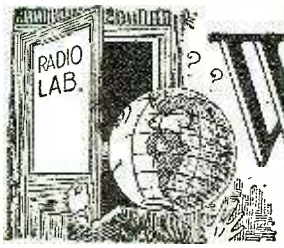


What's New in Radio

Names and addresses of manufacturers of devices described in this department may be obtained by writing to the "I Want to Know" department of RADIO NEWS.

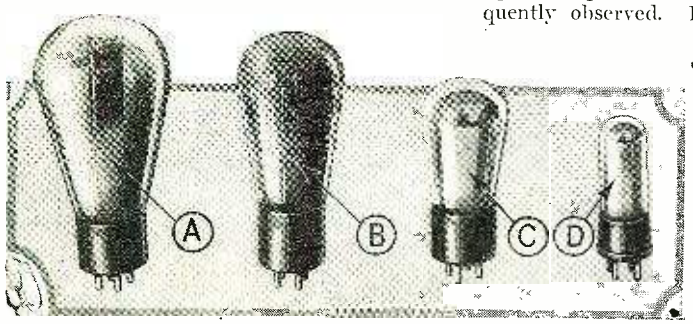
Power Tube Designed for Larger Output

A NEW power-amplifier tube, which has a far greater output than any tube previously designed for reception purposes, has recently been developed. The tube is known to the radio trade as the 250 type and it has a maximum output of 4,650 milliwatts; that is to say, the 250-type tube is capable of delivering more energy than two 210-type tubes connected in a push-pull circuit, or it can produce 6.6 times as much undistorted output as a single 171 type and three times as much as the 210 type. The tube has been designed primarily for use in conjunction with auditorium loud speakers where enormous volume is required; and it may be used for the operation of a plurality of loud speakers in hospitals and exposition work where a number of reproducers are supplied with energy from a common amplifier. Also, it is ideal for use in a roomy home; as the tube may be operated with low potentials at only a fraction of its maximum output. In this way it is possible to insure ample reserve power, thus guaranteeing distortionless output at all times.

The chart below shows the electrical characteristics of the 250-type tube for various values of plate voltage:

	Recommended				Max.
Plate voltage	250	300	350	400	450
Grid voltage	45	54	63	70	84
Plate current (MA)	28	35	45	55	55
Plate resistance	2100	2000	1900	1800	1800
Mutual conductance	1800	1900	2000	2100	2100
Amplification factor	3.8	3.8	3.8	3.8	3.8
Output (Milliwatts)	900	1500	2350	3250	4650
Filament voltage ..	7.5	7.5	7.5	7.5	7.5
Filament current ..	1.25	1.25	1.25	1.25	1.25

In size the new tube is considerably larger than the 210 type (6½ inches in height and 2 11/16 inches in diameter), but it is mounted on a standard UX-type base.



This illustration shows the comparative sizes of the new 250-type power-amplifier tube and other standard receiving tubes; A, 250-type; B, 210-type; C, 201A-type; and D, 199-type. The new tube has an undistorted output of over 4½ watts, or approximately three times that of the 210-type tube.

The filament is of the rugged oxide-coated ribbon type, which operates at a dull red heat. The current for heating this is usually obtained from a 7½-volt winding of a power transformer; and the design of the transformer should be such that, with normal line variations, the voltage applied to the filament is maintained within 5% of the rated value. The plate of the tube is blackened, and is tall and narrow, as in the 281-type rectifier.

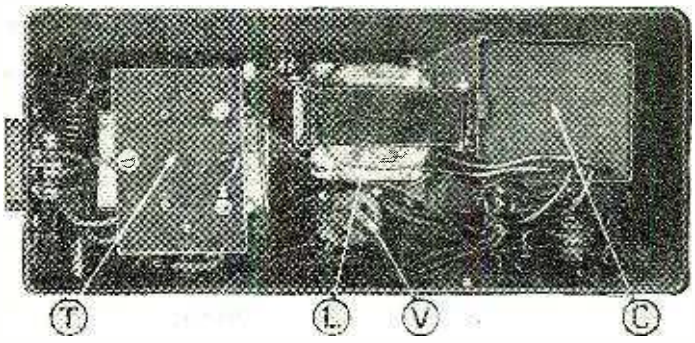
In operation the new tube should preferably be mounted in a vertical position, and provision should be made for sufficient air circulation (natural) to prevent overheating. Because of the high plate voltages used *the power supply should always be turned off when the tube is inserted or removed from the socket, or when adjustments are made to the circuits.*

By using low plate voltages the life of the tube may be greatly increased; and this is always recommended where the volume requirements are such that the maximum outut of the tube is not essential. A plate potential of 350 volts permits greater output than is usable in most installations. In cases where maximum plate voltage is used, the receiver design should be such that, even during the maximum expected line-voltage variations, the plate voltage will not exceed 450.

