends to prevent motion, or resists a change of motion.
- infinite**—Larger than imaginable. Without limit.
- infinite-impedance detector**—Another name for a C bias detector. Usually applied to a detector with the plate load in the cathode circuit.
- infinity**—A number greater than any known number. The sign used to designate infinity is  $\infty$ .
- infra-red rays**—Rays of longer wavelength than visible light rays, hence invisible to the human eye, used for photoelectric burglar alarm systems and other special purposes.
- injection grid**—A special grid element placed in a vacuum tube in such a way that it has reasonable control over the electron stream without causing interaction between itself and the control grid. It is used as the oscillator input in the first detector stage of some superheterodyne receivers.
- ink-vapor recording**—That type of electro-mechanical facsimile recording in which vaporized ink particles are directly deposited upon the record sheet.
- in phase**—Descriptive of two alternating quantities which have the same frequency and which pass through their zero and maximum values at the same instant of time, exactly in step with each other.
- input capacity**—The sum of all interelectrode capacities existing between the control grid and cathode of a vacuum tube.
- input impedance**—The impedance between the input terminals, equal to the ratio of the a.c. voltage applied to the input terminals of a circuit or device to the alternating current thereby produced.
- input transformer**—A transformer used to deliver energy to the input of a device or amplifier.
- instantaneous recording**—A recording which may be used without further processing.
- instantaneous value**—The value of an alternating current, voltage or power at any one point in its cycle.
- 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.
- insulator**—An object which offers a great deal of opposition to the movements of electrons, used for supporting or separating bare conductors.
- integer**—Any whole number (without fractions or decimals).
- integral sign**—The sign  $\int$ , used in higher

mathematics to indicate that the operation of integration (finding the sum of small elements or differentials) is to be performed.

**intelligence signal**—The electrical signal that corresponds to the information or intelligence (sound waves, television scenes, code, etc.) being handled; also known as the low-frequency signal.

**intensity**—Strength or value of current.

**intercarrier noise suppression**—A means for suppressing the noise otherwise heard in a high-gain receiver when it is tuned between station carriers. The audio input of the receiver is blocked automatically when no signals exist at the second detector. Also called interstation noise suppression.

**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 loudspeaker, 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.

**interelectrode 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 a source of interference and a radio receiver to attenuate or eliminate noise. It generally consists of coils and condensers arranged so as to oppose or bypass noise impulses and keep them out of receiver circuits.

**interference guard bands**—Bands of frequencies in which no signals are transmitted, existing on either side of the communication band in a radio channel, providing separation between signals of stations having adjacent frequency assignments so as to prevent station interference.

**interference pattern**—A pattern showing the distribution of pressure or some other quantity at a given location due to stationary waves. Also, any interfering patterns seen on a television receiver, caused by noise, hum, etc.

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

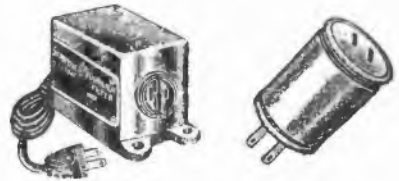
the next downward travel of the scanning beam.

**interlock**—A system which makes it impossible to open or close certain switches or relays until certain actions have taken place. For example, interlocking relays and switches may make it impossible to apply plate voltage to mercury vapor rectifier tubes until their filaments have reached operating temperature. Also, similar switches used on doors of transformers which automatically break the high voltage supply circuits when doors are opened, to protect the operator.

**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.



INTERFERENCE FILTER

**intermittent reception**—A type of radio receiver trouble in which the receiver performs normally for a time, then becomes dead or otherwise defective, with the process repeating itself at regular or irregular intervals.

**intermodulation**—A process wherein two or more different signal frequencies combine in a non-linear circuit to produce new frequencies corresponding to sums and differences of the fundamental frequencies and their harmonics.

**intermodulation interference**—A type of station interference which occurs when two undesired signals whose frequencies differ by exactly the i.f. value of a superheterodyne receiver force their way through the preselector to the first detector, and there produce an i.f. beat signal without the aid of the local oscillator. The trouble is characterized by garbled speech and squeals when a desired station is tuned in.



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

**interrupted continuous wave**—A continuous wave which is *interrupted* at an audio frequency at the transmitter. Abbreviated i.c.w. The audio tone modulation makes reception of i.c.w. code signals possible with ordinary receivers (without beat oscillators).

**interrupter**—Apparatus for breaking up a continuous current into successive pulses.

**interstage**—Between stages.

**interval timer**—An electronic tube device used to measure time intervals. It may consist of a blocked oscillator, where the rate of unblocking is controlled by a resistor and condenser. When the condenser discharge reaches a predetermined value, the oscillator is unblocked and produces a pulse. The condenser is then charged and the oscillator again blocks. The time constant of the resistor and condenser determines the time interval between oscillator pulses.

**inverse feedback**—Negative feedback, also called degeneration or stabilized feedback. A fraction of the output signal of an amplifier stage is intentionally fed back to the input so it is out of phase and decreases the amplification, thereby reducing distortion and noise and permitting greater undistorted power output.

**inversely proportional**—Related in such a way that when one value *increases*, the other *decreases* a proportionate amount, and vice versa.

**inverse peak voltage**—The maximum a.c. voltage that can be applied to a rectifier tube without arcing or flashover when the filament is positive and the plate negative.

**inverted amplifier**—An r.f. amplifier circuit in which power from a preceding stage is fed into the cathode circuit and the grid is operated at ground potential. This eliminates the necessity for neutralization.

**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.

**inverter**—A device which changes d.c. to a.c. It may be electromechanical, as a vibrator, or entirely electronic as in the thyatron inverter.

**ion**—An electrified particle, such as an atom or molecule, having either fewer or more electrons than normal. A positive ion is a particle which has lost electrons, and a negative ion is one which has acquired more electrons than normal.

**ionization**—An action whereby atoms or molecules of gas in an electronic tube are converted into electrically charged ions which are attracted by charged electrodes. Ionization makes a gaseous tube more conductive than an equivalent vacuum tube.

**ionosphere**—A portion of our atmosphere which contains the Heaviside layer (E region) the F region and other ionized layers. These layers reflect radio waves.

**ionospheric storm**—A period of disturbance in the ionosphere, during which radio waves are reflected in abnormal ways.

**ionospheric wave**—A radio wave that is reflected from the ionosphere. Often called a *sky wave*.

**$I_p$** —Plate current of a tube.

**IR drop**—Voltage drop produced across a resistor (R) by the flow of current (I) through it.

**$I^2R$  loss**—Power loss due to current flow through resistance.

**I.R.E.**—Institute of Radio Engineers.

**iron-core coil**—A coil having iron inside its windings. 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.

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

## J

**j**—A so-called imaginary number, equal to  $\sqrt{-1}$ .

**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.

**jewel bearing**—A small piece of natural or synthetic jewel, usually sapphire, carefully ground to form a bearing for the pivot of a meter movement.

**jitters**—Distortion in the received facsimile picture caused by momentary errors in synchronism between scanner and recorder in a facsimile system.

**joule**—The unit of electrical work or energy.

One joule equals one watt-second.

**jumper**—Any wire used to connect two points together or short out a part temporarily.

**junction**—A joint or connection. Also point of contact between two dissimilar metals or materials, as in a thermocouple or a copper-oxide rectifier.

## K

**K**—Letter used to designate the cathode of a tube. Also used in formulas to represent a constant or numerical value which does not change its value during any one discussion.

**kc.**—Kilocycles per second.

**keeper**—The piece of iron used to close the magnetic circuit of a permanent magnet to prevent loss in magnetic strength.

**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 radio reception.

**Kenotron**—A high-vacuum rectifier tube.

**Kerr cell**—A device used in some mechanical television systems to modulate a light beam with television signals. The cell rotates a beam of plane polarized light in proportion to the voltage applied between the two plates of the cell.

**key**—A lever-type switch designed for rapid opening and closing of a circuit during transmission of code signals. Also, a special type of lever switch used on telephone-type switchboards to control speech circuits of a transmitter.



KEY USED TO TRANSMIT CODE

**key-click filter**—A filter which attenuates the surge produced when the keying circuit of a transmitter is opened.

**key clicks**—Those components of a code signal which are created by the opening of the sending key but are not essential for communication.

**keying chirps**—Peculiar sounds accompanying code signals when the transmitter is unstable and shifts in frequency each time the sending key is closed.

**keystone-shaped**—A reproduced image which is wider at the top than at the bottom (or vice versa).

**keystoning**—The keystone-shaped scanning pattern secured when the electron gun

of a cathode ray television camera tube is placed at an angle with the principal axis of the tube.

**kick**—The sudden movement of the pointer of an ohmmeter when it is connected to a condenser of fairly large capacity.

**kilo**—Metric prefix meaning 1000.

**kilocycle**—One thousand cycles.

**kilogauss**—A unit of flux density equal to 1000 gauss or 1000 lines of flux per square centimeter.

**kilovolt-amperes**—A unit of apparent power, equal to 1000 volt-amperes.

**kilowatt**—A unit of electrical power equal to 1000 watts.

**kilowatt-hour**—A unit of electrical energy, equal to 1000 watt-hours. (Watts  $\times$  hours  $\div$  1000.)

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



Courtesy RCA

## KINESCOPES

**kinetic energy**—The energy (ability to work) which a moving object possesses by virtue of its motion.

**Kirchhoff'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.

**Kirchhoff's Voltage Law**—A fundamental electrical law which states that the sum of all the voltage sources acting in a complete circuit must be equal to the sum of all the voltage drops in that same circuit.

**klystron oscillator**—A type of microwave oscillator which uses a velocity-modulated electron stream inside a metal resonator to get considerable r.f. power at frequencies above 300 megacycles.

**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.

**knob**—A radio part, usually round but sometimes having a pointer or other position-indicating means, which is attached to the end of a control shaft to make it easier to rotate the shaft with the fingers.

**kw.**—Kilowatts.

**kwh.**—Kilowatt hours.

**kv.**—Kilovolts.

**kv.a.**—Kilovolt-amperes.

## L

**l**—Length.

**L**—Letter commonly used to designate a coil or an inductance value in henrys.

**laboratory**—A place (building or room) where scientific experiments and investigations are carried out, or where radio equipment is developed.

**lacquer discs**—Phonograph records usually of metal, glass or paper, which are coated with a lacquer compound (often containing cellulose nitrate) and used either for "instantaneous" recordings or lacquer masters.

**lag**—When two alternating quantities have the same frequency but do not pass through corresponding zero and maximum values at the same instants, the one which reaches a particular point in a cycle last is said to lag the other.

**lagging current**—An alternating current which is being retarded by the self-inductance of the circuit, so that its changes occur after the voltage changes have occurred. When there is only pure inductance in the circuit, the current lags 90 degrees behind the voltage.

**lambert**—The unit of brightness, equal to one lumen per square centimeter.

**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, in order to keep core losses at a minimum.

**lamination**—A thin sheet of magnetic iron or steel, used to build up the core of a transformer or other device designed to operate at low audio frequencies or power frequencies.

**land**—The surface between two grooves on a phonograph record.

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

**lap winding**—A method of winding an armature in which each coil terminates at the next adjacent commutator segment.

**lateral force**—Force exerted from the side.

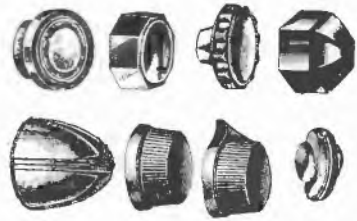
**lateral recording**—A lateral recording is one

in which the groove modulation is cut so the phonograph needle moves from side to side during playback.

**latitude**—Distance north or south of the geographical equator, measured in degrees, minutes and seconds, ranging from 0° at the equator to 90° at either pole.

**lattice-wound coils**—Coils in which the windings are criss-crossed.

**law of electric charges**—Like charges repel each other; unlike charges attract each other.



KNOBES

**law of magnetism**—Like poles repel, unlike poles attract.

**law of position**—The relationship which exists between the focal length and the distances of object and image from an optical

$$\text{lens: } \frac{1}{P} + \frac{1}{Q} = \frac{1}{f} \text{ where } P = \text{distance}$$

from lens to object, Q = distance from lens to image, and f = focal length of lens.

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

**lb.**—Pounds.

**LC**—Inductance times capacity.

**LC ratio**—Ratio of L to C ( $L \div C$ ).

**lead (pronounced leed)**—Any connecting wire, such as a battery lead, a test lead, etc. Also, the opposite of lag. When two alternating quantities have the same frequency but do not pass through corresponding zero and maximum values at the same instants, the one which reaches a particular point in a cycle first is said to lead the other.

**lead (pronounced led)**—A soft gray metal used in storage batteries, solder and for shielding cables. It is one of the few metals that will shield against the radiations of radium and other radioactive materials.

**lead cell**—The common storage battery cell, which uses lead compound plates for both positive and negative electrodes.

**lead-in**—That portion of an antenna system which connects the main portion of an antenna to the input of a receiver or to the disconnecting switches or instruments of a transmitter or its tuning house.

- 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.
- lead-in spiral**—A blank spiral groove at the beginning of a record, used to lead the phonograph needle into the recorded grooves.
- lead screw (pronounced leed screw)**—The threaded rod which leads the cutter or reproducer across the surface of the disc during recording.
- leakage**—Undesirable flow of current through or over the surface of an insulating material. This term is also used to describe magnetic flux which takes a short-cut path so that it does no useful work.
- leakage current**—A current flowing between two or more electrodes of a tube by any path other than that through space.
- 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 direct current.
- leaky**—A term used to describe a part whose resistance has dropped so much that excessive current flows or leaks through the normally high-resistance path.
- leaving here o.k.**—An engineering phrase indicating proper transmission at a certain point. Used in checking technical difficulties in broadcasting.
- lecher wires**—Parallel wires coupled to a transmitter or receiver for the purpose of measuring wavelength. The parallel wires form a transmission line along which standing waves appear. The wavelength is equal to twice the distance between any two consecutive current nodes.
- left-handed elliptically polarized wave**—An elliptically polarized wave in which the rotation of the direction of displacement is counterclockwise for an observer looking in the direction the wave is traveling.
- left-hand taper**—A volume or tone control having more resistance in the right half of the control than the left half, when held with the shaft pointing toward you and the terminal lugs pointing downward.
- leg**—A branch of a radio network.
- lens**—A transparent object, usually glass, having one or more curved surfaces designed to change the direction of rays of light.
- lens disc**—A form of television scanning disc in which each opening is fitted with a condenser lens for the purpose of securing greater brilliancy or light concentration.
- lens speed**—A measure of the amount of light a lens will pass, equal to focal length divided by diameter.
- Lenz's law**—An induced current always opposes the current which produced it.
- level**—A value or amount, as of voltage or power.
- light**—Visible electromagnetic waves.
- lightning arrester**—A protective device used to sidetrack directly to ground a discharge of lightning which strikes a radio receiving or transmitting antenna.
- light ray**—A beam of light having a small cross-section.
- light-sensitive cell**—Any device which changes its electrical characteristics when the amount of light (illumination) falling on it is changed. Photocells, photovoltaic cells and photoconductive cells are examples.
- light velocity**—All electromagnetic radiations, including those of light, travel in space (in a vacuum) with the same velocity of approximately 186,000 miles per second or 300,000,000 meters per second.
- 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.
- linear**—Having a straight-line characteristic.
- linear control**—A volume or tone control having uniform distribution of resistance along each unit length of the resistance element.
- linear detection**—A type of detection in which the audio frequency output is directly proportional to the radio frequency input for all normal signals.
- linearity control**—A control for adjusting scanning wave shapes in television systems. There may be top, bottom, right and left linearity controls all in one unit of a television system.
- linearly polarized wave**—A transverse wave in which the displacement has a constant direction at a point in space.
- linear rectification**—A process of rectification in which the rectified current or voltage is proportional to the amplitude of the input wave over a wide range of input amplitudes.
- 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.
- line cord resistor**—An asbestos-wrapped resistance element incorporated in a line cord for the purpose of dropping the line voltage to the proper value for application to the series-connected tube filaments of a universal a.c.-d.c. receiver. Sometimes known by the trade name Cordohm.

**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.

**line flyback**—In a television system, the right-to-left return motion from the end of one line to the beginning of the next. Also called *horizontal flyback* or *horizontal retrace*.

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

**line-stabilized oscillator**—An oscillator in which a section of transmission line is used as a sharply-selective frequency-controlling element.

**line synchronizing impulse**—In television, the impulse which is sent at the end of each line for controlling purposes.



LIGHTNING ARRESTERS. THE ONE AT THE LEFT IS INTENDED FOR A TWO-WIRE TRANSMISSION LINE.

**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 110 and 120 volts, but may vary at times above and below these limits.

**linkage**—Coupling together by lines of force which pass through both parts.

**link coupling**—The coupling of two separated inductances by a closed loop. A few turns of wire are placed about each inductance and are then connected together by a pair of wires or a low-impedance concentric line.

**Lissajou patterns**—The patterns obtained when alternating voltages of various amplitude ratios, frequency ratios and phase differences are applied to both pairs of deflecting plates in a cathode ray tube.

**literal number**—A letter or symbol used for representing quantities. Thus, R is a literal number (sometimes called a general number) when used to represent a number of ohms of resistance.

**litz wire**—A special stranded wire in which each strand is on the surface for a certain distance. Used to reduce skin effect.

