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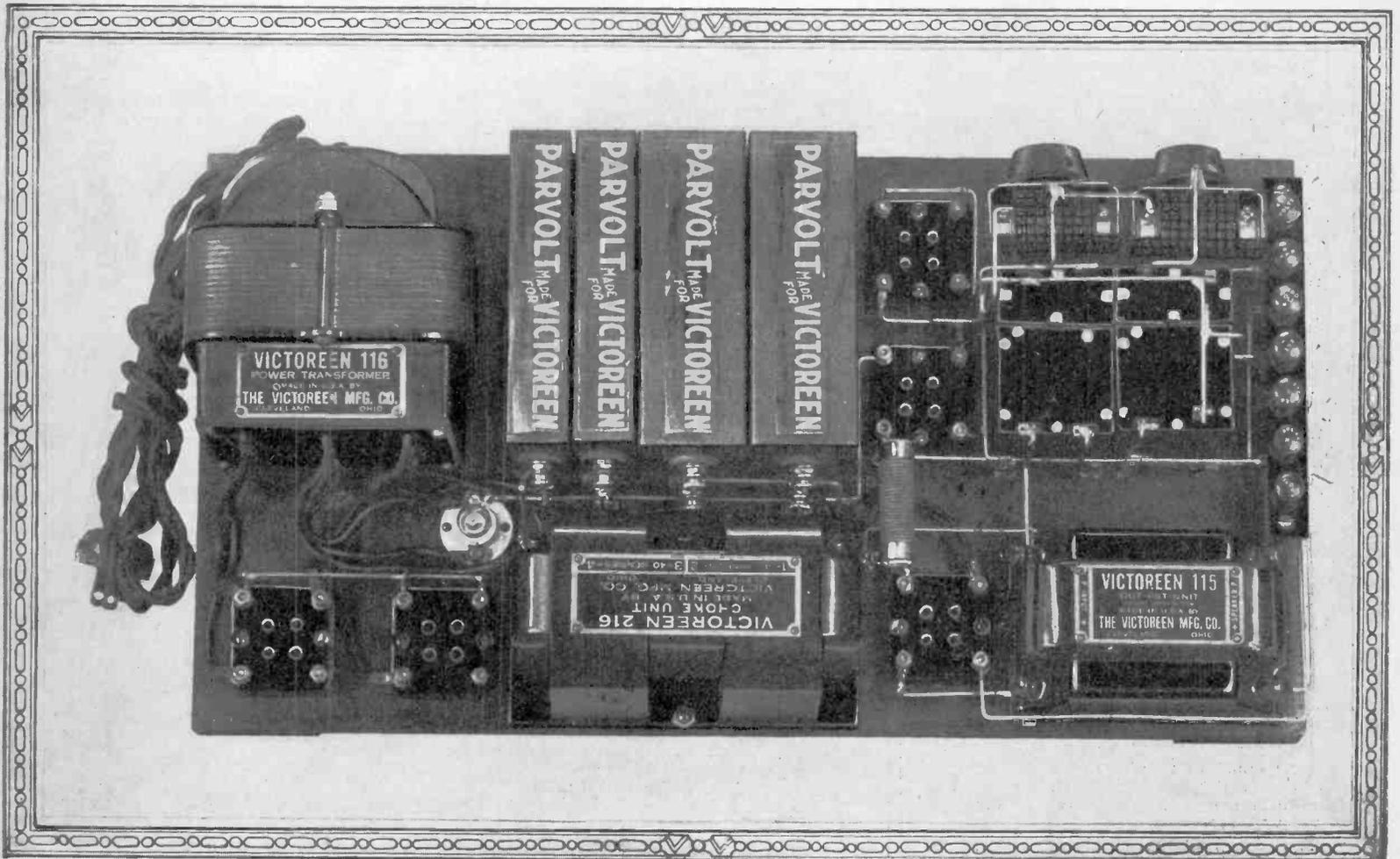
WORLD

The First and Only National Radio Weekly

341st Consecutive Issue—Seventh Year

**TELEVISED DRAMA:
HOW IT IS WORKED**

NEW VICTOREEN 250 POWER SUPPLY!



Top View of the New Victoreen 250 Power Supply and Audio Stage.
See Article on Pages 4 and 5.

**NEW
HBH
SPEAKER**

**RIDICULOUS
STATEMENTS ENGINEERS MAKE
ABOUT CIRCUIT FUNCTIONS!**

**Anderson's
Resistance
Amplifier**

Outstanding
in radio
Supremacy
for 1929

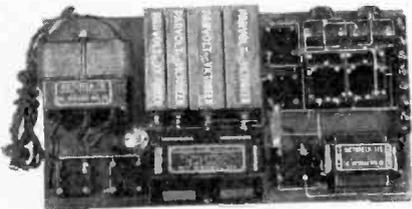
THE NEW
VICTOREEN
AC AND DC RECEIVERS

Realizing all the present developments in radio, and anticipating many still to come, this remarkable circuit offers now:

- A redesigned R. F. Transformer.
- A Special Oscillator, eliminating objectionable repeat points.
- A Smooth Volume Control.
- An Improved Method of Detection.
- A Simplified Circuit, making easier assembly.
- Variable adjustments reduced in number.

Hailed by thousands of fans at the Radio World's Fair at Madison Square Garden, New York City, as the Super-Sensation of the 1929 Radio Season.

A worthy addition:
the 1929 Victoreen
Power Supply



This power supply has been developed to meet the demand for a power supply and power amplifier employing the UX250 tube. It incorporates two voltage regulator tubes, which assures a constant potential to the radio set.

The following advantages are possessed by this new power supply:

A constant potential is supplied to the 90 and 180 volt terminals, making possible the use of definite known values of C voltage.

Fluctuation in the output circuit cannot affect the first audio and cause distortion.

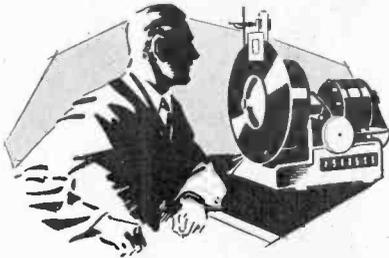
Four voltages are obtainable: 0-90 variable, 90, 180, 450 volts constant potential.

This unit may be used with almost any type set, containing any number of tubes, providing not more than three low voltages are required.

Write for Free Blueprints

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Merchandisers of Victoreen Radio Products
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Kino-Lamp



TWO PIONEER
TELEVISION
ACCESSORIES

The Raytheon Laboratories invite correspondence from both engineers and amateurs in regard to Kino-Lamp and Foto-Cell, two accessories now in successful operation.

Raytheon Kino-Lamp is the first television-reception tube developed to work on all systems.

Raytheon
Foto-Cell

—an extra sensitive broadcasting tube, is supplied in either HARD VACUUM or GAS-FILLED types.

Raytheon Mfg. Company
Cambridge, Mass.

REMEMBER

that poor condensers are soon broken down by voltage overloads. Blown condensers mean burned-out transformers and tubes. It's economy to buy the best.



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Cat. No. 595; 21 1/4" high, 18" wide, 15" deep; mounted in baffle board **\$1080**

Get No. 595—but if you can't spare the space, use Cat. No. 570 (6-foot tone travel; in baffle; 15" x 12" x 12") \$7.80

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Horn Motor, Cat. No. 112. Price \$4.20.

A splendid unit for horn loudspeakers. Stands 250 volts without need of filtered output. Enormous volume. Won't rattle. Excellent frequency response throughout a audible range. Fits any standard nozzle, including our No. 595 and 570.

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143 West 45th Street, New York City.

Please ship me at once the following (check off):

- One No. 595 at \$10.80, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
- One No. 570 at \$7.80, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
- One No. 112 horn motor (universal nozzle) at \$4.20 plus a few cents extra for shipping.

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Not only will we return your money, if you're not delighted, but we will then pay all packing charges and freight charges BOTH WAYS!

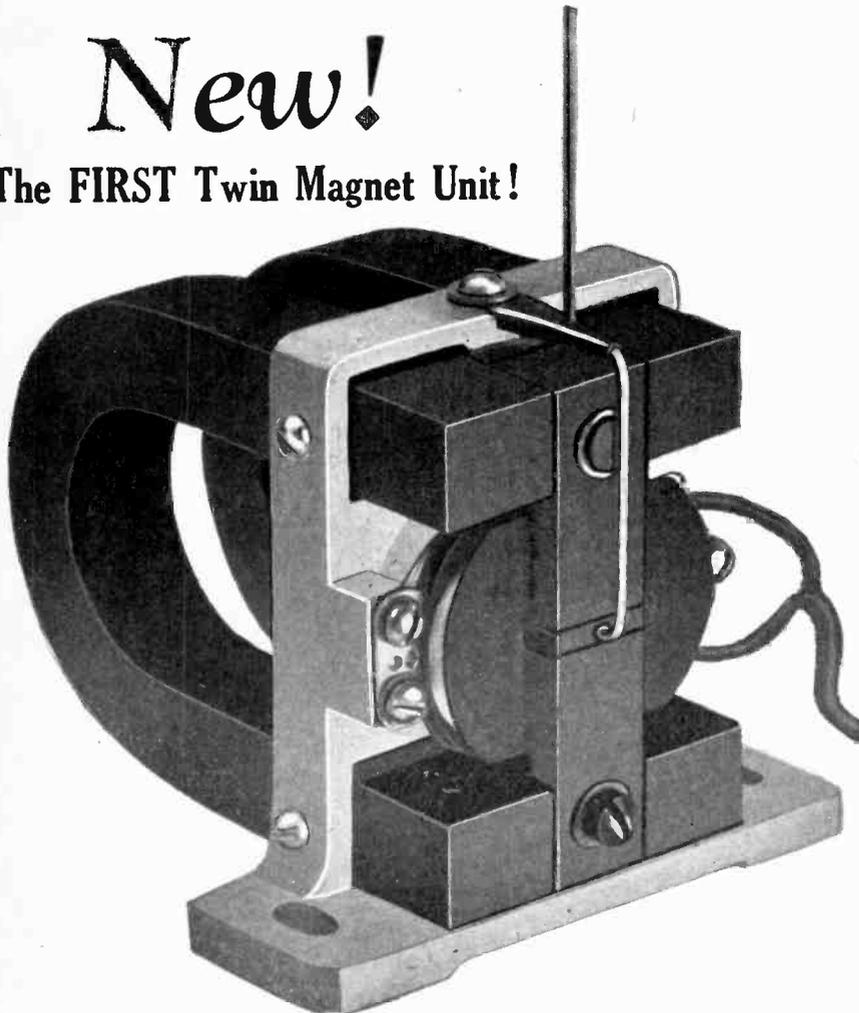
POLO

DUO-MAGNETIC UNIT

TWIN MAGNETS
DOUBLE SENSITIVITY

New!

The **FIRST** Twin Magnet Unit!



Polo Duo-Magnetic Unit, shown actual size. Weight three full pounds. Supplied complete with ten-foot cord, apex, chuck, nut and moulded metal mounting bracket (Senior model) \$10.00

No Filtering at 180 Volts!

THE magnet coil of the unit consists of two separate windings, connected in parallel, so that the current divides between them. This enables you to put **TWICE AS MUCH** current through the coil without danger of harming it! Use 180 volts on a -71A or -10 tube, with proper negative grid bias, and you do not need an output filter, the usual list price of which is around \$10.00. The coil of the unit safely carries 25 milliamperes!

Enormous Volume, No Rattling!

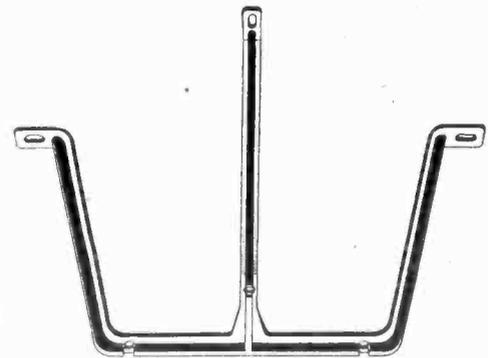
THE volume obtainable from a set depends to a large extent on the efficiency of the unit. The Polo Duo-Magnetic Unit is incredibly loud—enormously loud—yet without rattling! The **SENSITIVITY IS DOUBLED** by the use of two magnets—the first time two have been used in a commercial unit. The magnets are genuine, efficient, costly chrome steel, and there are no holes in them. Holes weaken a magnet and shorten its life.

ASTOUNDING

Performance—And Why!

THE new and startling Polo Duo-Magnetic Unit is of the balanced armature type, needing no adjustment and no servicing. It is exceptionally efficient, long-lived and mechanically rugged. Here is a summary of its superiority:

- (1) Twin magnets double sensitivity.
- (2) Magnets are of chrome steel.
- (3) Magnet coil consists of two windings in parallel, doubling the flux and the current handling capacity.
- (4) Volume is extraordinary, and without rattling, due to twin-magnets, great flux density, short air gaps, balanced silicon steel armature and single-piece coupling rod and pin. The pin **WON'T BREAK OFF!**
- (5) Die cast aluminum frame fits assembly to 1/1000 of an inch, enhancing rigidity.
- (6) Large, solid machined pole pieces.



Moulded bracket **FREE** with each unit order; also cord, apex, chuck and nut.

Every unit undergoes seventeen careful tests and is guaranteed against all mechanical or electrical imperfections. This unit needs no after-servicing, but will last indefinitely. It works superbly any cone, cloth, Balsa or skin speaker and is one of the most remarkable units ever produced. Make Polo your choice and you'll rejoice!

POLO ENGINEERING LABORATORIES,
57 Dey St. (Suite 6), corner Greenwich St.,
New York, N. Y.

Enclosed please find ten dollars for which send me one Polo Duo-Magnetic Unit, with ten-foot cord, moulded metal bracket, apex, chuck and nut. **YOU ARE TO PAY SHIPPING CHARGES.** If after a 10-day trial I return the unit **YOU WILL QUICKLY REFUND THE TEN DOLLARS.**

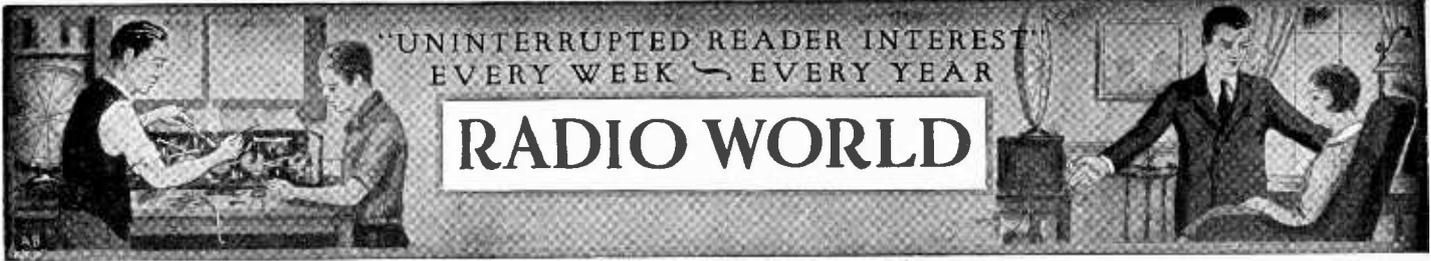
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OCTOBER, 6, 1928
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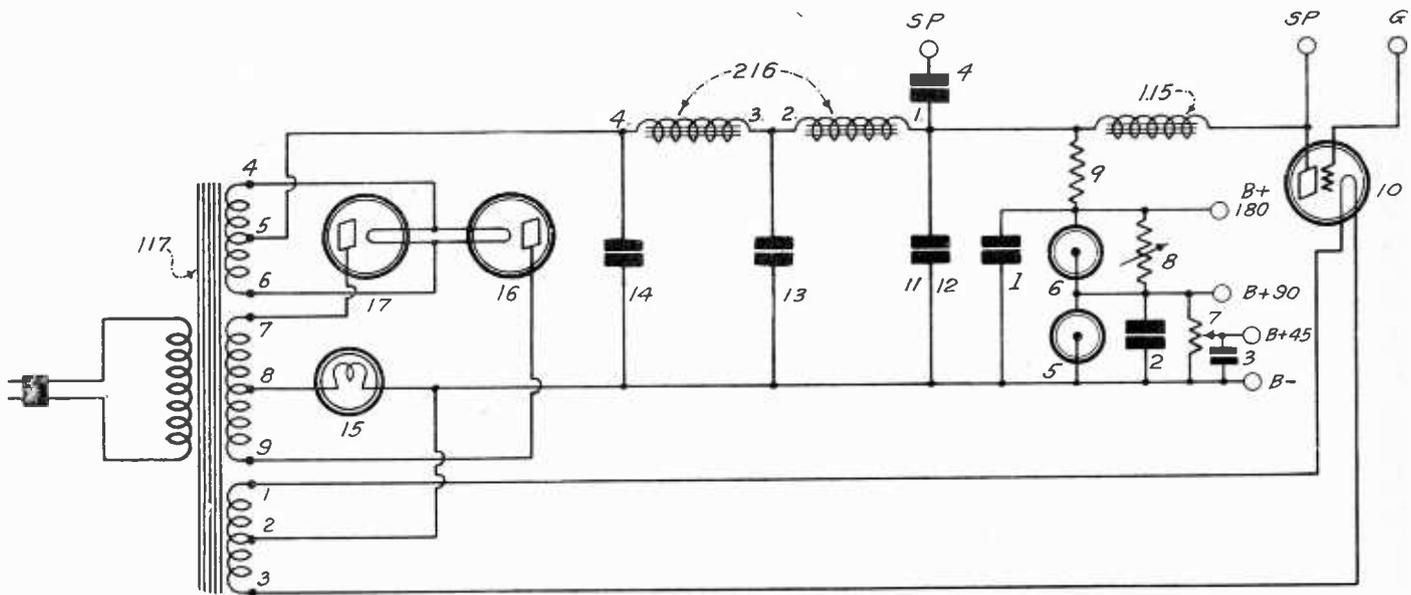
Technical Accuracy Second to None

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The New Victoreen 250 Power Supply

WITH EXTRA AUDIO STAGE FOR GREAT VOLUME

By A. E. Benson



THE CIRCUIT DIAGRAM OF THE VICTOREEN POWER SUPPLY UNIT AND POWER AMPLIFIER.

[The new AC Victoreen receivers, 1929 model, comprising eight tubes, was published in the September 22d and September 29th issues, its first presentation anywhere. Herewith the power supply is described for the first time in print. Next week, issue of October 13th, additional information will be given on the Victoreen power supply and power amplifier, as well as the details of the Victoreen C supply.]