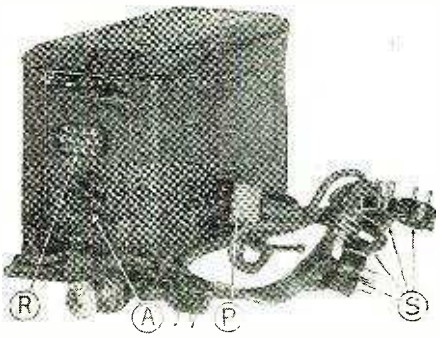
When deciding upon the plate voltage to be used it should always be remembered that the use of a high potential does not in itself appreciably increase the volume, but only allows greater volume without distortion. Also, it should be remembered that, when operating the tube at maximum voltages, the plate of the tube should be frequently observed. Plate temperatures exceeding a dull red heat indicate an excess of plate current, which may be caused by an overload of plate voltage or insufficient grid-bias voltage. Always, when operating this tube, it is essential to make sure that the grid-bias potential is of the correct value for the plate voltage used. It is also necessary to make sure that a coupling device (output transformer) is connected between the plate circuit of the tube and the loud speaker.

Power Converter Simplifies Receivers

A COMPACT and ingenious device recently placed on the market, makes it a very simple task to convert a battery-operated set into an electric set using the new A.C. tubes. The change may be accomplished *without changing a single wire in the old set,* and little technical knowledge is required. The device manufactured for this purpose is known as an "A-B-C" converter, and may be used in connection with any ordinary five-, six- or seven-tube receiver.



The parts shown in this internal view of the "A-B-C" converter are: T, step-down transformer; L, filter chokes; C, filter condensers; V, rectifier socket. It may be connected to a receiver without any wiring changes.



External appearance of the new "A-B-C" power converter, with wiring harness.

Pictures on this page show the appearance of the new converter. It is housed in a metal case only 5 x 7 x 11 inches, and is comparatively light in weight; yet this unit provides all filament, plate and grid potentials required by the receiver. In construction it is somewhat similar to the standard "B" power unit using a full-wave rectifier. Of course, three extra windings have been incorporated in the power transformer, to heat the filaments of the tubes in the set; and resistors have been added.

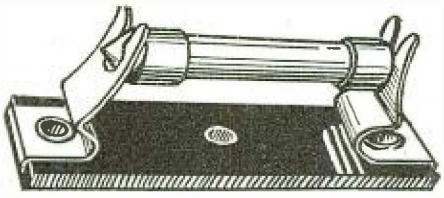
In the picture it will be noticed that, alongside the power unit, there is a wiring harness to which are attached a number of small plugs (S) which fit into vacuum-tube sockets. It may also be seen that at one end of the harness is provided a large plug (P) which fits into a socket (R) in the power unit.

To convert a receiver from D.C. to A.C., the old D.C. tubes are removed from the

sockets and the plugs (S) on the wiring harness are fitted into the sockets instead. One of the plugs is of special design and must be inserted in the detector socket, and another can be used only in the last audio stage; while the other plugs may be distributed as desired among the remaining sockets. Next, a 227-type tube is inserted into the plug placed in the detector socket; a 171-type tube is placed in the plug in the last audio-stage socket; and 226-type tubes are inserted in the remaining plugs. The "B" circuit may now be completed by connecting the binding posts of the set with the free wires of the harness which are similarly marked. As grid-bias is automatically provided, all "C-battery posts of the set must be short-circuited. The plug (P) at the other end of the wiring harness may then be inserted in the socket (R) on the power unit, and the conversion is completed.

Before operating the set, a new switch must be provided, as the old filament switch no longer has any effect on the circuit. A cord and plug is provided with the power unit and any 110-volt switch may be connected to this cord. To connect the switch into the circuit, it is necessary only to insert the plug into the socket (A) provided on the power unit. Also, it may be found that the change renders the volume control of the receiver useless; and, if this is the case, a new one must be provided. For this purpose a variable high-resistance unit may be connected across the aerial and ground binding posts of the receiver.