**live**—A term used to describe a wire or circuit which is energized and therefore has a voltage.

**live end**—The part of a radio studio which gives the greatest reflection of sound.

**liven the studio**—Removal of sound-absorb-

ing material from the studio, pushing back curtains to expose window and wall surfaces, and setting up sound-reflecting screens.

**load**—That part or combination of parts into which power is fed to accomplish a desired result. Also used to indicate the amount of power taken from a circuit.

**loading coil**—A coil inserted in a circuit to increase its inductance but not to provide coupling with any other circuit.

**load line**—A line drawn on a graph of  $E_p$ - $I_p$  curves to show what operating conditions will be for a particular load in the tube plate circuit.

**local oscillator**—The oscillator section of a superheterodyne receiver. It may have a separate tube or use a part of the mixer-first detector tube.

**local program**—A program released only through one station.

**locked groove**—A blank, endless groove at the end of modulated grooves on a record, to prevent further travel of the phonograph needle. This groove is off-center on most modern phonograph records, to provide an in-and-out motion for actuating the tripping mechanism of an automatic record changer.

**loctal**—Same as *loktal*.

**log**—Logarithm. A list of radio stations. A record of stations with which a radio transmitter has been in communication; 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.

**log<sup>-1</sup>**—Antilogarithm. To be read "A number whose log is."

**log<sub>10</sub>**—Logarithm of a number to the base 10, which is the common logarithm of a number.

**logs**—Logarithm of a number to the base  $e$ , which is 2.718 in the natural system of logarithms.

**logarithm**—The *common logarithm* of a quantity is the *exponent* of the power to which the number 10 (the base of the common system of logarithms) must be raised in order to equal the quantity. Thus, 4 is the logarithm of 10,000 ( $\log 10,000 = 4$ ) because  $10^4$  is equal to 10,000. In the natural system of logarithms, the base is 2.718, which is designated by the Greek letter  $e$ .

**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.

**loctal tube**—A small-size glass radio tube having a special base construction which locks the tube firmly in the corresponding special 8-prong loctal socket. The tube prongs are sealed directly into the glass envelope. Loktal tubes are used chiefly in midget a.c.-d.c. receivers and in auto radios.

**longitude**—The distance east or west of a meridian passing through Greenwich, England, measured in degrees, minutes, and seconds.

**long waves**—Wavelengths longer than the longest broadcast band wavelength of 545 meters. Long waves correspond to frequencies between about 15 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.



Courtesy Continental Radio & Television

#### LOOP ANTENNA USED ON PORTABLE RECEIVER

**loops**—Antinodes. The points of greatest amplitude in a standing wave.

**loose coupling**—Very little coupling between two coils, so that only a small part of the magnetic flux of one coil links the other coils.

**loss**—Energy which is dissipated before it accomplishes useful work.

**loudness**—That quality of a sound which determines how much sensation it produces in human ears.

**loudness level**—The intensity level in decibels of a 1000-cycle pure tone which seems equivalent in loudness to the sound under consideration. The threshold of hearing for a 1000-cycle pure tone is

usually used as the reference level for loudness levels in db. The loudness level is sometimes called *equivalent loudness* or *equivalent loudness level*.

**loudspeaker**—A device for converting electrical energy into acoustic energy which is radiated into a room or open air. A loudspeaker is often called a *speaker* when no confusion will result therefrom, as in compound terms like speaker field, speaker cone, etc.

**louver**—A type of loudspeaker grille construction 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 adjust the calibration of the circuit at the low-frequency end of the tuning range.

**low-level modulation**—Modulation at a point in a transmitter where the power level is low compared to that at the output of the transmitter.

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

**low-pass filter**—A filter network designed to pass all frequencies *below* a cut-off frequency value, while attenuating or rejecting higher frequencies.

**low-tension**—Low voltage.

**L pad**—An attenuation network having its elements arranged in the manner of the letter L.

**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.

**lumen**—A unit of light flux. One candle emits 4 $\pi$  or 12.56 lumens of light.

**luminescence**—Radiation of light by an object which has previously been exposed to strong light.

**lumped constant**—A single constant which is equivalent electrically to all the distributed constants of that type which exist in a coil or circuit.

## M

**m.**—Meters (metric unit of length).

**M**—Mutual inductance. Also, a letter sometimes used to indicate that a particular resistance value is to be multiplied by 1000. Thus, 50M would mean 50,000 ohms.

**M $\Omega$  or M $\omega$** —Thousand ohms. Thus, 50M $\Omega$  is 50,000 ohms.

**ma.**—Milliamperes.

**magic eye**—Popular name for a cathode ray tuning indicator tube.

**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. A *permanent magnet* possesses this property permanently while an *electromagnet* possesses magnetic properties only when current is flowing through its coil.

**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 contactor**—A magnetically actuated device for opening or closing an electric power circuit.

**magnetic damping**—Damping due to eddy currents which develop a retarding force.

**magnetic density**—The number of magnetic lines of force per unit cross-sectional area.

**magnetic field**—The space around a permanent magnet or a current-carrying conductor or coil where magnetic flux exists.

**magnetic flux**—Magnetic lines of force.

**magnetic focusing**—Focusing of an electron beam in a cathode ray tube by the action of a magnetic field.

**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 microphone**—A general term for any microphone in which the output voltage depends upon variations in the reluctance of a magnetic circuit. Dynamic and velocity microphones are examples.

**magnetic pickup**—A phonograph pickup 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 saturation**—A condition of an iron core whereby further increases in magnetizing force produce little increase in magnetic flux.

**magnetic shield**—An iron housing used with a radio part to prevent external magnetic fields from affecting the part and to prevent magnetic fields produced by the part from affecting other circuits and parts.

**magnetic storm**—A rapid and violent fluctuation in the intensity of the earth's magnetic field, disrupting radio and telegraphic communication.

**magnetic vane meter**—An a.c. meter containing a metal vane pivoted inside a coil in such a way that magnetic forces rotate the vane and attached pointer and thereby indicate the strength of the alternating current flowing through the meter.

**magnetism**—A property characterized by ability to attract iron objects and to influence moving electrons.

**magnetization curve**—A curve showing the relation between the magnetizing force  $H$  (ampere-turns or gilberts per cm.) and the flux density  $B$  (lines per sq. centimeter). Also called  $B-H$  curve.

**magnetizing force**—Magnetomotive force, which produces magnetic flux.

**magnetomotive force**—The force which produces magnetic flux in a magnetic circuit. That which sets up and maintains a magnetic field. It corresponds to electromotive force in an electric circuit.

**magnetostriction**—The very slight change in the size of material like nickel when it is magnetized.

**magnetostriction oscillator**—An oscillator in which the grid and plate circuits are coupled through a special rod of magnetic material. The alternate expansion and contraction of the rod with changes in plate current governs the fundamental frequency of the oscillator.

**magnetostrictive**—Changing in size (dimensions) when placed in a magnetic field.

**magnetron**—A specially constructed radio tube in which the electron flow is controlled by an external magnetic field.

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

**magnitude**—The amount or value of a quantity.

**mains**—Ordinary power lines.

**manganin**—A metal alloy commonly used for its resistance properties in rheostats and resistors, because it is not appreciably affected by changes in temperature. It is composed of about 84% copper, 12% manganese, and 4% nickel.

**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.
- mantissa**—The second part of a logarithm (to the right of the decimal point). It is always a decimal, is always positive, and is found by referring to a table of logarithms. Example: In  $\log 461 = 2.6637$ , the mantissa is .6637.
- manual tuning**—Tuning a radio receiver to a desired station by rotating the tuning control knob by hand.
- Marcconi antenna**—An antenna which is directly connected to ground or is close enough to ground so that the ground plays an essential part in the radiation of energy.
- marking wave**—In telegraphic communication, the active portions of the code characters being transmitted. The inactive portions, in between the code characters, are called the *spacing wave*.
- masking disc**—A device to restrict the cone of electrons to a small size to prevent spherical aberration in an electronic lens.
- mass**—That property of a body which determines the acceleration it will have when acted upon by a given force, such as by gravity.
- mast**—A vertical pole or structure supporting one end of an antenna.
- master**—The commanding officer on board a ship. Also the negative die made from the original wax recording which is used to produce other dies, from which are made the stamping dies used to produce phonograph records.
- master control board**—The panel on which all the main operating controls of a broadcast studio or transmitter are located.
- master oscillator**—The oscillator which establishes the carrier frequency of a transmitter.
- matched impedance**—Circuits balanced or matched so that their total impedances at the point of coupling together are equal.
- 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.
- matrix**—A negative from which duplicate phonograph records are molded.
- matter**—Any physical entity which has mass.
- maximum**—Greatest quantity or amount of anything.
- 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.
- maximum usable frequency**—The highest frequency that can be used for reliable radio transmission at a specified time between two points on the earth by reflection from the regular ionized layers of the ionosphere.
- maxwell**—The unit of magnetic flux, equal to one magnetic line of force.
- MAYDAY**—The international distress call for radiotelephone communication. It is derived from the French pronunciation of "M'aidez," meaning "Help me."
- MBS**—Mutual Broadcasting System.
- mc.**—Megacycles.
- m.c.w. or MCW**—Modulated continuous waves.
- mechanical bandspread**—The use of a vernier tuning dial to make the gang tuning condenser rotate more slowly than the tuning control knob, so as to make station tuning easier in crowded short-wave bands.
- mechanical damping**—The mechanical resistance which is generally associated with the moving parts of a cutter or a reproducer.
- mechanical television**—Any television system in which the scene to be transmitted is broken up into picture elements, and reconstructed at the receiving end by a moving mechanical mechanism such as a rotating scanning disc.
- meg.**—Megohm.
- megacycle**—One million cycles per second.
- megger**—A high-range ohmmeter used for measuring leakage resistances and insulation resistances. The necessary high voltage is generated by a self-contained, hand-operated generator.
- 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.
- Mershon condenser**—A commercial wet electrolytic condenser.
- mesotron**—A particle having a unit negative charge like an electron but a mass in between that of electrons and protons. Also called heavy electron, barytron, dynatron, penetron, X particle, etc. Mesotrons make up a large part of cosmic rays.
- metallized resistor**—A resistor made by de-



positing 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 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.

**meter**—The unit of length in the metric system. One meter is equal to 3.28 feet. Also an instrument used for making electrical measurements. A voltmeter measures voltage; an ammeter or milliammeter measures currents; a wattmeter measures power; an ohmmeter measures resistance.

**metric system**—A decimal system of measures and weights, using the meter and the gram as basic units. The system of units based on meters for length, grams for mass.

**mfd.**—Microfarads.

**mh.**—Millihenry.

**mho**—The unit of conductance. It is the reciprocal of resistance.

**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 apparatus.

**mica condenser**—A condenser which employs sheets of mica as the dielectric material which insulates adjacent plates from each other.

**micro**—Prefix meaning one millionth of.

**microammeter**—A meter designed to measure extremely small currents.

**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. or  $\mu\text{f}$ .

**microhenry**—One millionth of a henry. Abbreviated as  $\mu\text{h}$ .

**micromho**—A unit of conductance equal to the one-millionth part of a mho.

**micromicrofarad**—A unit of capacity equal to one millionth of a microfarad and abbreviated as mmfd. or  $\mu\mu\text{f}$ .

**micron**—A unit used to express wavelengths of light. One micron is equal to 10,000 angstrom units or .0001 cm.

**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 voltage which is fed to the input of an amplifier.

**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 cable**—The specially made group of wires connecting a microphone to an amplifier or mixer.

**microphone preamplifier**—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.



### Modern Dynamic Microphones

**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.

**microvolt**—One millionth of a volt. Abbreviated  $\mu\text{v}$ .

**microvolts per meter**—A measure of the radio field intensity, equal to the signal strength at the antenna in microvolts divided by the effective height of the antenna in meters.

**microwave**—A very short electromagnetic wave, usually having a wavelength less

- than one meter (higher than 300 megacycles).
- microwave oscillator**—An oscillator which generates a frequency higher than 300 megacycles (less than one meter).
- mike**—Microphone.
- mil**—A unit of measurement equal to one thousandth of an inch (.001 inch), used chiefly in specifying the diameters of round conductors.
- mil-foot**—A wire one foot long having a diameter of 1 mil.
- milli**—Prefix meaning one thousandth of.
- milliammeter**—A meter which measures current flow in milliamperes.
- milliampere**—A unit of current equal to one thousandth of an ampere. Abbreviated ma.
- millihenry**—A unit of inductance equal to one thousandth of a henry. Abbreviated mh.
- 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. Abbreviated mm.
- millivolt**—A unit of voltage equal to one thousandth of a volt. Abbreviated mv.
- milliwatt**—A unit of power equal to one thousandth of a watt. Abbreviated mw.
- min.**—Minutes. Minimum.
- minimum**—Lowest, least or smallest quantity of anything.
- minus sign**—A sign (—) used in mathematics to indicate subtraction or a negative value. Used in radio to indicate the negative terminal of a voltage source or to indicate negative polarity.
- minute**—One-sixtieth part of a degree. One complete revolution of an angle-generating line is  $360^\circ$ , which is  $360 \times 60$  minutes or  $360 \times 60 \times 60$  seconds.
- 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.
- mixer-first detector**—The stage in a superheterodyne receiver in which the desired signal is combined with the signal of a local oscillator to create the intermediate frequency.
- mm.**—Millimeter.
- mmfd.**—Micromicrofarads.
- M.O.**—Master oscillator.
- mobile receiver**—A receiver designed to be operated while in motion. Usually refers to commercial communication equipment.
- mobile station**—A radio station operated in a movable location such as on an automobile, fire truck, railway train, ship or airplane.
- mobile transmitter**—A transmitter designed to be operated while in motion and normally so operated.
- MOD.**—Modulator. Modulation. Modulated.
- modulated amplifier**—The r.f. stage in a transmitter at which the intelligence signal is made to modulate the r.f. carrier signals.
- modulated stage**—The radio frequency stage to which the modulator is coupled and in which the continuous wave (carrier wave) is modulated in accordance with the system of modulation and the characteristics of the modulating wave.
- 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.
- modulating electrode**—An electrode used in a cathode ray tube to control the beam current.
- modulating wave**—The a.f. signal, picture signal, facsimile signal, code signal, etc., which is made to modulate the carrier wave of a transmitter.
- modulation**—The process of producing a wave, some characteristic of which varies as a function of the instantaneous value of another wave which is called the *modulating wave*.
- modulation capability**—The maximum percentage modulation which can be used without objectionable distortion.
- modulation distortion**—Distortion of wave form due to a greater plate current change on positive half cycles than on negative half cycles. Prevalent in screen grid tubes.
- modulation envelope**—A curve which is drawn to pass through the peaks of a graph showing the wave form of a modulated r.f. carrier signal.
- modulation factor**—The ratio of the maximum amplitude of the modulation envelope to the amplitude of the unmodulated carrier. Multiplying this factor by 100 gives percentage modulation.
- modulation percentage**—The ratio of signal voltage to carrier voltage, expressed in per cent.
- 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.
- molded condenser**—A condenser molded in bakelite or other suitable insulating material for the purpose of keeping out dust and moisture.

- molecular theory of magnetism**—The theory which treats each molecule of matter as a complete permanent magnet. When a piece of material is magnetized, all the molecular magnets line up with like poles pointing in the same direction.
- molecule**—The group of atoms which constitutes the smallest particle in which a compound or material can exist separately.
- monitor**—A person who checks the quality of a radio or television program at the studio or transmitter. Sometimes called monitor operator. Also, a receiver or loudspeaker used at broadcast studio, transmitter or other location for the purpose of checking or monitoring the programs of a radio station or public address system.
- monitoring**—The act of listening to a program picked up by a microphone, either during rehearsals or actual broadcasts, to check quality and determine proper levels for sound effects.
- monitor panel**—A group of controls used to govern the level of sound signals from a studio, or of television video signals as picked up by the scanning mechanism or television camera tubes at a television transmitter.
- 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.
- M.O.P.A.**—Master oscillator power amplifier.
- 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 radiotelegraphy, while the American Morse Code is used only for wire telegraphy.
- mosaic**—In television, the light-sensitive surface of an iconoscope, consisting of millions of tiny silver globules on a sheet of ruby mica, each globule treated with caesium vapor to make it photosensitive.
- mother**—A positive recording produced directly from the metal master or negative.
- motor**—A machine which converts electrical energy into mechanical energy. It consists essentially of a large number of conductors mounted on an armature which rotates in a magnetic field produced by field coils.
- 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.
- mouth of a horn**—The large end of the horn of a horn loudspeaker.
- moving-coil loudspeaker**—Another name for a dynamic loudspeaker, in which the mechanical forces acting on the diaphragm are produced by interaction between the magnetic field of the moving conductors (voice coil) and the steady applied magnetic field produced by a field coil or permanent magnet.
- moving-coil microphone**—A moving-conductor microphone in which the moving conductor is in the form of a coil located in a strong magnetic field produced by a permanent magnet. Usually called a *dynamic microphone*.
- moving-conductor microphone**—A general term applying to all microphones in which the output voltage depends upon motion of a conductor in a magnetic field.
- M.S.T.**—Mountain Standard Time.
- multi-band antenna**—An antenna which can be used with satisfactory results on a number of frequency bands.
- multielectrode tube**—A vacuum tube having more than three electrodes associated with a single electron stream.
- multimeter**—A test instrument having provisions for measuring voltages and currents, as well as resistance.
- multipath transmission**—Signals reaching the radio receiving antenna by two or more paths. The resulting differences in amplitude and phase give an echo effect.
- multiple-tuned antenna**—An antenna which is connected to ground through tuning coils or condensers at more than one point, so that the total of the reactance in parallel will make the antenna resonant at the desired frequency.
- multiple-unit tube**—A vacuum tube having two or more groups of electrodes, each with its own electron stream, in a single envelope. See *duodiode*, *duotriode*, *diode-pentode*, *duodiode-triode*, *duodiode-pentode* and *triode pentode*.
- multiplex radio transmission**—The transmission of two or more carrier waves, using a common carrier wire circuit.
- multiplication**—The process of determining by a briefer computation the result of adding any given number or quantity a

certain number of times. Thus,  $3 \times 4$  is 4 added together 3 times, or  $4 + 4 + 4$ . Multiplication is indicated by the sign  $\times$ . In algebra, the multiplication sign is usually omitted between general numbers (numbers expressed by letters), or the symbol  $\cdot$  is used to denote multiplication. Examples:  $I \times R$ ,  $IR$  and  $I \cdot R$  all mean that  $I$  is to be multiplied by  $R$ ;  $2\pi fL$  means 2 times  $\pi$  times  $f$  times  $L$ . In algebra, the product of two numbers having like signs is positive. The product of two numbers having unlike signs is negative.

