DYNAMIC SPEAKER CONNECTIONS

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RADIO WORLD

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The First and Only National Radio Weekly

342d Consecutive Issue—Seventh Year

4-TUBE AC CIRCUITS

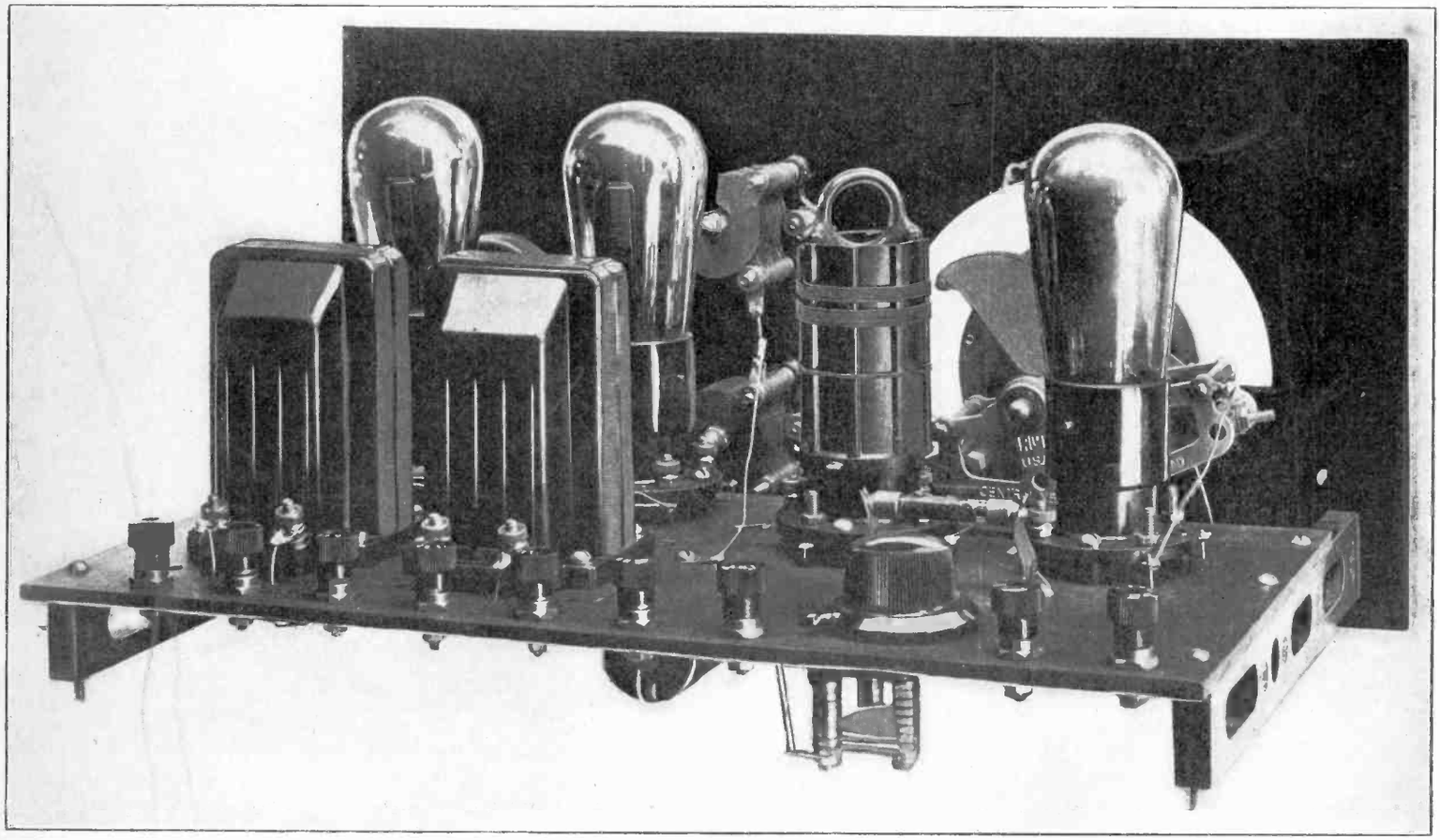
One for Screen Grid, Other for Standard AC Tubes

The Birth of the Tube

By Dr. Lee DeForest

Reallocation Debated

DX ON SHORT WAVES WITH THE WASP!



Rear View of the Wasp. See Article on Pages 4 and 5.

Victoreen Type 250 Power Supply

PICTURE WIRING OF ECONOMY 3

First Curves on Space Charge Detection

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.

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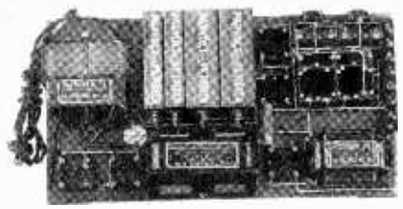
A Simplified Circuit, making easier assembly.

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.

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ELECTRAD Truvolt All-Wire Variable and Fixed Resistances have unusual current carrying capacity because the construction permits the use of larger resistance wire—and the unit is cooled on the air-cooled engine principle.