To place a receiver in operation after the changes described above have been completed, it is necessary only to connect the power unit with the light socket and snap the switch. The receiver will operate as before, and no other adjustments are necessary.



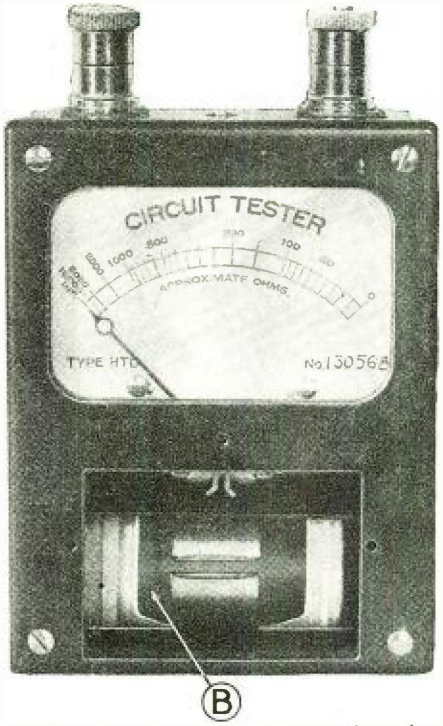
This new grid-suppressor resistor fits in any standard grid-leak clip.

"Grid Suppressors" are Now Made in Handy Tubes

IN the design of modern tuned-radio-frequency receivers, the "grid suppressor" has been quite generally employed, by set constructors and radio manufacturers, to prevent oscillations in the R.F. stages. In well-designed sets, this method has produced entirely satisfactory results, and such receivers are very stable in operation over the entire broadcast waveband. However, faulty application of this system has been the cause of a considerable amount of grief in some instances. Usually, poor results are caused by the *inductance and capacity* of the resistors used; and, when such a condition exists, it is most difficult to determine the reason for the unstable operation of the receiver.

A "grid-suppressor" unit, to accomplish its purpose, should be as nearly as possible free from inherent inductance and capacity. If a measurable amount of inductance is present, it is almost certain to affect the circuit, as well as to nullify the advantages sought in the use of the grid suppressor. It is the sole purpose of such a component to provide a "pure-resistance" load in the grid circuit; and the apparatus which accomplishes this, without introducing appreciable inductance or capacity, best answers the requirements of the set builder. The ohmic value of resistors suitable as grid suppressors varies with different types of sets; however, in most cases, the resistance of the units must be between 250 and 3,000 ohms.

A resistor of a new type is illustrated on this page; it is similar in appearance to a standard grid leak and fits into a standard grid-leak mount. It is short, hermetically-sealed, and of metallized-filament construction and, consequently, free from troublesome inductive or capacitive effects. It is available in a large number of values between 250 and 3,000 ohms.



This meter automatically measures the resistance of an electric circuit in ohms without the necessity of an external battery. B is a small flashlight cell.

Simple Instrument Measures Resistance of Circuits

SERVICE men will find a new meter, recently placed on the market, a great aid to them when trying to locate trouble in radio receivers. The meter is known as a "circuit tester," and indicates the approximate ohmic resistance of the circuit in which it is connected, without the use of an external battery. Although the readings of this meter are not to be compared with laboratory precision measurements, they are sufficiently accurate to be of great service to the radio repair man.

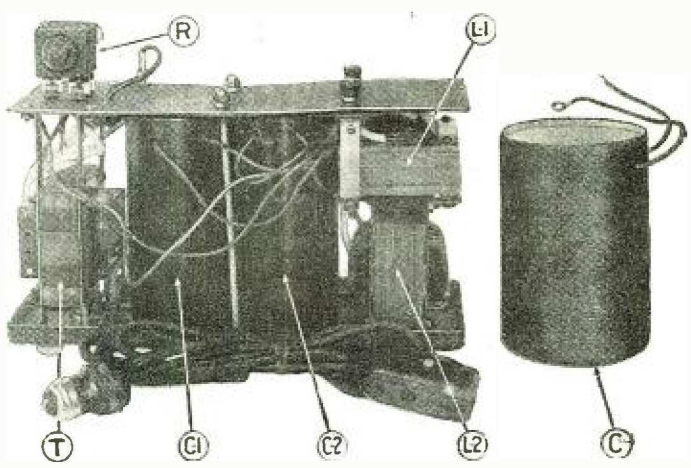
When computing the resistance of a circuit by the usual methods, three instruments are required: viz., a voltmeter, an ammeter and a battery. The voltmeter is inserted *in shunt* with the instrument or circuit to be measured, and the ammeter is inserted *in series;* while the battery is so connected that a current passes through the circuit. To determine the resistance, the current and voltage readings must be made simultaneously on the voltmeter and ammeter, and these measurements must be substituted in the "Ohm's Law" formula; *i.e.*, resistance is equal to voltage divided by current. To make a measurement in this way, considerable apparatus is needed; and it takes time and trouble to connect up the apparatus, make the measurement and solve the formula.