THE introduction of the —50 power tube created a demand for heavy duty, high voltage power supply devices.

The 1929 Victoreen power supply unit meets this demand effectively, for it supplies the high plate voltage and heavy current required and it insures a constant voltage regardless of the current drain.

The suitability of this power supply for modern high power receivers can be judged by the following advantages:

1. It supplies a constant potential to each of the 90 and 180-volt terminals, thus making possible the use of definite, known values of grid potentials.

LIST OF PARTS

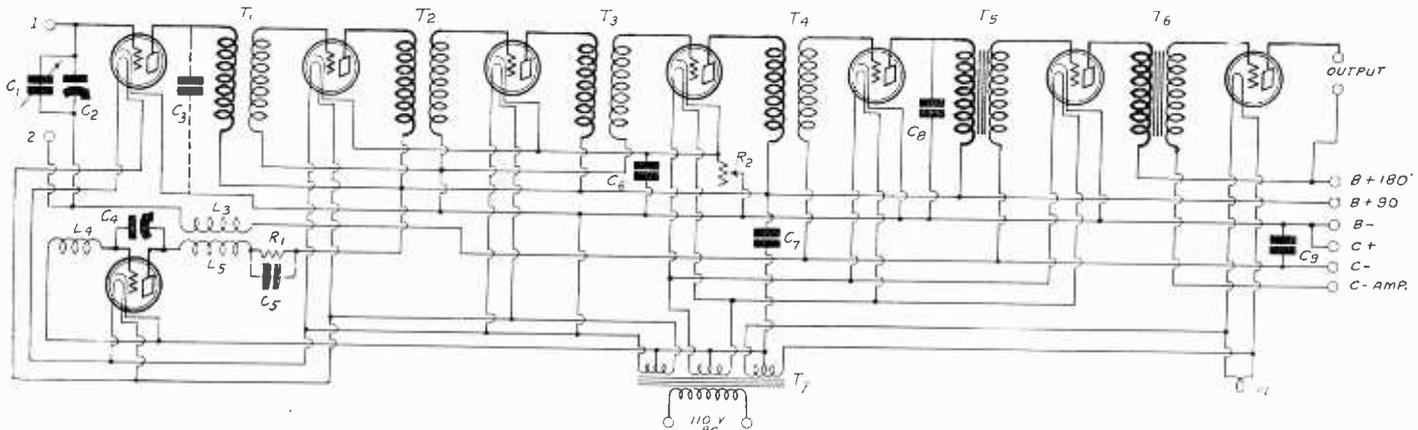
- One No. 117 Victoreen power transformer
- One No. 216 Victoreen choke unit
- One No. 115 Victoreen output unit
- Two 2 mfd. 600 volt Acme Parvolt condensers
- Two 4 mfd. 600 volt Acme Parvolt condensers
- Two 2 mfd. small size Acme condensers
- Two 1 mfd. small size Acme condensers
- Two 25,000 ohm Electrad Truvolt resistors (variable)
- One 5,000 ohm Electrad fixed resistor
- Five UX type tube sockets
- One porcelain miniature socket
- Seven binding posts
- One binding post strip
- One baseboard 9½x18 inches
- One —50 post strip
- One —81 type rectifier tubes
- Two UX 374 voltage regulator tubes
- One Mazda No. 31 or 6 volt flashlight lamp

- 2. Its design prevents fluctuations in the output circuit from affecting the first audio stage and thus from causing distortion.
- 3. It employs no resistor for supplying grid potentials, but uses the superior method of separate grid voltage supply.
- 4. The use of two voltage regulator tubes tends to prevent puncture of high voltage condensers.
- 5. It provides four voltages, namely a variable 0-90 potential, a constant 90-volt potential, a constant 180-volt potential and a 450-volt potential.
- 6. The unit may be used with almost any type of set containing any number of tubes, providing not more than three low voltages are required.

Power Supply Kit

The power supply comes in kit form. A layout and wiring blue print comes with the parts, as well as complete and positive directions for wiring the circuit. (Continued on next page)

How to Test B Supply



THE CIRCUIT OF THE NEW AC VICTOREEN RECEIVER. WHEN THIS IS USED IN CONJUNCTION WITH THE POWER SUPPLY, A REALLY REMARKABLE COMBINATION RESULTS. THE RECEIVER AND THE B SUPPLY WITH 250 POWER STAGE ARE BIG IMPROVEMENTS OVER THE FORMER VICTOREEN DESIGNS, WHICH HELD A HIGH RECORD, AT THAT.

These directions are of the progressive, point-to-point type. Every terminal is numbered and the directions give the points which are to be connected by number. Thus if the wiring directions are followed carefully the possibility of making an error of commission or omission is remote. The only tools required for assembling the job are a screw driver, a pair of wire snippers and a soldering iron.

The layout is the most compact possible consistent with good ventilation of heat dissipating parts, long life of condensers and a minimum of inductive interaction, between coils and transformers.

If the builder prefers to use his own layon he may do so provided he will observe certain rules. The choke coil must be kept away from the power transformer and the entire power supply must be kept at least a foot away from the audio end of the radio set. The power transformer and tubes must also be kept away from the condensers so that the condensers will not become heated. A very important point is that the frames of the two variable resistors in the output voltage divider do not touch each other.

Testing of Parts

The parts should be tested before they are mounted in place on the baseboard. Connect a 45-volt battery across each of the condensers for a moment. Then touch the terminals of the condensers together. If there is a sharp spark the condenser is in good condition.

The 216 choke unit may be tested with a 6-volt battery. Connect the battery across terminals 1 and 2 for a moment. Then break the circuit. There should be a sharp spark on break. Similarly test across terminals 3 and 4. The spark is caused by the collapse of the magnetic field in the coil and its intensity is a measure of the inductance of the choke.

Test the coil for ground also. Touch one terminal of the 6-volt battery to an exposed part of the case of the choke and the other terminal of the battery to each of the four terminals on the choke. If a spark occurs at any point the winding is grounded and the unit must be returned for replacement. Do not mistake a tiny capacity discharge spark on making the circuit for a spark at break. A voltmeter in series with the battery is a better means of determining a grounded winding. The meter should not deflect if the coil is good.

Test the 117 power transformer the

same way as the choke. There should be a spark, or deflection on voltmeter between 1 and 2, 2 and 3, 4 and 5, 5 and 6, 7 and 8 and between 8 and 9. The spark between 7, 8 and 9 should be very faint. There should be no spark between 2 and 8, 2 and 5, 5 and 8, that is, before the transformer is connected.

Test the power transformer for ground in the same manner as the choke was tested.

In wiring the power supply it is advisable to use bus bar wire and to cover it with "spaghetti" in order to prevent any short circuits. It is also well to avoid crossing any wires so that they will touch as a short circuit may develop.

The voltages in the power supply are high and may prove painful. Never touch any wiring as long as the power is on. If there is any occasion for making changes turn the power off first and then make the changes. The wisdom of this will be brought very forcefully to the attention of any one who disregards the warning. A shock is not dangerous, because the current is relatively low.

C Voltage Supply

When using a --50 type power tube with the power supply the output voltage will be about 450 volts. This requires a grid bias on the tube of approximately 90 volts. The best means of supplying this is a separate C supply circuit. This is much more economical than the resistor drop method and it does not introduce the complications the resistor does. The C supply also takes much less space than a 90-volt battery, and it always delivers the correct voltage.

The power supply provides a variable voltage from zero to 90 volts. The setting of the tap depends on the number of tubes in the set, or on the total current furnished by the tap. The unit also supplies a constant 90-volt potential. This is kept constant by the use of a voltage

regulator tube. A constant voltage of 180 is also supplied. This is held constant by two voltage regulator tubes connected in series. Of course, only two of these regulator tubes are used in the circuit, the 90-volt potential being taken off at the junction between the two tubes.

The constancy of the 90 and 180-volt potentials is of prime importance in the operation of the circuit. It prevents feedback and consequent distortion or oscillation.

* * *

[A complimentary blueprint of the new Victoreen Power Supply, as well as a complimentary blueprint of the new AC Victoreen Receiver, will be sent by the author to radio World readers. Address your request to A. E. Benson, care Radio World, 145 West 45th Street, New York City]

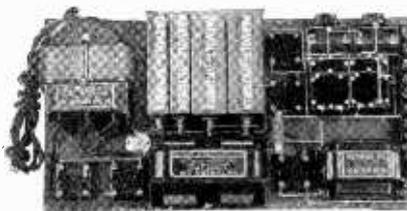
Best's New Pick-up Displayed by Kiley

Pat Kiley was one of the shining lights at the Radio World's Fair. With beaming face he displayed for the first time at the B. B. L. booth the new Best Phonograph Pick-up. This is a sturdily constructed apparatus of beautiful finish, delivering fine tone quality through the radio receiver. It avoids the faults of being either too light or too heavy to reproduce excellently disc recordings, by being delicately balanced so that the pressure on the needle is just right. The B. B. L. Unit in the red box with the yellow label was also displayed. Show week also marked the first appearance of Mrs. Kiley at any radio show in her new role of bride.— J. H. C.

"Scout" Changes Name

Pursuant to the general policy of the Boy Scouts of America to keep scouting free from all commercial associations, the Pilot Electric Manufacturing Company of Brooklyn, N. Y., has been requested by the Department of Scout Supplies to discontinue the use of the name "Air Scout" in describing the popular broadcast receiver kit manufactured by that firm.

The Pilot Company gladly complied. The name of the receiver kit will be known as "Air Commander."

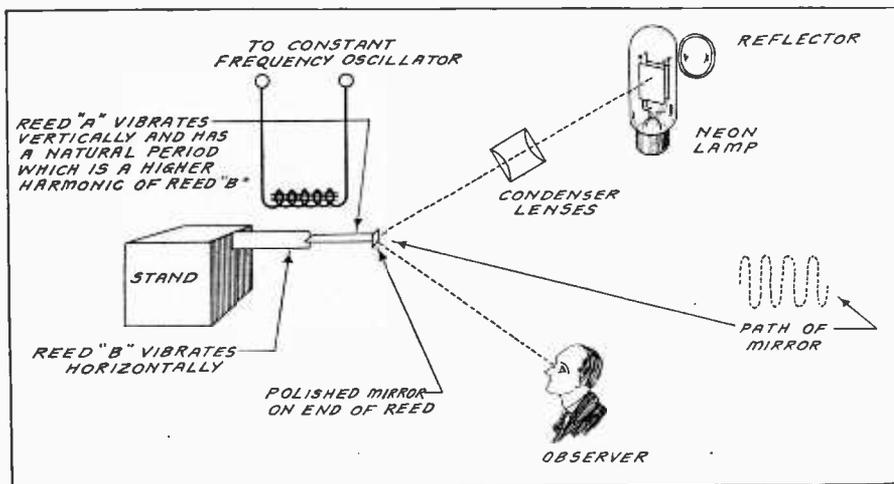
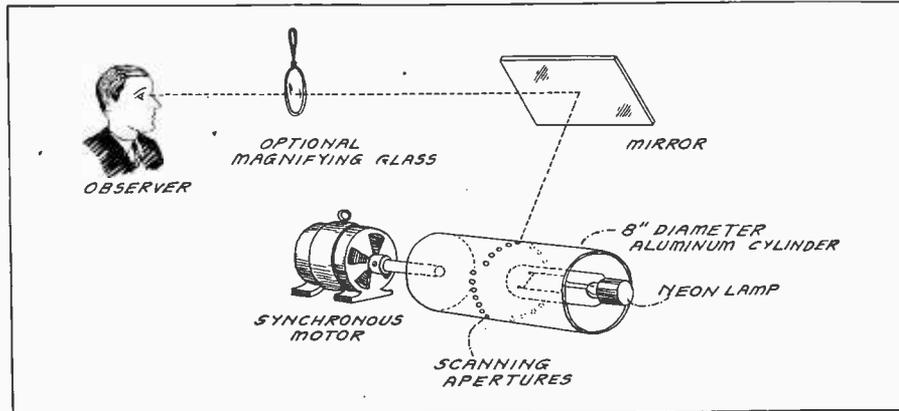


Eliminator Craze Starts In Television

First Tele

HEARD AND SEEN ACROSS ACCOUNT OF TH

By W. T.



A LARGE HOLLOW CYLINDER CONTAINING A NEON LAMP AND HAVING A SERIES OF HOLES ARRANGED IN A SPIRAL CAN BE USED FOR SCANNING. THE LIGHT FROM THE HOLES IS SPREAD OUT OVER THE MIRROR OVER THE CYLINDER. THE OBSERVER SEES THE IMAGE IN THE MIRROR, EITHER DIRECTLY OR AS ENLARGED BY A MAGNIFYING GLASS. A DIAGRAM SHOWING HOW TWO VIBRATING REEDS CARRYING A SMALL MIRROR MAY BE USED FOR SCANNING IN TELEVISION. ONE REED VIBRATES SLOWLY IN A HORIZONTAL PLANE AND THE OTHER, CARRIED BY THE FIRST, VIBRATES IN A VERTICAL PLANE AT A FREQUENCY WHICH IS A HIGHER HARMONIC OF THE SLOW VIBRATION. A SMALL MIRROR IS MOUNTED AT THE END OF THE VERTICALLY VIBRATING REED. THE LIGHT FROM A NEON LAMP, CONCENTRATED ON THE MIRROR BY A COLLIMATING LENS, IS SPREAD OUT ON A SCREEN.

By James Millen

Many of the engineers and scientists working on the development of Television have at various times made the remark that the scanning disc is merely a temporary and rather unsatisfactory means of securing television and before television can come into the home it must graduate from the machine-shop stage.

One of the first and so far only practical steps in the direction of "machinery elimination" is the use of very small scanning devices of say 6 inches or so in diameter as described in September 22 issue of RADIO WORLD.

Easy Compensation

As a result of the use of such small discs for scanning, not only is the cost, vibration, noise, and motor size reduced, but the entire apparatus may be assembled into a small cabinet of such appearance as to become readily acceptable in many living-rooms.

At first thought it might seem that the smaller image resulting from the use of the smaller disc might be a serious handicap and a decided step in the wrong direction. The improved detail of the smaller image, however, makes readily possible the enlarging of the image to the same size as with the larger discs.

Brightness Retained

The reduced illumination resulting from the optical magnification of the image may be easily compensated for by the use of a condenser lens between the Kino lamp and the disc to gather in as much as possible of the illumination from the large plate of the Kino lamp and focus it as a spot of the desired area, but of increased brilliancy, on the back of the scanning disc.

One of the first television engineers to actually demonstrate a workable small diameter scanning device was C. Francis

WGY'S broadcast of the first play by television was received at Los Angeles, Calif., by Gilber Lee and Kenneth G. Ormiston. Mr. Ormiston reported as follows:

"Results only fair due to fading of 21-meter wave. Voices very strong with occasional glimpses of faces."

An independent investigator, Mr. Camilli, of Pittsfield, Mass., also reported reception of the television signals. He stated that the signals were much better after midnight.

WGY established itself as the first station anywhere to present a drama by television, transmitting picture and voice simultaneously on separate radio channels.

Those equipped with suitable receivers for vision and sound were able to see and hear the actors in the play, though miles separated them from the actual performance.

Alexanderson's Feat

Drama by radio was made possible by recent development of a simplified and portable television transmitter or camera by Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company and chief consulting engineer of the Radio Corporation of America.

Martin P. Rice, manager of broadcasting for the General Electric Company, explained that in presenting the drama through the medium of television, WGY is co-operating with the engineers in the development of a studio technique well in advance of the time when it will be practical to offer television to the public as a finished production.

Statement By Rice

Such practical application affords the only reliable method of determining the

Jenkins, of Washington, D. C. Many months ago Jenkins used a cylinder of 8 inches in diameter, on the surface of which were laid out, in a form of a helical spiral, the scanning apertures. In the centre of this cylinder was located the Neon lamp.

How Image Is Seen

By observing the surface of the revolving drum in an inclined mirror, the image could be seen. But Jenkins in his complete demonstration sets, did not stop with the mere drum idea, and its resulting compactness, but also added such refinements as quartz rods or spokes for more efficient light transmission, a quadruple aperture spiral for increasing the image size and a novel synchronization method.

The important point, however, is that he eliminated the 24-inch disc of the laboratory and replaced it with a cylinder of 8 inches in diameter, which could be taken out of the commercial laboratory and into the home experimental workshop, and even into the living-room.

But why use a disc or drum for scanning? Already several foreign patents have been issued on a system utilizing a compound vibrating reed for such purposes.

Two reeds are so mounted that one vibrates at right angles to and at some

Revised Drama

CONTINENT—AN INTIMATE STUDIO WORK

Meenam

future possibilities as well as the limitations of television.

"WGY was the pioneer broadcasting station in the field of radio drama," he stated, "and it is fitting that we, in co-operation with Dr. Alexanderson, should thus early investigate the adaptation of this new branch of the radio art to the drama.

"Three years ago scientists in many countries began a thorough investigation of television and its possibilities.

"We have shown what Dr. Alexanderson has accomplished and, in broadcasting a one-act play by television, we have endeavored to point out one of the very interesting applications of the new art.

"When television has reached that stage of development where 'sight' signals may be received as reliably as 'sound' signals are now received, we at WGY hope to be prepared to carry the image as well as the voice of the actor to thousands not heretofore privileged to enjoy the drama."

The play was "The Queen's Messenger," written thirty years ago by J. Hartley Manners. The television version was the same in every respect as the stage offering, but many new problems in dramatic technique were presented in putting on the air a performance intended for reproduction instantaneously in homes distant from the scene of the action.

Nine months ago Dr. Alexanderson exhibited a simplified television receiver. Television was then taken out of the laboratory and shown in the home. Voice and picture were simultaneously broadcast by WGY on different wavelengths and observers stationed three to five miles from the transmitters saw and heard the performers.

The presentation of the drama by television was made possible by further de-

higher frequency than the other. The frequency of the slower reed determines the number of pictures per second while the frequency of the faster reed determines the number of "scanning lines."

If the higher frequency reed has a natural period which is a harmonic of the natural period of the slower reed, the reeds may readily be kept in motion by means of a suitable magnetic drive operated from an audio oscillator or other alternating current source of the same frequency as the reed B and containing a fairly strong harmonic of the frequency of reed A.

Polished Reed

The end of reed A is polished to form a minute mirror which reflects the light from the Kino lamp. It is not believed that an actual demonstration of this interesting system has yet been made in this country.

Another method which has been suggested a number of times in the past for eliminating the scanning disc but so far not put to practical use, is by means of the cathode ray oscillograph.