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ELECTRAD

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NEWS to Set Builders

Barawik offers set builders bigger bargains — bigger opportunities to make money this season. New sets, new kit ideas, all the leading parts, dynamic speakers, supplies, etc. Lowest rock-bottom prices. Bigger stocks, quicker service. Send for Big Bargain Book today—*free.*

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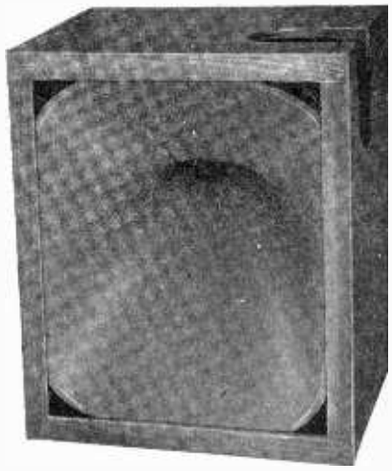
WOODEN HORN LOUD SPEAKERS GIVE BEST TONE!



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Real MUSICAL Instruments are made of wood—Violin. Piano, Cello, etc. Wood is the Unsurpassed Vehicle of Sound. Wood ground to a pulp, pressed under thousands of pounds pressure, and moulded into an 8-foot long Tone Travel, gives you the very finest results! The Horn is wound around to Economize Space. All Notes come through Splendidly. Human Voice Incredibly Natural. In an Orchestra you can pick out each instrument. Unit ($4.20 extra) fits in top, right.

Cat. No. 595; 21¼" high, 18" wide, 15" deep; mounted in baffle board **$10.80**

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.

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☐ One No. 595 at $10.80, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.

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☐ One No. 112 horn motor (universal nozzle) at $4.20 plus a few cents extra for shipping.

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RADIO WORLD, a weekly paper, published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y. Phone: BRYant 0558 and 0559. 15c per copy, $6 per year. This issue is dated October 13th, 1928, and is Vol. XIV, No. 4. Whole No. 342. Entered as second-class matter, March 1922, at the post office at New York, N. Y., under Act of March 1879.

BIG OFFER!

Radio World for Four Weeks 50c

Blueprint FREE!

of 4-Tube Screen Grid Diamond of the Air

At 15c per copy RADIO WORLD costs you 60c for four weeks. But if you send 50c NOW you get the first and only national radio weekly for four consecutive weeks and a blueprint FREE!

This blueprint is life-sized and shows in easy picture diagram form how to mount parts and wire this super-sensitive receiver. One screen grid tube is used as radio frequency amplifier. The rest of tubes are two—01A and one 112A.

This circuit gives you distance, tone quality, ease of performance. No shielding, no neutralizing required!

ACT NOW!

This offer holds good only until November 30th and coupon below MUST be used as order blank.

Radio World, 145 West 45th Street, New York City

Enclosed please find 50 cents (stamps, coin, check or money-order) for which please enter my name on your mail subscription list for the next four issues of RADIO WORLD, and send me FREE at once a blueprint of the Four-Tube Screen Grid Diamond of the Air (front panel and subpanel wiring, schematic diagram and parts list.

Address .....

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☐ Renewal.

If you are a mail subscriber for RADIO WORLD you may extend your subscription four weeks. Put a cross in the square in front of the word "renewal," to show you are a subscriber already

Red Handle	17 to	30 m.
Orange	" 30 to	52 m.
Yellow	" 48 to	105 m.
Green	" 73 to	202 m.
Blue	" 200 to	500 m.

11,000 Miles on Wasp Set

Are you getting world-wide reception? You can with a WASP short wave set, 17 to 500 meters. Complete construction kit for 3-tube WASP, with 5 coils, Micarta panels, etc., blueprints, and 48-page instruction giving 700 S. W. station calls, postpaid in U. S. A. or Canada $18.50

Set of 5 plug-in coils only, postpaid..... $5.75

48-page Instruction Book and Blueprint..... $1.00

These S. W. coils and the WASP receiver were designed by R S. Kruse and M. B. Sleeper. Official WASP sets and coils are used by U. S. Army, Byrd Expedition, and foremost operators of the ARRL. Several ships have reported reception of the Tunney fight from WGY across the Atlantic. New York amateurs have received confirmation cards from Australia, England and Holland broadcast stations.

SPEED, Inc., FASTEST MAIL SERVICE

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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

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145 WEST 45TH STREET NEW YORK, N. Y.

COMPLETE ADVANCE STATION LIST—Sept. 22 issue of RADIO WORLD contained complete advance list of stations compiled according to the new allocation plan of the Federal Trade Commission, effective Nov. 11. Mailed for 15 cents a copy, or send $1.00 for trial subscription of 8 weeks, including Sept. 22 issue. RADIO WORLD, 145 W. 45th Street, New York City.