In the meter described here, a small 1½-volt flashlight battery is located inside the case, directly behind the name-plate; its location is clearly shown in the illustration, which pictures the meter with the name-plate removed. The meter and battery are connected in series, and the free terminal of each is connected to one of the binding posts. Therefore, when the two binding posts of the meter are connected to two ends of a resistance, there is formed a series circuit consisting of the meter, the battery and the resistance. As the voltage of the battery is known, it is possible to graduate the scale of the meter in ohms, and in this way save the service man the trouble of making computations. In the case of the meter under discussion, it is possible to make approximate measurements of circuits whose resistance is not less than one ohm and not more than 100,000 ohms.

It is not difficult to find hundreds of useful ways in which such a meter may be used when testing radio receivers. For example, one can detect open circuits, short-circuits, defective apparatus, etc. It is also possible to determine which is the primary winding of an audio transformer, and many other facts of a similar nature.

"Dry-Electrolytic" Condensers Used in "A" Power Units

THE design of a suitable filter system has been one of the most difficult problems for radio engineers to solve, in connection with the construction of "A" power-supply devices. In low-voltage devices of this type which operate from a 60-cycle source of alternating current, the capacity



"A" power units of compact construction are made possible by use of the new "dry-electrolytic" condensers, which house an enormous capacity in a very small space.

quired in the filter circuit is in the order several thousand microfarads; and for is reason the use of paper condensers is it of the question. The cost of a paper ndenser having a capacity of 5,000 mf., r example, would probably be several ousand dollars; and, in addition, the filter ould weigh several ndred pounds and ould require many bic feet of space.

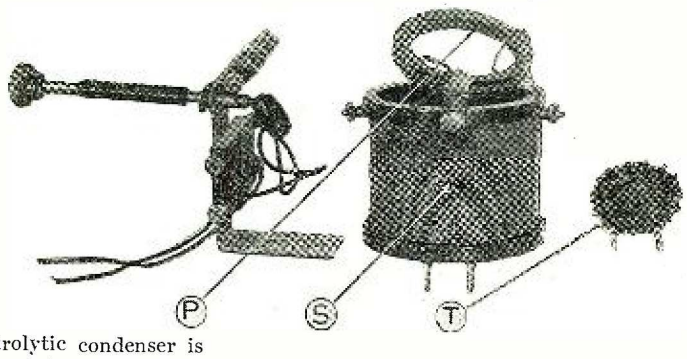
In their search for suitable solution of is problem, engi- ers have developed e electrolytic con- nser; and devices this type are now ving excellent satis- ction in thousands commercial "A"- wer units. The electrolytic condenser is mpact, inexpensive, and has ample ca- city for the purpose; and was at once ught the ultimate solution to the prob- n. However, notwithstanding this inven- n, engineers have continued their search. an ideal condenser.

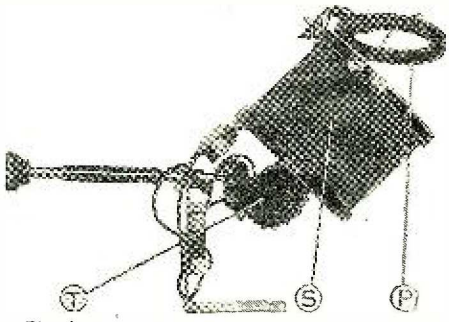
The "dry-electrolytic" condenser is a new velopment which is exciting interest oughout the entire industry. It is a emical" unit, capable of providing enor- us condenser capacity in a very small ace; yet it does not use any liquids nor uire any attention after it has been in- lled.