Such a system has the outstanding advantage over all others of utilizing no moving mechanical parts but also the disadvantage of high cost and low illumination intensity.

velopments by Dr. Alexanderson, the simplification of the transmitting apparatus in a convenient and portable form.

Portability Demonstrated

The transmitter may now be carried from place to place as easily as modern broadcast equipment is transported, and it was indicated that the time will come when the television transmitter or camera will be set up in the radio studio, on the lecture platform, the stage or at the banquet table. To illustrate the portability of the outfit, WGY recently set up the camera on the platform in the assembly chamber at Albany, where Gov. Alfred E. Smith delivered his address accepting the Democratic nomination for the Presidency.

The camera consists of three units—a cabinet containing a 24-hole disc and a 1,000-watt lamp as a light source, and two smaller cabinets, each housing a photo-electric tube with amplifier. All three cabinets are mounted on tripods, enabling the operator to raise, lower or tilt the light source to suit the height or position of the performer.

Three Cameras Used

In the presentation of "The Queen's Messenger" three cameras were used—a camera for each of the characters in the drama and a third for the introduction of "props" and other visual effects.

The actual adaptation of the television apparatus to the play was made by Mortimer Stewart, producer and director of a series of radio plays from WGY last Spring and of numerous dramatic offerings from the New York stations of the National Broadcasting Company.

Mr. Stewart's problem was not only the development of a technique for a new dramatic form, but to work with apparatus as yet crude and inadequate. For example at present only the heads of the actors can be shown, and the image in the television receiver is the red of the neon lamp, this being the only device at present which has the necessary simplicity.

The drama was presented in one of the studios of WGY. The director, standing between the two "character" cameras, governed the radio output by means of a small control box with two knobs.

Microphone For Each

With one of these knobs he brought any one of the cameras into the circuit, depending upon which character was speaking. The second knob enabled him to fade the images in and out, very much as the fade-out is used in motion pictures. In front of the director was a television receiver in which he could at all times see the image going on the air, and check the performance.

In addition to the cameras there was a microphone for each actor, to pick up the lines of the play.

The performance went out on three wavelengths—the picture on 379.5 meters and 21.4 meters, and the voice on 31.96 meters only.

As only the heads of the actors can be transmitted at present, it became necessary for the director to find some means

(Continued in next column)

Actors Wore Paint When Televised

other than head movements or the change of facial expression to convey action. This was accomplished by utilizing the third transmitter for hands and "props." For example, when the lady of the play offers to pour some wine for the messenger, the third camera picked up the image of the lady's hands with bottle and glass, as she poured the wine. Keys, a ring, a revolver and many other "props" were thus introduced to add realism to the performance and to break the monotony of head images only.

Framing Successful

Because of the limited range of the camera, great pains were taken to keep the actor "framed," that is within the small area in which the eye of the pick-up camera may find him. Each actor worked in front of a white screen, a background which gave definiteness to his features. Borders were established within which the actor had to stand or be lost to the camera.

Special problems in make-up were presented that the red image might have definition and clarity. Make-up technique of both the stage and screen were drawn upon and an effect different from either was reached.

The eyes of the actors were accentuated to a point of exaggeration and the mouth and nostrils were sharply defined with strong color. The skin was softly shaded and blended in an effort to remove the shiny effect.

It was found that diamonds or other bright stones could not be used on the hands for they catch the light and produce a disturbing glare in the image. Bright shiny surfaces such as polished glass cause a suffusion of light that destroys sharpness of image.

Only Two Characters

"The Queen's Messenger" has only two characters. The lady was played by Izetta Jewel, a former stage star and now the wife of Prof. Hugh Miller of Union College. Maurice Randall, veteran member of the WGY Players, was cast for the messenger. Joyce Evans Rector and William J. Toniski doubled for Miss Jewel and Mr. Randall; that is, they doubled for their hands, and at the third transmitter or camera handled the various "props," cigarettes, glasses, keys, dispatch case, etc.

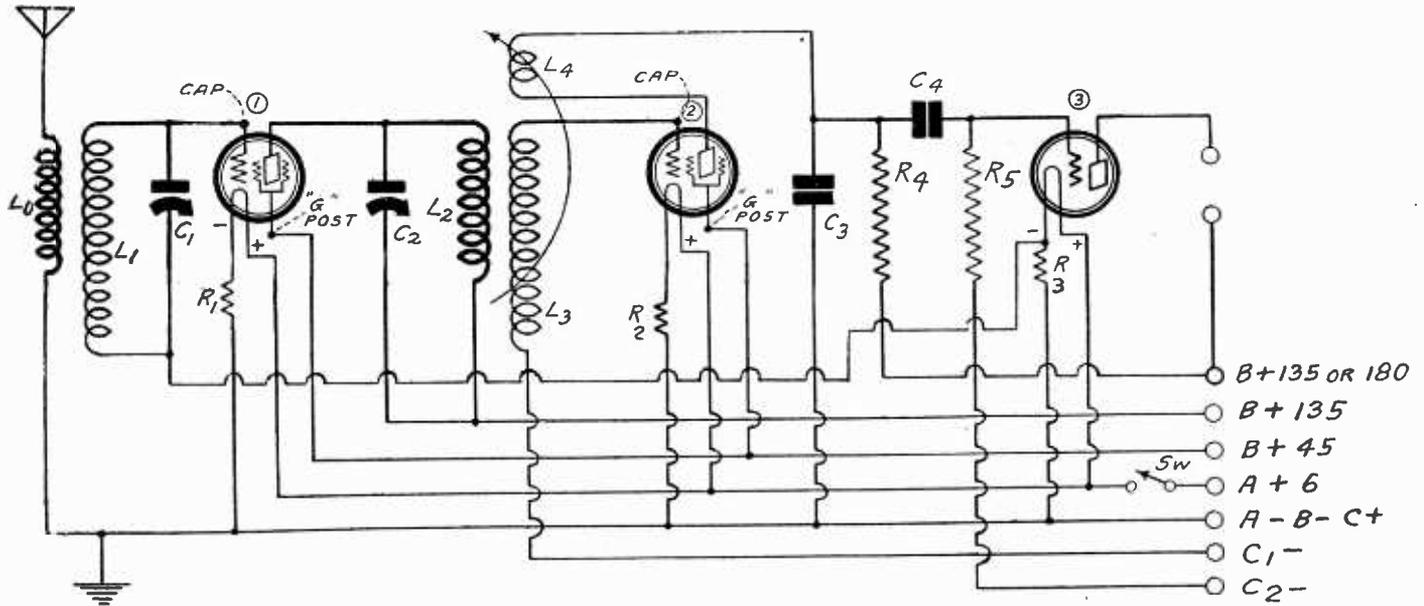
The visitors viewed the performance in several television receivers wire-connected to the transmitters. One receiver picked up the signals from the air, getting an excellent image from the transmitter of WGY, about four miles from the studio. The image was seen in an aperture in the receiver three by three inches square.

More Demonstrations

The demonstration of the play by television utilizing the new portable cameras was witnessed by a large group of newspaper and magazine writers. Dr. Alexanderson also exhibited recent television developments of his laboratory including apparatus for the projection of a twelve-inch image on a screen, 10 feet from the projector. This apparatus was later featured at the Radio World's Fair at Madison Square Garden, New York. It permits the transmission of the full figures of two performers, or a life-sized head.

WE SAY Ridiculous

By John



IS ANY ENERGY DELIVERED BY TUBE 1 to TUBE 2? IS ANY ENERGY DELIVERED BY THE DETECTOR TO THE THIRD TUBE IN THIS CIRCUIT? SEE ARTICLE ON THIS PAGE FOR ANSWERS.

PERHAPS there is no subject in which technical terminology is more misused than in electro-magnetism. Electro-magnetic terms are often used in a manner that borders on the ridiculous. And the worst offenders are not always those who do not understand the subject, but often those who are well versed in it.

Naturally, writers on radio are conspicuous offenders against reasonable usage, and all of them are guilty. To make this assertion more inclusive, if possible, this should be written in the first person plural.

The use of electro-static field is most often ridiculous. How often have we not seen such expressions as a "moving," a "varying" and a "fluctuating" electro-static field! How can an electro-static field be so styled by any one who lays claim to being reasonable?

The term "static" signifies the opposite to change in position and intensity.

An electro-static field is a fixed field and does not admit of any adjectives which nullify the fixity.

As soon as it varies, fluctuates or moves, it is no longer an electro-static field, but it still is an electric field. It may be a moving electric field, or fluctuating, or varying, but it cannot be static at the same time. An electro-static field is just one type of electric field.

Electro-static Loudspeaker

So-called electro-static loudspeakers are now being designed. But no speaker can be static, for then it will not speak. It may be an electric speaker, one which operates on the principle of a varying electric field, or varying electric force.

Similarly we have heard of electro-static microphones. The only time a condenser microphone is static is when it is inoperative, idle. As soon as it is spoken to it ceases to be static, but it remains electric.

In a catalogue issued by a company making high class radio apparatus we are told that the insulators in variable con-

densers are placed in weak and "non-varying" electro-static fields. Why the tautology? Is it not enough to say that the insulators are placed in an electro-static field, if that is true? If the field is static, it is non-varying of necessity.

But it is not clear to this writer how the field can be non-varying when the condenser is in use in an alternating current circuit. It may be weak, all right, but certainly it cannot be non-varying. It would be non-varying, and static, if the condenser were used in a direct current circuit, that is, if a steady electric potential were applied across it.

Electric Flux

Sometimes we hear the term electro-static flux. Again the same contradiction in terms! If the electric field is static it does not flow. But that does not mean there cannot be an electric flux.

It may be argued that there cannot be a steady magnetic flux for the same reason. But that does not hold. There may be, for example, a steady stream of water, although the water does not stand still. Magnetism is conceived as a flow, and that flow may be at a constant rate, or it may be varying, alternating or fluctuating. Not many erroneous expressions have been used in discussing magnetic phenomena.

The term "electro-magnetic" indicates that electricity and magnetism are closely related—two manifestations of the same phenomenon. Magnetism is associated only with moving electricity. This may not be apparent in a permanent magnet, or a natural magnet, but a permanent magnet has been made with the aid of moving electricity, or by another magnet which can trace its origin to moving electricity.

The question arises as to how the permanent magnetism is maintained without a continued motion of electricity. That gives rise to another question, namely: "Who can deny that electrons do move

around in the permanent magnet so as to maintain the magnetic field?" The polarization of a permanent magnet may be entirely due to the circulation of electrons in the magnetic material in a manner similar to the circulation of electrons in the wire in an electro-magnet.

Power, Energy, Current

The terms power, energy, current, quantity, potential and others are often confused in radio. Some text book writers on the subject are particularly careless. Energy is used for all the others. This is done, although they are entirely different conceptions.

Energy is work in its technical sense. That is, it is force times distance, or the product of a force by a distance. It is the work done on a material body in moving it a certain distance against a force, or it is the work done in giving a material body a velocity. Power is the time rate of doing the work. If a certain amount of work is done in one second the power may be unity. If the same amount of work is done in half the time, the power is just twice as great.

Electric Current a Rate

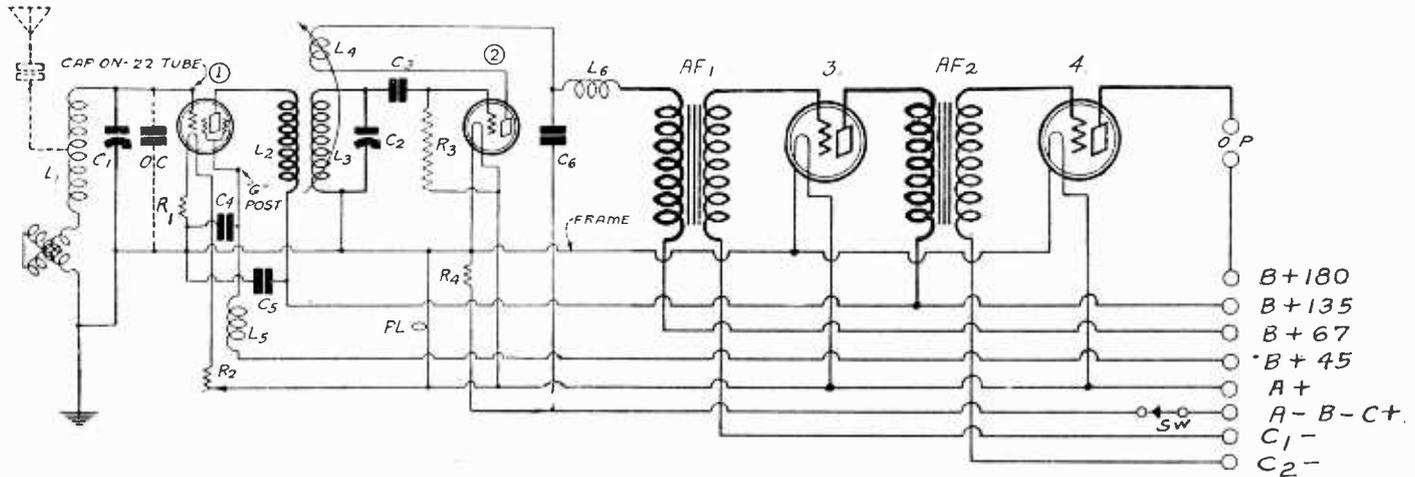
Electric current is the time rate of flow of electricity, or the time rate of change in electric quantity. This is analogous to a water current, which is the rate at which quantity of water flows past a point. Potential is defined as the work done in moving a unit quantity of electricity against the electric force from an infinite distance up to the point at which the potential is measured. This is not a very practical definition, but it assumes more definite form when the potential difference between two points is defined.

The difference in potential between two points is the work done in moving a unit charge of electricity from one point to the other against the electric force between the points.

A certain text book on radio is replete

us Things!

Edmonds



DOES A COUPLING TRANSFORMER IN A CORRECTLY DESIGNED RECEIVER DELIVER POWER OR POTENTIAL TO THE GRID OF THE FOLLOWING TUBE? DOES THE LAST TUBE IN THE RECEIVER DELIVER POWER TO THE LOUDSPEAKER OR MERELY POTENTIAL? SEE ARTICLE HEREWITH FOR ANSWERS.

with examples of confusion of terms and of loose usage. For example, it says that the energy radiated by an antenna is obtained by using a certain formula, when that formula gives the power radiated. And the energy (?) is expressed in "watts."

The statement should have been that the formula in question gave the rate at which energy was radiated.

A few lines below in the same book it states that the energy in the antenna is the current as measured by the antenna ammeter. Of course, it is nothing of the kind. The current merely gives an indication of the power radiated, provided that the radiation resistance is known.

More Confusion

The same book gives an expression of the "power" stored in a condenser when it is charged to a certain voltage, when the formula gives the energy. Power cannot be stored, but energy can.

Nothing that depends on time for its value can be stored, and power is the time rate of using energy, or of storing it.

Money can be placed in a bank for safekeeping, but the rate at which the money is deposited or withdrawn cannot be put in the bank.

The whole idea looks ridiculous as soon as it is applied to familiar things.

The confusion of power and potential is complete when it comes to amplifiers. Writers and speakers on radio continually refer to the power impressed on the grid of a vacuum tube. A radio engineer at the New York radio show proclaimed in loud tones that if "enough power was shoved into the grid of a power tube a dynamic speaker would shake a house with fine quality."

No power should be expended in the grid circuit of an amplifier, and if any is expended the quality of the output will not be good.

Matching Fallacy

What is impressed on the grid of an amplifier is a varying potential. The matching of transformer primaries

to the output resistance of amplifier tubes is still being talked of as a condition for maximum output.

A greater fallacy there never was.

Writers apply the condition for maximum power output for maximum potential. The fallacy is even applied to direct coupling, such as impedance and resistance, where the fallacy of the matching condition ought to be most obvious.

The only place in a receiver where matching should be indulged in is in the output of the last tube. The resistance of the last tube should be matched to the impedance of the speaker in order to get maximum power out of the tube.

And it is well known that if maximum, undistorted output is desired, the speaker impedance should be twice the internal resistance of the tube.

Energy Indeed?

So the old time matching condition does not even apply there, that is, the condition that the two impedances should be equal.

Some writers prefer to design their receivers so that the greatest possible energy is transferred from one tube to the next, or from the primary of a coupling transformer to the secondary. If they really did what they say, they would turn out terrible receivers. The trouble is they don't use the correct terms, or they use terms where no terms at all ought to be used.

A coupling transformer is a potential transformer. It may take some energy to operate it, but it does not deliver any. If it does, the circuit is short of perfection by the amount of this energy.

A coupling transformer delivers a potential, and it should deliver no power and no energy. Of course, if it does not deliver any power at any time it delivers no energy.

It is true that energy is expended in the primary of a coupling transformer or in a coupling resistor or impedance, but none of this is, or should be, expended in the following grid circuit.

Taylor Gives Course on the Vacuum Tube

A course on theory and operation of the vacuum tube will begin at the College of the City of New York Tuesday evening, October 2nd, and will continue through the sixteen weeks of the term. Class hours are from 7:30 to 10:30 p.m. and the instructional work will be made up of two hours of lectures and discussion and one hour of laboratory work each evening.

The course will be given by E. Gordon Taylor, M.S., who is well qualified for this work, having conducted, since the inception of radio, a high-class tube plant at 235 Ninth Street, West New York, N.J., where special tubes are designed and made for any purpose.

The course will work up by easy stages from a review of the fundamental physical laws of electricity and magnetism, bringing the students up through the general theory of the ionization of gases; thermionic emission of filaments; vacuum tubes containing two or more electrodes; characteristic curves of different types of tubes; vacuum tubes as power or voltage amplifiers; rectification of alternating currents by means of vacuum tubes; photo electric cells, etc.

The fee for the entire course is \$25 and the class will be limited, so that those interested should inquire at once. Further information may be had from Mr. Taylor at the College, 140th Street and Convent Avenue, New York City, or by addressing him at his laboratories, above.—J. H. C.

WSUN ALL BY ITSELF

WSUN, St. Petersburg, Fla., 333.1 meters, 900 k.c., 1,000 watts, operated by the Chamber of Commerce, will enjoy undivided time under the reallocation plan effective November 11th. WSUN-WFLA were paired under a previous listing, but the Federal Radio Commission has changed this.

The New Linen D

By H. B.