LYNCH

3 stage resistance-coupled amplifier Kit for quality televis.on reception..... $9.00

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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 5-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

"UNINTERRUPTED READER INTEREST"
EVERY WEEK — EVERY YEAR

RADIO WORLD

OCTOBER 13, 1928
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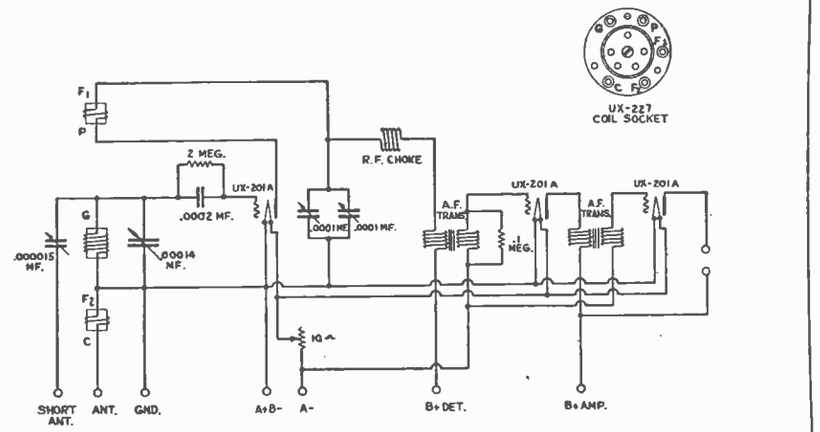
HOW TO BUILD THE THREE-TUBE

Pilot Wasp Set

FOR RECEPTION OF SHORT WAVES

By M. B. Sleeper



THE SCHEMATIC CIRCUIT DIAGRAM OF THE PILOT WASP.

"CAN you really hear England on that little Wasp set?"

All week at the Pilot Booth at the recent New York Radio Show one man, or boy, after another asked that question.

"Sounds fascinating, almost uncanny," one set builder told me, "to think of reaching around the world with a little outfit like that."

Great Popularity

But short waves are getting to be so popular that the man who can't bring in the midnight chimes from Big Ben, in London, when he tunes in at 7:00 P. M. Eastern Standard Time, just hasn't any set at all.

Even 5 SW, Chelmsford, England, isn't much distance now. You don't get excited until you bring in Perth, Australia, 6 AG, at 32.9 meters; Casablanca, Morocco, AIN, at 51 meters; or Malabar, Java, ANA, on 17 meters.

Foreign DX Stations

Just to give you an idea of the broadcasting—not code telegraph—that is being done on short waves, at right are a few of the more distant foreign stations that are on regular schedules, and which you can hear on the Pilot Wasp.

These 42 broadcast stations, in addition to many more in the United States and Canada, are being augmented rapidly by new ones under construction, so that you have a wide range to choose from.

What Next? Can't Tell

The airplanes of the Byrd Antarctic Expedition, which are using Wasp coils for the receivers, are licensed to transmit on twelve bands, from 13 to 91 meters. They will use the calls WFC and WFF. The Pilot Airplane Radio Laboratory, in which the first Wasp short wave sets were tested, operated on various short waves, using 2XBQ for the airplane call, and 2XBP for the experimental ground station.

The remarkable thing about short waves is that you never know what you are going to hear next. There are only 90 channels from 200 to 500 meters, but there are 1,350 from 20 to 200 meters.

In addition to the short wave broadcast stations there are over 1,000 commercial transmitter sending phone, code, still pictures and television, and about 25,000 amateur code and phone transmitters.

Real DX Costs Less

Not the least remarkable thing about short wave reception is the low cost of the set. If you build the Pilot Wasp, as shown in the accompanying illustrations, the complete kit comes to less than $20.00.

Add three O1A tubes, a small 6-volt battery, 90 volts of B battery—medium

(*Continued on next page*)

SHORT WAVE STATIONS

EUROPE

Meters	Call	City
85.	H9XD	Zurich, Switzerland
84.25	D7RL	Copenhagen, Denmark
80.	F8AV	Nogent-sur-Seine, France
70.	OHK2	Vienna, Austria
67.65	AFK	Doberitz, Germany
61.	F8GO	Paris, France
56.7	AGJ	Nauen, Germany
52.5	SAS	Karlsborg, Sweden
45.	I1AX	Rome, Italy
40.2	YR	Lyons, France
37.65	AFK	Doberitz, Germany
37.	——	Paris, France
37.	EATH	Vienna, Austria
32.5	——	Caterham, England
32.05	D7MK	Copenhagen, Denmark
32.	FL	Paris, France
32.	H9XD	Zurich, Switzerland
32.	H9DC	Berne, Switzerland
31.5	——	Helsingfors, Finland
31.4	PCJJ	Eindhoven, Holland
31.25	——	Bergen, Norway
30.75	——	Agan France
30.7	EAM	Madrid, Spain
30.	LGN	Bergen, Norway
24.	5SW	Chelmsford, England
22.2	——	Vienna, Austria
18.4	PCLL	Kootwijk, Holland
17.2	AGC	Nauen, Germany
15.5	——	Nancy, France