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

**multiplier tube**—A tube in which emitted electrons are pulled along by increasingly higher potentials and are made to strike a number of plates (called dynodes) successively. At each plate, secondary emission occurs, resulting in a high current from the last plate. This gives the effect of high gain.

**multiplying factor**—The number by which a meter reading is multiplied to get the true value.

**multivibrator**—A type of relaxation oscillator which consists of two triode tubes connected so that energy from the plate circuits is fed to the opposite grid circuit at the proper time and in the proper phase to produce a square-wave output.

**muting switch**—Device used in automatic tuning systems to silence the audio system while stations are being selected or tuned in.

**mutual conductance**—The ratio of the change in plate current to the change in grid potential producing it, under the condition of constant plate voltage.

**mutual inductance**—The common property of two associated coils or electric circuits which determines how much electromotive force will be induced in one by a change of current in the other. Mutual inductance is measured in henrys, and is designated by the letter  $M$ .

**mutual induction**—The generation of a voltage in one circuit by the varying current in another circuit when inductive coupling exists.

**mv.**—Millivolts.

**mv./m.**—Millivolts per meter. (Sometimes used for microvolts per meter.)

**mw.**—Milliwatts.

## N

**N**—Number of turns on a coil.

**National Electric Code**—A set of rules governing construction and installation of electrical apparatus, as approved by the National Board of Fire Underwriters.

**natural frequency**—The fundamental (lowest) resonant frequency of a coil-condenser circuit, not a harmonic frequency.

**natural frequency of an antenna**—The fundamental resonant frequency of an antenna alone (without added inductance or capacity).

**natural wavelength**—The wavelength corresponding to the natural frequency of a circuit.

**NBC**—National Broadcasting Company.

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

**needle pressure**—Effective weight of the stylus or needle on the phonograph record.

**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 charge**—A body is negatively charged when it has more than the normal number of electrons. The number of excess electrons is a measure of the amount of charge.

**negative feedback**—Degeneration, which decreases the amplification. Also called inverse feedback or stabilized feedback.

**negative modulation**—In an a.m. facsimile system, that form of modulation in which the maximum transmitted power corresponds to the maximum density of the subject copy. In an f.m. system, it is that form of modulation in which the highest transmitter frequency corresponds to the maximum density of the subject copy. In television, a method of transmission in which a decrease in scene illumination causes an increase in the radiated power of the transmitter.

**negative picture phase**—A condition wherein increases in brilliancy make the television picture signal voltage swing in a negative direction, below the zero level.

**negative resistance**—A characteristic of an electric arc or some vacuum tubes wherein the voltage drop across a circuit decreases when the current increases.

**negative terminal**—A terminal having more than the normal number of electrons.

**N.E.M.A.**—National Electric Manufacturers Association.

**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.

**neon oscillator**—A neon lamp with a condenser and resistor incorporated in a circuit in which the time constant may be varied over a wide range by adjustment of the capacity or resistance value, thereby changing the frequency of oscillation.

**neper**—Obsolete unit of power gain or loss, replaced by the decibel and volume unit.

**network**—Any complex electrical circuit. Also, 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.

**neutral**—An object which has its normal number of electrons and therefore is uncharged electrically.

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

**neutralizing condenser**—A variable condenser used in transmitting and receiving circuits to feed a portion of the a.c. plate voltage back to the grid circuit. This voltage is  $180^\circ$  out of phase with the grid voltage and reduces the tendency of the stage to go into oscillation.

**neutralizing tool**—See *aligning tool*.

**neutral wire**—The middle wire of a three-wire two-phase power line, usually grounded.

**neurodyne circuit**—A circuit in which a portion of the r.f. plate voltage is fed back into the grid circuit  $180^\circ$  out of phase to reduce the tendency toward oscillation.

**neutron**—An electrically neutral particle having about the same mass as a proton.

**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.

**Nicol prism**—Two prisms of Iceland Spar crystal cemented together with Canada balsam. The combination is used to polarize light beams.

**night errors**—Errors introduced by variations in terrain, time of day, season of year, different transmission characteristics, etc., which affect bearings taken with loop antennas of radio direction finders.

**nodal point keying**—A method of keying an arc transmitter in which the transmitting

key connects to a point in the antenna circuit which is essentially at ground potential at all times.

**node**—Any point, line or surface which has zero amplitude in a stationary-wave system. The type of node is usually specified, since there can be voltage nodes, current nodes, pressure nodes, velocity nodes, etc.

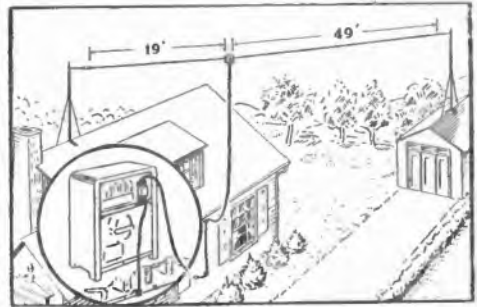
**noise**—In radio, a term used chiefly in connection with interfering disturbing sounds heard along with desired programs.

**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 filters are also placed between the power line and the device producing noise, to prevent escape of the noise signals into the power line.

**noise level**—The strength of noise signals in a tube circuit, amplifier, program line, etc., or the level of acoustic noise in a particular location.

**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-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.



NOISE-REDUCING ANTENNA OF THE ALL-WAVE TYPE. THE LEAD-IN IS A TWISTED PAIR OF WIRES.

**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.

**nomogram**—Alignment chart or graph used to speed up calculation of inductance or other properties. Also called nomograph.

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

**non-homing tuning system**—A motor-driven automatic tuning system in which the direction of motor rotation is reversed at the ends of the tuning range. When a station-selecting button is pressed, the motor will rotate in the direction in which it was last rotating. Should the dial setting for the desired station be in the other direction, the motor will rotate the tuning mechanism to the end of the scale and will then reverse and proceed to tune the receiver to the desired station frequency.

**non-inductive circuit**—A circuit having practically no inductance.

**non-inductive condenser**—A condenser having practically no inductance. The layers of foil and paper are staggered in winding so that one layer of foil protrudes at one end, while the other layer protrudes at the other end.

**non-inductive resistor**—A wire-wound resistor so constructed that the wire coil has practically no inductance. Used at high frequencies.

**non-inductive winding**—A method of winding a coil so that the magnetic field about a turn cancels the field produced about the next adjacent turn. Used in making non-inductive resistors.

**non-linear**—Not directly proportional.

**non-magnetic**—Descriptive of materials such as glass, wood, copper, brass and paper which are not affected by magnetic field and which cannot be magnetized.

**non-resonant line**—A transmission line having a physical length much shorter than a quarter wavelength at the operating frequency so that the distributed voltage and current are practically uniform. Also, a line of any length having terminating devices matching the surge impedance so that there are no reflected (standing) waves.

**non-storage camera tube**—A type of television camera tube which produces a picture signal which is proportional at any instant to the intensity of the illumination on the corresponding elemental area of the scene at that instant.

**non-synchronous vibrator**—A vibrator which only interrupts a direct current, without rectifying the resulting stepped-up a.c. pulses.

**normal**—The perpendicular to the point of contact. Also, the expected or regular value.

**north pole**—The pole of a magnet at which the magnetic lines of force leave the magnet.

**nucleus**—The central portion of an atom consisting of a proton alone or various

combinations of electrons and protons. The plural is nuclei.

**null**—Zero.

**null indicator**—Any device which will indicate when a Wheatstone bridge circuit is in balance (will indicate when current is zero).

**number**—One or more written or printed characters used to express an amount of units. Examples: 1, 7, 45, 10,000, etc.

**numeral**—One or more written or printed characters used to express a number. Example: Arabic numerals 1, 2, 3, etc. Roman numerals I, V, X, etc.

**numerator**—The part of a common fraction which is written above the line. Example:

$$\frac{\omega L}{R}$$

In  $\frac{9}{16}$ , the numerator is 9; in  $\frac{\omega L}{R}$ , the numerator is  $\omega L$ .

## O

**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.

**obtuse angle**—An angle that is greater than a right angle (greater than  $90^\circ$ ).

**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.

**octave**—The interval between two frequencies having a ratio of two to one. The reference frequency used in the United States for music is 440 cycles; with this the frequencies between 440 and 880 cycles would be one octave, and 220 to 440 cycles would be the next lower octave.

**octode**—A vacuum tube having eight electrodes—a plate, a cathode, a control grid and five other electrodes.

**oersted**—Unit of magnetic reluctance equal to magnetomotive force in gilberts divided by flux in maxwells.

**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 ohm.

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

**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 essen-

tially of a milliammeter in series with a suitable d.c. voltage and suitable series or shunt resistors.

**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 (of the meter and multiplier resistors) by the full-scale voltage value. The higher the ohms-per-volt rating, the more sensitive is the meter.

**opaque**—Preventing the passage of light rays.

**open circuit**—A circuit which is not electrically continuous and in which current cannot flow.

**operating angle**—In an amplifier, the angular portion of a cycle during which plate current flows. For class C amplifiers it is less than  $180^\circ$ ; for class B amplifiers it is about  $180^\circ$ ; for class A amplifiers it is  $360^\circ$ .

**operating point**—The point on a grid-voltage plate-current characteristic curve of a tube which corresponds to the d.c. grid bias value and d.c. plate current value for operating conditions.

**operating power**—The power that is actually supplied to the radio station antenna. "Maximum rated carrier power" is the maximum power at which the transmitter can be operated satisfactorily, and is determined by the design of the transmitter and the type and number of vacuum tubes used in the last radio stage. "Plate input power" means the product of the direct plate voltage applied to the tubes in the last radio stage and the total direct current flowing to the plates of these tubes, measured without modulation. "Antenna input power" or "antenna power" means the product of the square of the antenna current and the antenna resistance at the point where the current is measured.

**operating voltage**—The d.c. voltages applied to the filament, plate, screen grid and control grid elements of a tube to establish its operating characteristics.

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

**optical pattern**—The pattern which is ob-

served when the surface of a phonograph record is illuminated by a beam of parallel light.

**optics**—The science which treats of the phenomena of light.

**optimum**—Best possible.

**optimum coupling**—That amount of coupling between two circuits which gives maximum transfer of signal energy.

**ordinary wave**—One of two components into which a radio wave is split in the ionosphere by the earth's magnetic field. This wave is sometimes called the O wave. See *extraordinary wave*.

**ordinate**—The coordinate value which specifies distance in a vertical direction on an ordinary graph.

**orient**—To turn or adjust in a definite direction with respect to some reference.

**osc.**—Oscillator.

**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. Also, a signal generator used by servicemen.

**oscillator coil**—The r.f. coil used in the oscillator circuit of a superheterodyne receiver or other radio apparatus to produce oscillation.

**oscillator harmonic interference**—The result of interaction between incoming signals and harmonics of the local oscillator (usually the second harmonic) in a superheterodyne receiver.

**oscillator-mixer-first detector**—A single stage, usually employing a pentagrid converter tube, which combines the functions of the local oscillator and the mixer-first detector in a superheterodyne receiver.

**oscillator padder**—An adjustable condenser in series with the oscillator tank circuit of a superheterodyne receiver used to make possible better tracking between oscillator and preselector at the low-frequency end of the tuning dial.

**oscillatory circuit**—A circuit containing inductance and capacity having values such that a voltage impulse will produce an oscillatory (alternating) current.

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

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

**outdoor antenna**—An elevated wire erected outside a building for the purpose of receiving radio waves.

**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 capacity**—The sum of all inter-electrode capacities existing between the plate and cathode of a vacuum tube.

**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 indicator**—A meter, tuning eye or other device used to show changes in output during receiver alignment.

**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. It is often mounted on the loudspeaker.

**output tube**—See *power output tube*.

**overcutting**—Excessively high level in recording.

**overlap**—The amount by which the effective height of the scanning spot exceeds the nominal width of the scanning line in a facsimile system.

**overload**—A load greater than an electrical device is designed to carry.

**overload relay**—A relay which opens a circuit automatically when current becomes excessive.

**over-modulation**—Modulation greater than 100%, resulting in distortion due to complete stoppage of radio frequency oscillations during portions of each cycle.

**overtone**—A harmonic of a fundamental sound frequency.

**oxide**—A combination of an element with oxygen. Rust is an oxide of iron.

**oxide-coated filament**—A filament coated with a metallic oxide to increase the electron emission. Oxides of barium and strontium are most often used. These oxides are also applied to cathodes of heater type tubes.

**oz.**—Ounces.

## P

**P**—Plate of a tube. Power in watts. Primary winding of a transformer.

**p.a. or P.A.**—Public address. Power amplifier.

**pad**—A network of resistors, sometimes variable, inserted in a circuit to introduce a loss. Used where input and output impedances must be matched or maintained constant.

**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. It is usually constructed in tubular form.

**parabolic reflector**—A reflector which brings parallel light rays from a distant source to a sharp focus at a single point.

**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 through all parts. Thus, 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.

**parallel-rod oscillator**—A microwave oscillator whose grid and plate tank circuits are formed of parallel rods, wires or pipes of required length and dimensions.

**parasitic element**—An antenna element which receives its excitation by induction or direct radiation from the driven element, and which reradiates the energy in the proper phase relationship to get the desired results.

**parasitic oscillations**—Unintended self-sustaining oscillations in a circuit.

**parasitic suppressor**—A combination of in-



- ductance and resistance inserted in the grid circuit of an r.f. amplifier stage to suppress high-frequency parasitic oscillations by damping the circuit in which they occur.
- patchboard**—A board or panel containing a series of single or double jacks at which various circuits are terminated. The circuits are interconnected by short cables called patchcords. Used in telephone and broadcast practice.
- patchcord**—A short two- or three-conductor cable with male plugs at each end, used to interconnect various circuits which are terminated at a control panel, or patchboard.
- peak**—The maximum instantaneous value of a varying voltage or current.
- peak forward anode voltage**—The maximum instantaneous plate-cathode voltage in the direction in which a vacuum tube is designed to pass current.
- peak inverse anode voltage**—The maximum instantaneous plate-cathode voltage in the direction opposite to that in which a tube is designed to pass current.
- peak response**—Maximum response.
- peaks**—Momentary high volume levels produced during a radio program as a natural result of changes in pitch, accent or speech emphasis, causing the volume indicator to swing upward.
- pedestal**—The constant voltage value existing just before and after the synchronizing impulses occur in a television signal.
- penetration frequency**—The highest frequency at which a radio wave traveling vertically upward will still be reflected regularly by a particular ionized layer of the ionosphere. Also called the critical frequency.
- pentagrid tube**—A tube having five grids. Often called a pentagrid converter tube because of its frequent use as a converter (oscillator-mixer-first detector) in superheterodyne receivers.
- pentode**—A vacuum tube having five electrodes. Ordinarily these will be the cathode, control grid, screen grid, suppressor grid and anode.
- percentage modulation**—With respect to an amplitude-modulated wave, this means the ratio of half the difference between the maximum and minimum amplitudes of the modulated wave to the average amplitude, expressed in percentage. In other words, it is the value obtained when the modulation factor is multiplied by 100 to express it as a percentage. With respect to a frequency-modulated radio wave, percentage modulation is the ratio of the actual frequency deviation to the frequency deviation required for 100% modulation, expressed in percentage.
- percentage modulation meter**—An instrument used to measure the percentage of modulation of a transmitter. It may be a meter or a cathode-ray oscilloscope.
- percent ripple**—The ratio of the r.m.s. ripple voltage value to the average d.c. voltage value at the output of a rectifier or d.c. generator, expressed in per cent.
- Peridynamic loudspeaker baffle**—Trade name for a special box-type loudspeaker baffle which reduces standing waves and gives good bass response.
- period**—In alternating current, the time required for one cycle or one complete change to take place.
- periodic antenna**—An antenna which varies in impedance when the frequency changes, because of reflections or standing waves in the antenna system. Open-end wires and resonant antennas of all kinds are examples.
- permalloy**—An alloy of nickel and iron used as core material for high-quality audio frequency transformers.
- permanent magnet**—A piece of hardened steel or other magnetic material which has been artificially magnetized and retains its magnetism.
- permanent magnet dynamic speaker**—A moving coil speaker with its field supplied by a permanent magnet.
- permeability**—A measure of how much better a particular material is than air as a path for magnetic lines of force. The permeability of air is assumed as 1. Permeability values for good magnetic materials can be as high as 5000 or more.
- permeability tuning**—A method of varying the inductance of an iron-core r.f. coil by moving a pulverized iron core in or out of the coil.
- permeance**—The reciprocal of reluctance.
- p.f.**—Power factor.
- phantom circuit**—A circuit superimposed on two other circuits. Used in telephone and broadcast work to make two pairs of wires provide three complete circuits.
- phase**—A particular instant of time in an alternating current cycle. When two alternating current values pass through corresponding zero values at the same instants of time, they are said to be *in phase*.
- phase angle**—The amount, expressed in degrees, by which a voltage or current lags behind or leads another voltage or current. One cycle = 360°.
- phase distortion**—A type of distortion occurring when a radio circuit or part changes the phase relationship between different frequencies in the incoming signal. Phase distortion is not particularly important in radio, but is highly important in television.
- phase inverter**—A single vacuum tube used

to change the phase of a signal voltage  $180^\circ$ , so a push-pull stage can be properly driven without the use of a coupling transformer.