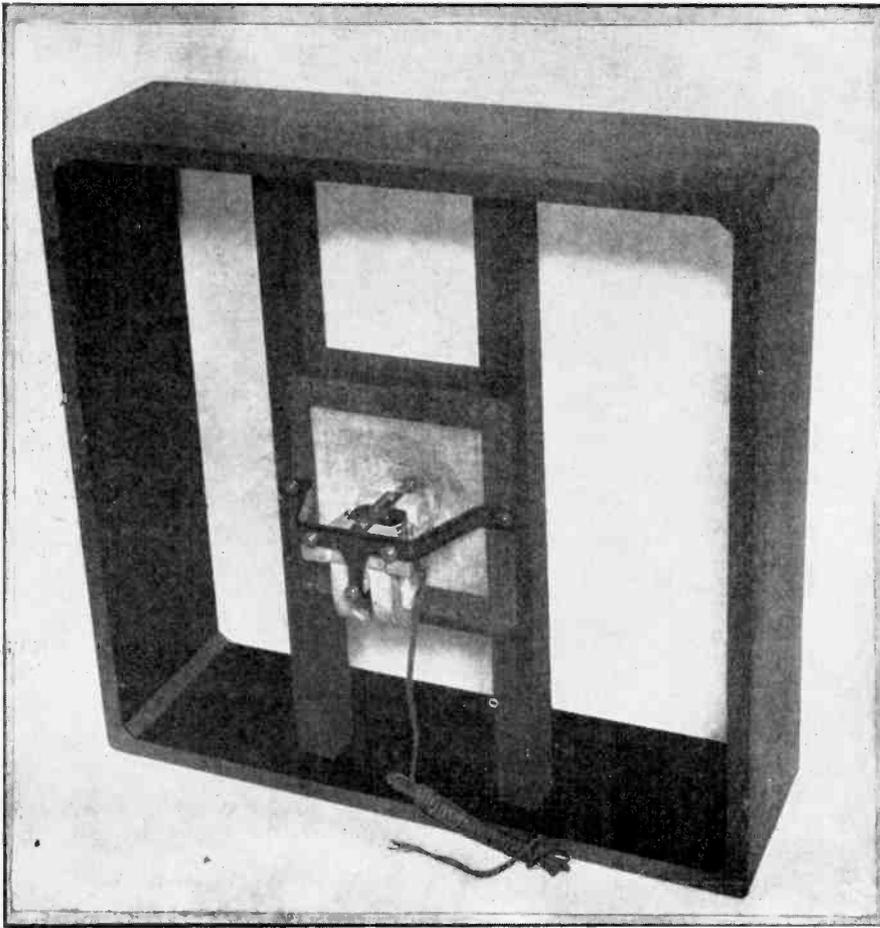


FIG. 1

TIGHT STRETCHING OF THE FRONT DIAPHRAGM, CAUSING A CURVATURE OF THE THIN LINEN; RIGID MOUNTING OF A FINE UNIT AND 8-INCH DEPTH OF THE FRAME PRODUCE AN EXCEPTIONAL SPEAKER.

NEWEST advances in the construction of cloth diaphragm reproducers improve the fidelity of their performance to a compelling degree, enhance their appearance and add slightly to their cost. The driving motor is an electro-magnetic unit, which represents the most performance for the lowest cost.

When this type of speaker came upon the home constructionist and custom builder about a year ago, the crudest kind of pine constituted the frame, mechanical construction of this baffle-board was poor, none too good cloth was used, the "doping" process was not so well understood as it is now, but the unit was good; therefore, despite handicaps, the speaker performed very satisfactorily. In fact, it won a wide circle of devotees, and these, as well as countless others, are asking what the new season holds forth along this line.

Many varieties of cloth have been tried, including airplane cloth, muslin, gingham, balloon cloth, artist's tracing cloth and linen, and while some varieties were better than others, all were good, and linen was best, if the linen was thin. In fact, it had to be exceedingly thin. Then the high frequencies were given full expression and the drumminess avoided.

Sheer Linen Cost Most

Of all the cloths tried, the sheer type linen was the most expensive, almost twice the cost of any of the other types,

but proved itself well worthy of the additional outlay.

While frequency response is an all-important virtue of thin linen, another salient fact is that when the linen is properly doped it is least affected by moisture and temperature changes that otherwise might require unit adjustment.

The cloth used on front therefore had better be thin speaker linen, a fabric not easily obtainable, as several large dry goods stores where inquiries were made for this cloth reported that they never carried it in stock. It is an imported texture—Irish linen.

The front should be large. A square, with 24 inches on each side, is an excellent choice.

The cloth type speaker is generally constructed so that it has two diaphragms, the large one in front and a much smaller one at rear. By tightening the front one against the rear one the driving rod of the unit encounters about the same resistance one way or the other, hence is rendered free in its back-and-forth action. Thus the quantity of useful energy is highest.

Also, it will be observed, a cone type unit, that is, one with a pin on it, must be used, for a horn type unit, with a threaded circular opening, can not be used.

In constructing a linen diaphragm speaker, the frame is assembled, preferably purchased already assembled, as to

its four sides, and with an H-shaped center piece, also assembled but detached.

The rear square is 6x6 inches at the opening, although the cloth may extend an inch more at each side for pulling and tacking purposes (8x8"). This rear cloth, however, should be airplane cloth or some other material much stronger than thin linen, since thin linen might break under the heavy tension to which the rear cloth is subjected.

Because the area of the smaller cloth is only one-sixteenth that of the other, the tension upon any one point on it is proportionately greater. While the rear cloth is a diaphragm, although of small order of effectiveness, it is mainly a spring that counteracts the tension of the front piece.

In the ready-made frame, with center support detached, the rear piece is cut to 8x8 inches, the central point found by drawing pencil lines across diagonally opposite corners, and the cloth then folded twice in opposite directions, so that the center mark is on the outside, accessible to scissors.

Very Small Hole Here

The tiniest possible hole is cut at this point. Then a sharpened pencil is used, and the hole widened without rending the fabric. Do not widen the hole with shears or knife or anything but a blunt conical device like a sharpened pencil.

The opening is made just wide enough to admit the shank of the apex.

Next the 26x26" piece of thin linen is centered as was the other one, and the apex opening provided in exactly the same fashion. The dimensions permit of a 24x24-inch wooden front (outside measurement), with one inch extra protruding at each edge for pulling and tacking purposes.

The small back piece is tacked on to the center square of the upright support. This support comes as a part of the speaker construction kit, but is not introduced into the "hold" of the frame until the back piece is tacked on. The apex is not on yet.

Make the rear piece tight, but no extraordinary efforts need be made or this may be overdone. Good stiffness is required, no strong pulling.

Simply put a tack in one corner, then slightly pull the cloth and put a tack in the diagonally opposite corner, then follow the same procedure as to the two other corners. The cloth is pulled tight as other tacks are put in, an inch apart. Do your pulling just before you drive in the small tack.

A Secret of Success

Thus you mount the rear cloth, which is of very strong material, and now you are ready to insert the H-shaped upright in the 7-inch deep frame, about 1½ inches in from the rear of the bottom, measured to the rear of the upright.

Four nails are driven through the outer frame to secure the H-piece.

The front is distinguished from the rear because of the decorative moulding you put on the front, or also by the finish, if you get a de luxe sprayed frame.

The way the cloth-mounting is done is one of the secrets of success. You can get a far tighter stretch by putting on the rear piece first, and tugging against it than by tugging against the front with the rear piece, so long regarded as the orthodox manner.

Now, the center hole having been made in the front piece—the thin linen—you

Diaphragm Speaker

Herman

are ready to attach the apex. The threaded screw, to be used for fastening the unit's driving pin to the apex, should be on the outside of the large diaphragm.

The attachment of the two pieces of cloth to each other by means of the apex is done simply by tightening the apex nut. Take pains not to tighten so much, however, that you injure the cloth.

A Word to the Wilful

If you happen to be using sheer cloth for the rear, too, contrary to instructions, you may cut out two extra pieces, 1½ inches square, and use these between the apex and each side of the rear cloth, for reinforcement. But if stronger material is used for the back, as recommended, no special safeguard against tearing need be made.

Airplane cloth should not be used as the front piece in preference to thin linen.

You tack down one corner of the linen, but without driving the tack all the way home. Then the diametrically opposite corner is fastened in the same incomplete way. Then the next two corners get the same treatment. Then one complete side is tacked down temporarily. Then the opposite side is fastened, but this time with an extra strong pull on the cloth before each tack is inserted. Try your best. Get someone to help you pull, maybe.

You can not be sure of your position now, and you continue the tacking with the heads sticking far enough out of the wood so that removal of the tack is easy.

Next you tackle the two remaining sides. Perhaps the cloth might be on a bit more evenly. The removable tacks make correction simple.

Why You Take Pains

You take great pains with this front piece, because you must provide a curvature if you desire best results. The curvature attests to the tightness of the front cloth. The front must be tight so that tone will be best. Also a small horn effect is created, and that improves quality. Besides, you have a baffle board, consisting of the frame, and this favors low notes, so that by getting a tight diaphragm and a curved front, you tend to equalize the frequency response.

The rear cloth will give a little, which is fine.

Next you mount the unit. See that the pin emerges from the apex opening, but only about ¼ inch. If the pin is longer, cut it down. Pliers may be used.

A bracket supports the unit. This bracket should be fastened down tightly.

Now, satisfied that everything is as it should be, alas, you find out it is not, because without stiffening fluid or "dope" the outfit is worthless as a speaker. But the application of the "dope" is simple.

The easiest way to apply the fluid is with a brush, although factories use sprayers, which are expensive. The brush results are excellent, and you need not hesitate on this score.

It Works Now

First put a coat of the fluid on the rear cloth, only on the back of it, however. While this begins drying, which happens at once, coat the front. It takes from fifteen minutes to half an hour for the coat to dry, depending on the temperature of the room, humidity and the weather, but as soon as one coat is dry on each piece of cloth put on another coat. A minimum of three coats must be put on the back piece. Five coats

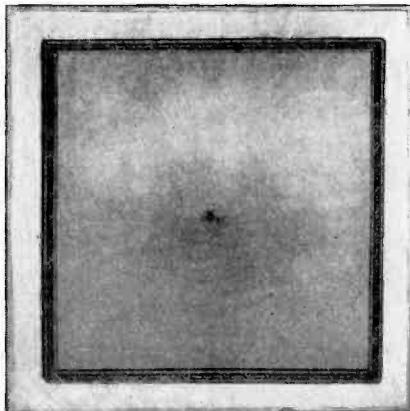


FIG. 2.

THE DIAPHRAGM CURVES INWARD TO PRODUCE BEST TONAL EFFECTS. THIS CURVATURE IS ACCOMPLISHED BY FIRST INSTALLING THE SMALL PIECE OF CLOTH AT REAR

should be used in front, using one quart of dope. You can get three thin coats from a pint. Better results will be obtained by putting on the five front coats than by skimping along with three.

When the final coat is dry, and before you try out the speaker, tighten down on the unit mounting bracket very carefully, because there must be severe rigidity here to prevent vibration. Also tighten the chuck on the apex.

Try out the speaker. Perhaps you hear only chattering. That is due to the armature maladjustment. Take care to readjust at once. Some types of units will not chatter due to armature displacement, because they are permanently adjusted at the factory, like the Polo Duo-Magnetic Unit, while others may chatter until you readjust the armature with a slight turn of the knob at rear, as in the case of the 1929 Model Powertone Unit. There is no problem here. If you have an adjustable unit, simply adjust it. If your unit is not adjustable you don't have to adjust it.

Which Unit?

As for the choice of a unit, you get about in proportion to what you pay. A unit that costs \$3.75 can not be expected to perform as well as one that costs \$10. It is a question of what you can pay. The cheaper unit will give very satisfactory service. It will stand considerable volume, it will require no output filter up to 150 volts, it will permit a good frequency response. The \$10. Polo Unit will produce twice as great volume from the

LIST OF PARTS

- One built-up wooden frame, splice jointed, size 24x24 inches, with rounded edges and moulding.
- One built-up upright wooden support, splice-jointed, to go inside the frame, with hardware for attachment to frame.
- One piece of extra-thin speaker linen, 26x26 inches.
- One piece of airplane cloth, 8x8 inches.
- One unit with mounting bracket, apex, chuck, nut and 10-foot cord (either Polo Duo-Magnetic Unit or 1929 Model Powertone Unit).
- Two 1-pint cans of Aerolac ("dope").

same output, will stand much greater power without rattling, and permit 180 volts application without filtering. It is twice as sensitive, since it has two magnets instead of one.

Those who want to have an ornamental speaker of this type should decorate the frame and inside support, or purchase these already decorated, particularly the type sprayed with a mottled, rich brown-and-blue soft-finish effect, bordered with conservative gold lines. This sprayed decoration gives a luxurious finish second to none and is bound to make a hit with the woman of the house, no less than with the constructor of the speaker.

It represents one point of advance over the awkward models of last year—a distinct advance, too, for all the beauty of expensive furniture is conferred on the otherwise drab-looking speaker.

In tone, appearance, mechanical strength and unit improvement have the advances been made in the intervening year, and it is to everyone's advantage to capitalize on these fully, to obtain results he never dreamed were possible, and to charm his visitors with a perfection of reproduction from the 1929 HBH speaker that makes him the envy of his host of friends.

Iowa Wants Better Deal Under Shake-up

Washington.

A delegation headed by Representative Cole (Rep.), of Cedar Rapids, Ia., and Governor John Hamill, of that State, conferred with the Federal Radio Commission on the recent reallocation of radio facilities as it affects Iowa.

The delegation presented a protest that Iowa had not received the facilities to which the State is entitled, citing that the State does not have a cleared channel under the new allocation, while stations in the Chicago area, which is in the same radio zone, are scheduled to receive four cleared channels and half time on two other cleared channels.

"We are very hopeful that the situation will be remedied," Mr. Cole said following the conference.

Commissioner Sam Pickard, of the Fourth Zone, which includes Iowa, said that the Commission will hold a hearing on the Iowa situation.

The Commission held another closed conference with representatives of the American Publishers' Committee, headed by Joseph Pierson, of Chicago. This conference had to do with proposals for the allocation of the 20 transoceanic short wave channels, which has been set aside by the Commission for use in transoceanic point to point communication. No details were made public.

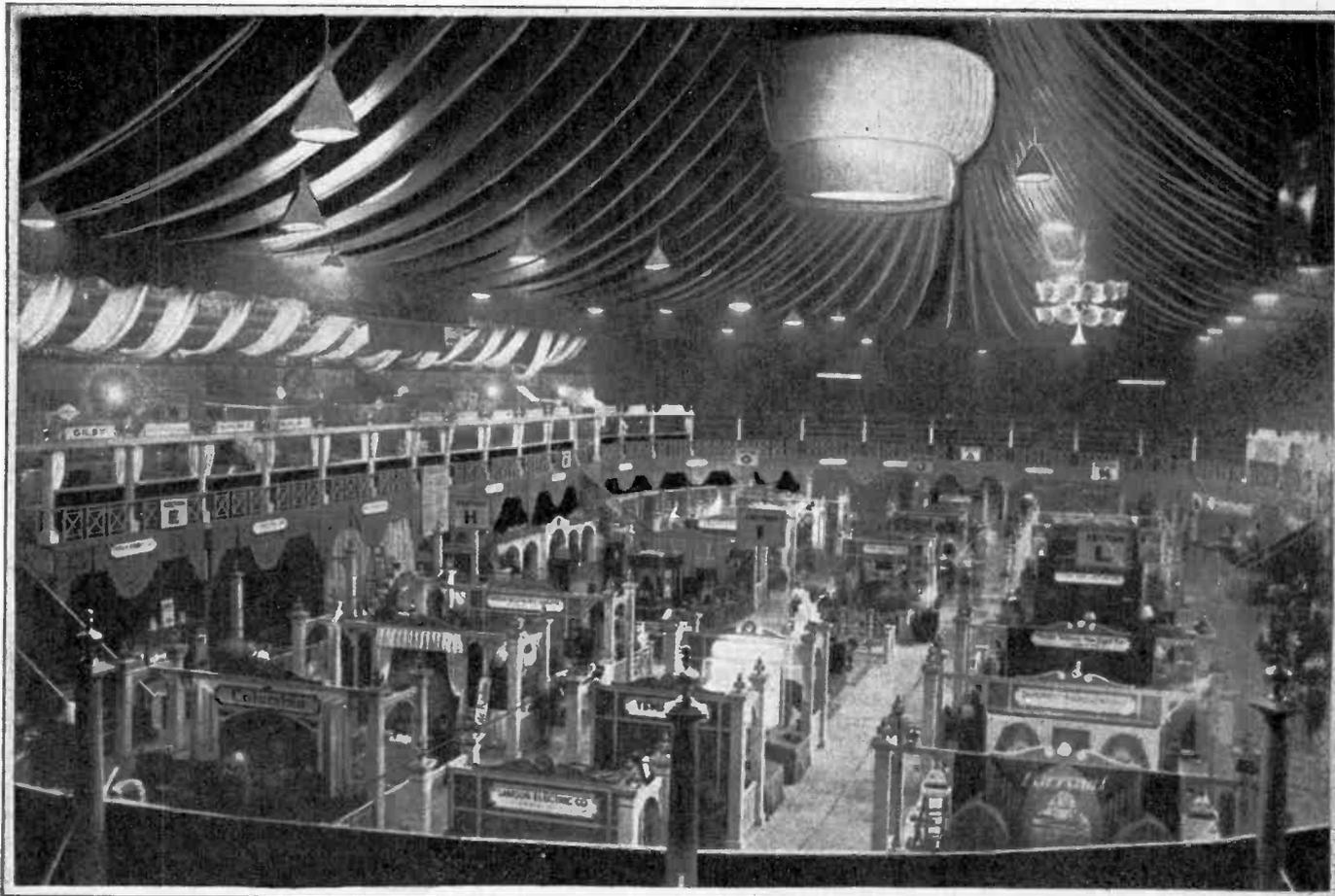
Complete Kit of Parts as Specified by H. B. Herman for 4-Tube

SCREEN GRID \$39.50 DIAMOND

BLUEPRINT FREE WITH EACH KIT! Kit consists of Hammarlund HR 23 coils, Karas tuning condensers and audio transformers, four Amperites, Clarostat, Yaxley switch and pilot bracket with lamp, aluminum subpanel with sockets on, drilled front panel, Lynch leak, Aerovox fixed condensers, Mar-co dials, Pee-wee clip, Vac-Shield, binding posts.

Custom Set Builders Supply Co. 57 Dey Street, N. Y. City

TELEVISION BIGGEST CARD AT GARDEN SHOW



(HERBERT PHOTOS)

A VIEW OF THE RADIO WORLD'S FAIR, MADISON SQUARE GARDEN, BEFORE THE DOORS OPENED ON THE LAST DAY OF THE EXPOSITION. THE TELEVISION EXHIBITS OF GENERAL ELECTRIC AND A. J. CARTER ATTRACTED MOST ATTENTION. INTEREST IN PARTS RAN HIGH, WHILE SETS ENGAGED THE EYES OF MULTITUDES, TOO.