AUSTRALIA

32.9	6AG	Perth
32.5	2BL	Sydney
32.	3LO	Melbourne
28.5	2FC	Sydney
28.5	2ME	Sydney

NORTH AND EAST AFRICA

90.	——	Nairdi, Kenya
51.	AIN	Casablanca, Morocco
42.8	8KR	Constantine, Turio

JAPAN

39.5	JFAB	Taipeh
37.5	JHBB	Hirasio

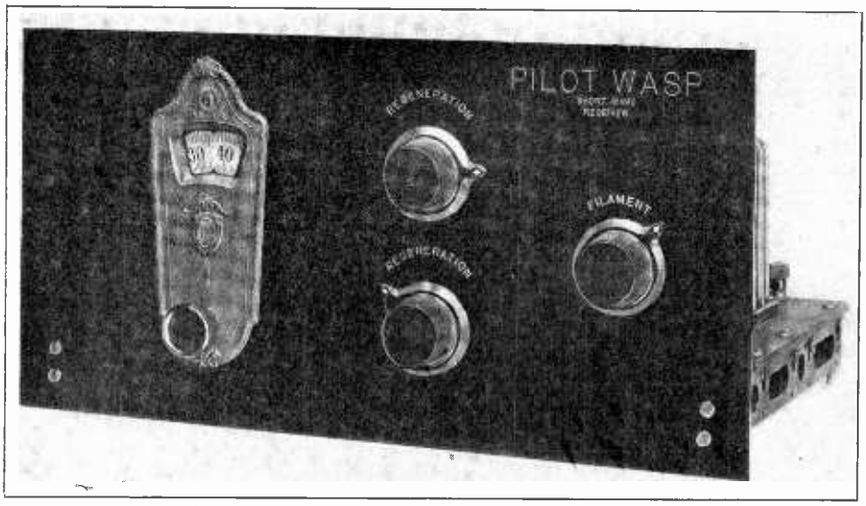
JAVA

31.86	ANE	Bandoeng
17.	ANH	Malabar
15.93	ANE	Bandoeng

DX on a Short Aerial

LIST OF PARTS

One No. 180-4, set of Pilot Wasp plug-in coils.
One No. 1282 Pilot illuminated dial.
One No. 1608, Pilot .00014 mfd. condenser.
Two No. J-23, Pilot .0001 mfd. midget condenser
One No. J-5, Pilot .000015 mfd. midget condenser.
One No. 761 10-meg. grid leak.
Four No. 50, Pilot grid lead clips.
Three No. 206, Pilot UX sockets.
Two No. 391, Pilot A. F. transformers.
One No. 212, Pilot UY socket.
Two No. 35, Pilot 1-inch bakelite brackets.
One 7 by 14-inch front panel.
One 7 by 13-inch base panel.
Nine Pilot engraved binding posts.
One No. 750, Pilot .1 meg. resistor.



FRONT VIEW OF THE PILOT WASP SHORT-WAVE RECEIVER SHOWING THE TUNING CONTROL AT LEFT, REGENERATION CONTROLS IN THE MIDDLE, AND FILAMENT RHEOSTAT AT RIGHT. THE TWO REGENERATION CONTROLS ARE IN PARALLEL, THUS PERMITTING VERY FINE ADJUSTMENTS TO MAXIMUM SENSITIVITY. THE VERNIER TUNING CONTROL PERMITS VERY CLOSE TUNING AND ACCURATE SETTINGS.

(*Continued from preceding page*)
sized cells and a pair of phones, and you have spent less than the cost of the cheapest broadcast receiver.

On a mileage basis, the Wasp will give you a thousand times more miles per dollar than any broadcast outfit.

And of various kinds of short wave circuits you might build, the Wasp has unusual antecedents to recommend it.

Choose Wasp

During the tests on the Floyd Bennett, the big tri-motor Ford plane which will fly over the South Pole, Lieut. Hanson, using the standard Wasp coils, not only maintained a schedule with 2UO, New York, from Mitchel Field to Hampton Roads, Va., but picked up many distant stations, including Java and Holland.

American amateurs report 5SW strong enough for loudspeaker reception. Fort Wood, adjacent to the Statue of Liberty in New York Harbor, has discarded three other short wave sets in favor of the Wasp receiver for handling Army traffic.

Army officers, taking the Signal Corps Radio School course at Ft. Monmouth, N. J., build Wasp sets as part of their training in the construction and operation of short wave equipment.

Pair Designed Circuit

The Pilot Wasp short wave outfit was designed by R. S. Kruse, former technical editor of "QST", and the author. Most of the work was done at Kruse's laboratory in Hartford, Conn.

We used the Pilot airplane laboratory to fly back and forth so that we could work together between New York and Hartford with the least loss of time.

Plane Preferred

It is only fifty minutes from Curtiss Field to Hartford by plane, against three hours on the train, and even then the train schedules cannot be arranged to order, while the Pilot plane is always ready to hop off.

Kruse, known throughout the radio industry as an expert on short wave receivers, planned the Wasp as an outfit which can be built by unskilled experimenters and, with the least amount of experience, operated at the greatest possible degree of efficiency.

The diagrams and photographs show how the set should be put together. The tuning condenser, two midget condensers, and the rheostat are mounted on the front panel. On the base panel are the detector and two AF amplifier tubes, lined up with the UY socket which takes the Pilot plugin coils. The grid leak, with the grid condenser under the panel, is between the detector and plugin coils sockets, and the special antenna series condenser at the rear.

The RF choke is mounted under the sub-panel. Both audio transformers are of the new Pilot moisture-proof type, with bakelite cases. Just in front of the transformers are clips for the .1 meg. resistance used to prevent the circuit from howling as the regeneration condenser makes the detector tube go in or out of oscillation.

Distinguished by Colors

Each of the five plug-in coils has a colored bakelite finger ring to distinguish the wave length ranges. The standard bands are as follows:

Red ring, 17 to 30 meters.
Orange ring, 30 to 52 meters.
Yellow ring, 48 to 105 meters.
Green ring, 73 to 202 meters.
Blue ring, 200 to 500 meters.