**phase modulation**—A system of radio communication in which the *phase* of the r.f. carrier is varied in proportion to variations in the audio signal.

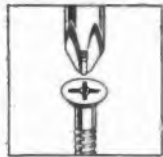
**phase shift**—A change in the phase difference between two varying quantities.

**phasing**—The adjustment of the picture position along the scanning line in a facsimile system.

**phasing line**—That portion of the length of a scanning line set aside for the phasing signal in a facsimile system.

**phenomenon**—Any observable action, change or occurrence having scientific interest.

**Phillips screw**—A screw having an indented cross in its head in place of the conventional slot.



PHILLIPS SCREW. THE SCREW-DRIVER IS SHOWN IN THE BOX AT THE RIGHT.

**phon**—A term sometimes used in place of decibel to specify equivalent loudness levels.

**phone**—A headphone.

**phonograph**—See *record player*. Also an early machine using a spring motor, reproducing the recording by mechanical means.

**phonograph connection**—A set of two terminals sometimes provided at the back of a radio receiver for making connections to a phonograph pickup. 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 pickup, 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 pickup**—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.

**phonograph record**—A 10- or 12-inch diameter shellac-composition disc recording manufactured chiefly for home use, and designed for playing at 78 revolutions per minute. It does not have as high fidelity as an electrical transcription.

**phonotron**—A hot-cathode gas discharge tube in which there is no means for controlling the magnitude of the unidirectional current flow.

**phosphor bronze**—A hard, springy, non-metallic alloy of copper, tin and phosphorus, widely used in radio for contact springs.

**phosphorescence**—The ability to give off light without being heated to incandescence.

**photo cell**—A popular name for a photoemissive cell or phototube.

**photoconductive cell**—A type of light-sensitive cell whose ohmic resistance varies with changes in light falling on the cell.

**photoelectric**—Electrically sensitive to changes in light.

**photoelectric cell**—A light-sensitive cell, which can be any one of three basic types—photoemissive, photoconductive or photovoltaic. It converts variations in light into corresponding variations in voltage or current.

**photoemissive cell**—A type of light-sensitive cell in which a treated cathode, mounted in a glass envelope, emits electrons under the action of light, these electrons being collected by the anode. There are two kinds, vacuum and gas-filled. Also called photocell and phototube.

**photographic recording**—Facsimile recording by exposure of a photosensitive surface to a signal-controlled light beam or spot of a facsimile receiver.

**photo-island grid**—A thin sheet of metal having many very fine perforations (about 400 holes per inch). Used as the photosensitive surface in the storage-type Farnsworth television dissector tube.

**photometer**—An instrument for measuring the brightness of various sources of light.

**photometry**—A branch of the science of optics dealing with the measurement of illumination.

**photosensitive**—Responsive to changes in light intensity.

**phototube**—A vacuum tube in which the cathode is irradiated with visible or invisible light for electron-emitting purposes. A high-vacuum phototube is one which is evacuated to such a degree that its characteristics are unaffected by gas ionization. A gas phototube is one containing a quantity of gas to give increased sensitivity.

**photovoltaic cell**—A type of light-sensitive cell which generates a voltage when illuminated, this voltage varying with the amount of light falling on the cell. Also called a self-generating cell.

**Photronic cell**—A trade name applied to one make of photovoltaic cell.

**pickup**—See *phonograph pickup*. Also, any device which converts original intelligence into an equivalent electrical signal, such as a television camera or a microphone.

**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.

**picture signal**—The electrical impulses resulting from scanning of successive elements of a visual scene by a scanning device.

**picture synchronizing impulse**—The impulse which controls the time at which the television reproducing device returns from the lower right corner to the upper left corner.

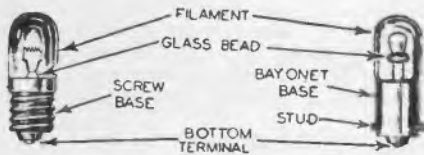
**pie**—One layer or section of a multisection winding.

**Pierce oscillator**—A form of crystal oscillator circuit in which the frequency-controlling crystal element is connected between grid and plate of the oscillator tube. It needs no tuned plate circuit, and may therefore drive a final amplifier or buffer stage with but one tuning control. Used primarily by amateur radio operators.

**piezoelectric**—Possessing the ability to produce a voltage when mechanical force is applied, or produce a force when a voltage is applied, as in a piezoelectric crystal.

**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.



PILOT LAMPS

**pin jack**—A small receptacle into which is pushed a pin-like member to complete a circuit connected to the two parts.

**piped program**—A program which has been transmitted over wires.

**pipe line**—A shielded transmission line consisting of coaxial cylinders (a wire inside a pipe). Also called coaxial line, coaxial cable, concentric line, etc.

**pitch**—The frequency of a tone.

**plane**—A flat surface.

**plane of polarization**—In a radio wave, this is a plane which is perpendicular to the wave front and parallel to the electric vector component of the wave. In a vertically polarized wave, this plane is vertical (perpendicular to the earth). In a horizontally polarized wave, this plane is horizontal (parallel to the earth).

**plane-polarized wave**—A transverse wave in which the direction of the displacement at all points in a certain space is parallel to a fixed plane parallel to the direction of travel.

**plano-concave**—A lens having one flat and one inward-curved surface.

**plano-convex**—A lens having one flat and one outward-curved surface.

**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 naturally smooth, glossy surface which requires no finishing or polishing operations after molding.

**plate**—The common name for the principal anode in a vacuum 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 dissipation**—The power in watts which is used up as heat in the plates or anodes of tubes. It is equal to the product of the plate voltage and the plate current.

**plate impedance**—The ratio of the change in plate voltage to the change in plate current, all other conditions being fixed.

**plate keying**—Keying a telegraph transmitter stage by interrupting the plate circuit supply of a transmitter.

**plate load impedance**—The impedance of the path between plate and cathode in a tube.

**plate modulation**—Modulation produced by introduction of the modulating wave into

the plate circuit of any tube in which the carrier frequency wave is present.

**plate resistance**—The resistance in ohms of the plate-cathode path in a tube.

**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.

**playback**—An expression used to denote the immediate reproduction of a recording.

**pliotron**—A high-vacuum thermionic tube having one or more grid electrodes to control the magnitude of the unidirectional current flow. Radio amplifier tubes are thus pliotrons.

**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. Also, a bit of advertising material inserted into a radio program.

**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.



PLUG-IN COILS

**plug-in resistor**—A filament voltage-dropping resistor mounted in a metal or glass enclosure and provided with a plug-in base.

**plus sign**—A sign (+) used in mathematics to indicate addition or a positive value. Used in radio to indicate the positive terminal of a voltage source or to indicate positive polarity.

**p.m. dynamic**—Permanent magnet dynamic.

**pointer**—That part of a meter or tuning dial which moves over the scale; an indicator.

**point-to-point resistance**—A method of testing wherein the resistance between given points in a set is measured and checked against expected normal values. Any

major discrepancy indicates a defect between the two points.

**polarity**—In a radio part or circuit, the quality of having one of two possible charges, negative or positive. In a magnetic circuit or part, the quality of having one of two possible poles, north or south.

**polarization**—The particular property of an antenna system which determines its radiation characteristics, such as vertical or horizontal polarization.

**polarization errors**—Errors in the bearing or course indicated by a radio direction finder or radio beacon, introduced by horizontally polarized components of the electric field under certain atmospheric conditions which usually occur at night. Sometimes called *night effects*.

**polarized cell**—A cell that has become inoperative due to the formation of hydrogen about its positive pole.

**polarized light**—Light vibrating in only one direction, produced by passing the light through a piece of quartz, a Nicol prism, a Kerr cell or a special type of glass called Polaroid.

**polarizing current**—The d.c. current flowing through an iron-core choke coil or transformer which determines the permeability of the core and thus the value of inductance.

**Polaroid**—Trade name for a certain type of light-polarizing material made by depositing on a transparent celluloid or glass sheet a chemical solution having light-polarizing properties.

**polar radiation pattern**—A graph showing how much sound is radiated from the cone of a loudspeaker in various directions, or how radio waves are radiated from an antenna.

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

**police calls**—Broadcasts or calls made by police radio stations.

**polyphase**—Having more than one phase.

**porcelain**—A material used for insulators. Made by baking a molded mixture of silica, clay, feldspars and water. It has a dielectric constant of from 4 to 6.

**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.

**position**—The point of intersection of two or more radiocompass bearings taken from widely separated radio beacons.

**positive**—A term used to describe a terminal having fewer electrons than another. So that it attracts electrons from the other terminal in seeking to return to its nor-

mal state. Thus, electrons flow into the positive terminal of a voltage source.

**positive charge**—The charge on an object having less electrons than normal.

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

**positive ion sheath**—Collection of positive ions on the control grid of a gas-filled triode tube. If a high negative bias is applied to the grid, the positive sheath will get so thick as to stop plate current flow.

**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. In an a.m. facsimile system, that form of modulation in which the maximum transmitted power corresponds to the minimum density of the subject copy. In an f.m. system, that form of modulation in which the highest transmitter frequency corresponds to the minimum density of the subject copy.

**positive picture phase**—A condition wherein increases in brilliancy make the television picture signal voltage swing in a positive direction, above zero level.



Courtesy Philco

PORTABLE RECEIVER

**positron**—A natural elemental quantity of positive electricity having much smaller mass than a proton. Often called a positive electron, because its mass appears to be about the same as that of an electron.

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

**potential difference**—The difference in voltage between two points as a result of current flow.

**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. Also, the result obtained when a number or quantity is multiplied by itself a particular number of times. The *exponent* of the number indicates the number of times this self-multiplication is to be performed. Examples: 36 is the second power of 6; 27 is the third power of 3.

**power amplification**—The ratio of signal output power to signal input power.

**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 cord**—The cord which carries power from a standard wall outlet to a radio receiver. A line cord.

**power detector**—A detector which may be operated at fairly high values of input voltage without objectionable distortion.

**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 per cent power factor.

**power factor meter**—Meter used to indicate per cent lag or lead produced by a load. Used to monitor loads when a power company exacts a penalty for low power factor (caused by too high an *inductive* load).

**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 line**—A pair of wires carrying electric power from one location to another.

**power of ten**—A number obtained by multiplying 10 by itself one or more times. Thus, 100 is the second power of 10.

**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.

- 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 ratio**—The ratio between power input and power output, used in calculating db loss and gain.
- power relay**—The final relay which controls a power circuit or magnetic contactor. Often called auxiliary relay.
- power switch**—Sometimes known as ON-OFF switch. The device which applies power to a device so it can operate.
- 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 tube**—See *power output tube*. Also the tube used in the last r.f. stage of a transmitter, capable of handling more current and power than an ordinary amplifier tube.
- preamble**—That part of a radio message which contains the prefix, message number, office of origin, word check, time filed, date and other data.
- preamplifier**—An amplifier used ahead of the main amplifier or at the input of a transmission line.
- pre-emphasis**—A method whereby the relative recorded level of some frequencies is increased with respect to other frequencies during recording or during f.m. transmission.
- preselector**—The section ahead of the frequency converter in a superheterodyne receiver. It may include one or more tuned or untuned r.f. stages or may simply consist of one or more tuned circuits connected between the antenna and the input of the first detector.
- pressing**—A record produced from a matrix or stamper in a record-molding machine.
- pressure microphone**—A general term for any microphone in which the electrical output is caused by variations in the pressure exerted by a sound wave. Examples are carbon, condenser, crystal and dynamic microphones.
- PRI. or P**—Primary winding of a transformer.
- 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 colors**—This refers to *light*, not *paint*. The primary *light* colors are red, green and blue. All other colors may be formed by mixing various combinations of these three.
- primary relay**—The relay which responds to the initial change in a sequence of operations.
- primary skip zone**—The area around a radio transmitter beyond the ground-wave range but within the skip distance. Radio reception is possible in the primary skip zone only by sporadic, scattered and zig-zag reflections.
- primary standard**—An exact quantity, size, frequency or interval deriving its characteristics from an absolute standard fixed by general agreement.
- 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.
- prime number**—A number which has no factor other than itself and unity. Examples: 5, 13, 17.
- prism**—A piece of transparent material with a uniform triangular cross-section.
- product**—The result obtained by multiplying together two or more numbers. Example: 48 is the product of  $12 \times 4$ .
- propagation**—Transfer of energy by wave motion.
- property**—Whatever belongs or pertains to a certain object, as a distinguishing quality or characteristic.
- proton**—The natural, elementary quantity of positive electricity. The mass of the proton is 1847 times that of the electron. A proton has the same quantity of positive electricity as an electron has of negative electricity, hence one proton balances one electron.
- protractor**—An instrument for measuring or constructing angles.
- P.S.T.**—Pacific Standard Time.
- 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.
- pull-up current**—The minimum current which will cause the armature of a relay to be pulled up against the relay core.

**pulsating current**—A current which changes in value but not in direction. It can be considered as a direct current combined with a smaller value of alternating current.

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

**push-back hook-up wire**—Tinned copper hook-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**—A switch which opens or closes a circuit by means of pressure upon a button.

**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 preadjusted 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. 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.

**pyrometer**—An instrument for measuring high temperatures.

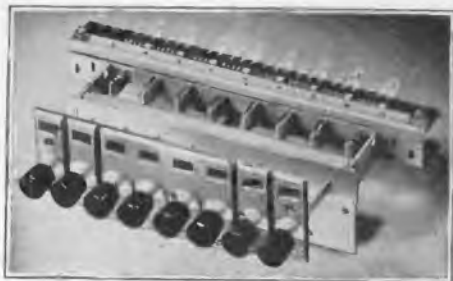
## Q

**Q**—The merit (degree of perfection) of a coil or condenser, equal to the reactance of the part divided by the a.c. resistance of the part. Since the average condenser

has an extremely high Q, this term is usually limited to coils.

**Q factor**—A rating used to express certain characteristics of coils, condensers and resonant circuits. In a circuit, it is obtained by dividing the reactance of one of the components (usually the inductance) by the a.c. resistance of the circuit.

**Q signal**—One of the three-letter abbreviations starting with Q in the International List of Abbreviations, used to represent complete sentences in radiotelegraphy. 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?" Other common Q signals used in a similar manner are: QRN, Atmospheric interference. QRR, Amateur distress call—equivalent to SOS. QRT, Stop sending, used to clear bands in emergency. QRX, Wait. QSY, Shift frequency. QSO, Conversation; a contact, a series of transmissions.



PUSH-BUTTON TUNER

**QSL card**—A card sent by a radio amateur to verify communication with another amateur.

**quadratic equation**—An equation which contains the square of the unknown quantity and no higher degree. Examples:  $P = I^2R$ ;  $9x^2 + 7x = 60$ .

**quantitative**—Capable of measurement.

**quarter-wavelength transformer**—A section of transmission line one-quarter wavelength long, used as an impedance-matching transformer.

**quartz**—A natural crystalline material widely used in radio.

**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.



**quenching signal**—A signal introduced into a regenerative detector stage to prevent oscillation on strong signals.

**quotient**—The result obtained by division. Example: In  $1400 \div 70 = 20$ , the quotient is 20. (The dividend here is 1400, and the divisor is 70.)

## R

**R**—Resistor; resistance in ohms.

**radial**—Extending from the center in the form of rays.

**radian**—An angle which, when placed with its vertex at the center of a circle, intercepts an arc equal in length to the radius of the circle. A complete circle contains  $2\pi$  radians, hence 1 radian is  $57.2959^\circ$ , and  $1^\circ$  is 0.01745 radian.

**radiate**—To emit electromagnetic waves into space.

**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 efficiency**—A transmitting antenna rating, equal to the ratio of the power radiated to the total power supplied to the antenna at a given frequency.

**radiation field**—The electro-magnetic field which breaks away from the transmitting antenna and goes out into space. Also called radio wave or electro-magnetic wave.

**radiation pattern**—A diagram showing how well an antenna system radiates or picks up radio waves in various directions.

**radiation resistance**—A transmitting antenna rating.  $R_r = P \div I^2$ , where  $R_r$  is the radiation resistance in ohms,  $P$  is the power in watts radiated by the antenna, and  $I$  is the current in amperes measured at the point where power is supplied to the antenna.