WGY Protests Shift as Unjust, Illegal

By *Martin P. Rice*

Manager of Broadcasting, General Electric Company

WGY appreciates the spontaneous interest shown by the newspapers and the public in the recent regulation of the Federal Radio Commission which virtually limits the operation of WGY to daylight hours during the Winter after November 11th.

We shall shortly file a protest with the Commission and request an opportunity to prove that the new regulation is unfair to WGY and detrimental to the listening public.

Aside from the important developmental work conducted by the General Electric Company through WGY, and the broadcast service which this station has rendered since its opening in February, 1922, WGY occupies a unique position in the broadcasting field.

Many localities are served by several stations so that if one station is silent, listeners may tune to another.

Many Depend on WGY Alone

But a large part of WGY's audience is so located that they are entirely dependent upon this station. Therefore, to silence WGY at any time during its regular program period means depriving many sec-

tions of the country not only of the programs originating at WGY, but of the New York programs transmitted through this station.

Under the radio law the entire country is divided into five zones, each with its Commissioner appointed by the President and confirmed by the Senate. WGY is in the first zone, of which O. H. Caldwell is the Commissioner.

Old Wave Taken Away

The Davis Amendment to the radio law requires an equalization of radio power and channels throughout the five zones. In attempting to conform to the requirements of this amendment, the Federal Radio Commission redistributed the available wavelengths and assigned forty to be used as cleared channels. Eight of these wavelengths or cleared channels were assigned to each zone, and the Commissioner representing the zone nominated the stations which should have these channels in his zone subject to the approval of other members of the Commission.

In the regulations which are issued by

the Federal Radio Commission to be effective November 11th, the wavelength of 379.5 meters, corresponding to a frequency of 790 kilocycles, on which WGY has broadcast since May 21, 1923, has been taken from WGY in the first zone and transferred to the fifth zone (Pacific Coast) as one of the eight cleared channels assigned to that zone.

Objects to Part Time

This wavelength or frequency is in the group assigned to specific zones according to Section A of paragraph 4 of General Order No. 40. Such wavelengths are clearly designated by the regulations for full-time operation as stated in Section F of the same paragraph as follows:

"Whenever the word 'frequency' is used in the preceding subparagraphs A, B, C, D, and E, of this paragraph, it is to be understood as connoting periods of full-time operation; that is to say, 24 hours daily, and every allocation herein of a frequency to a particular zone is to be considered as carrying with it an assignment of full-time operation on that frequency to that zone."

This regulation clearly indicates that the wavelength which is taken from WGY and transferred to the Pacific Coast is to be used for full-time operation in that zone. Notwithstanding this fact, the Radio Commission has deprived WGY of its full-time privilege and has designated it as a part-time station to share the wavelength or frequency of KGO.

Appears to Violate Law

This assignment not only ignores all the important experimental work carried on by WGY, and the public service it has

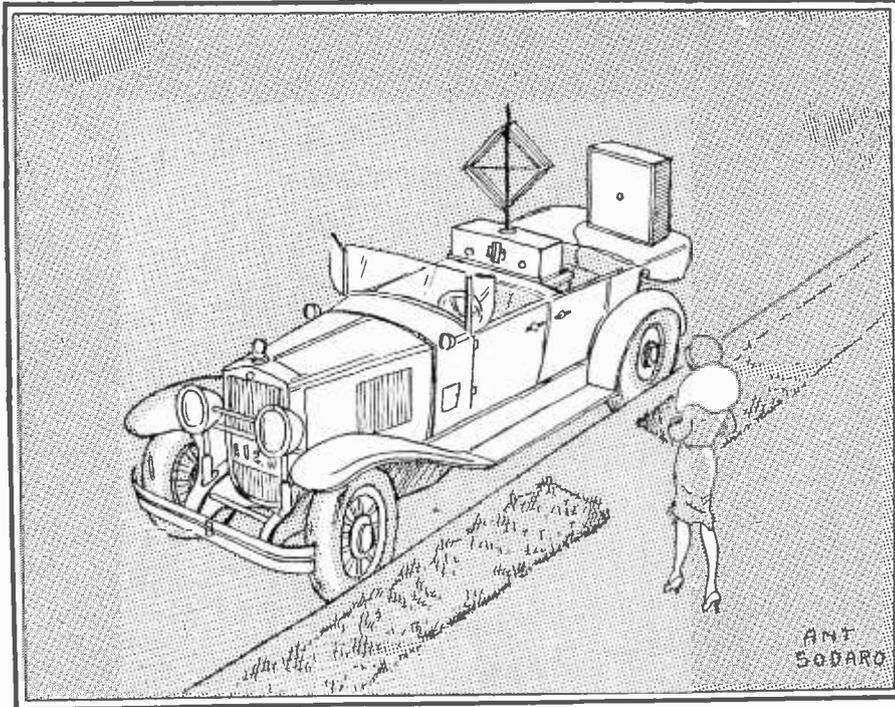
GOT WGY DRAMA



(Acme)

KENNETH G. ORMISTON, TECHNICAL EDITOR OF "RADIO DOINGS," IS BUSY WITH TELEVISION TESTS IN LOS ANGELES. HE REPORTED GETTING WGY'S TELEVISION DRAMA ACROSS THE CONTINENT

STREET CROWDS HEAR CANDIDATES



LOOP RECEIVER AND LINEN DIAPHRAGM SPEAKER FOR REPRODUCING TO CROWDS IN THE STREET THE SPEECHES OF PRESIDENTIAL CANDIDATES.

rendered since its opening, but appears to be in actual violation of the law and regulations, because the order giving WGY this assignment was accompanied by the following comment by the Commission:

"The foregoing stations will not be permitted to operate during the evening hours simultaneously with other stations assigned to the same frequencies."

Therefore, the order by which the Commission has taken this frequency away from WGY, and the first zone, also destroys its usefulness as a cleared channel in the fifth zone.

The fact that the wavelength taken from WGY, was assigned to KGO, our Pacific Coast station, has no important bearing on the matter.

More Than Wave Conflict

Commissioner O. H. Caldwell has implied that the programs of WGY and the Western station could be so scheduled that it would not be necessary for either station to cancel more than one or two hours a day. Such operation is certainly not provided for in the law or in the regulations applying to cleared channels, but, assuming that it were legally permissible, it would involve canceling KGO's program from 4:30 to 7:00 p. m., or WGY's program from 7:30 to 10:00 p. m.

Thus, while the Commissioner suggests that we may decide whether we will ripple our Eastern or our Western station, this alternative is not offered us by the regulations, and in any event we believe that we have an equal responsibility in both of these zones to serve the listening public as we have served them in the past. This is no mere conflict of wavelength of two stations owned by the same company.

Five Reasons Listed

Our protests will be based on the following facts:

1. That the Commission has taken WGY's wavelength and transferred it to the Pacific Coast without providing any substitute.
2. That the interests of listeners wholly dependent upon WGY for programs have been disregarded.
3. That the priority rights of WGY, and

Campaigners Use Radio Ingeniously

During the election campaign in Sweden, which ended September 15, one of the Swedish political parties purchased six automobiles and equipped them with loudspeakers for use by its campaigners, according to a report from the American Consul General at Stockholm, John Ball Osborne, made public by the Department of Commerce. There was a public address system in each automobile. This is the first year, according to the report, that this method of campaigning has been used in that country, and local party leaders state it met with considerable success, not only because the novelty of the arrangement attracted large gatherings, but also because speakers were able to cover a wide territory with comparative ease.

Method Used in Germany

This recalls a similar method of campaigning in the recent election in Germany. Certain candidates on one of the liberal groups had become subject to arrest when the Reichstag was dissolved. These candidates could not come out in public to do their speaking because the police were looking for them. But this handicap did not deter them and their friends from entering into a vigorous campaign. The candidates made phonograph records of their speeches in their hiding places and the records were played in public places. Once they were re-elected the candidates were no longer subject to arrest, due to the parliamentary

immunity enjoyed by members of the Reichstag.

its long record of service to the public have been ignored.

future development of radio have apparently had no weight.

The method used in the Swedish election could be applied and extended in this country. Automobiles with public address systems and radio receivers could be taken where large numbers of people pass or congregate.

A campaign speaker in front of the microphone in the automobile could address thousands of people who could not be reached in any other way.

Or when a Presidential candidate is broadcasting over radio, a receiver in the automobile could be used for picking up the speech, which speech in turn could be impressed on the amplifier of the public address system and made audible to thousands of voters who could not be at home at the time to listen to the speech over their own radio sets.

TELEVISION DEMONSTRATION

As a means of acquainting the public with the facts of television a complete television broadcasting studio and a battery of television receivers were in operation during the Radio World's Fair at Madison Square Garden, September 17th to 22nd.

The object was to show the public the present state of the art and is the result of the desire of the Radio Manufacturers' Association "to do everything in its power to remove the 'bunk' from television and correct a situation pregnant with danger to the logical and orderly development of the art."

5. That the broadcasting of WGY's programs on short waves, which has been a factor in promoting international goodwill, is apparently not considered.

The New Push-Pull Re

By J. .
Techni

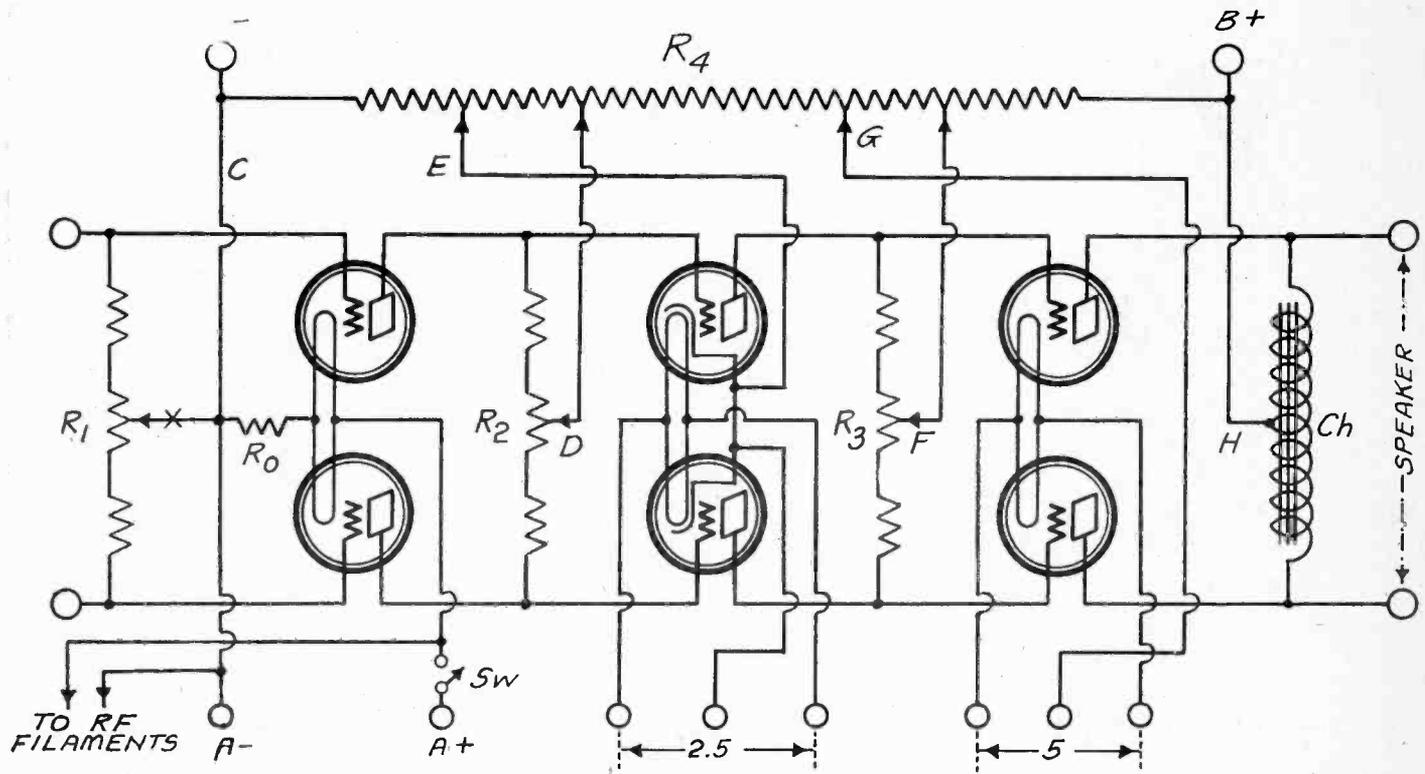


FIG. 1

A THREE-STAGE RESISTANCE COUPLED AMPLIFIER SO DESIGNED THAT THERE IS NO HUM IN THE OUTPUT.

WHEN direct heated tubes are used in the novel resistance coupled amplifier, described in the September 15th issue of RADIO WORLD, there is considerable hum in the output. This is particularly true when such tubes are used in the first stage, or when high mu tubes with thoriated filaments are used in either the first or the second stage.

It is possible to use tubes having an indirectly heated cathode. Such tubes will not introduce any hum. But their amplification is not high enough for a resistance coupled amplifier, except the AC screen grid tube. With proper coupling resistance a voltage amplification of 8 and over is possible. Two such stages would give 64 or over. Since a voltage amplitude of 40 is necessary to load up a -71A tube, the input voltage amplitude to the first audio tube would have to be .625 volt. That is just a little more than an ordinary detector can deliver without excessive distortion, even if the voltage is first stepped up with a transformer.

What To Do

Hence at least one stage of high mu tube amplification is desirable. If this can be made the first, it is possible to heat the filaments of the tubes by the battery supplying the radio frequency tubes and the detector. The second stage can then be a pair of -27 type heater tubes and the last stage a pair of -71A power tubes. This combination will be almost entirely free of hum, and it will have sufficient amplification.

To design a push-pull circuit of this type incorporating the heater tubes it was necessary to take curves on the tube. Three curves were taken at three different plate voltages. One was for 45 volts on the plate, another for 110 volts on the plate, and still another for 175 volts. These plate voltages are not exact,

for they were obtained with a low resistance meter which took more current than the tube under measurement. But they are sufficiently accurate for design purposes.

Determining Voltages

It will be found generally that the output curves are reasonably straight down to a point where the output voltage is 10 volts. This fact may be used in determining the plate voltage required under given conditions.

Allowance must be made for a swing of 40.5 on the grid of the power tube. Thus there must be a drop of 81 volts in the output resistor in addition to the 10-volt minimum. That is, the drop should be at least 91 volts. That means the applied voltage in the plate circuit must be somewhat greater than 91 volts. In order to provide a margin of safety against possible distortion it ought to be about 20 percent greater. Thus 110 volts is suitable.

The middle curve in the graph was taken for this applied plate voltage. It will be observed that when the bias on the tube is zero the drop in the load resistor is 107 volts. When the drop in it is 10 volts the grid bias is 12.5 volts. Thus a possible signal amplitude of 6.25 volts is permissible. But all that is not necessary. A 5-volt swing is ample.

Design of First Stage

A suitable operating point on the curve is at 6 volts bias, where the drop in the output resistor is 56 volts. The grid bias on the power tube should be 45 volts rather than 40.5 volts. Thus the 56-volt drop is 11 volts greater than the required bias, and this must be allowed for in connecting the filaments to the voltage divider R4, Fig. 1.

Since the tubes in the first stage are

high mu, the voltage amplification will be about 17 times. Hence only a small signal input is required to get the 5-volt output. In fact only .3 volt is required. Thus it is not necessary to provide any other grid bias than that obtained from the ballast resistor R0, in which the drop is 1 volt.

The plate voltage on this stage need not be greater than 50 volts. With this plate voltage and 1 volt bias the voltage drop in the .5 megohm load resistor R2 will be about 25 volts, 19 more than required for the bias on the second stage. This difference must be allowed for in connecting the cathode to the voltage divider R4.

Each of the resistors R1, R2 and R3, consists of three units—two fixed resistors and one adjustable voltage divider between them. The fixed resistors may be of .5 megohms and the voltage divider about 100,000 ohms. The object of the slider is to find the exact center of the coupling resistance.

Since the required plate voltage on the first stage is 50 volts, the drop between B— and D should be 51 volts. If the current in the negative end of R4 is 50 milliamperes the resistance between D and B—should be 1,020 ohms. A small variation is of little importance since it really does not make any difference whether the voltage is 49 or 51 volts. Hence a 1,000-ohm resistor may be used, provided that it has a slider for the E connection.

Now if E and D are connected together the bias on the second pair of tubes will be too high by 19 volts, as was determined above. Hence E should be connected 19 volts to the left of D.

The voltage drop between F and E should be 110 volts. Hence that between F and D should be 91 volts. The voltage drop in FG should be 11 volts as was

Resistance Coupled Amplifier

Anderson

Editor

previously determined. Hence the drop between G and D should be 80 volts. The current in this section of R4 is very nearly 50 milliamperes. Hence this portion of the resistance should be 1,600 ohms. The current between G and F will be only 10 milliamperes, so that the resistance should be 1,100 ohms.

Voltage On Last Tube Determined

The voltage on the plate of the last tube should be 180 volts. Since the drop in GF is 11 volts that between B plus and F should be 169 volts. The current in this portion of R4 is only 10 milliamperes. Hence the resistance should be 16,900 ohms.

The total voltage is somewhat less than the sum of the three plate voltages. The voltage between B and D is 51 volts. The drop between D and F is 91 volts and that between F and H is 169 volts. Hence the total voltage required is 311 volts.

The total resistance required is 20,620 ohms. The best way of getting this is to use several commercial resistors provided with taps and to connect them in series. The resistors to the left of G should be able to carry 50 milliamperes and those to the right 10 milliamperes.

A vacuum tube voltmeter should be rigged up for adjusting the circuit, although the plate voltage may be measured with sufficient accuracy with a 1,000 ohm per volt voltmeter. But the plate voltages are not so important as the grid voltages, and these can only be measured with a vacuum tube voltmeter. The bias on the grids of the first tubes should be 1 volt. No special measurement need be made on this for the drop in R0 will take care of it.

Grid Voltages Measured

The voltage between the cathodes and either of the grids of the heater tubes should be 6 volts. If the measured voltage is less it may be increased by moving E toward D and if it is greater it may be decreased by moving E away from D. When making this adjustment all the tubes should be lit and all the plate voltages should have approximately the correct values. And the current in the negative end of R4 should be held constant at 50 milliamperes.