These wave-length ranges are for the coils when the antenna is connected to the set through the midget series condenser.

Stick to Layout

When you assemble the set, follow the arrangement of the wiring shown in the picture diagram next week. Do not change the locations of the parts or make any other variation. The wiring must be short and direct, with all joints carefully soldered. Never use soldering paste for this work. Rosin core solder is the only suitable material.

It is most convenient to work from the official panel patterns and 48-page instruction book. The blueprints are drawn full size, so that you can use them as drilling templates and to guide you in the locations of the parts.

Antenna Pointers

Two antenna binding posts are provided, but it is generally better to use the post marked "Short Ant." That connects to the secondary coil through the midget condenser on the base panel. The size of the antenna is not important. In many locations a twenty-foot wire run along the ceiling is used to bring stations several thousand miles away. On the other hand, you may find that your regular broadcast antenna will give even better results. Try different types until you find what is best.

One At a Time

Do not use two antennas at the same time. The ground connection is very important.

It should be only a few feet long and run to a water pipe which has water in it all times.

To tune the set plug in one of the coils, set the upper midget on the front panel, at zero, get an approximate adjustment on the rheostat and tune with the vernier dial, turning back the regeneration condenser until you clear up the signal. This is very much like handling a three-circuit regenerative broadcast set.

Interesting Work

When you become acquainted with the operation of the outfit you will find that tubes make a vast difference. Learn how to set the antenna series condenser so as to make the circuit oscillate at all wave lengths. Try different grid leaks until you find a value which gives the best results with the detector you are using.

If you find you can make the set work with the broadcast coil and cannot get anything with short waves, do not be discouraged. Take the set to the place where you bought the parts, or call upon the Pilot service station to check over the wiring.

Once you get the set operating properly, you will find short wave work far more interesting than broadcast reception.

[*This concludes the constructional article on the Pilot Wasp. Next week other information on the circuit will be published.*]

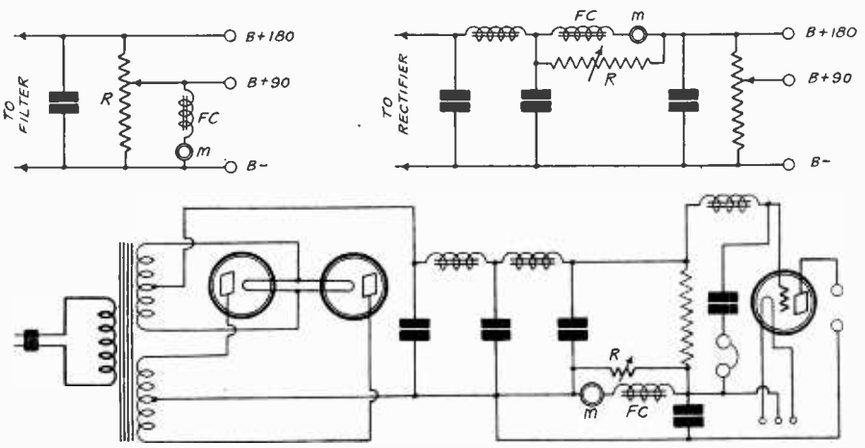
$7.50 Is List Price of the Kino-Lamp

Announcement was made that the list price of the Raytheon Kino-Lamp is $7.50. This lamp, which is a kino-lamp for television reception and kindred purposes, is made by the Raytheon Mfg. Company, of Cambridge, Mass.

The Kino-Lamp has proven highly successful in establishing television reception records.

How to Power the

By Brunsten



FIGS 1, 2 AND 3

AT LEFT TOP IS SHOWN HOW THE FIELD COIL FC OF A DYNAMIC SPEAKER MAY BE ENERGIZED BY CONNECTING IT TO THE 90-VOLT TAP OF A BATTERY ELIMINATOR (FIG. 1). AT RIGHT IS SHOWN HOW IT MAY BE DONE BY CONNECTING THE FIELD COIL IN SERIES (FIG. 2). BELOW (FIG. 3), WHEN A HIGH VOLTAGE, HEAVY CURRENT POWER SUPPLY IS AVAILABLE THE FIELD OF A DYNAMIC SPEAKER CAN BE PLACED SO AS TO UTILIZE THE DROP IN IT FOR A GRID BIAS ON THE POWER TUBE.

THE recent popularization of dynamic speakers has accentuated the problem of supplying the field coil with filtered direct current.

Two general systems of meeting this problem are in use. In one the field coil is wound for low voltage and high current. In the other field coil is wound for high voltage and low current.

The low voltage coil is designed to be connected across a 6-volt storage battery or an equivalent source of steady current. The high voltage field is designed to be connected across a source of about 90 volts, which may be either a storage B battery or a battery eliminator.

In this article several methods for obtaining the necessary steady current from B battery eliminators will be discussed.

The Problem

Suppose a B battery eliminator is available with which it is desired to establish a field in a dynamic speaker designed for 90 volts. Undoubtedly there is a 90-volt tap on the eliminator. Let the field winding be connected across B— and this tap. It will be found that the speaker will not work very well, and also that the receiver served by the same B battery eliminator will not work as well as it did before the field winding was connected to the 90-volt tap.