**radical sign**—The sign  $\sqrt{\quad}$ , which is placed before a number to indicate that its square root is to be extracted. Always combined with a *vinculum* to form the symbol  $\sqrt{\quad}$ . When some other root is to be extracted, the index number of that root is placed in the angle of the radical sign. Examples:  $\sqrt{49}$  means square root of 49, which is 7;  $\sqrt[3]{64}$  means cube root of 64, which is 4;  $\sqrt[4]{81}$  means fourth root of 81, which is 3.

**radicand**—The number or quantity under a radical sign. Examples: In  $\sqrt{x}$ , the radicand is  $x$ ; in  $\sqrt[3]{64}$ , the radicand is 64.

**radio**—The art of communication by means of radio waves. Radio is a branch of electronics. Travel of radio waves through

free space (radiation) is implied by the term *radio*, while *wired radio* is used to describe radio waves which are guided intentionally by conductors. 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, or other sounds.

**radioactivity**—The emission of radiant energy by an element or material, either spontaneously or under the influence of a cyclotron or other activating device.

**radio beacon**—A radio transmitting station which is fixed in location and transmits a characteristic signal which can be used by mobile (ship or aircraft) stations to determine bearings, locations or courses.

**radio bearing**—The angle between the direction of travel of a radio wave and due north.

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

**radio channel**—A band of frequencies sufficiently wide for a single radio circuit between two points. The width of a channel depends upon the type of transmission; a broadcast band channel is 10 kc. wide, and a television channel is 6 mc. wide.

**radio circuit**—A system for carrying out radio communication between two points. Also, any individual circuit in a radio system.

**radio communication**—The transmission and reception of any form of intelligence, such as writing, signs, signals, pictures, and sounds of all kinds.

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

**radio control**—The control of moving objects such as airplanes, automobiles, ships, torpedoes, etc., by means of signals transmitted over radio waves from the transmitter location to special radio receiving equipment in the object being controlled.

**radio direction finder**—A radio receiving device which can be used to determine the line of travel of radio waves.

**radio fadeout**—Partial or complete blocking of radio waves through the parts of the ionosphere affected by a sudden ionospheric disturbance.

**radio field intensity**—The effective (r.m.s.) value of the electric or magnetic field produced at a point by radio waves from a particular station. It is usually expressed as electric field intensity in microvolts per meter or millivolts per meter. Unless otherwise specified, it is assumed that the measurement is made in the direction of maximum field intensity.

**radio frequency**—A frequency at which



electromagnetic radiation of energy is useful for communication purposes. The present useful limits of radio frequencies are about 10 kilocycles to 10,000 megacycles.

**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 preselector) 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 landing beam**—A radio beam, usually curved, which serves for vertical guidance of aircraft when landing during unfavorable weather conditions.

**radio link**—The carrying of a program (sound or television) from point of pickup to main studio by means of radio (usually at u.h.f.) instead of telephone lines.

**radio marker beacon**—A radio beacon station used for marking the location of a point, a boundary or a small area, such as for aircraft blind landing systems.

**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 ultra-high frequency radio signals which can be interpreted by

ground observers 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. Also called radiosonde.

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

**radio range beacon**—A radio beacon station which transmits waves in definite directions, in such a way that departures from a given course can be observed by aircraft or ships.

**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 into sound waves.

**radiosonde**—A radio meteorograph.

**radio spectrum**—All the wavelengths or frequencies which may be used for the transmission of energy, communications or signals by radio. At the present development of the art, the useful radio spectrum is considered to extend from 10 kilocycles to 30,000 megacycles, or 3000 meters to 0.01 meter. These frequencies are classified into bands with designations and abbreviations as given in the table on this page.

**radio station**—A station equipped to engage in radio communication or radio transmission of energy. A station includes all apparatus used at a particular location for one class of service and operated under a single instrument of authorization. Radio stations are classified according to the nature of the service they furnish.

**radio station interference**—Selective interference caused by radio waves from one or more undesired stations.

**radiotelegraphy**—Radio communication by means of the International Morse Code.

**radiotelephone transmitter**—A transmitter capable of sending voice and music, as contrasted to a radio-telegraph transmitter which can send only code.

## FREQUENCY CLASSIFICATION IN THE RADIO SPECTRUM

	Frequencies		Designations	Abbreviations
	10 kc to	30 kc inclusive	Very Low	VLF
Above	30 kc to	300 kc	Low	LF
"	300 kc to	3 mc	Medium	MF
"	3 mc to	30 mc	High	HF
"	30 mc to	300 mc	Very High	VHF
"	300 mc to	3,000 mc	Ultra High	UHF
"	3000 mc to	30,000 mc	Super High	SHF

- radiotelephony**—Two-way voice communication between two or more stations by means of radio waves.
- radio transmission**—The transmission of signals through space at radio frequencies by means of electro-magnetic waves.
- radio transmitter**—A device for producing r.f. power for purposes of radio transmission.
- Radiotrician**—A graduate of National Radio Institute, thoroughly trained as a radio serviceman or radio operator.
- 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.
- radio wave propagation**—The transfer of energy by electromagnetic radiation at radio frequencies.
- radius**—The distance from the center of a circle or arc to any point on that circle or arc.
- random winding**—A winding made with no regard for the position of the turns or layers in reference to each other.
- ratio**—The value obtained by dividing one number by another. Thus the ratio of 15 to 3 is 5. The ratio of 3 to 15 is 1/5.
- ray**—The path along which electrons or light waves travel in space.
- R-C**—Resistor-condenser coupling.
- RC**—Time constant (product of resistance in megohms and capacity in mfd.)
- RCA**—Radio Corporation of America.
- RCA 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.
- real image**—An image formed by an actual concentration of light.
- receiver**—A device for receiving radio waves.
- reciprocal**—The reciprocal of a number is 1 divided by that number. Example:  
 $\frac{1}{R}$   
 — is the reciprocal of R.
- 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.
- recording**—A phonograph record. Also, the process of making records or of registering the received signal upon the record sheet of a facsimile receiver or measuring instrument.
- record player**—A motor-driven turntable and an electrical pickup used for converting the variations on a phonograph record into electrical 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.
- rectangular coordinates**—The two values which specify the position of a point with respect to two reference lines at right angles to each other. The horizontal reference line is called the X axis or the axis of abscissas, and the vertical reference line is called the Y axis or the axis of ordinates.
- rectification**—The process of changing alternating current into a current which flows in only one direction (usually a pulsating direct current).
- 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 and may provide either half-wave or full-wave rectification.
- rectilinear scanning**—The process of scanning an area in a predetermined sequence of narrow straight parallel strips.
- reference recording**—Recording of a radio program or other material, made for the purpose of checking same.
- reflected impedance**—The effective impedance which appears across the primary of a transformer when a reactive load is connected to the secondary.
- reflected resistance**—The effective resistance which appears across the primary of a transformer when a resistive load is connected across the secondary.
- reflected wave**—The wave caused by the reflection of part of an incident or oncoming wave.
- reflection loss**—The power lost in a transformer or transmission line due to a difference in the impedance of the source and load.
- reflector**—In a directional antenna system, the reflector is the rear portion which is not connected to the transmitter or receiver. The purpose of the reflector is to increase the effectiveness of the antenna in the forward direction.



*Courtesy General Electric*

RECORD PLAYER—TABLE MODEL RECEIVER COMBINATION

**reflex circuit**—A circuit through which a radio signal passes both before and after a change in its frequency.

**refracted wave**—The wave caused by the refraction (change in direction) of the part of an incident or oncoming wave which travels into a new medium.

**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 an increase in strength each time. Also called positive feedback.

**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, greatly increasing the useful amplification.

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

**regulation**—Ability to maintain constant output despite variations in load.

**relaxation oscillator**—A type of oscillator circuit in which alternate charging and discharging of a condenser through a resistance determines the number of pulses, so the frequency is determined by the time constant of the condenser and re-

sistor. Either a saw-tooth or square output wave can be obtained.

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

**relay transmitter**—A transmitter which rebroadcasts television or sound programs to increase the service area. Often called repeater stations.

**reluctance**—Magnetic equivalent of electrical resistance. Opposition offered to magnetic flux.

**reluctivity**—The reciprocal of permeability.

**remote control**—Controlling from the regular studio a program which is produced outside and relayed to the studio by wire or short-wave channels. Control of any device from a distance.

**remote pickup**—A radio program picked up from a remote location and sent to the studio by wire or ultra-shortwave facilities. Any program not originating in the studio.

**repeater**—An amplifying station used to boost the volume on long telephone lines.

**repeat point**—Double-spot tuning in a superheterodyne receiver.

**reproduction speed**—The area of copy recorded per unit time in a facsimile system.

**re-recording**—A recording made from the reproduction of a recording.

**residual magnetism**—Magnetism which remains in the core of an electromagnet after the electrical circuit has been broken.

**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-capacitance coupling**—The coupling together of two vacuum tube stages or circuits by means of a resistor and condenser.

**resistance coupling**—Another name for resistance-capacitance coupling.

**resistance loss**— $I^2R$  loss.

**resistivity**—A measure of the ability of a material to oppose the flow of electricity. 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 series resonant circuit, the *current* is a maximum at resonance. In a high Q parallel resonant circuit, the voltage across the coil or condenser is a maximum at resonance, and the external current is a minimum. 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.

**resonance curve**—A frequency response curve which shows in graphical form the manner in which a tuned r.f. amplifier (or any other apparatus containing at least one resonant circuit) handles or amplifies the various frequencies in its operating range.

**resonant circuit**—A circuit containing inductance and capacity values such as to produce resonance at an operating frequency. Also called a tuned circuit.

**resonant current step-up**—The ability of a parallel resonant circuit to circulate a current many times greater than the current fed into it.

**resonant frequency**—The frequency at which resonance occurs in a coil and condenser circuit.

**resonant line**—A transmission line whose inductance, capacity and length make it resonant at the transmitted frequency.

**resonant-line oscillator**—A self-excited ultra-high-frequency oscillator using parallel rods to form the grid and plate inductances.

**resonant resistance**—The resistance of a parallel resonant circuit at resonance.

**resonant voltage step-up**—The ability of a series resonant circuit to deliver a voltage several times as great as that fed into it.

**resonator**—A hollow chamber forming the tuned circuit of a micro-wave oscillator.

**resonator, cavity**—A hollow tube or box of such dimensions to make it resonant at certain ultra-high frequencies. An extreme form of concentric-line oscillator tuned circuit.

**response characteristic**—A curve showing the response of a radio device, circuit or system over a range of frequencies. It is usually made with response values as ordinates and frequency values as abscissas. A logarithmic frequency scale is employed.

**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.

**retentivity**—The property of retaining magnetism after the magnetizing force has been removed.

**retrace**—The path traveled by an electron

beam from the end of one line or field to the start of the next line or field.

**return wire**—The ground or common lead. The negative wire in a d.c. circuit.

**reverberation**—The continuation of sound by successive reflection.

**reverberation time**—The time in seconds required for a sound of a given frequency to decrease, after the sound source is stopped, to one millionth of its initial value.

**r.f. or R.F.**—Radio frequency.

**rheostat**—The general name for a device which has the resistance element partly exposed to enable the amount of resistance in use to be easily adjusted by the simple movement of a control knob. A rheostat enables frequent and immediate change in resistance while the circuit is electrically alive.

**rhombic antenna**—A directional antenna consisting of four long wires arranged to form a rhombus (a parallelogram with all four sides equal, like a diamond).

**ribbon microphone**—A moving-conductor microphone in which the moving conductor is a single corrugated metal ribbon mounted between the poles of permanent magnets. Often called a *velocity microphone*.

**ride gain**—To control the volume range of a program electrically in order to transmit it over lines and equipment within proper limits. The monitor engineer does this while watching the volume indicator.

**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.

**right angle**—The angle formed by two straight lines which meet at an angle of 90°.

**right-handed elliptically polarized wave**—An elliptically polarized wave in which the rotation of the direction of displacement is clockwise for an observer looking in the direction the wave is traveling.

**right-hand taper**—A volume or tone control potentiometer having more resistance in the left half of the control than the right half, when held with the shaft pointing toward you and the terminal lugs pointing downward.

**right triangle**—A triangle in which one of the angles is a right angle (90°).

**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.

**ripple filter**—A low-pass filter (which passes only frequencies *below* a critical cut-off frequency) used to reduce the ripple current of a rectifier or d.c. generator while allowing direct current to pass freely.

**ripple voltage**—The a.c. component in the output of a rectifier 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 part values and part leads by colored markings.

**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. Equal to about .7 of the peak value.

**rocking**—A term applied to the back and forth rotation of the main tuning gang as the oscillator paddler in a superheterodyne receiver is adjusted at the low frequency end of the dial.

**root**—A number which, when multiplied by itself a number of times, equals the given number. The radical sign  $\sqrt{\quad}$  is used to indicate square root, and the radical sign with an index number in its angle is used to indicate any other root. Example:  $\sqrt[5]{3125} = 5$ , which means that the fifth root of 3125 is 5.

**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.

**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 position either manually or by an electric motor drive.

**rotary converter**—A dynamo having a single armature equipped with both slip rings and a commutator, so that both a.c. and d.c. can be obtained from it simultaneously if used in conjunction with a motor or engine. If a.c. is fed into the slip rings, the dynamo will act as both a motor and a generator, and deliver a d.c. output.

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

**rotor**—The rotating part, such as the rotating armature of an electric motor or generator.

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

**$R_p$** —Plate resistance of a tube.

**r.p.m.**—Revolutions per minute.

**runble**—Low-frequency vibration mechanically transmitted to the recording or reproducing turntable and superimposed on the reproduction.

## S

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

**sal ammoniac**—Ammonium chloride. A chemical used in primary cells.

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

**saturation**—In a magnetic circuit, the condition wherein increases in magnetomotive force produces negligible additional flux.

**saw-tooth a.c. voltage**—An a.c. voltage whose wave form looks like the teeth of a saw.

**scalar quantity**—A quantity which has only magnitude.

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

**scale divisions**—Lines which divide a meter scale into many parts. A scale division is the region between one line and the next adjacent line.

**scaling circuit**—A circuit which actuates a counting device on receiving a predetermined number of pulses. If it acts on every other pulse, it is a scale-of-two circuit.

**scan**—In mechanical scanning, the scanning lines are produced by a beam of light controlled by a scanning disc or other moving mechanical part. In electrical or electronic scanning, the scanning lines are produced by a beam of electrons sweeping over the surface.

**scanner**—That part of a facsimile transmitter which systematically translates the densities of the elemental areas of the subject copy into signal-wave form.

**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.

**scanning disc**—A rotating disc having a spiral row of holes or lenses near the edge, used to break up a picture or scene into elemental areas, or to reconstruct

- televised scenes. Used in some mechanical television systems.
- stripping line**—A single continuous narrow strip which is determined by the process of scanning in television or facsimile.
- scanning spot**—The area viewed simultaneously by the pickup system of the scanner in a facsimile system.
- scattered reflections**—Reflections from a region of the ionosphere, which interfere and cause rapid fading. They are variable in respect to time of occurrence, geographical distribution, intensity and frequency range.
- 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 pickup to block those frequencies at the higher end of the audio range at which needle scratch is most prominent.
- screen**—A shield.
- 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).
- 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 positive with respect to the cathode.
- sealing compound**—Wax employed in condenser blocks and transformer housings to prevent air and moisture from reaching the parts.
- sec**—Secant.
- sec.**—Seconds.
- SEC.**—Secondary winding of a transformer.
- secant**—The secant of an acute angle of a right triangle (written  $\sec \theta$ ) is equal to the hypotenuse divided by the adjacent side. Secant is the reciprocal of cosine. See *trigonometric function*.
- 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 electrons**—Electrons emitted from a body due to the impact or bombardment of other electrons.
- secondary emission**—Emission of electrons from an electrode when it is hit or bombarded by high-speed electrons.
- secondary winding**—Any of the output windings in a transformer.
- second detector**—That stage of a superheterodyne receiver which separates the audio modulation from the intermediate frequency carrier signal.
- selective fading**—Fading which is not the same at all frequencies.
- selective interference**—Radio interference whose energy is concentrated in a narrow band of frequencies. Some examples are other radio stations on the same or adjacent frequencies, harmonics of other radio stations, and unshielded diathermy equipment.
- selectivity**—The degree to which a radio receiver is capable of reproducing signals of one station while rejecting signals from all other stations on adjacent channels.
- selenium cell**—A photoconductive cell using some form of selenium as the light-sensitive material. The resistance of the cell varies with the amount of light falling on the cell.
- 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.
- self-excited oscillator**—An oscillator which starts itself, being connected so any change in plate current will induce a voltage in a tank circuit, which changes the grid voltage so that oscillations will be developed and maintained.
- self-inductance**—The property which determines how much electromotive force will be induced in a coil or circuit by a change of current in that same coil or circuit. Self-inductance, often called simply inductance, is measured in henrys and is designated by the letter L.
- Selsyn motor**—A synchronous motor which accurately follows the phase of the voltage fed to it. Usually, a pair of these motors are connected together and used for remote control purposes. One then acts as a generator, so that any speed, position or direction of rotation of its rotor is accompanied by a similar speed, position or direction of rotation in the other.
- sense finder**—The portion of a radio direction finder which determines which of two opposite directions (180° apart) a radio wave is coming from.
- sensitive relay**—A relay requiring very small amounts of current for operation.
- sensitivity**—A measure of the ability of a

radio receiver to reproduce weak signals with satisfactory volume. The smaller the input necessary to give a stated output, the higher the sensitivity.