If the grid voltages on the two tubes are different they may be brought together by sliding D on R2.

The voltages on the grids in the last stage should be 45 volts, measured from G to either of the grids. If the measured voltage is not the value required, it may be changed by sliding G. Also, if they are not equal they may be equalized by sliding F on R3.

The tubes used should be selected in pairs for equal characteristics. It is better to have equal tubes than to equalize the output voltages by sliding the mid-taps.

Terminations of Circuit

The plate voltage to the last two tubes is supplied through a mid-tapped choke coil CH, such as the primary of the National push-pull output transformer. The loud speaker is connected across the terminals of this coil, or from plate to plate.

The circuit is supposed to be coupled to a detector by means of a good audio transformer, preferably a push-pull input transformer. The output of this transformer will be divided equally between

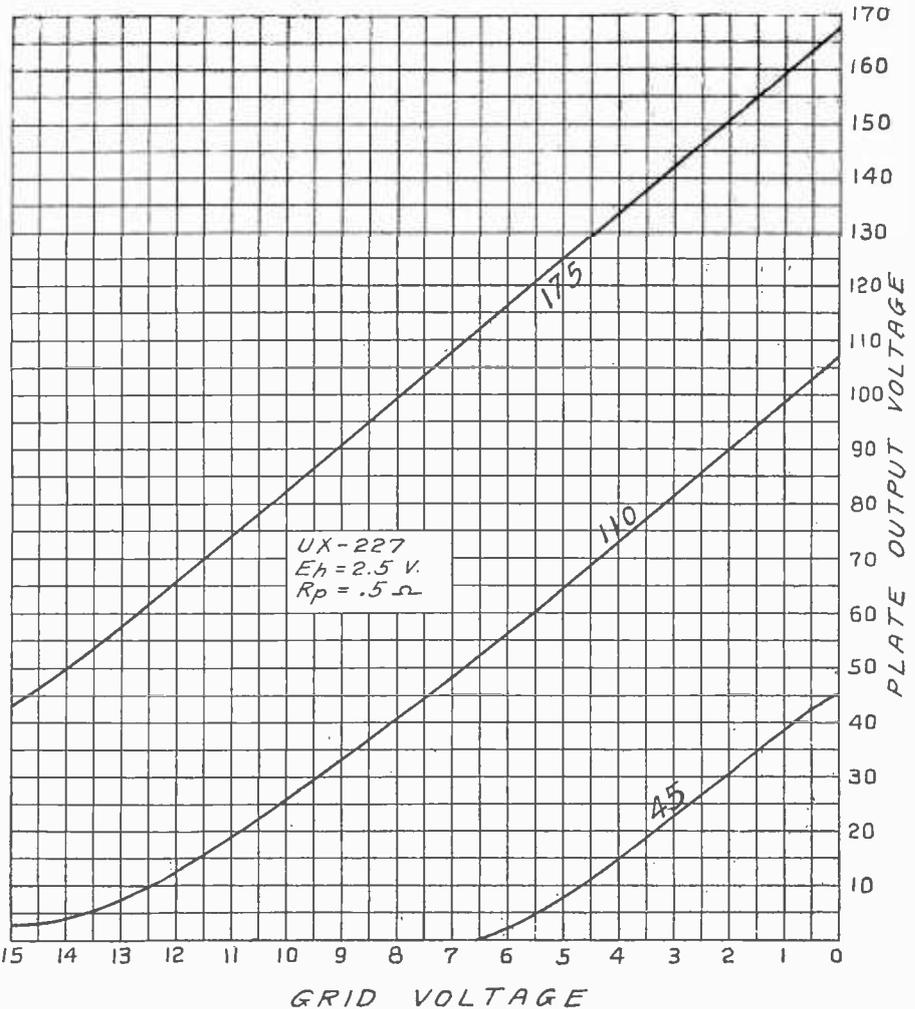


FIG. 2
GRID VOLTAGE PLATE OUTPUT VOLTAGE CURVES FOR A TYPE 227 TUBE WORKING INTO A HALF MEGOHM RESISTOR WITH THREE DIFFERENT VOLTAGES ON THE PLATE

the two sides of the push-pull circuit. Hence the voltage amplitude across the secondary should be .6 volt if the circuit is to be worked to its limit. If the ratio of the transformer is 4-to-1 the voltage across the primary should be .15 volt. It is possible to get this from a good detector without distortion.

The plate voltage for the RF tubes and the detector may be taken from the same voltage source as that which supplies the push-pull circuit. But it is preferable to use a separate voltage divider, connected in parallel with R4. This is in order to avoid as much as possible a redistribution of the currents and voltages in R4, and also to avoid coupling.

By-Passing Necessary

By-passing is required in the push-pull circuit. One condenser should be connected between B and D, another from F to E and a third from H to G. Each of these condensers should have a capacity of 1 mfd. or more. The larger these condensers are the better will the operation be.

Additional by-pass condensers may be used between D and E and F and G. These condensers by-pass the grid circuits, just as the other condensers by-pass the plate circuits.

The 45 volt curve on the graph for the -27 tube can be used when the heater tube is used in the first stage of audio amplification. A bias of 3 volts is suitable, allowing an amplitude of 3 volts without distortion. At 3 volts the output voltage is 22.5 volts.

The 175 volts curve could be used if the -27 tube was to feed a -50 type power tube, provided that the power tube is not worked to the limit with 450 volts on the plate. But a voltage amplitude of 75 volts may be obtained by making the bias on the heater tube 9 volts. If a greater signal voltage is desired on the power tube the plate voltage on the -27 should be raised to about 200 volts.

An advantage of the heater tube is clearly shown on the curves in Fig. 2. Although the tube was heated with AC there is no apparent curvature due to grid current for low values of grid bias, such as is the case for tubes of the -26 and -40 types.

The curves are straight all the way to zero bias except the lowest curve which shows a slight bend. This lack of curvature shows there will be no distortion due to grid current as long as the signal does not drive the grid positive with respect to the cathode.

It also has a bearing on the absence of hum.

Chain to Put Football on Air Weekly

Sixteen intercollegiate football games will be "covered" by the National Broadcasting Company during the gridiron season this year.

Graham McNamee and Phillips Carlin will be the radio reporters. Two games will be broadcast each week, McNamee at the microphone at one game, Carlin at the other. Extensive networks will be used.

The radio football season will open Saturday afternoon, October 13th, when Yale meets Georgia at New Haven, and Notre Dame and Navy clash at Soldiers Field, Chicago. Carlin will describe the Georgia-Yale game, McNamee the other.

On October 20th Harvard will meet the Army eleven at Cambridge. Notre Dame plays Georgia Tech on the same date. Both will be broadcast by the chain.

Dartmouth and Harvard will meet at Cambridge, October 27th, and Yale and Army will clash at New Haven on the same date.

Sears-Roebuck Sells WLS to Farm Paper

Chicago

WLS, the Sears-Roebuck station, has been sold to "Prairie Farmer," America's oldest farm paper.

The present ideals of service to agriculture and maintenance of midwest culture will be continued. Sears, Roebuck and Company will continue to be represented each day on the air. These announcements have been made by the officers of the two companies.

E. L. Bill, director of the station since its opening four and one-half years ago, will remain in charge. The wavelength remains 345 meters (870 kilocycles). The time each week on the air is 70 hours. The call letters will remain the same.

New Waves Aid Sales, Lafount Tells Trade

Steps recently taken by the Federal Radio Commission in the interest of improved radio reception "open up great possibilities for expansion in radio sales," according to Commissioner Harold A. Lafount.

In a letter to three manufacturers of apparatus, the Commissioner stated that the rural areas heretofore deprived of good radio will have excellent reception under the reallocation of stations ordered by the Commission to become effective November 11. Consequently, he declared, increased radio sales should follow.

The letter was addressed to Harold Wrape, president, Radio Trades Association, St. Louis; Herbert H. Frost, vice-president of the Federal Kolster Co., New York City, and Louis B. F. Raycroft, Electrical Storage Battery Co., Philadelphia.

Former Radio Maker

The full text of the letter follows:

"During the past week certain orders have been announced affecting radio broadcasting stations, which will in my opinion open up great possibilities for expansion in radio sales.

"As a former manufacturer of radio apparatus, I naturally feel interested in that branch of the industry and feel at liberty to address you on this subject. Also, being from the great open spaces of the West, I know the value of the radio to the farmer, and that it is becoming a necessity in every home.

"The radio industry has assumed tremendous proportions; manufacturers have kept pace with the art, modernizing transmitting and receiving equipment, with the result that radio has become a potent factor in the lives of millions of people of all classes. During its spectacular growth, the regulation of the ether channels (the foundations of every branch of radio activity) has been and is understood by comparatively few people.

Mistake Would Be Fatal

"A mistake on the part of the Federal

Radio Commission would wreck the entire industry. If all the applications for radio stations had been granted, or if the Commission had taken favorable action upon one-half the applications for increased power, such a thing as radio reception would have been impossible.

Seeks Improvement

"Consequently, the first thought of the Commission is to improve radio reception and at the same time protect the invested millions, thus assisting in building and stabilizing a permanent, progressive and profitable industry. The most recent action of the Commission will, in my opinion, assist materially in the accomplishing of these things.

Extremely Interested

"I am extremely interested in your undertaking and most sincerely hope that you and all other manufacturers will greatly increase your sales this Fall, to the end that the public everywhere may enjoy this new, remarkable, unique medium of entertainment, education, etc., etc., known as radio."

New AC Regulator

A new and highly efficient voltage regulator for the users of AC tube sets has been brought out after long experimentation by the Ward Leonard Electric Co., Mount Vernon, New York. This is the Vitrohm 507-109 unit and is of the general order of high excellence of the Ward Leonard products. It is easily and instantly installed and answers all the requirements of a unit of this kind. Once installed it lengthens the life of any type of AC tubes by automatically lowering the filament voltage to the proper level and keeping it there, no matter how high the line surges. Full information on this unit and on the complete line of Ward Leonard products may be had by addressing Frank Logan, care Ward Leonard Electric Co., 31 South Street, Mount Vernon, N. Y. Mention RADIO WORLD.—J. H. C.

Half of Quota Goes to Small Stations

Washington

The smaller broadcasting stations throughout the country have been given particular attention by the Federal Radio Commission in its reallocation of broadcasting facilities to become effective November 11th at 3 a. m., according to a statement made public by the Commission.

The statement compares present assignments of stations with those to become effective in November. The full text of the statement follows:

August, 1928, assignments compared with assignments as of November, 1928, reallocation:

Note: Particular attention has been given by the Radio Commission to the needs of the smaller broadcasting stations.

In carrying out its desire to provide liberally for such local broadcasters, it should be observed that nearly one-half (48 per cent) of the assignments to each State are for local broadcasters having powers of 10, 50 and 100 watts, while the remaining assignments are divided among

the larger stations of 250 and 500 watts upwards.

The figures given first indicate the number of stations operating in August, 1928, and those given second, the number assigned in the November reallocation.

Zone I: Maine, 3 and 2; New Hampshire, 3 and 1; Vermont, 2 and 1; Massachusetts, 16 and 9; Rhode Island, 7 and 2; Connecticut, 3 and 4; New York, 35 and 24; New Jersey, 18 and 9; Delaware, 1 and 1; Maryland, 4 and 4; District of Columbia, 3 and 2; Porto Rico, 1 and 3; total, 96 and 62.

Zone II: Pennsylvania, 33 and 21; Virginia, 10 and 6; Ohio, 20 and 15; West Virginia, 4 and 4; Michigan, 20 and 10; Kentucky, 3 and 6; total, 90 and 62.

Zone III: Alabama, 5 and 6; Florida, 11 and 4; Georgia, 6 and 7; South Carolina, 2 and 4; North Carolina, 6 and 6; Tennessee, 13 and 6; Texas, 29 and 12; Louisiana, 11 and 4; Mississippi, 5 and 4; Arkansas, 3 and 4; Oklahoma, 9 and 5; total, 100 and 62.

Zone IV: Illinois, 33 and 17; Indiana, 16 and 7; South Dakota, 8 and 1½; North Dakota, 6 and 1½; Nebraska, 13 and 5; Wisconsin, 15 and 6; Iowa, 18 and 5; Kansas, 7 and 4; Minnesota, 15 and 7; Missouri, 19 and 18; total, 154 and 62.

Zone V: Alaska, 3 and 2; Arizona, 5 and 3; California, 38 and 24; Colorado, 12 and 5; Hawaii, 2 and 2; Idaho, 4 and 3; Montana, 7 and 3; Nevada, 0 and 1; New Mexico, 2 and 2; Oregon, 11 and 4; Washington, 16 and 8; Wyoming, 1 and 2; Utah, 4 and 3; total, 105 and 62.

Total assignments, all five zones, 310.

Total assignments for 250, 500, 1,000, 5,000 watt stations, 165.

Total assignments 10, 50 and 100 watt stations, 145.

Figures here shown are for "full-time assignments," that is, positions operable during night hours. One assignment may, however, be shared by two, three or more broadcasting stations, depending upon the extent of the time-sharing required to accommodate the actual number of licensed stations in the State or locality

62 Stations Deleted for Bad Record

Washington

A summary of the decisions of the Federal Radio Commission in the cases of the 164 broadcasting stations cited for alleged failure to serve the "public interest, convenience and necessity," shows that 62 stations were deleted. Only 81 of the aggregate number escaped adverse action of the Commission, some having been reduced in power or ordered to consolidate, according to the summary.

The full text of the Commission's statement follows:

"Altogether there were 164 broadcasting stations involved in the hearings held in July, in the course of which they were called upon to demonstrate to the Commission that their continued operation would serve public interest, convenience or necessity; of the 164 stations only 81 escaped adverse action of the Commission, and even as to those there may be changes in frequency, or reduction in hours of operation shown by the new reallocation.

"Of the remaining stations 12 were reduced in power, 4 were placed on probation, and 5 were left on as the result of a consolidation (two of these consolidations being also reduced in power).

"The remainder of the stations, a total of 62, were all deleted, either as the result of orders of the Commission refusing to grant the applications for renewal of licenses, of default, or of voluntary surrender of licenses.

"Consequently, a very considerable reduction has been made in the number of broadcasting stations licensed to operate, and among the stations left on the air reductions have been such as to assist the Commission in eliminating interference."

Washington

A thousand local low-powered radio broadcasting stations can be accommodated without interfering with good reception of the national programs broadcast by the larger stations, in the opinion of O. H. Caldwell, Commissioner for the First Radio Zone, as expressed in two letters which Mr. Caldwell made public.

One of the letters was addressed to Senator Watson (Rep.), of Indiana, and the other to a correspondent in New York City whose identity was not made public. In both letters, Mr. Caldwell reaffirms his belief in the feasibility of high-powered stations, but says that he is also in favor of a larger number of licenses for stations in small communities to operate on powers of from 10 to 50 watts.

Letter to Watson

His letter to Senator Watson follows in full:

"Dear Senator Watson: There has been so much misinformation spread concerning the use of high power radio stations, that is, stations of 15 to 50 kilowatts (which means only 20 to 65 horsepower—less than the power of an ordinary automobile), that I believe you may find the enclosed statement of interest.

"The main point is that were we to cut the powers of all the 50,000 watt stations to 5,000 watts, such stations would occupy exactly the same space in the broadcasting spectrum, and so would not

Board Will Restrict Visual Broadcasting

Washington

Regulation of television and picture broadcasting shortly will be undertaken by the Federal Radio Commission, in the opinion of Commissioner Harold A. LaFount.

In a letter to broadcasters in the Fifth Radio Zone, which he represents, the Commissioner suggested that broadcasters defer the purchase of any equipment or the making of any investment for visual broadcasting until this action has been taken.

Text of Letter

"In my opinion the Commission will shortly issue orders for the regulation of television and picture transmission, particularly in the broadcast band. I, therefore, suggest that you defer the purchase of any equipment or the making of any investment until such action has been taken.

"It also appears probable to me that the Commission will announce a policy or regulation of rebroadcasting and relay broadcasting. If you are particularly interested in these matters, I suggest you communicate with me at once, telling me just what your interest is and what you believe the Commission should do. It will help me in discussing these problems with the Commission.

Expects Quality Transmission

"Although the Commission is not prepared at this time to announce a regulation ordering the maximum percentage of modulation and the highest possible degree of accuracy or frequency control consistent with modern radio engineering, it expects all stations to give the listening public the benefit of the highest quality of transmission possible.

"You will notice on the key to the allocation plan that three Fifth Zone sta-

tions are shown to be operating on channels assigned to other zones. These three stations are daylight stations only and for that reason during daylight hours operate on channels assigned to other zones."

Caldwell's View

"In view of the increasing time being taken by television on the broadcasting band," Commissioner O. H. Caldwell has written to several stations experimenting with television, "I find there is a determination on the part of my fellow Commissioners to eliminate wholly such experimentation except between the hours of midnight and 6 A. M.

"Personally, I am not in sympathy with this view and have, therefore, drafted an order, which would somewhat relax the drastic provision preferred by a majority of the Commission.

"Will you give me your own views on this proposed order of mine, as an alternative to complete elimination of visual broadcasting during aural broadcasting hours?"

New Books to Go On Air as Playlets

Arrangements have been concluded between the Literary Guild of America and the Eveready Hour whereby Eveready, a pioneer in broadcasting radio programs, will broadcast a number of the books chosen each month by the Literary Guild for distribution to its 55,000 members.

The plan, which provides for putting "on the air" all Guild books which lend themselves to broadcasting, is considered to mark a distinct forward step in the progress of radio broadcasting to a place of distinction among the cultural arts.

Room for 1,000 Small Stations

Washington

A thousand local low-powered radio broadcasting stations can be accommodated without interfering with good reception of the national programs broadcast by the larger stations, in the opinion of O. H. Caldwell, Commissioner for the First Radio Zone, as expressed in two letters which Mr. Caldwell made public.

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"The main point is that were we to cut the powers of all the 50,000 watt stations to 5,000 watts, such stations would occupy exactly the same space in the broadcasting spectrum, and so would not

make room for any more small stations. To cut the powers would, however, deprive millions of listeners of their programs and this deprivation would fall upon the farmers, the ranchers, the people living in mountain cabins, and the residents of villages.

Can Handle 1,000

"Along with my recommendation that stations be granted the highest possible power when operating above 5,000 watts, I am also urging that a larger number of licenses be issued to small communities of 10 to 50 watts.

"We can handle a thousand such little stations, each of which would provide the outlet for its local community and would give fair service over the few miles of area in which local events are of interest.