What is the reason?

Voltage Changed

As soon as the field winding is connected the voltage is no longer 90 volts. The field winding does not get enough current and the plates of the tubes served by the 90-volt tap no longer get 90 volts In fact, no plate in the circuit gets as high voltage as before, for the voltage at every tap has been reduced. This reduction is due to the poor voltage regulation of the B battery eliminator.

Now, if the field winding is connected across the 180-volt tap in the output of the B battery eliminator the voltage will be too high for the speaker and again it will not be high enough for the plates of the receiver served the same power supply, assuming that the voltages were correct before. The current required by the field coil increased the voltage drop in the rectifier and the filter, leaving a lower output voltage.

In Fig. 1 is shown one method of adjusting the field voltage to the proper value. A milliammeter M is connected in series with the field FC and the combination is then connected between the 90-volt tap and the negative side of the circuit. Then the 90-volt slider is moved up on the voltage divider R until the current in the field as indicated by the meter is 40 milliamperes. The voltage across the field will then be of the proper value. Of course, the voltage at the 180-volt tap will not be 180 volts. Another adjustment will be necessary by means of a tap on the primary of the power transformer. If there is no provision for varying the primary the reduced voltage may be accepted, since 180 becomes about 150, and this proportion holds good throughout—not a serious reduction.

Another Solution

Another way of accomplishing the same result is to connect a variable resistance in series with the field winding and then connect the combination from B—to the 180-volt tap. The resistance is adjusted until the current in the field is 40 milliamperes. The approximate value of this resistance can be computed on the assumption that the current in the resistor is 40 milliamperes and that the voltage drop in it is 90 volts. This makes the resistance 2,250 ohms. This will be found too high because of the voltage drop at the 180-volt tap. In one particular case the voltage dropped to 150 volts, so that the drop in the resistor was only 60 volts. Thus the resistance required was 1.500 ohms.

If the voltage between the 180-volt tap and B—is 220 volts, as it is in most properly designed and built eliminators for 171A tube, the resistance in series with the field should be 3,250 ohms, assuming that there is no drop of voltage. Since there will be some drop due to poor regulation the resistance should have a lower value. These values are given only as an aid in determining the correct resistance. The correct value is found by adjusting the resistance until the milliammeter reads 40 milliamperes.

Field Coil in Series

Many B battery eliminators have appeared in which it is suggested that the field coil be put in series with the voltage supply line so that the field coil can be used as a filter choke. How this can be done is shown in Fig. 2. The field coil FC occupies the position of the second filter coil. This method can be used only if the available voltage is high enough to spare 90 volts for the field. And it is in many voltage supply units.

In high power installations it is probable that the total current is more than 40 milliamperes. To allow for this a variable resistance R should be connected across the field coil and adjusted until the current in the field is 40 milliamperes. This resistor must be such as to take the current in excess of 40 milliamperes.

Suppose the total current drawn by the receiver, including the field is 60 milliamperes. The voltage across the field coil, and therefore across R, is 90 volts when the field gets the proper current. Hence 20 milliamperes should flow through the resistor when the drop in it is 90 volts. Hence the value should be 4.500 ohms.

The resistor R partially destroys the value of the field coil as a choke. Hence it may be necessary to use the regular filter arrangement and the field in addition. The connection shown in Fig. 2 is not recommended except in special cases, where high voltage and adequate filtering are available.

Grid Bias from Field Coil

In a high voltage power supply designed for serving one or more 50 type tubes it is possible to connect the field coil so that the drop in it can be used for grid bias. Fig. 3 shows the connection.

As in the former case a variable resistor R is connected across the field FC to adjust the current through the coil and the voltage across it. If the drop is 90 volts the bias on the power tube will have the same value. This is too much when the maximum voltage of 450 volts is applied to the plate of the tube. Hence R may be reduced so that the drop is somewhat less than 90 volts. If the voltage drop is 84 volts the bias on the tube will be correct and the speaker will be only slightly less sensitive than if the full 90 volts were used across the field.

If it is desired to use a drop of 90 volts or more across the field, the grid bias might be adjusted to the proper value by returning the grid of the power tube to a slider on the resistor R.

Disadvantage of Connection

There are some disadvantages of the grid bias connection shown in Fig. 3. In the first place, the drop in the field coil is increased so that 450 volts may be applied to the plate and 90 volts to the grid, the filter condensers must be chosen so as to withstand the higher voltage.

Another disadvantage of the grid bias connection is that the field coil constitutes a common coupling between the grid and the plate circuits of the power tube. There will be feedback from the plate circuit to the grid circuit both by direct coupling and by coupling between the

Dynamic Field Coil

Brunn

armature coil and the field coil acting as a transformer. Both of these forms of coupling can be neutralized partly by the condenser of C connected across the field coil. The larger this condenser is the more effective it will be in reducing the coupling, and it should not be smaller than 4 mfd.

Separate Voltage Source

Perhaps the best method of establishing a field in the 90-volt B type of dynamic speaker is the use of a separate rectifier-filter, such as shown in Fig. 4. The circuit there shown is a standard B battery eliminator with the field coil FC substituted for the output voltage divider. A variable resistor R is connected in series with the field for adjusting the current to the desired value. The meter M shows when this adjustment has been attained.