**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 feed**—Application of d.c. operating voltage through a circuit carrying a signal current.

**series resonant circuit**—A circuit in which a coil and condenser are connected in series with the source of voltage, or where the exciting voltage is induced into the coil, and where 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.

**serrated pulse**—In television, a vertical synchronizing pulse divided into a number of small pulses which act for only half a line.

**serrated rotor plate**—A variable condenser rotor plate having slots cut radially around its axis to divide the plate into sections which may be bent in or out to change capacity during alignment.

**service area**—The region around a broadcast station in which its signal strength is strong enough to insure satisfactory reception at all times.

**service band**—A band of frequencies allocated to a given class of radio communication service, such as the broadcast band, a specific police band, etc.

**serviceman**—A radio repairman or radio technician.

**service oscillator**—A test instrument used to generate radio frequency oscillations for alignment and test purposes.

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

**s.g.**—Signal generator.

**shaded-pole induction motor**—An induction motor utilizing field displacement caused by a small coil (may be a single shorted turn) wound around a part of one field pole for purposes of initiating rotation.

**shading ring**—A large copper ring placed around the central pole piece of a loud-speaker field magnet to act as a shorted turn and buck out hum voltages. Also called shading coil, and used on part of one pole of small a.c. motors to produce a rotating magnetic field.

**shading signal**—A signal which raises the gain of the amplifier of a television camera for those intervals of time when the

electron beam is in a dark-spot area.

**shadow tuning indicator**—A tuning meter having a small square metal vane mounted on a shaft, which in turn is connected to a meter movement. A pilot lamp is mounted behind the vane 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.

**sharp**—A term usually used to describe the selectivity of a circuit which will respond to a very limited range of frequencies or to a single frequency only.

**SHF**—Super high frequencies.

**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 line**—A transmission line having an external conducting surface (a sheath or shield) which confines the radio signals to the space within the shield (prevents radiation of radio waves by the line) or prevents pick-up of undesired signals by the line.

**shielded pair**—A two-wire transmission line surrounded by a metal sheath.

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

**shock excitation**—Production of oscillations in an oscillatory circuit by a sudden electrical discharge or pulse.

**short circuit**—An undesirable connection, occurring accidentally or because of a part breakdown, which exists 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-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.

**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.

**shot effect**—The uneven or non-uniform impact of electrons on the plate of a vacuum tube, which shows up as noise in a very sensitive audio amplifier.



**shunt**—A resistor placed across the terminals of an ammeter to allow a definite part of the circuit current to go around the meter. Also, any parallel-connected part, or the act of placing one part in parallel with another.

**shunt feed**—Same as parallel feed. The application of d.c. operating voltage through a circuit parallel to and separated from the signal circuit.

**shunt-wound**—A motor or generator wound so the armature and field are in parallel.

**shutter**—A device for cutting off light reaching a lens, as in a television camera.

**side band**—A band of frequencies on either side of the carrier frequency of a modulated radio wave.

**side frequency**—A frequency on either side of the carrier frequency, produced in amplitude modulation.

**sign**—A symbol used to indicate a particular operation in arithmetic, algebra, or mathematics in general.

Examples :

+ Addition sign (plus).

− Subtraction sign (minus).

× Multiplication sign (times).

÷ Division sign (divided by).

√ Radical sign (square root of).

∫ Integral sign (integral of).

= Equality sign (equals).

**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, which varies in some manner with time for the purpose of conveying information, a message or an effect in communication.

**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



SIGNAL GENERATOR

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 plate**—The metal plate on the back of the mica sheet supporting the mosaic

of one type of cathode ray television camera tube. A capacity exists between each globe and this plate. As each globe loses electrons, the effect is relayed electrically to the signal plate through the mica dielectric.

**signal-shifter**—Trade name of a variable-frequency r.f. exciter or oscillator intended chiefly for amateur communication transmitters.

**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.

**signal-tracing instrument**—A test instrument designed to indicate the presence of signals at any point in a radio receiver at a particular frequency.



Courtesy RCA

SIGNAL TRACING INSTRUMENT

**signal wave**—A wave which conveys a signal. It frequently consists of a carrier and side bands.

**sin**—Sine.

**sine**—The sine of an acute angle of a right triangle (written  $\sin \theta$ ) is equal to the opposite side divided by the hypotenuse. See *trigonometric function*.

**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 micro-



phone having a carbon-filled button on only one side of its diaphragm.

**single-dial control**—Tuning in a station by means of a single control which is mechanically linked to all tuning condensers in the set.

**single-ended tube**—A metal tube with all grid connections on the base (no top cap). Its type number contains the letter S after the first numerals, as 6SK7 or 12SQ7.



SLIDE RULE DIALS

**single-pole switch**—A toggle or knife switch having only one movable contact arm or blade.

**single-side-band transmission**—A method of broadcasting in which one side band is transmitted but the other side band is suppressed. The carrier wave may be either transmitted or suppressed. Used in television.

**single-throw switch**—A toggle or knife switch of the ON-OFF type, capable of closing or opening only one circuit for each blade of the switch.

**sink**—Term sometimes used by telephone engineers to designate a load or power-consuming device.

**sinusoidal**—Having a sine wave form.

**skew**—Distortion produced by a facsimile recorder due to lack of synchronism between scanner and recorder.

**skin effect**—The tendency of a high-frequency current to flow near the surface of a conductor.

**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 sky wave comes back to earth. This skip effect usually occurs only during high-frequency transmission (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**—A device consisting of sliding ruler-like scales and a movable indicator, arranged to give a convenient mechanical equivalent of a table of logarithms. It is used chiefly for performing the operations of multiplication, division, squaring, cubing, extracting square root and determining trigonometric functions.

**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.

**slip**—The difference between synchronous and actual speed in an induction motor.

**slip rings**—The collector rings of an a.c. generator.

**S meter**—A meter used in communication-type receivers to indicate the strength of the received signal in arbitrary units.

**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.



SOCKETS FOR TUBES

**soft tube**—A vacuum tube in which a small amount of gas was allowed to remain when the bulb was evacuated. Soft tubes were formerly used as detectors. They are sensitive but noisy. Also, a tube which has become gassy.

**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.

**solderless connections**—Wiring connections made by the use of small screw clamps which firmly hold the wires to be joined.

**solenoid**—An electromagnet having a movable iron core.

**sound**—A general term used to specify a sound wave (a travelling vibration in air or some other elastic medium) or a sound sensation (the effect of this sound wave on human ears). Sound is sometimes defined as a vibration of a body or material at a rate which can be heard by human ears. The extreme limits of human hearing are 20 cycles and 20,000 cycles, but animals can hear still higher frequencies. Thus, bats can hear sound waves as high as 50,000 cycles. Sound can travel through any medium which possesses the ability to vibrate; the resulting travelling vibrations are called sound waves.

**sound effects**—Various devices or record-

ings used to produce life-like sound imitations.

**sound gate**—The mechanism through which sound motion picture film passes for the purpose of converting the sound track on the film into audio signals. An exciter lamp, lens assembly and photocell are associated with the sound gate. Television film pickup devices use a sound gate to provide the sound accompaniment for the televised movie.

**sound level meter**—An instrument for measuring sound intensities electrically, having an output indicator calibrated in db or directly in units of sound intensity.

**sound panel**—Movable panels of rock wool for sound absorption, or hard surfaces for reflection.

**sound sensation**—The sensation produced in the human ear and brain by a sound wave.

**sound track**—A graphic record of sound produced on film or on sensitized paper for reproduction.

**sound wave**—A travelling wave produced by vibration of an elastic medium (air, metal, wood, etc.) at a rate which can be heard.

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

**south pole**—The pole of a magnet at which the magnetic lines of force enter the magnet.

**space charge**—The electrons accumulated in the space between the cathode and plate of a vacuum tube, usually close to the cathode. Being negative, the space charge tends to limit the number of electrons which can reach the plate, and hence limits the plate current.

**space-charge effect**—The repulsion exerted on electrons emitted from the cathode of a vacuum tube by electrons accumulated in space near the cathode, resulting in a reduction of plate current.

**space-charge grid**—A grid located next to the cathode and made positive with respect to the cathode, for the purpose of reducing the limiting effect of the space charge on plate current.

**spacing wave**—In telegraphic communication, the emission which takes place in between the code characters or when no code characters are being transmitted.

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

**spark gap**—An arrangement of electrodes across which a spark will jump at a predetermined voltage. Among the types of spark gaps formerly used in transmitters are plain gap, rotary gap, synchronous gap and quenched gap.

**spark transmitter**—A radio transmitter

which utilizes the oscillatory discharge of a condenser through a coil and a spark gap as the source of its r.f. power.

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

**speaker**—A loudspeaker. This short term is frequently used when no confusion will result therefrom, as in compound terms like speaker field, speaker cone, etc. Also may mean a lecturer performing before a microphone.

**specific gravity**—The weight of a substance as compared to the weight of an equal volume of water.

**specific inductive capacity**—Another name for dielectric constant, which is the ratio of condenser capacity with a given dielectric to the capacity of a similar condenser with air as the dielectric.

**specific resistance**—The resistance of a unit conductor having a cross-sectional area of 1 circular mil and a length of 1 foot (a circular-mil-foot). Also called resistivity, and designated by the Greek letter  $\rho$  (rho).

**spectrum**—All frequencies used for a particular purpose. Thus, the ratio spectrum extends from about 10 kc. up to over 10,000 megacycles.

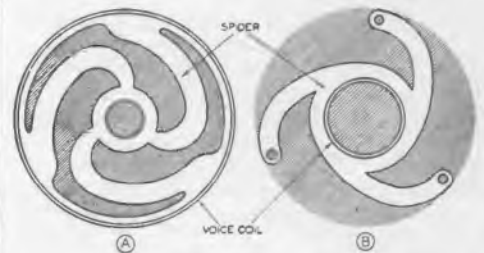
**speech amplifier**—An audio amplifier.

**spherical**—Having the form of a ball or sphere.

**spherical aberration**—A lens defect in which the light rays coming from a single point are brought to different focal points by the edges of the lens than by the center of the lens, causing a blurred image. In manufacturing high-quality lenses, it is avoided by grinding the lens slightly different from spherical form.

**spherical wave**—A wave whose wave front is a spherical surface.

**spider**—A highly flexible fiber ring which serves to center the voice coil of a dynamic loudspeaker between the pole pieces and at the same time provide a restoring



SPIDERS. AN INTERNAL SPIDER IS SHOWN AT A. WHILE AN EXTERNAL SPIDER IS SHOWN AT B. THE NAME INDICATES WHETHER THE SPIDER IS INSIDE OR OUTSIDE THE VOICE COIL

force, causing the voice coil to return to the same starting point after each movement. Also, a small metal cap used to couple the driving pin to the apex of the cone in magnetic speakers.

**spider-web antenna**—A special type of all-wave antenna.

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

**split rotor plate**—See *serrated rotor plate*.

**sponsor**—A person or business firm who pays a broadcast station and the performers for a radio program in which a certain amount of the time allotted is devoted to advertising a commercial product.

**sporadic E layer**—A portion of the normal E layer of the atmosphere which sometimes breaks away and exhibits special characteristics.

**sporadic reflections**—Sharply defined reflections of substantial intensity from an ionized layer of the ionosphere at frequencies greater than the critical frequency of the layer. They are extremely variable in respect to time of occurrence, geographic distribution, and frequency range.

**spot projection**—The optical method in which the scanning (or recording) spot is created by an aperture between the light source and the subject copy or record sheet.

**spot speed**—The product of the length of scanning line by the number of scanning lines per second in a facsimile system.

**spottiness**—The effect in a television picture resulting from variations in the instantaneous light value of the reproduced image due to electrical disturbances between the scanning and reproducing devices.

**spreader**—The insulating cross-arm used to space aerial wires when more than one wire is used.

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

**spurious radiation**—Any emission from a radio transmitter at frequencies outside of its assigned communication band.

**spurious response**—A condition wherein a receiver is resonant at one or more frequencies other than that to which it is tuned.

**sq. ft.**—Square feet.

**sq. in.**—Square inches.

**square**—The product obtained by multiplying a number by itself. Example: 49 is the square of 7, because  $7 \times 7 = 49$ .

**square-law detector**—A detector whose output current is proportional to the square of the r.f. input voltage.

**square mil**—The area of a square whose sides are .001 inch (one mil).

**square root**—A number which, when multiplied by itself, equals the given number. Examples: 2 is the square root of 4; 13 is the square root of 169. The radical sign  $\sqrt{\quad}$ , without an index number in the angle of the sign, indicates that the square root of the number is to be extracted (determined).

**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.

**stability**—Freedom from oscillation in tuned or other circuits of a receiver.

**stabilized feedback**—Another term for negative feedback, degeneration or inverse feedback, used because this type of feedback can stabilize the gain of an amplifier stage or reduce distortion or noise arising in the stage.

**stage**—A single vacuum tube circuit containing either a single vacuum tube or two or more tubes connected in push-pull, push-push, or parallel.

**stage-by-stage elimination method**—A method of servicing receivers similar to the circuit disturbance method except that the test signal is introduced by means of a test oscillator.

**standing wave**—The distribution of voltage or current along a single or multiple conductor, after the circuit has reached a steady state. An instantaneous picture of the distribution has a wave shape along the conductor, hence the name.



STAND-OFF INSULATORS

**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.

**static characteristic**—The characteristic of a tube when supplied only with d.c. operating voltages (no signal voltages).

**station**—An assembly of radio transmitting equipment and its transmitting antenna.

**stationary wave**—A wave produced by combining two or more waves having the

- same frequency, often called a *standing wave*. The standing wave in a half-wave doublet antenna, for example, is produced by combining of an original wave with its reflections from the ends of the antenna.
- stator**—The fixed set of plates in a variable condenser. The non-rotating part of an electric motor or generator.
- 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.
- 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 in the ordinary automotive storage battery, delivering a voltage slightly higher than two volts and capable of being recharged.
- storage-type camera tube**—A type of cathode ray television camera tube in which the elemental areas on the photo-sensitive plates build up their charges gradually, developing a picture signal which is proportional to the time of charging of the plates by light from the scene. The iconoscope is an example.
- straight line characteristic**—Any action which can be represented by a straight line on a graph. When this condition exists, one quantity varies in direct proportion to another.
- strain**—The change of shape, size, or form caused by applied force.
- strand**—One of the small wires in a group of wires twisted or braided together.
- stranded wire**—A number of small wires twisted or braided together and used as a single conductor.
- stray capacity**—Capacity which exists between parts, between wires and between a chassis and various parts and wires.
- stress**—The force which causes a displacement or distortion in the shape of a substance.
- striking potential**—The grid potential of a gas-filled triode at which plate current begins flowing.
- stroboscope**—An instrument used to permit visual inspection of moving objects by illuminating them at the same definite points in their rotation or recurring movement.
- strobotron**—A special glow lamp which has the ability to produce accurately timed flashes of light which permit visual inspection of high-speed moving parts. Used in a stroboscope.
- studio**—A room in which radio programs originate.
- stylus**—A specially shaped needle used to cut grooves and record sound waves in wax or prepared record blanks.
- stylus drag**—The effect of the friction between the record surface and the reproducing stylus.
- stylus force**—Effective weight of reproducer or force in vertical direction on stylus when same is in operating position.
- subcarrier**—An intermediate wave modulated by the facsimile signals and in turn used to modulate the main carrier, either alone or in conjunction with subcarriers on other channels.
- subharmonic**—A frequency which is a fraction of the fundamental frequency. Thus, the second subharmonic is  $\frac{1}{2}$  the fundamental frequency; the third subharmonic is  $\frac{1}{3}$ , etc.
- subject copy**—The material in graphic form which is to be transmitted by a facsimile transmitter for facsimile reproduction by the recorder.
- subscript**—A small number or letter written at the right of and below another letter, for distinguishing purposes. Example: In  $X_L$  and  $X_C$ , the subscripts L and C serve to distinguish inductive reactance ( $X_L$ ) from capacitive reactance ( $X_C$ ); in  $R = R_1 + R_2 + R_3 + R_n$ , numeral subscripts serve to distinguish different resistor values.  $X_L$  is pronounced "X sub L";  $R_3$  is pronounced "R sub three" or "R three."
- subtraction**—The process of finding the numerical difference between two quantities or numbers.
- SUP**—Suppressor grid of a tube.
- super**—Superheterodyne.
- 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, and mixer-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.
- super high frequency**—A frequency in the band between 3000 mc. and 30,000 mc.
- superimposed**—Added on to.
- super-regenerative detector**—A form of regenerative detector in which the feedback