"The method of increasing the radio service to the public is, therefore, on the one hand, to increase the powers of the big stations, and on the other, to increase the number of small stations, many hundreds of which can be operated on a very limited number of wave lengths."

Place for Low Power

Mr. Caldwell's letter to his New York correspondent follows in part:

"Dear Sir: While, as you say, I am a stout defender of the high power station, still I believe there is a place for the little low power transmitter of 10 to 50 watts.

Of course, such stations should not be permitted to get in the way of the big stations which render 99 per cent of the service.

"From a radio standpoint, I feel that there is plenty of room for a comparatively large number of such small local transmitters of 10 to 50 watts power, so that every community of 10,000 population and above can have its voice on the air, without interfering with the important general service furnished by the larger stations.

Greater Usefulness

"To my mind, the usefulness of every home radio receiver will be expanded if, in addition to receiving the great general programs which will always be the backbone of radio service to all listeners, there is also made available at one end of the dial, out of the way of present popular programs, a local band where the listener can tune in his town or county transmitter, and hear events and ceremonies of strictly local interest.

"Examples of such features would be local basketball and baseball games, high-school events, town patriotic exercises, church music and sermons, town meetings and debates of local issues, and so on.

"Therefore, I feel that there is a very real need for this class of local broadcasting, providing it does not get in the way of the great program features which bring entertainment, inspiration and enlightenment to millions."

A THOUGHT FOR THE WEEK

IF the crowds that attended the recent Radio World's Fair at Madison Square Garden, New York City, count for anything, then indeed the new radio season of 1928-29 finds the country full of enthusiasm and keen expectancy. Perhaps television or the coming election has given a new fillip to public taste for the science, the art and the entertainment of radio—but why look a gift horse in the mouth?

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

TELEPHONES: BRYANT 0558. 0559

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This 3 stage resistance-coupled amplifier kit is available at your dealer for quality television reception. With this precision built apparatus you can easily and cheaply assemble an efficient television amplifier. \$9.00 complete.

Send for free book.

ARTHUR H. LYNCH, INC.

1775 Broadway

New York City

New Kent Hour Series Starts Sunday Night

The fourth year of Atwater Kent radio concerts, featuring grand opera and concert stars, will open Sunday night, October 7, with the first of a new Fall and Winter series of one-hour programs.

Many new singers and instrumentalists of international renown, in addition to other great artists previously presented, will be heard on the Atwater Kent hour during this series, according to announcement just made by A. Atwater Kent. A network of twenty-six stations, virtually covering the country, will carry this premier program of the air to the millions of listeners who tune in for it each Sunday evening.

An ensemble of ten Metropolitan Opera artists, starring Frances Alda, leading Metropolitan soprano, and Mario Chamlee, tenor, will feature the October 7th concert.

Papi Will Direct

The Atwater Kent orchestra of twenty-four pieces on this occasion will be under the leadership of Gennaro Papi, former Metropolitan conductor. An octet of women's voices from the Metropolitan and a male quartet will supplement the vocal numbers of Alda and Chamlee.

The opening concert will present a rare opportunity for the radio audience to hear

selections from the operas of Puccini. By special permission from the publisher, Ricordi, a concession seldom extended the Metropolitan stars will present selections from the works of this famous Italian composer.

Some Other Celebrities Later

The list of artists included in the announcement of plans for the forthcoming Atwater Kent Hours includes also Sonhie Breslau, Giuseppe DeLuca, Maria Kur-enko, Beniamino Gigli, Josef Hofmann, Albert Spalding, Nina Morgana, Titta Ruffo, Mary Lewis, Richard Bonelli, Charles Hackett, Carmela Ponselle, Luc-rezia Bori, Tito Schipa and Jeanne Gordon.

The stations to broadcast this series in association with the National Broadcasting Company are, WEAf, New York; WEEL, Boston; WFI, Philadelphia; WRC, Wash-ington; WGY, Schenectady; WGR, Buf-falo; WCAE, Pittsburg; WTAM, Cleve-land; WWJ, Detroit; WSAI, Cincinnati; WGN, Chicago; KSD, St. Louis; WCCO, Minneapolis; WOC, Davenport; WHO, Des Moines; WOW, Omaha; WDAF, Kansas City; KVOO, Tulsa; WTAA, Dallas; WSM, Nashville; WMC, Mem-phis; WSB, Atlanta; WBT, Charlotte; KOA, Denver; KPRC, Houston; WOAI, San Antonio.

Rules for Talking Before Microphone

Radio speakers are more susceptible to microphone fright than musicians, is the opinion of Byron Mills, of KGO. He said:

"It takes but a few minutes for the mike with its blank stare to squelch the most experienced speaker making his radio debut. Unlike the singer, the radio speaker is unable to become so wrapped up in what he is doing as to forget himself.

Definite Technique

"There is a definite radio technique in talking over the air.

"Approximately 100 words a minute is the speed for a radio speech.

"Raising the voice cannot be used to

stress a point. This must be done by pausing, repetition and phrasing.

"The pompous, grandiloquent speaker of yesterday is ridiculous over the air.

Distance from Mike

"Quality and tone of voice should be natural and should carry the speaker's personality.

"A light voice is generally broadcast about a foot and a half from the micro- phone, while a heavy voice just about half again that distance.

"The letter 's' should be avoided as much as possible. Not that it cannot be reproduced over the air satisfactorily, but because so few speakers articulate it."

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Radio University

A QUESTION and Answer Department conducted by RADIO WORLD, by its staff of experts, for University members only.

When writing for information give your Radio University subscription number.

IS IT POSSIBLE to measure alternating voltages with a vacuum tube voltmeter? If so, please explain how it may be done.

(2)—If alternating voltages can be measured with such a voltmeter, are peak values or effective values obtained?

(3)—Is it possible to measure alternating currents with a vacuum tube?

AUSTIN BRADFORD,
Binghamton, N. Y.

* * *

(1)—A vacuum tube voltmeter may be used to measure either alternating or direct voltages. Alternating voltages are measured in the same way as direct voltages, except that the meter is calibrated for alternating instead of direct voltages.

(2)—Either peak or effective values may be obtained, depending on the calibration.

(3)—Alternating currents may be measured indirectly. The voltage drop in a resistance of known value is measured first and then the voltage obtained is divided by the known resistance to get the current.

* * *

HOW CAN a voltmeter be used for testing whether a condenser is short-circuited?

(2)—How can a voltmeter be used for testing the continuity of a resistor or a coil?

(3)—Is it possible to use a milliammeter for testing a condenser? If so, please show how.

ALFRED N. ROBINSON,
Wilmington, Del.

(1)—Connect a battery of suitable voltage in series with the meter and the condenser and note the deflection. If the condenser is good there should be no deflection. If there is a steady reading the condenser is shorted.

(2)—Connect the meter in series with the coil or resistor and a battery of suitable voltage. There should be a deflection if the coil or resistor is continuous. If there is no deflection the tested apparatus is open.

(3)—A milliammeter may be used for testing a condenser by first charging the condenser by means of a battery and then discharging it through the meter. Between the charge and the discharge wait a moment. If the condenser is poor the charge will leak off during this wait. If the condenser is good the charge will remain for a considerable period. When the condenser is discharged through the meter the needle jumps. Care must be used not to use too heavy charge for the meter. A voltmeter may be used for this test the same as a milliammeter, and it is always much safer.

* * *

WHAT IS the normal plate current for a 171A tube when the plate voltage is 180 and the grid bias is 40½ volts? I use such a tube but I get only 13 milliamperes.

(2)—Is the plate current for this tube less than normal when it is operated from a B battery eliminator?

(3)—When the grid bias is obtained from a 2,000-ohm resistor in the lead to the mid-tap of the filament, does the grid bias adjust itself to the proper value, or is it necessary to change the resistance when the plate voltage is changed?

FRANKLYN P. WILLIAMS,
Philadelphia, Pa.

(1)—The normal plate current is 20 milliamperes. One reason why you get

only 13 milliamperes is that the effective plate voltage is not 180 but some lower value.

(2)—In many eliminators the sum of the grid bias and the plate voltage is 180 volts. This voltage is divided so that the plate gets about 147 and the grid 33 volts.

(3)—The 2,000-ohm resistor need not be changed. The grid bias adjusts itself.

* * *

I BUILT the four-tube screen grid Diamond of the Air according to your blueprint, but I am not getting the results which I expected. The tickler has no effect whatsoever and the signals on the low stations are very weak. Can you suggest a remedy?

(2)—In the circuit diagram on the blueprint the screen grid voltage lead points to 135 volts and on the wiring diagram it says 16½ to 45 volts. Which is correct?

(3)—Can a high mu tube be used as detector in place of the screen grid tube? If so, what changes are necessary in the circuit?

MALCOLM S. WILSON,
Galveston, Texas.

(1)—Possibly you have short-circuited the tickler by the by-pass condenser in the plate circuit of the detector. This condenser should be connected from A minus to the P binding post on the first audio transformer, not to the plate post on the socket.

(2)—There is no discrepancy between the two diagrams. One indicates you should find what value is best and the other indicates that you should look for it between 16½ and 45 volts.

(3)—Yes, you can use a high mu tube for detector, if a low-ratio transformer follows the detector.

* * *

CAN A DOUBLE LOOP be used for a regenerative receiver if a large loop is used for pick-up and tuning and a smaller loop is used for tickler?

(2)—Would such an arrangement cause any interference with other receivers?

WATSON WILSON,
Omaha, Neb.

(1)—Such an arrangement can be used and it is quite effective.

(2)—It will cause considerable inter-

ference with other receivers in the neighborhood if it is permitted to oscillate. And at times it is practically impossible to prevent it from oscillating.

* * *

I HAVE an electro-dynamic speaker of the 90-volt field type. I connected this across the 90-volt tap on my B battery eliminator and turned on the receiver. The results are not satisfactory, the volume being poor and the quality very bad. I had heard the same speaker before I bought it and it worked all right. What accounts for the difference in the results?

(2)—If my B battery eliminator is at fault how can I correct the trouble?

(3)—Is it possible to connect the field of the loudspeaker in series with the negative side of the B battery eliminator line and use the entire current for polarizing the dynamic speaker?

FRANCIS OVERTON,
St. Paul, Minn.

(1)—When the field of the dynamic speaker is connected across the 90-volt tap the voltage drops to a small fraction of 90 volts. The field of the dynamic speaker gets only a small fraction of the current required and the voltage on the plates of the tubes serviced by the 90-volt tap drops to such a low value that the tubes cannot function.

(2)—The speaker in question requires a total field current of 40 milliamperes. If the field winding is connected in series with a suitable resistance across the high voltage tap the resistance can be varied until the current is 40 milliamperes. If the resistance is on the high voltage side of the field winding the drop in the field can be used for the 90-volt plates in the receiver. Then not only will the current in the speaker field be right but also the voltage on the plates of the tubes.

(3)—Yes, it is possible to connect the speaker in series with the line provided the 90 volts can be spared. If the total current is more than 40 milliamperes a resistor can be connected in parallel with the field and adjusted until the current in the field is 40 milliamperes. In case of a high power receiver using a -50 tube with 450 volts on the plate, the 90-volt drop in the field can be used for grid bias on the power tube. If 90 volts is too much for bias the field drop can be reduced to about 84 volts without a great reduction in the sensitivity of the dynamic.

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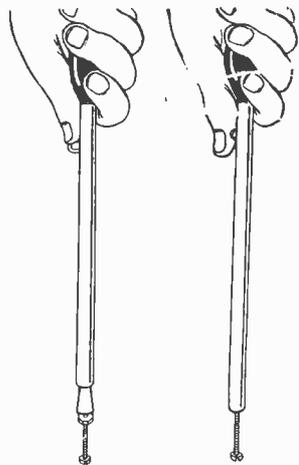
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OCT. 29—The Victoreen Power Supply with Audio Channel, by J. E. Anderson; Beauty of Sound and Appearance in Reproducers, by H. B. Herman.

NOV. 5—Part I of a two-part article on The Fenway Electric Concertrola; The Lynch Five, by Arthur H. Lynch; The How and Why of J-Ft. Cone, by James H. Carroll.

NOV. 12—The New Nine-in-Line Receiver, by John Murray Barron; Part II on how to construct the Electric Concertrola; Unbiased Facts About Underbiased Grids, by Roger C. Brooks; Data on Meters, by Frank De Rose.

NOV. 19—Part I on how to build the Improved Laboratory Model Super-Heterodyne (Silver-Marshall Jewelers Time Signal Amplifier), by E. R. Pfaff; Part III of a four-part article on the Electric Concertrola; New Model DC Set, by James H. Carroll.

NOV. 26—The Four Tube DX Fountain, by Herbert E. Hayden; concluding installment on the Fenway Concertrola; A Squealless 5-Tuber, by Joseph Bernsey; Secrets of DX in a Creative Receiver, by J. E. Anderson.

DEC. 3—How to Modernize the Phonograph, by H. B. Herman; Part I of two-part article on the Everyman 4, by E. Bunting Moore; Efficiency Data on 4 and 5-Tube Diamond (not Screen Grid Diamond), by Campbell Hearn.

DEC. 10—Seven-page article on the Magnaformer 9-8, the best presentation in the history of radio literature, by J. E. Anderson (this article complete in one issue); The Object of a Power Amplifier, by C. T. Burke, engineer, General Radio Co.; Constructional Data on the Everyman 4 (Part II); The 2-Tube Phonograph Amplifier, by James E. Carroll.

DEC. 17—Complete Official Call Book and Log; How I Tuned In 98 Stations in Six Nights with Magnaformer 9-8, by Thomas F. Meagher. Starting Facts About Harmonics, by H. B. Herman; The G.R. Amplifier and B Supply, by Stuart S. Bruno.

DEC. 24—The AC 300 (four tubes); How Service Men Cheat Radio Builders; Part I of two-part article on the Victoreen Power Supply with one audio stage.

DEC. 31—How DC Sets Are Converted to AC Operation, by W. G. Masson-Burbridge; Cures for Uncanny Noises, by J. E. Anderson; Part II of two-part article on the Victoreen with a Stage of Audio; Complete Driver for an AC Set, by Robert Frank Goodwin.

JAN. 7, 1928—The Shielded Grid Six, first national presentation of loop and antenna models of the new Silver-Marshall circuit, utilizing the new tubes of strong amplification, Part I, by McMurdo Silver; How to Build a Power Amplifier and 210 Push-Pull Unit, by A. R. Wilson, of General Radio Co.

JAN. 14—Assembly and Wiring of Shielded Grid Six, Part II, by McMurdo Silver; Meter Range Extensions, by Bramhall Torrence; Uses of B Batteries and Power Devices, by E. E. Horine, National Carbon Co.; A 5-Tube Set Costing but 2 Cents an Hour to Run, by Capt. Peter V. O'Rourke.

JAN. 21—Bias Resistor Fallacy Exposed, by J. E. Anderson; The Shielded Grid Six, Part III (conclusion); How the "Victory Hour," Reaching 30,000,000, Was Broadcast, by Herman Bernard.

JAN. 28—How to Build the AC Five, a Battery-less Receiver, by H. H. Chisholm; Technique of Home Television Machine, by Dr. E. F. W. Alexander; A Quality Analysis of Resistance Coupling, with Trouble Shooting, by Herman Bernard.

FEB. 4—Tyrman "70" with Shielded Grid Tubes (Part I of four-part article), by Brunsten Brunn; The Four Tube Shielded Grid Diamond, by H. B. Herman; Television's Stride, by Neal Fitzalan, Radio Vision Editor.

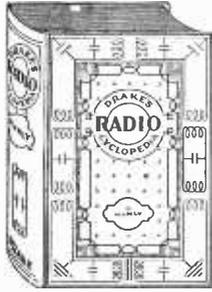
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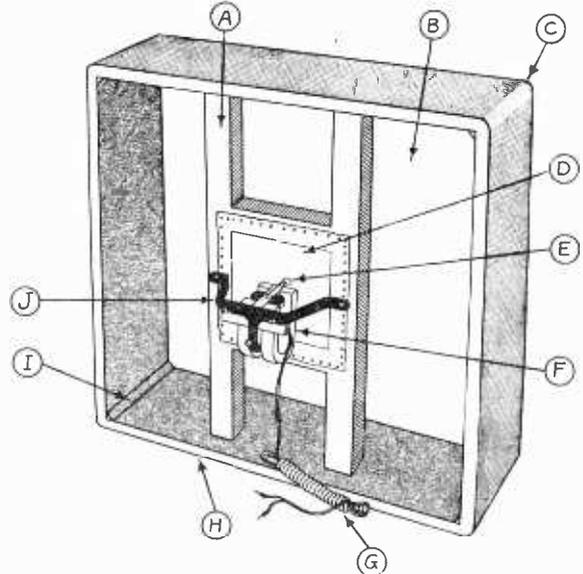
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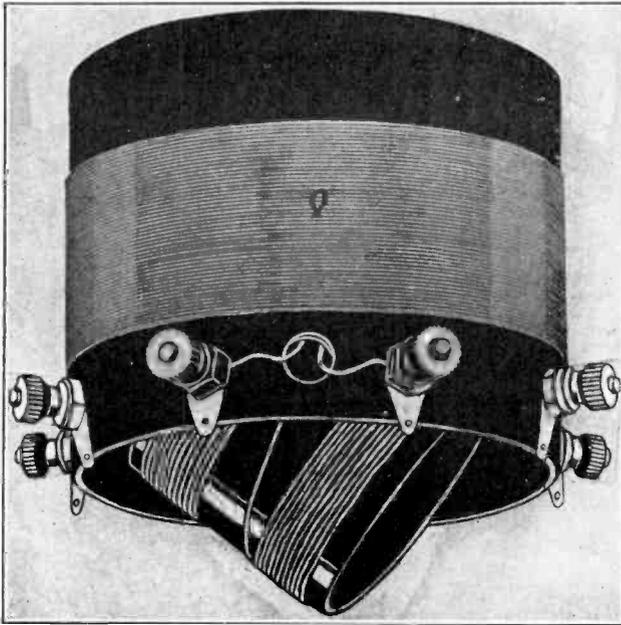
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The primary, the outside winding, is tuned by a variable condenser the user puts across it. At resonance this gives *infinite impedance!* What the screen grid tube needs is a high impedance plate load, otherwise the tube's full, amazing quantity of amplification is missed. Could there be any impedance higher than *infinite?*

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ANTENNA COIL

Like the High Impedance Tuner, the Screen Grid Antenna Coil is specially designed for input to a screen grid tube. Its inductance is so arranged that the dial readings of the antenna circuit will be like those of the tuned circuit in which the High Impedance Tuner is used.