This method is now being used by the writer with splendid results. An old B battery eliminator, discarded because of its low voltage output, was pressed into service.

If a separate voltage source is used for the field coil this source may be used also for the grid bias for all the tubes in the receiver. One way of doing this is shown in Fig. 5. A high resistance voltage divider P has been connected across the field coil FC. This resistance of P might have a value of 50,000 ohms, so that it will not take more than 1.8 milliamperes when the voltage across it is 90 volts.

This resistor should be provided by as many sliders as the number of different grid bias values which will be required. Three are shown in the figure. Note that C plus, A minus and B minus are indicated at the same binding post at the positive end of the resistor.

When this circuit is used the voltage across the field coil and the potentiometer may be adjusted by means of a variable resistor R put in series with the line. The value of this resistor depends on the current flowing in the circuit, on the voltage generated in the circuit, and by the voltage required. It is adjusted until the meter M reads the desired value.

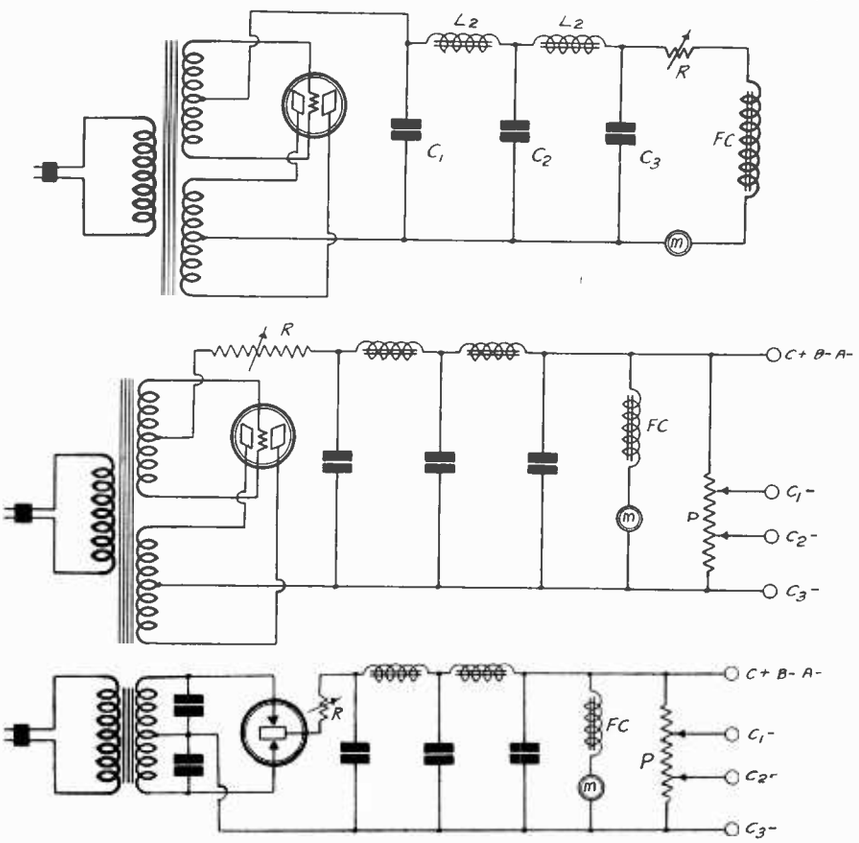
Types Interchangeable

Fig. 5 shows a circuit in which the rectifier is of the 80 type. The same circuit with a Raytheon rectifier is shown in Fig. 6.

If there is any reaction between the armature coil and the field coil in the dynamic speaker there will be some feedback through this unit acting as a transformer. However, this cannot be very great.

Feedback Avoided

In Fig. 7 is illustrated another method of obtaining the field coil current. It is not unlike the method shown in Fig. 3. But in this case only the current of the power tube flows through the field coil FC. If the plate current in the tube exceeds about 40 milliamperes a variable resistor R can be connected across the winding and adjusted so that the proper current goes through FC. Of course, this arrangement is subject to feed-back from plate to grid. The condenser C prevents this, if it is large enough. Another aid in reducing the feedback is to return the loudspeaker to the mid-point of the filament transformer. If the loudspeaker is connected to any other point the signal current through the speaker is forced through the field coil and the impedances in parallel with it.



FIGS. 4, 5 AND 6

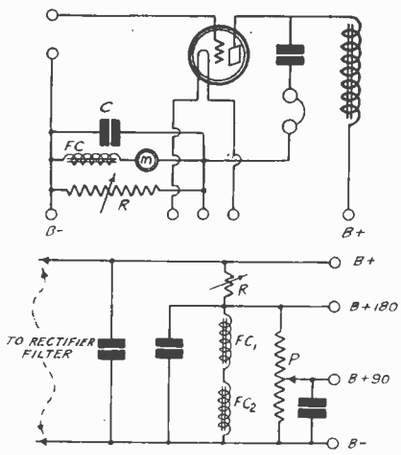
A SEPARATE CURRENT SUPPLY CAN BE USED AS HERE SHOWN FOR ENERGIZING THE FIELD COIL OF A DYNAMIC SPEAKER (IG. 4, TOP). FIG. 5, CENTER DRAWING, SHOWS FILAMENT TYPE RECTIFIER AND LOWER A GASEOUS RECTIFIER IN THE SAME CIRCUIT. WHEN A SEPARATE BATTERY ELIMINATOR IS USED FOR ENERGIZING THE FIELD OF A DYNAMIC SPEAKER THE GRID VOLTAGES FOR ALL THE TUBES IN RECEIVER MAY BE TAKEN FROM THE CIRCUIT AS ILLUSTRATED IN FIG. 6.