- is periodically reduced by a quenching frequency to prevent oscillation and still maintain high sensitivity. This quenching frequency may be generated by a separate tube or by the same tube. Used principally in ultra-high frequency circuits.
- super-sensitive relay**—A relay which operates on a current value less than about 250 microamperes ( $\frac{1}{4}$  ma.).
- supersonic frequency**—A frequency just above the audible range.
- supersonic vibrations**—Vibrations which cannot be heard by the unaided human ear because they are *above* the audible frequency range.
- supply**—Another name for voltage source.
- 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. Also, a resistor or choke coil used in a radio circuit to suppress oscillations.
- suppressor grid**—A grid placed between the screen grid and the plate of a vacuum tube and maintained at or near cathode potential, in order to force secondary electrons back to the plate.
- surface defects**—Defects which are readily visible on top the radio chassis or in the connections to a radio, such as: tube top cap off; disconnected antenna lead-in, a dead tube, etc.
- surface leakage**—A leakage of current over the surface of insulation.
- surface noise**—The noise reproduced in playing a record due to rough particles in the record material and/or irregularities in the walls of the groove left by the cutting stylus.
- surge impedance**—The impedance in ohms as measured between the terminals of a transmission line at the operating frequency. Also called characteristic impedance, and designated by the notation  $Z_0$ .
- surges**—Sudden increases of current in a power line or circuit.
- susceptance**—The reciprocal of reactance.
- SW**—Short-wave. Switch.
- sweep circuit**—A special oscillator circuit which generates a voltage having a saw-tooth wave form suitable for making the electron beam of a cathode ray tube sweep back and forth across the fluorescent screen.
- swinging choke**—A special iron-core choke operated with an almost saturated core, in order to make the inductance vary or swing as the average current changes. It is sometimes used as the input choke of a rectifier filter system so as to improve regulation.
- switch**—A mechanical device for opening and closing an electrical circuit, or for changing the connections between parts or circuits.
- SWL**—Short-wave listener.
- symbol**—A simple design used to represent a radio part on a schematic diagram. Also, a letter used in formulas to represent a particular quantity.
- symmetrical**—Balanced. Equal to each side of a normal or center line.
- synchronization**—The process of keeping the image-reconstructing part of a television or facsimile receiver in step with the corresponding device at the transmitter.
- synchronized**—In step with.
- synchronizing**—In facsimile, the maintenance of predetermined speed relations between the scanner and the recorder within each scanning line.
- synchronizing separator**—The circuit which separates the control impulses from the video signals.
- synchronizing signals**—Electrical impulses used to keep the television receiving system in step with the transmitting system, so that the picture or scene will be reconstructed properly.
- synchronous**—Simultaneous in action and in time (in phase).
- synchronous condenser**—A synchronous motor which is over-excited so that it produces a leading current, used to correct power factor where inductive loads are across the power line.
- 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

- table model receiver**—A radio receiver having a cabinet of suitable shape and size to permit placing on a table.
- talk-listen switch**—A switch used in intercommunication systems to enable the operator to use the receiving loudspeaker as a microphone. It connects the loudspeaker to the input of the amplifier and connects the line to the output of the amplifier when in the "talk" position.
- tan**—Tangent.
- tangent**—The tangent of an acute angle of a right triangle (written  $\tan \theta$ ) is equal to the opposite side divided by the adjacent side. See *trigonometric function*.

**tank circuit**—A resonant circuit used in an oscillator to store energy.

**T antenna**—A flat-top antenna, the lead-in of which is taken from about the center of the horizontal portion.

**tap**—A connection made somewhere along an inductance or resistance, other than the ends.

**taper**—Distribution of resistance over the range of rotation of a volume or tone control.

**tapped control**—Volume or tone control potentiometer having a fixed tap somewhere along the resistance winding for the purpose of providing fixed bias or automatic bass compensation.

**tapped resistor**—A fixed resistor of the wire-wound type, with extra terminals along the winding to provide various voltage values needed in voltage divider applications.

**tap switch**—A multipoint switch.

**target**—the electrode which collects electrons in a Farnsworth television dissector tube.

**televic projector**—A device used to televise motion picture film.

**telegraph-modulated wave**—A continuous wave which is varied in amplitude or frequency by means of telegraphic keying.

**telephony**—A method of reproducing sounds, especially those of the voice, at a distance.

**telephotography**—Radio or wire transmission of still pictures or photographs.

**telephoto lens**—A lens used to photograph or televise distant objects.

**Teletrician**—A graduate of National Radio Institute, thoroughly trained in television theory and service.

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

**television channel width**—The range of frequencies necessary to broadcast a television signal.

**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 connection terminals.

**temperature coefficient**—The change in characteristics of a substance for each degree Centigrade change in temperature.

**temperature coefficient of resistance**—The amount which each ohm of resistance is increased for each degree rise in temperature. For all pure metals, over ordinary temperatures, the increase in resistance is

directly proportional to temperature. The formula for determining the resistance at any given temperature is:  $R_t = R_0(1 + \alpha t)$ , where  $R_t$  = total resistance at a temperature of  $t$  degrees Centigrade,  $R_0$  = total resistance at  $0^\circ\text{C}$ . and  $\alpha$  = temperature coefficient of resistance at  $0^\circ\text{C}$ . This value is 0.00427 for copper.

**temperature-compensating condenser**—A condenser used to compensate for reactance changes in oscillator circuits due to changes in temperature, being designed to change in capacity in the opposite manner so the reactance change will be cancelled.

**temperature saturation**—Also known as filament saturation. The condition whereby no more electrons will be emitted from the cathode even though the cathode temperature is further increased.

**tension**—Potential difference or voltage.

**term**—A portion of an algebraic expression which is separated from other parts by a plus or minus sign. Example: In the expression  $17a^2 - 3a + 2b^2$ , the terms are  $17a^2$ ,  $3a$  and  $2b^2$ . Like terms have the same literal parts (the same letter combinations). Thus, the expression  $17a^2x + 6.7a^2x - 2a^2x$  contains all like terms, and they can be combined by direct addition and subtraction to give  $21.7a^2x$ . Unlike terms contain different letter combinations, and cannot be combined directly by addition and subtraction. Example:  $17ab + 8I^2 + 3x$ .

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

**thermal agitation**—The effect produced by the random movement of free electrons in a conductor, due to heat. They produce tiny pulses of electron current which, if taking place in a resonant circuit such as a tuning coil and condenser, will be amplified along with the signal currents.

**thermionic**—Relating to electron emission under the influence of heat. Practically all modern vacuum tubes are thermionic tubes.

**thermionic emission**—emission of electrons from an electrode under the influence of heat.

**thermionic tube**—A vacuum tube in which the cathode is heated for electron-emitting purposes.

**thermocouple**—A pair of dissimilar conductors so joined as to produce a voltage when the junction is heated.

**thermocouple ammeter**—An ammeter dependent for its indications on the voltage produced in a thermocouple when heated by the current to be measured.

**thermometer**—An instrument for measuring temperature.

**thermostat**—A device used to open or close circuits with changes in temperature.

**thoriated filament**—A vacuum tube filament made by compounding thorium and tungsten.

**three-band receiver**—A radio receiver having three different tuning ranges.

**threshold**—Just at the verge of being observed by our senses or by an indicator of some sort.

**threshold of audibility**—The loudness level at which sound is just barely heard.

**threshold of feeling**—The loudness level at which sound is felt rather than heard. Often causes painful sensations.

**throat of horn**—The smaller end of the horn of a horn loudspeaker.

**throw-out spiral**—A blank spiral groove cut in an eccentric manner at the end of a recording; provided to actuate the mechanism of an automatic record changer.

**thyatron**—A grid-controlled mercury vapor tube.

**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.

**tie-down point**—A frequency at which a receiver is aligned. Usually 600 kc. and 1400 kc. for the standard broadcast band. Alignment may also be checked at 1000 kc., thereby making three tie-down points.

**tier array**—An array (arrangement) of antennas one above the other, used chiefly in ultra-high-frequency work.

**tight-coupling**—The closest possible coupling between two circuits under given conditions.

**tilting**—A vertical sweep (up or down movement) of a television camera.

**time constant**—In a *capacitive-resistive circuit*, the number of seconds required for the capacity to receive 63% of its full charge after the e.m.f. is applied. With steady applied voltage the time constant is equal to the product of the circuit's capacity in farads and its resistance in ohms. In an *inductive-resistive circuit*, the number of seconds required for the current to reach 63% of its final value after the e.m.f. is applied. With steadily

applied voltage the time constant is equal to the circuit's inductance in henrys divided by its resistance in ohms.

**time delay relay**—A relay whose contacts open or close a specified length of time after the controlling impulse has been applied.

**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. 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 rebroadcast by some broadcasting networks at certain hours.

**tip jack**—A small receptacle into which a metal tip can be plugged to complete a circuit.

**tip plug**—A small plug which fits into a tip jack.

**toggle switch**—A small switch operated by means of a lever.

TOGGLE SWITCH



**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; the quality of the program. Also used to describe a single frequency audio sound.

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

**tone-modulated wave**—An interrupted continuous wave, which is a continuous wave modulated at an audio frequency.

**tone modulation**—Modulation of a carrier with fixed audio frequency tone.

**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.

**torque**—The force which produces rotation. T. P. T. G.—Tuned-plate-tuned 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.

**transceiver**—A radio circuit used both for transmitting and receiving, by employ-



- ment of suitable switching arrangements.
- transconductance**—Same as mutual conductance. The amplification factor divided by the a.c. plate resistance. The a.c. plate current divided by the a.c. grid voltage with no load in the plate circuit. It is measured in mhos.
- transcribe**—To broadcast a program by means of electrical transcription.
- transcription**—An electrical transcription, in which part or all of a radio program is recorded for future use.
- transducer**—A device which transfers energy from one system to another. The energy may be any form—electrical, mechanical, acoustical, etc.—and it may or may not be changed from one form to another by the transducer. Examples: A loudspeaker is a transducer which changes electrical energy into acoustical energy. A phonograph pick-up is a transducer which changes mechanical energy into electrical energy.
- transfer relay**—A relay controlled by and controlling other relays.
- 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 corresponding a.c. voltage.
- transients**—Erratic changes in voltage or current. A momentary voltage or current surge.
- transient time**—The time necessary for an electrical circuit to reach a steady-state condition.
- transition frequency**—The frequency at which the changeover from constant-amplitude recording to constant-velocity recording takes place.
- transitron oscillator**—An oscillator in which the inner tube grid is used as an anode, the outer grid as a control element and the plate merely as a collector anode. The outer grid has a negative transconductance to the anode grid. Used to produce stable sine wave oscillations at both high and low frequencies.
- translation loss**—The loss in high-frequency reproduction which occurs as the groove velocity decreases in a recording.
- transmission line**—Any set of conductors used to carry r.f. or a.f. signals or energy from one location to another.
- transmission loss**—The loss of power suffered by a transmitted wave in passing along a transmission path or through a circuit or other device. Usually measured in decibels.
- transmission unit**—A decibel.
- 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.
- transparent**—Permitting the passage of light rays.
- transpose**—To interchange position.
- transverse wave**—A wave in which the displacement is transverse (crosswise) to the direction of propagation.
- treble**—A term sometimes used to designate high audio frequencies.
- t.r.f.**—Tuned radio frequency.
- triangulation**—A method of fixing the position of an aircraft or surface vessel by taking bearings with a radiocompass on at least two (and sometimes more) shore or fixed land stations.
- trickle charger**—A device, usually a rectifier operating from an a.c. power line, which is designed to charge a battery continuously at a low rate.
- trigger-action**—Any circuit in which a weak controlling impulse initiates the main current flow.
- trigonometric function**—Any of the ratios which exist between the sides and angles of a right triangle.
- trigonometry**—A branch of mathematics which deals with the relations existing among the angles and sides of triangles.
- 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.
- triode-pentode**—A vacuum tube having a triode and a pentode in the same envelope.
- tri-tet oscillator**—An oscillator circuit popular with amateur radio operators because it has strong harmonics which make it ideal for multiband operation. Also has the feature of buffering or isolating the crystal circuit and the output, since the screen grid acts as the oscillator anode.
- troposphere**—That part of the earth's atmosphere extending outward from the earth for about six miles, in which temperature generally decreases with altitude, clouds form, and convection is active.
- tropospheric wave**—A radio wave that is reflected by some location in the troposphere.
- T.U.**—Transmission unit (replaced by db).
- tube**—A vacuum tube, gaseous tube or photoelectric cell mounted in a somewhat tube-shaped glass or metal envelope.
- tube heating time**—The time required for



the coolest portion of a mercury-vapor tube to reach normal operating temperature.

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

**tube voltage drop**—In a gas or vapor-filled tube, this is the plate-cathode voltage during the conducting period.

**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 antenna**—An antenna which is made to resonate at the desired operating frequency.

**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 filter**—A parallel resonant circuit used to attenuate signals at the resonant frequency.



TUNING METERS. THE ONE AT THE RIGHT IS A SHADOW METER.

**tuned-grid, tuned-plate oscillator**—A vacuum tube oscillator having a parallel resonant circuit in series with the plate circuit and another parallel resonant circuit in series with the grid circuit. The grid resonant circuit is tuned to the operating frequency and the plate resonant circuit is tuned slightly above the operating frequency, so as to act like an inductance. Oscillation is maintained by capacity feedback through the internal capacity of the tube.

**tuned radio frequency amplifier**—An r.f. voltage amplifier circuit using tuned circuits in the coupling system.

**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.

**tuned radio frequency transformer**—A transformer having one or both windings tuned; used for coupling two r.f. amplifier stages.

**tungar rectifier tube**—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 circuit**—Usually a circuit containing inductance and capacity, either of which may be adjusted so the circuit will be responsive to a particular frequency.

**tuning control**—The receiver control by which the operator varies the tuned circuits of the receiver to bring in the desired sound or television program.

**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.

**tuning wand**—A flexible rubber or fiber rod having a brass plug in one end and a powdered iron core at the other end, used for checking receiver alignment.

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

**turns-per-volt**—The number of turns needed on the secondary winding of a transformer to give 1 volt of output voltage when the primary voltage is normal.

**turns ratio**—The ratio of the number of turns in a secondary winding of a transformer to the number of turns in the primary winding.

**turnstile antenna**—A series of crossed horizontal doublet antennas arranged vertically on a mast and fed 90° out of phase. Used in television and other u.h.f. systems where circular radiation patterns are desired.

**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.

**tweeter**—A loudspeaker designed to handle only the high audio frequencies (about 6000 to 15,000 cycles).

**twin-triode**—Two triode type tubes in a single envelope.

**twisted pair**—Two small insulated conductors twisted together, without a common covering.

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

## U

**u.h.f. or UHF**—Ultra-high frequency.

**ultra-audion oscillator**—A variation of the Colpitts oscillator circuit.

**ultra-high frequency**—A term commonly used to indicate a frequency higher than about 30 megacycles. Now limited by a definition of the F.C.C. to the band of frequencies between 300 mc. and 3000 mc. See *radio spectrum*.

**uncharged**—Without electrical charge. Having a normal number of electrons.

**undamped wave**—A continuous wave.

**underlap**—The amount by which the effective height of the scanning spot falls short of the nominal width of the scanning line in a facsimile system.

**unidirectional**—Flowing in one direction only, as direct current.

**unidirectional loop**—A loop which will pick up energy from one direction only.

**unilateral bearing**—A bearing obtained with a radio direction finder having a unidirectional response.

**unit**—A reference quantity for measuring purposes. Common radio units are the volt, ampere, ohm, watt, henry, farad, etc.

**unity coupling**—The condition wherein all the magnetic flux of the primary passes through the entire secondary.

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

## V

**v or V**—Volts. Voltage. Voltmeter. Vacuum tube.

**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 first been removed. Also called an electron tube or radio tube. Conduction of electricity between two or more of the electrodes may take place through the intervening space inside the tube.

**vacuum tube keying**—A keying system in which a vacuum tube is placed in series with the center-tap lead of the final stage, its grid being connected to filament through the transmitting key. When the key is open, the tube blocks and no plate current (cathode current of final stage) flows. Grounding the grid (closing the key) unblocks the tube, current flows, and a pulse is sent out.

**vacuum tube transmitter**—A radio transmitter in which vacuum tubes are utilized to convert the applied electric power into radio frequency power.

**vacuum tube voltmeter**—A test instrument which utilizes a vacuum tube circuit for measuring voltages without greatly 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 mu tube**—A screen grid tube having a grid so designed that the mutual conductance varies with the C bias. When used as an amplifier, the amplification varies with the C bias.

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

**variocoupler**—A variable r.f. transformer consisting of two independent windings, one stationary and the other adjustable with relation to the fixed element so as to change the mutual inductance.

**variometer**—A variable inductance having a movable coil mounted inside a stationary one. The two coils are connected in series. The total inductance of the unit can be varied continuously through a wide range of values by rotating the inner coil 360°.

**Varley loop**—A variation of the Wheatstone resistance bridge, used to determine distance from the bridge to the point at which a line may be grounded. Used mostly in telephone and telegraph work.

**vector**—A straight line whose length is proportional to the magnitude or amount of a quantity, and whose arrow head points in the direction of that quantity.

**vector diagram**—An arrangement of vectors showing the relations between alternating quantities.

**vector quantity**—A quantity which has both magnitude and direction.

**vee antenna**—A long single-wire antenna arranged in the form of a "V", used by itself or as an element of a directional array.

**velocity microphone**—A microphone made up of a thin, light-weight corrugated ribbon mounted between the poles of powerful permanent magnets. Sound waves move this conducting ribbon back and forth in the magnetic field, with the result that an a.f. voltage is induced in the ribbon. The ribbon responds to the velocity of the air particles rather than to air pressure.

**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.

**vertical deflecting electrodes**—The electrodes of a cathode ray tube to which voltage is applied to move the electron beam up and down (from top to bottom) on the screen.