The picture on page 1225 shows an "A" wer-supply unit of very compact design ich uses two of the new dry-electrolytic ndensers; and, at the right of the power t, one of the new condensers is shown. e condenser is hermetically sealed in an l can, 2¾ by 4 inches, by 6 inches high; ide the can are two strips of aluminum l, each of which is 4 inches wide, 68 inches g, and .009-inch in thickness. The two ces of foil are separated by strips of per which have been impregnated with a mical which causes an electrolytic action. e two strips of aluminum separated by paper are coiled up and make a total of ½ turns.

The picture gives a clear idea of how mpact an "A" power device may be con- ucted by using these condensers; the unit strated fits into a metal case 4½ x 8½ 1½ inches. In the picture, T indicates power transformers; L1 and L2 are the ke coils; C1 and C2 the electrolytic con- sers; and R is a full-wave dry-electro- ic rectifier of a new type.

The electrolytic condenser illustrated has effective capacity stated to be approxi- tely 1,250 mf., when properly connected the circuit. However, because of the uliar features of this type of condenser, s difficult to make accurate measurements capacity with the usual laboratory meth- . In this connection, it should be ex- plained that condensers of the electrolytic type can be used only in direct-current circuits; because these condensers, when connected in one direction, act as a short-circuit across the line but, when connected in the opposite direction, they offer a very high resistance and there is no appreciable leakage of current on low voltages. In operation, these condensers may be used on only low voltages; but, should one accidentally break down from an overload in voltage, it will heal itself when connected to a low-voltage source.





Plug-in secondary (S) and tickler (T) coils are a salient feature of the new three-coil coupler pictured above. (P) is the primary.

Plug-In Coils Used in New Coupler Unit

THERE are a great many listeners who wish to have the opportunity of receiving broadcasting, and the opportunity as well to receive signals which are transmitted on other wavelengths. For example, the wavelength range to which the average American broadcast receiver responds is approximately 200 to 550 meters; but there are many excellent programs which may be heard on wavelengths below 200 meters, and most high-power European broadcasts are carried on on wavelengths above 550 meters.

Of course, there have been in the past systems for increasing the wavelength range of radio receivers; but the methods used do not measure up when compared with present-day standards of efficiency. Before the days of broadcasting "honeycomb" coils were used for this purpose, and a different set of coils was utilized for each wave band. However, these coils are not very satisfactory on waves below 600 meters and for this reason have not been popular in broadcast receivers. Other methods required the use of large shunt condensers or loading coils; but these also were intended primarily for use on long waves.

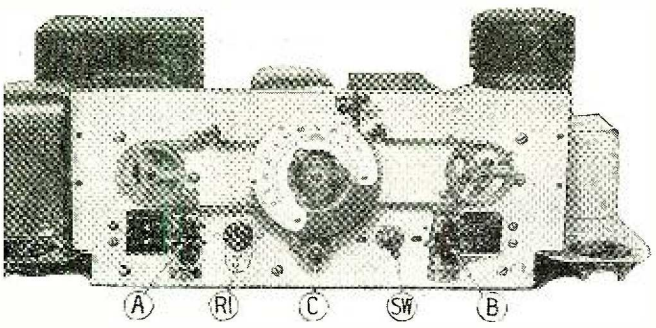
Accompanying this article is an illustration of a new type of regenerative tuner which has been designed especially for use in receivers intended to cover several wavebands. In appearance the coupler is identical to the standard design used generally in this country for broadcast reception. However, it is so constructed that the secondary and tickler coils may be removed and others substituted for shorter or higher wavelengths. Electrically the unit has the same efficiency as standard types of similar design, but its use makes possible the more convenient construction of a receiver with a universal wavelength range. It is of Austrian manufacture.