The antenna coupling is conductive, giving the maximum signal strength consistent with selectivity—a degree of volume that is so enormous as to astound you! Using these two coils, the volume is so great that only one stage of audio works a loud speaker superbly—thrillingly!

For short wave reception all except 14 turns of this single, continuously-wound coil are shorted out, and short-wave tuning confined to the succeeding stage or stages.

The Screen Grid Antenna Coil is matched to the High Impedance Tuner, by having dissimilar turns that equalize the tuning. Dial readings track nicely because the Screen Grid Antenna Coil's individual inductance is made to atone for the effect mutual inductance has on the High Impedance Tuner's primary.

Screen Grid Antenna Coil. One tap for short waves. For .0005 mfd. (Model 2A) **\$1.75**
For .00035 mfd. use (Model 3A)..... **\$2.00**

REPLACEMENT COIL

A great many persons now possess good radio receivers and do not desire to part with them, but would like to gain the benefit of the wonderful new screen grid tubes that, with proper coils, increase volume and sensitivity enormously, and without reducing selectivity.

Moreover, they do not want to tear down existing receivers and virtually rebuild them. No need to do so. The Screen Grid Replacement Coil, for either .0005 mfd. or .00035 mfd. tuning, occupies a space only 2½ x 2½ inches, so can be put in almost any receiver from which the old coil has been removed.

The replacement coil has an untuned primary of high impedance—generous number of turns—while the secondary is tuned. Thus it conforms to requirements of the usual tuned radio frequency receivers. Custom Set Builders, Service Men and Home Experimenters will welcome this opportunity to redeem "the old set," make it pep up and step out—cure that loss of the old kick—capitalize the great advantages of radio's outstanding tube! In replacement work one of these coils should be used as the antenna coil.

Screen Grid Replacement Coil for .0005 mfd. Secondary center-tapped for short waves. (Model 2R5) **\$1.50**

Screen Grid Replacement Coil for .00035 mfd. Secondary center-tapped for short waves. (Model 2R3) **\$1.75**

OTHER SCREEN GRID COILS

For circuits using screen grid tubes, with single tuning control, four models of coils are manufactured with rotors that serve as trimmers, so that no midget trimming condenser is needed.

These single control coils are:

Model 2SC5. Conductively coupled antenna coil, for input to a screen grid tube, with two turns taken from the stator and wound on the rotor. Thus the variations in tuning, due to the antenna's capacity effect on the tuned circuit, are compensated for by turning the panel knob. For .0005 mfd. tuning. Usual tap for short waves. (Model 2SC5) **\$2.75**

Model 2SC3, same as above, except that inductance is for .00035 mfd. tuning. Usual tap for short waves. (Model 2SC3)..... **\$3.00**

Model 2RSC5 is a replacement coil for single control sets, corresponding to 2R5, but having the trimmer coil on a rotatable form, so that any interstage coupling out of a screen grid tube may be accomplished efficiently. Usual tap for short waves.

(Model 2RSC5) **\$2.75**

Model 2RSC3, same as above, except this is for .00035 mfd. tuning. Usual tap for short waves. (Model 2RSC3)..... **\$3.00**

Coils for Other Than Screen Grid Tubes

For all circuits other than screen grid circuits the STANDARD group of coils is manufactured, as distinguished from SCREEN GRID Coils. The STANDARD coils are for 201A, 240, 199, 226AC, 227AC and all other non-screen grid tubes.

All the coils, both STANDARD and SCREEN GRID, have 2½ inch diameter, the smallest diameter consistent with high efficiency!

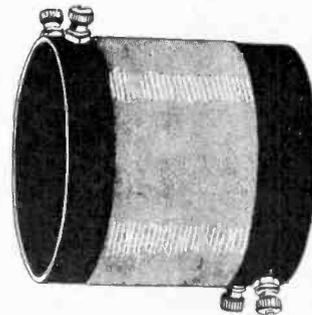
All are sturdily made and are carefully designed and constructed with the idea of having them last TEN YEARS. That includes coils with rotatable forms, for they are no less rugged than the others—another exceptional virtue.

All coils have a short-wave tap, but this need not be used, if not desired.

STANDARD COILS

- 3-circuit tuner, for .0005 mfd. Secondary center-tapped for short waves. (Model T5) **\$2.25**
- 3-circuit tuner for .00035 mfd. Secondary center-tapped for short waves. (Model T3) **\$2.50**
- TRF coil. Interstage coupler and also used as antenna coil. For .0005 mfd. Secondary center-tapped for short waves. (Model RF3) **\$1.00**
- TRF coil. Same as above, except it is for .00035. Secondary center-tapped for short waves. (Model RF3) **\$1.25**

[Note: This advertisement contains our complete line of coils. Inquiries invited from the trade, custom set builders, etc.]



Screen Grid Antenna Coil, for input to any Screen Grid RF Amplifier. Tapped once for short waves. (Model 2A) **\$1.75**

SCREEN GRID COIL COMPANY

143 WEST 45th STREET
NEW YORK CITY

Just East of Broadway

Please mail me at once your following coils, for which I will pay post-man the advertised prices, plus a few cents extra for postage.

Screen Grid Coil Co., 143 W. 45th St., N. Y. City.

Specify Quantity in the Squares

Model..... Model..... Model.....

Name.....

Address.....

City.....

State.....

SEND NO (RW)

SET Builders **FREE**
 Elections have brought back Custom Set building. Business is booming. Thousands of old-timers are cleaning up. Let Barawik show you the way to bigger profits, more sales. Send today for Barawik's Big Bargain Book—the radio man's bible.
BARAWIK CO. 1310 Canal Sta., CHICAGO, U. S. A.
 LATEST RADIO GUIDE

RADIO WORLD, published every Wednesday, dated Saturday of same week, from publication office, Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y., just east of Broadway. Roland Burke Hennessy, President; M. B. Hennessy, Vice-President; Herman Bernard, Secretary. Roland Burke Hennessy, Editor; Herman Bernard, Managing Editor; J. E. Anderson, Technical Editor; Anthony Sodaro, Art Editor.

CONTROL

Prevent the ups and downs of your tubes. Install **AMPERITES**—the filament control that keeps voltage constant. AMPERITES insure long tube life and better reception. A type for every tube—battery or A. C.

\$1.10 with mounting (in U.S.A.) **Radiall Company** 150 FRANKLIN ST., NEW YORK



FREE New "Amperite Blue Book"—brim full of useful radio pointers and circuit diagrams. Write Dept. R.W.-10.

AMPERITE
 The "SELF-ADJUSTING" Rheostat

Improve Your B-Eliminator

Get more power out of it—secure higher working voltages from any voltage tap—obtain the necessary C or grid bias voltages—bring it up to date, in short. And "The Gateway to Better Radio" will tell you just how to do it. Here's a big batch of practical radio information for a quarter. Get your copy at your dealer or direct from

CLAROSTAT MANUFACTURING COMPANY 285 N. Sixth St. :: Brooklyn, N. Y.

CLAROSTAT
 R.F.G. U. S. PAT. OFF.

Bakelite Front and Aluminum Subpanel for the 4-Tube Screen Grid **DIAMOND OF THE AIR** - - **\$5.00**

Five-Day Money-Back Guaranty

Finest eye appeal results from construction of the 4-tube Screen Grid Diamond of the Air when you use the official panels. The front panel is bakelite, already drilled. The subpanel is aluminum, with sockets built-in, and is self-bracketing. Likewise it has holes drilled in it to introduce the wiring, so nearly all of it is concealed underneath set. Make your set look like a factory job.

Front panel alone, bakelite, drilled.....\$2.35
 Aluminum subpanel alone, drilled, with sockets built-in..... 3.00
 Screws, nuts and insulating washers supplied with each subpanel.

GUARANTY RADIO GOODS CO.

145 WEST 45TH STREET NEW YORK, N. Y.
 [A few doors east of Broadway]

New Powertone Unit Brilliant to Eye and Ear!
1929 Model Far Excels Anything Else in Its Price Class!

Having won highest repute last season, the Powertone Unit, which gave maximum volume and quality reproduction at lowest price, again wins leadership because, without any increase in price, it assures still better performance.

The coil is wound a new way, with double the former impedance, giving remarkably faithful low-note reproduction, a region in which many units are deficient. The middle and high notes are faithfully reproduced, too.

GOLD AND VAN DYKE

The magnet is gold-dipped, giving it a rich and handsome appearance. The dipping is done before the "horseshoe" is magnetized, so there is no detrimental effect on flux. The back frame is sprayed with a Van Dyke finish—deepest brown, a splendid color combination. Imagine gold against Van Dyke! Use this unit for its superior performance and fetching appearance!

WHAT YOU GET:

At \$3.75 each, this unit represents the utmost you can obtain at anywhere near this price. Not only do you get the unit, but also a mounting bracket, apex, chuck, thumbscrew nut, and 10-foot cord.



\$ 3.75

This unit will drive any type of cone, airplane cloth, linen or similar speaker, but will not work a horn. The Powertone Unit will stand 150 volts without filtering and is fully guaranteed against ALL defects for one year. The armature is adjustable to power tube impedance. Order a unit NOW!

SEND NO MONEY!

Just order one new Powertone Unit with equipment. It will be mailed at once C. O. D. You will pay postman \$3.75 plus a few cents extra for postage.

Try it for five days. If you don't think it superb, simply return the unit with a letter asking for refund, and your purchase money will be returned immediately! You run no risks! All you can do is win!

36" OR 24" KIT

You can use this unit on any type cone or other diaphragm speaker you prefer. If you want to build a 36" or 24" cone yourself, specify which, and unit, paper, bracket, apex, nut, thumbscrew, cement, pedestal, cord and instructions will go forward at \$6.00 C. O. D. plus small cost of cartage.

You will be overjoyed with the new 1929 model improved Powertone Unit. Order one TO-DAY!

GUARANTY RADIO GOODS CO., 145 W. 45th St., New York City. Just East of Broadway

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

FREE BLUEPRINTS! GET YOUR SHARE! National Short Wave Circuit blueprint, exact circuit used by James Millen for tuning in television, voice, code, music, programs. National Screen Grid Five (broadcast receiver circuit) blueprint FREE also. John F. Rider's B Eliminator blueprint free. Send separate request for each of the above free blueprints you desire. Custom Set Builders Supply Co., 37 Dey Street, N. Y. City.

EXCELLENT unit for phonograph attachment, to play records. Connects to speaker terminals, nozzle to phonograph, \$4.20. P. Cohen, 236 Varet St., Bklyn., N. Y.

CHOKES, Condensers, resistances and transformers for eliminators, television and special circuits, also made to your specification. M. C. MFG. CO., 1215 Gilbert Place, New York City

ARTISTS and Art Students are printing 250 signs or pictures an hour without machinery. Sample and particulars 10c. Straco, 1014 Mulberry, Springfield, Ohio.

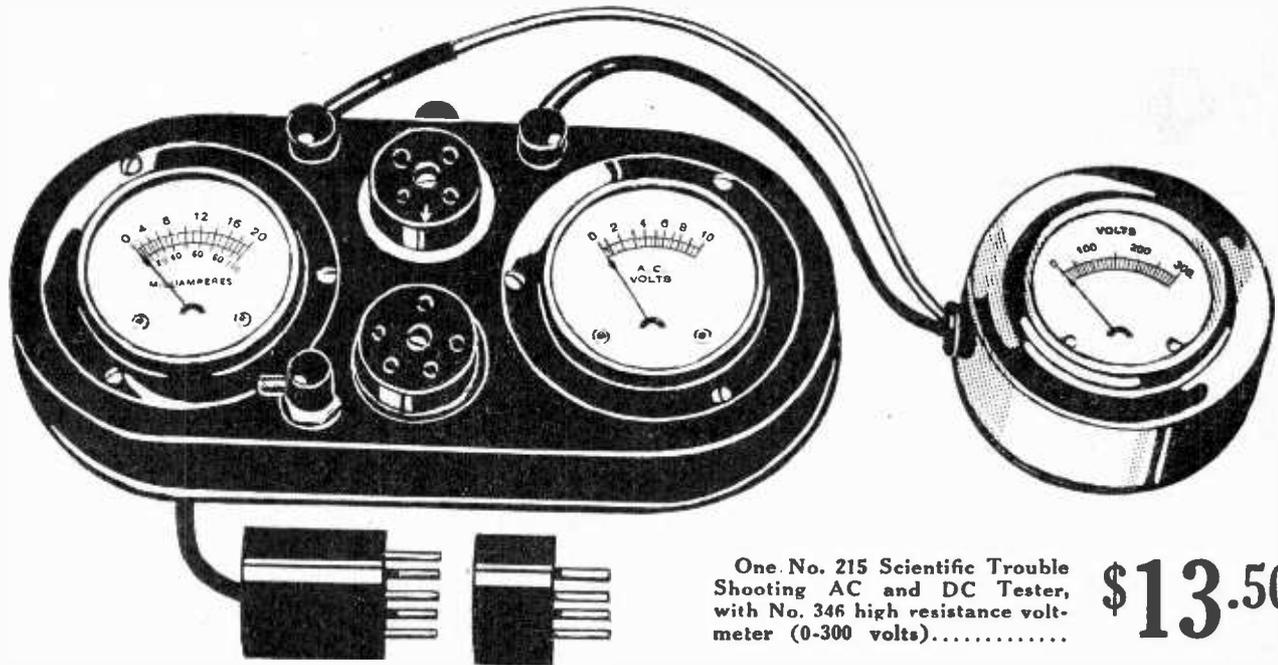
Recent Issues of RADIO WORLD, 15 cents each. Any number published in 1928 available for a short while. Six issues 75 cents, 10 issues \$1.00. Send stamps, coin or money order NOW, before the issues are sold. RADIO WORLD, 145 West 45th Street, New York City.

QUICK SERVICE. Order radio goods now, shipments made day following receipt. All merchandise pre-tested. Set of Screen Grid Coils for Bernard's Economy Three, consisting of antenna coil Model 2A and High Impedance Tuner, Model 5 HT, \$4.75. One screen grid tube, one high mu tube, one -12A tube, total for three tubes, \$7.00. Blueprint for Bernard's Economy Three, \$1.00. Front panel and subpanel for 4-tube Screen Grid Diamond of the Air, \$5.00. All merchandise guaranteed on five-day money-back basis. Send remittance and I pay carrying and shipping charges. Philip Cohen, 236 Varet Street, Brooklyn, N. Y.

All in a Jiffy!

Tube Any Good?
Set Getting Proper Voltages?
Any Shorts or Open Circuits?
Universal Tester Answers 12 Questions in a Jiffy!

You are lost without meters when you shoot trouble and seek remedies. The Universal Tester is your reliable diagnostician for both AC and DC.



One No. 215 Scientific Trouble Shooting AC and DC Tester, with No. 346 high resistance voltmeter (0-300 volts)..... **\$13.50**

The Scientific Trouble Shooting AC and DC Tester (at left) and high resistance meter (at right) Make Twelve Vital Tests in 4½ Minutes. The instruments are exactly TWICE the size pictured. They are handy and handsome.

Amplly Accurate, Even for Service Men!

SERVICE men, going out on calls, must have a reliable test set. The Universal Tester and separate Voltmeter are reliable and versatile. The readings are accurate to 5% plus or minus, which is ample. Twice as great accuracy as this costs four to five times as much money, and isn't really necessary, except for engineering work in laboratories.

The Universal Tester and Separate Voltmeter can be used to make ALL the following twelve tests in 4½ minutes:

- (1) to measure the filament voltage, up to 10 volts, of AC and DC tubes. (2) to measure the plate current of any one tube including any power tube, from less than 1 milliamperes up to 100 milliamperes; (3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly a set draws more.) Open common A and B of set and connect to P of tester socket and to P prong under adapter plug; (4) to measure the B voltage applied to the plate of tube; the voltage across B batteries or B eliminators, up to 300 volts (5) to determine the condition of a tube, by use of the grid bias switch. (6) to measure any tube's electronic emission (tester puts in at no load, hence plate current equals filament emission) (7) to regulate AC line, with the aid of a power rheostat, using a 27 tube as a guide, turning rheostat until filament voltage is 2.5 or 2.25 volts. (8) to test continuity of resistors, windings of chokes, transformers and circuits generally (9) to find shorts in bypass and other condensers, as well as in inductances, resistors and circuits generally (10) to read grid bias voltages (including those obtained through drops in resistors (bias read by noting plate current and voltage and consulting chart). (11) to determine the presence of distortion and overloading, by noting if milliammeter needle fluctuates (12) to determine starting and stopping of oscillation, as milliammeter needle reads higher current for oscillation and lower for no oscillation.

Fits Your Needs, As Well As Your Purse!

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City.

Please send me at once, by parcel post, on a five-day money-back guaranty, one complete Two-in-One (AC and DC) scientific trouble-shooting test set, consisting of one No. 215 and one No. 346, for which I will pay the postman \$13.50, plus a few cents extra for postage.

If 0-500 v. high resistance voltmeter No. 347 is preferred, put cross in square and pay \$14.50, plus postage, instead of \$13.50, plus postage.

- One No. 215 and one No. 346, with two adapters for UV199 tubes \$14.50
- One No. 215 and one No. 347, with two adapters for UV199 tubes \$15.50
- One No. 215 alone, \$10.00.
- One No. 346 alone, \$4.50.
- One No. 347 alone, \$5.50.

NAME
ADDRESS
CITY STATE.....

FIVE-DAY MONEY-BACK ABSOLUTE GUARANTY!

Try out the combination tester and high resistance voltmeter. If you are a service man, custom set builder, home constructor, experimenter, teacher or student. You run no risk. These instruments are guaranteed. Money back if you're not satisfied after a five-day test.

High value and low price combine to give these instruments a field all to themselves, because they meet your needs fully in quality as well as in economy.

HERE'S WHAT YOU GET FOR ONLY \$13.50:

- (1) One two-in-one 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale specially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
 - (2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
 - (3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
 - (4) One 5-prong plug with 30-inch cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
 - (5) One grid switch to change bias.
 - (6) One 5-prong socket.
 - (7) One 4-prong socket.
 - (8) Two binding posts.
 - (9) One handsome noire metal case.
 - (10) One instruction sheet.
- If 0-500 voltmeter No. 347 is desired instead of No. 346, price of combination is \$14.50.
- No. 215 Universal AC-DC Tester Alone.....\$10.00
No. 346 high resistance 0-300 voltmeter alone..... \$4.50
No. 347 high resistance 0-500 voltmeter alone..... \$5.50

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145 West 45th Street
New York City Just East of Broadway