**vertical hold**—The control in a television receiver which adjusts the free-running period of the vertical sweep oscillator.

**vertically polarized wave**—A linearly polarized wave whose direction of polarization is vertical.

**vertical polarization**—A method of transmitting radio waves in which the plane of polarization is perpendicular to the surface of the earth.

**vertical recording**—A recording in which the groove modulation is up and down. Also called *hill and dale recording*.

**vertical sweep**—The downward movement, line-by-line, from the top to the bottom of a picture or scene being televised.

**very high frequency**—Any frequency between 30 mc. and 300 mc.

**V.I.**—Volume indicator.

**vibrate**—To move back and forth.

**Vibrating reed frequency meter**—A series of metal reeds whose natural periods of vibration are adjusted to different values. When the meter is placed in contact with a vibrating object or an a.c. current is passed through a series of coils close to the reeds, the reed which is tuned to the frequency of the vibration or current vibrates violently. The reed ends are usually painted so that looking at the ends will show which one is vibrating.

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

**video frequency amplifier**—The amplifier stages which build up video signal strength after the video demodulator stage.

**video signal**—The picture signal by itself in a television system.

**viewing screen**—In a cathode ray oscilloscope, the screen which converts the useful energy of the electron beam into a visible pattern.

**vinculum**—A straight horizontal line serving as a sign of grouping, used chiefly with radical signs and fractions. Examples:

$$\sqrt{R^2 + X^2}, \quad \frac{ab}{a + b}$$

When used with fractions, the vinculum indicates that the entire group above the line is to be divided by the entire group below the line.



VIBRATORS

**virtual cathode**—The space charge or electron cloud in front of the cathode in a vacuum tube.

**virtual height**—The height of an ionized layer of the ionosphere at which reflection from a definite boundary surface would cause the same time of travel as the actual reflection for a wave transmitted from the ground to the ionosphere and reflected back.

**virtual image**—An image which appears to be where it isn't, such as behind a mirror.

**voicer**—A device consisting of vacuum tube circuits and highly selective electrical filters controllable through a keyboard in

- such a way that speech sounds can be artificially produced. The name is an abbreviation of Voice Operation Demonstrator.
- voice coil**—The moving coil which is attached to the diaphragm of a dynamic loudspeaker. The coil which has audio voltages applied to it.
- volt**—The practical unit of voltage or electromotive force. One volt will send a current of one ampere through a resistance of one ohm.
- 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 amplifier**—An amplifier designed primarily to build up voltage without supplying any appreciable amount of power.
- 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 terminals. 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 doubler**—A rectifier circuit which doubles the output voltage by charging a condenser on one-half cycle and discharging it in series with the applied voltage during the next half-cycle.
- voltage drop**—The voltage developed across the terminals of a radio part by the flow of current through the part.
- voltage feed**—A method of exciting a transmitting antenna by applying voltage at a voltage loop or antinode.
- voltage node**—Any point which has zero voltage in a stationary wave system. Thus a voltage node exists at the center of a half-wave doublet antenna.
- 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.
- voltage regulating transformer**—A type of power transformer used to deliver a constant output voltage value in spite of considerable variation in input voltage.
- voltage regulation**—The ability of a generator or other voltage source to maintain nearly constant terminal voltage for all load values from zero to the maximum rated capacity.
- 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 rise**—A generated or source voltage.
- voltage saturation**—The plate voltage at which all electrons emitted from the cathode are being collected by the plate so that further increases in plate voltage have no effect on plate current.
- voltage cell**—Any cell which produces voltage.
- volt-ampere**—The unit of apparent power in an a.c. circuit containing reactance. It is equal to the voltage in volts multiplied by the current in amperes, without regard for phase. True power is always less than apparent power.
- voltmeter**—A meter used to measure electrical pressure or voltage in volts.
- volt-ohm-milliammeter**—See *multimeter*.
- volume**—The intensity or loudness of the sound produced by a radio loudspeaker.
- volume compression**—Limitation of volume range so over-modulation will not take place.
- 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-adjusted audio circuit which can be set to increase the volume range of a radio program or phonograph record by making the loud portions of the program louder, thereby counteracting volume compression at the transmitter. Volume expanders are also made as self-contained, self-powered units which can be inserted between a phono pick-up and the input terminals of an audio amplifier.
- volume indicator**—A meter which indicates the volume level of sound, enabling the monitor engineer to determine whether the level is too high or too low.
- volume unit**—A unit used to specify the number of db above a reference level of 1 milliwatt (.001 watt). When a level is given in volume units (vu), there is no need to specify the reference level since it is implied in the definition of vu. A vu is equal to a db when changes in power are involved.
- volume-unit indicator**—An instrument calibrated to read a.f. power level in vu when connected across a 600-ohm line.
- VT**—Vacuum tube.
- v.t.v.n.**—Vacuum tube voltmeter.
- vu**—Volume unit.

## W

- w or W**—Power in watts.
- 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.

**walkie-talkie**—A small pack transmitter-receiver which can be carried by one man, used for portable communication work.

**water-cooled tube**—A transmitting tube whose plate element is cooled by circulating water.

**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.

**watt-hour**—Unit of electrical energy. One watt expended for 1 hour equals 1 watt-hour.

**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**—A vibration in an elastic medium, such as sound waves in air or radio waves in space.



TOP VIEW



BOTTOM VIEW

WAFER SOCKET

**wave angle**—The angle at which a radio wave leaves a transmitting antenna or arrives at a receiving antenna. The two angles needed to specify the direction of a radio wave are the *azimuth angle* (corresponding to a direction above the surface of the earth) and the *deviation angle* with respect to the surface of the earth.

**wave antenna**—An antenna approximately one wavelength long at the operating frequency. It has definite directional characteristics.

**wave band**—A band of frequencies, such as that assigned to a particular type of communication service. Waves between two



Courtesy General Electric

WATER-COOLED TUBES. THESE ARE TELEVISION TYPES.

arbitrarily chosen wave-lengths, including waves of all lengths between the lowest and highest chosen.

**wave band switch**—A switch used in a transmitter or receiver to change from one wave band to another.

**wave duct**—A tubular conductor capable of concentrating the propagation of radio waves within its boundaries.

**wave form**—The shape of a wave as shown pictorially or graphically, usually with reference to changes in voltage or current.

**wave front**—A surface composed, at any instant, of all points just reached by a travelling radio wave.

**wave guide**—A tubular conductor through which ultra-high-frequency electromagnetic waves will pass without the use of a return conductor. More generally, any system of material boundaries which is capable of guiding radio waves.

**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.

**wavemeter**—A device arranged and calibrated to measure or indicate the length of a radiated wave directly in meters. (Also known as frequency meter.)

**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.

**weak coupling**—Loose coupling.

**wet electrolytic condenser**—An electrolytic condenser which uses a liquid electrolyte.

**wheatstone bridge**—An instrument invented by Sir Charles Wheatstone, English physicist, and used for accurate resistance, inductance or capacity measurements. It is called a bridge because the balance between the known and unknown values is indicated by the absence of current in a wire which forms a bridge or path between opposite junctions of the circuit.

**wide-angle lens**—A lens having a short focal length, so as to give a wide field of view.

**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 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 a radio carrier signal travelling through wires instead of through space.

**wire gauge**—A system of numbers used to designate wire sizes (diameters). The American Wire Gauge or A.W.G. (formerly Brown and Sharpe or B. & S. Gauge) is in common use in this country, and has numbers ranging from 0000 as the largest size to 40 and beyond for the smallest sizes.

**wireless**—Radio.

**wireless record player**—A motor-driven turntable and phono pickup mounted in the same cabinet with an r.f. oscillator. The phono pickup 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.

**wirephoto**—A process of transmitting facsimiles of pictures over telephone wires by converting into and reconvertng from electrical signals.

**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.

**wobbulator**—A device used with a signal generator to vary the frequency between two values periodically.

**woof**—A word-sound used by engineers to check "peaks."

**woofer**—A loudspeaker designed particularly for the reproduction of low audio frequencies at fairly high power levels.

**work**—The product of the force acting on a body and the distance through which the body is moved. Thus, lifting a 5-lb. loudspeaker a distance of 3 feet is equivalent to 15 ft.-lb. of work.

**working voltage**—The highest voltage which can be applied continuously to a condenser without causing a break-down of the dielectric.

**wow**—A flutter of low frequency, perceptible to the ear as a change in pitch during reproduction of a recording.

## X

**X**—A letter used in formulas to designate reactance or to designate an unknown quantity.

**X axis**—A reference axis in a quartz crystal. Also the horizontal axis of a graph.

**X<sub>c</sub>**—Capacitive reactance in ohms.

**x-cut**—A piezoelectric crystal or quartz plate cut in such a manner that the X axis is perpendicular to its faces. Sometimes called a Curie cut.

**X<sub>L</sub>**—Inductive reactance in ohms.

**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<sub>tal</sub>**—Abbreviation for *quartz crystal*.

## Y

**y**—Symbol used for the admittance in mhos.

**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. Also, the vertical axis of a graph.

**Y circuit**—A network of three resistors or impedances arranged in the form of a Y or star.

**y-cut**—A piezoelectric crystal cut in such

a manner that the y-axis is perpendicular to its faces. Also sometimes called a face-parallel cut or 30° cut.

**yoke**—A coil placed around the neck of a tube which produces magnetic deflection of the electron beam in an iconoscope or kinescope when energized by currents of the proper voltage, phase and wave form.

## Z

**Z**—A letter used in formulas to designate impedance in ohms.

**Z axis**—The optical axis of a crystal. Perpendicular to the x and y axis.

**Zeppelin antenna**—An antenna which is one-half wavelength long or a multiple thereof, fed at one end by one lead of a transmission line, at a voltage loop. The total length of the two leads of the transmission line is a half wavelength long or a multiple thereof.

**zero-beat**—A condition where two frequencies are exactly the same.

**zero bias**—Zero voltage between the control grid and cathode of a vacuum tube, so that these two electrodes are at the same potential.

**zero level**—The reference level used when specifying a level in decibels. Zero level is 6 milliwatts in most radio work.

**zone of silence**—An area in which radio signals cannot be received or sent.

## COMMONLY USED GREEK LETTERS

$\epsilon$ —Greek letter epsilon, used to represent 2.718, the base of the natural system of logarithms.

$\theta$ —Greek letter theta, frequently used to represent phase angle.

$\lambda$ —Greek letter lambda, used to designate wavelengths in meters.

$\mu$ —Greek letter mu, meaning micro, which is "one millionth of."

$\mu\text{a}$ —Microamperes.

$\mu\text{f}$ —Microfarads.

$\mu\mu\text{f}$ —Micromicrofarads.

$\mu\text{h}$ —Microhenrys.

$\mu\text{v}$ —Microvolts.

$\mu\text{v}/\text{m}$ —Microvolts per meter.

$\mu\text{w}$ —Microwatts.

$\pi$ —Greek letter pi, used to designate 3.1416, which is the ratio of the circumference of a circle to its diameter.

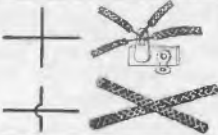
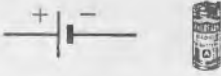
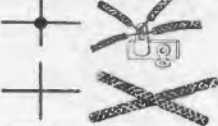
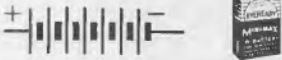









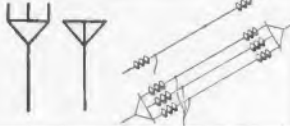




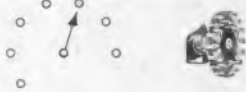
$\rho$ —Greek letter rho, used to indicate specific resistance.

$\omega$ —Greek letter omega, used to designate  $2\pi\text{f}$ , which is 6.28 times the frequency in cycles.










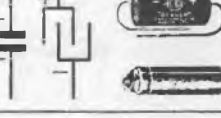
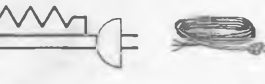





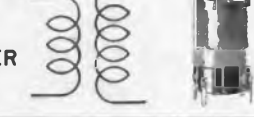
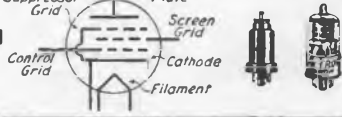
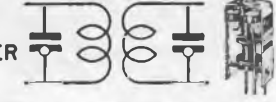
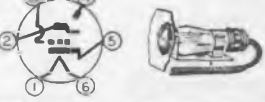
$\omega$ —Greek letter omega, used to designate ohms.



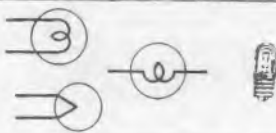



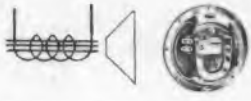

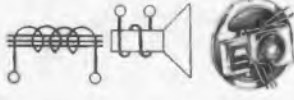
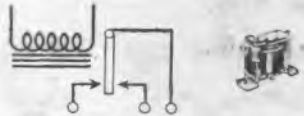
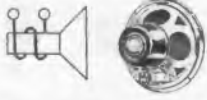

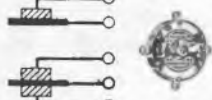

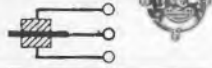
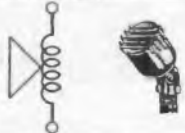
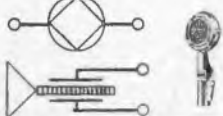

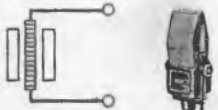

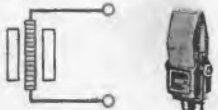
$\Omega$ —Greek letter omega (capital letter), used to designate ohms or sometimes megohms.

# COMMON RADIO SYMBOLS

<p><b>CONNECTION</b> (When No-Connection Cross Overs are indicated by Loops)</p> 	<p><b>DRY CELL</b></p> 
<p><b>CONNECTION</b> (When Connections are indicated by Dots)</p> 	<p><b>BATTERY</b></p> 
<p><b>TWISTED WIRES</b></p> 	<p><b>STORAGE BATTERY</b></p> 
<p><b>LINE CORD PLUG</b></p>  <p><b>WALL OUTLET</b></p> 	<p><b>GRID BIAS CELL</b></p> 
<p><b>TERMINALS, BINDING POSTS OR FAHNESTOCK CLIPS</b></p> 	<p><b>SINGLE-POLE, SINGLE-THROW SWITCH</b></p> 
<p><b>FUSE</b></p> 	<p><b>SINGLE-POLE, DOUBLE-THROW SWITCH</b></p> 
<p><b>AERIAL OR ANTENNA</b></p> 	<p><b>DOUBLE-POLE, SINGLE-THROW SWITCH</b></p> 
<p><b>GROUND</b></p> 	<p><b>DOUBLE-POLE, DOUBLE-THROW SWITCH</b></p> 
<p><b>LOOP AERIAL</b></p> 	<p><b>ROTARY SELECTOR SWITCH</b></p> 



<p><b>FIXED RESISTOR</b></p> 	<p><b>IRON-CORE A.F. CHOKE COIL</b></p> 
<p><b>VARIABLE RESISTOR or RHEOSTAT</b></p> 	<p><b>A. F. TRANSFORMER</b></p> 
<p><b>VOLTAGE DIVIDER</b></p> 	<p><b>POWER TRANSFORMER</b></p> 
<p><b>ADJUSTABLE VOLTAGE DIVIDER</b></p> 	<p><b>FIXED CONDENSER</b></p> 
<p><b>POTENTIOMETER</b></p> 	<p><b>ELECTROLYTIC CONDENSER</b></p> 
<p><b>LINE CORD RESISTOR</b></p> 	<p><b>TRIMMER CONDENSER</b></p> 
<p><b>PLUG-IN RESISTOR</b></p> 	<p><b>VARIABLE CONDENSER</b></p> 
<p><b>R. F. CHOKE COIL</b></p> 	<p><b>GANG TUNING CONDENSER</b></p> 
<p><b>R. F. TRANSFORMER</b></p> 	<p><b>VACUUM TUBE</b></p> 
<p><b>I. F. TRANSFORMER</b></p> 	<p><b>CATHODE RAY TUNING INDICATOR</b></p> 

<p>PHOTOCELL</p> 	<p>MAGNETIC PHONO PICK-UP</p> 
<p>PILOT LAMP</p> 	<p>CRYSTAL PHONO PICK-UP</p> 
<p>HEADPHONES</p> 	<p>QUARTZ CRYSTAL</p> 
<p>MAGNETIC LOUDSPEAKER</p> 	<p>VIBRATOR</p> 
<p>ELECTRO-DYNAMIC LOUD-SPEAKER</p> 	<p>RELAY</p> 
<p>P. M. DYNAMIC LOUDSPEAKER</p> 	<p>JACK</p> 
<p>SINGLE-BUTTON CARBON MICROPHONE</p> 	<p>TELEGRAPH SENDING KEY</p> 
<p>DOUBLE-BUTTON CARBON MICROPHONE</p> 	<p>DYNAMIC MICROPHONE</p> 
<p>CRYSTAL MICROPHONE</p> 	<p>CRYSTAL DETECTOR</p> 
<p>VELOCITY or RIBBON MICROPHONE</p> 	<p>METER</p> 
<p>VELOCITY or RIBBON MICROPHONE</p> 	<p>COPPER-OXIDE RECTIFIER (Arrows Indicate Direction Of Electron Flow)</p> 