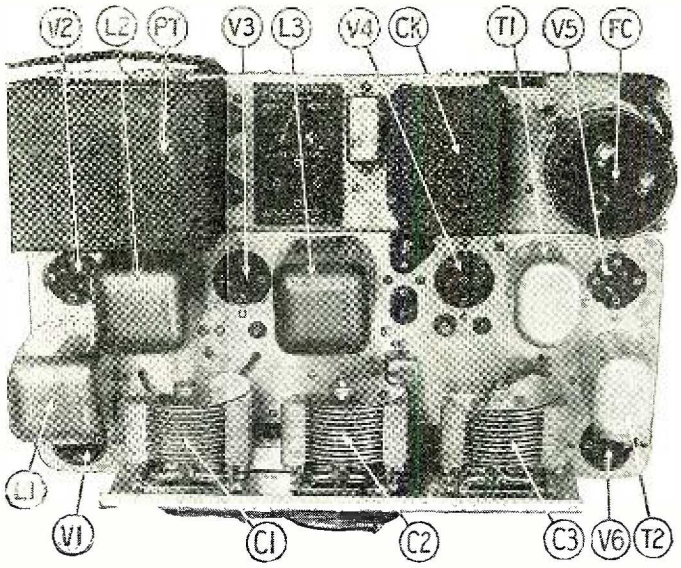
New A. C. Set is Example of Modern Design

THE receiver illustrated on this page is an interesting example of an inexpensive, but completely modern, all-electric radio set; it features single-control tuning, chassis construction, complete shielding, a metal cabinet, power amplification and a built-in power-supply unit.

The pictures which accompany this article clearly illustrate the construction of the receiver; it is assembled on two metal chasses, firmly attached together. On the front chassis, the parts used in the receiving circuit are mounted and, on the rear one, all power apparatus is located. Practically all wiring is located beneath the assembly and, in this way, the appearance of the receiver is greatly improved. Also, the receiver unit includes a structural panel

Two views of a modern all-electric six-tube receiver. Right—Top view of chassis, with shielding removed. Apparatus at the rear of the chassis is in the power-supply circuit. Below—Front of chassis, showing condenser coupling gear for single control.





for mounting the various tuning units. This is necessary because the front panel of the receiver is part of the metal cabinet and cannot be removed with the chassis.

The assembled set is shown, in the front view on page 1292, with receiver and power unit completely enclosed in the metal cabinet. The knob C, in the center of the panel, turns the illuminated vernier dial which controls the three tuning condensers of the set. This is the only wavelength control in the receiver. The switch turning the set on and off is controlled by the knob marked "Sw," and the volume-control knob is located at R1. The levers A and B adjust small compensating condensers which are used only for making critical adjustments when receiving distant stations.

Another picture on page 1226 shows the appearance of the receiver chassis when viewed from the front, and especially the small metal panel on which the tuning instruments are mounted. Three pulleys have been attached to the shafts of the three variable condensers, and coupled together for single-control operation by belts of copper ribbon. (In the case of the center condenser the pulley is concealed by the scale of the dial.) Holes have been drilled in the front panel of the cabinet to pass the shafts of the various instruments. These are independent of the front panel, but it is necessary to remove their knobs to take the chassis from the cabinet, or replace it.

In the top view of the chassis, the shielding around the variable condensers has been removed to show the construction. In this picture, L1, L2 and L3 are the three R.F. transformers; C1, C2 and C3 the three tuning condensers; T1 and T2 the A.F. transformers. V1 to V6 are the sockets for the tubes in the receiving circuits; PT is the power transformer; CK the filter choke coils; and FC is the electrolytic filter-condenser bank.

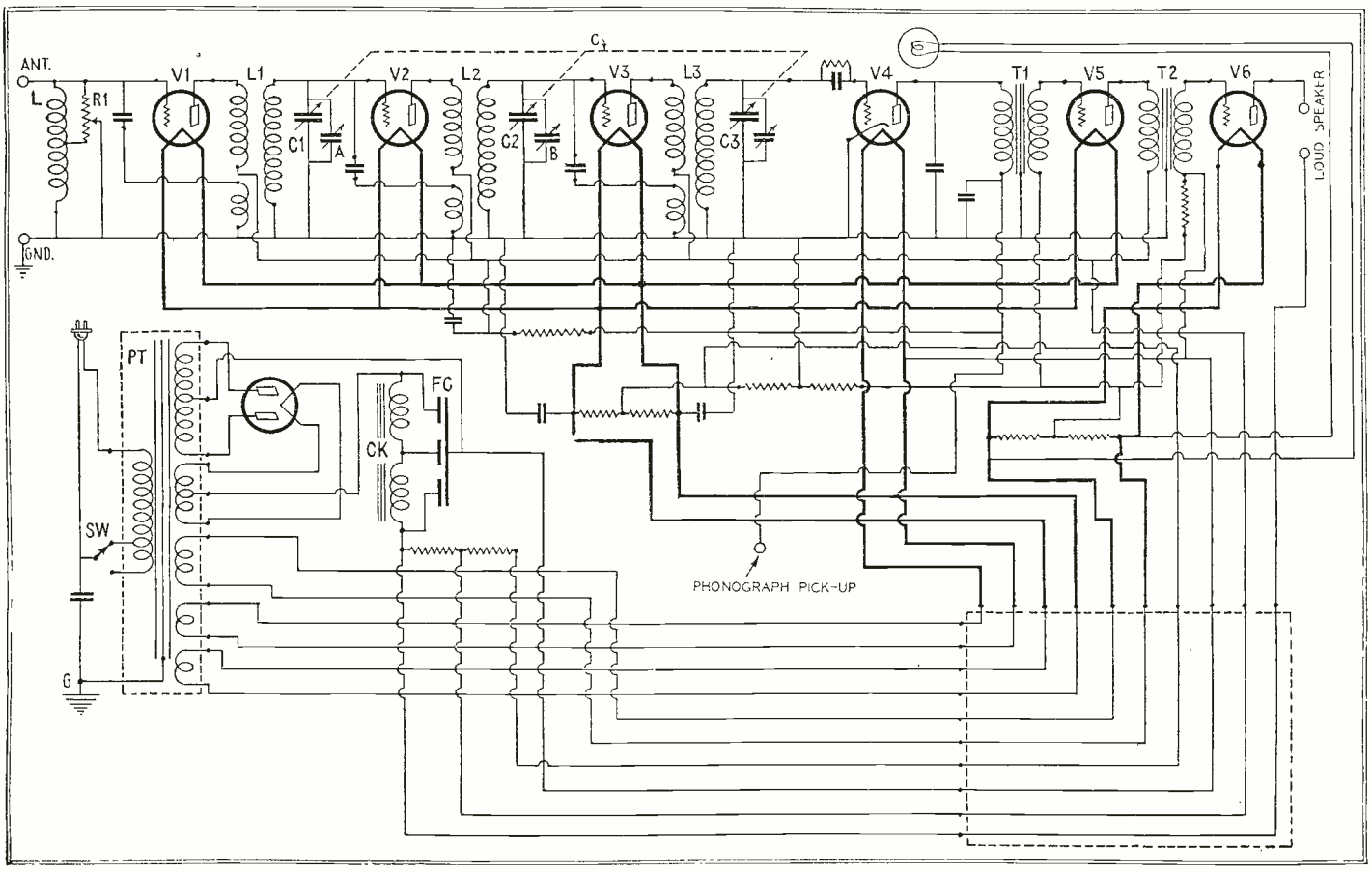
THE CIRCUITS

The wiring diagram on this page shows the complete electrical circuit of the set, including the power-supply unit. It will be seen that the receiver includes one untuned stage of R.F., followed by two tuned stages, a non-regenerative detector and two stages of transformer-coupled A.F. amplification. The plate current is supplied by a power transformer and rectified, in this model, by a full-wave tube of the filament type. The filament current for the receiving tubes and the rectifier is supplied by four low-voltage windings in the power transformer. The R.F. stages of the receiver and the first A.F. stage use four A.C. tubes of the 226 type; the detector circuit a 227-type A.C. tube; the last audio stage a 171-type power tube; while the rectifier is a 213- or 280-type tube.

It is interesting to note that the grid of the first tube is directly coupled to the antenna, across an untuned choke coil, and that the receiver's volume is regulated by a variable resistor connected in shunt across a section of this coil. This system is used to keep the tuning operation as simple as possible. If the antenna circuit were tuned, it would necessitate the use of an additional tuning control to obtain maximum efficiency. The second and third R.F. stages are tuned, and in these oscillation is prevented by use of the standard neutrodyne circuit. The circuit of the detector and audio stages is standard transformer coupling.

All voltages required for the operation of the tubes in this receiver are supplied by the power unit, and the set is turned on and off by a single-pole switch connected in series with the 110-volt A.C. supply wires, which run directly to the primary winding of the power transformer. This transformer has five windings; one for high-voltage (plate-power) supply, and four for the different filament voltages. After the plate current has undergone full-wave rectification, it is delivered to the filter, which consists of a double choke coil (CK) and an electrolytic condenser bank with a total

(*Continued on page* 1292)



Complete schematic wiring diagram of the six-tube, all-electric receiver and built-in power equipment described on this page.