Low Voltage Field

The fields of many dynamic speakers are wound for six volts. For such there are two methods for obtaining necessary current. One is to connect the field winding directly across a six volt storage battery, or across the output terminals of an A battery substitute. The other is to build a separate low voltage current supply. This would consist of a step-down transformer, a rectifier such as is used in A battery eliminators or trickle chargers, and a filter. The filter could consist of an electrolytic condenser and a choke capable of carrying about one-half ampere. Not much of a choke is required because the field coil itself is a choke coil.

AC Dynamic Speaker

One model dynamic speaker is termed the AC, because it has a field supply built in. When using this model it is only necessary to plug in an AC outlet and the field is properly established. The built-in current supply is usually of the low voltage type employing a dry rectifier. This type is the most convenient for those whose power supply is alternating current and who do not care to hook up any of the arrangements suggested in this article.



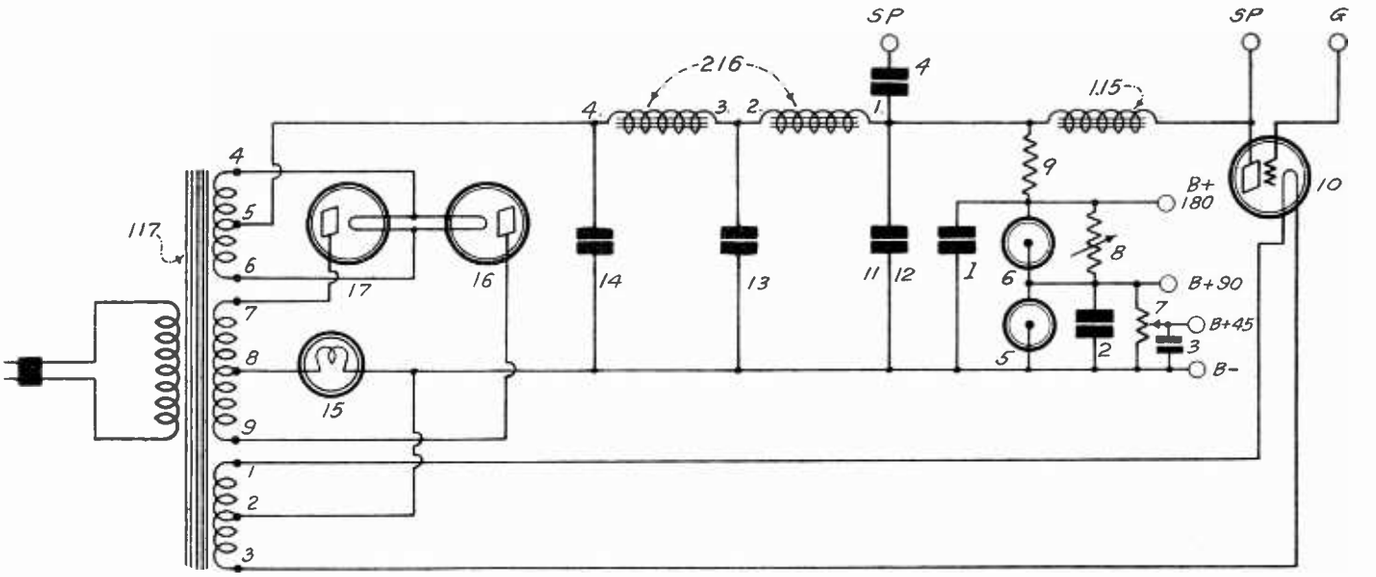
FIGS. 7 AND 8

UPPER DRAWING (FIG. 7) SHOWS HOW TO CONNECT THE FIELD COIL FC IN THE PLATE RETURN OF THE POWER TUBE SO AS TO UTILIZE THE DROP IN THE FIELD COIL FOR GRID BIAS ON THAT TUBE ALONE. LOWER SHOWS HOW TWO FIELD COILS CAN BE CONNECTED IN SERIES ACROSS A 180 VOLT SOURCE.

CONSTRUCTION ADVICE ON THE NEW 250

Victoreen B Supply

By E. A. Benson



THE Victoreen 115 output unit is unlike other output devices. It is not an output transformer and it may be used with or without a 2 mfd. condenser in series with the speaker. If the condenser is omitted, several milliamperes of direct current will flow through the speaker, which is an advantage in some speakers. The 2 mfd. condenser has the advantage of partly insulating the speaker from the high voltage. When complete insulation is desired a 2 mfd. condenser may be put in each lead of the speaker. When that is done there is no possibility of getting even a little shock when touching the loudspeaker.

The Victoreen 115 output unit should be used to protect the speaker whenever the applied voltage is 90 volts or more. Even when no condenser is used in series with the speaker, practically all the plate current for the power tube passes through the choke coil in the output unit, because the direct current resistance of the choke is very low in comparison with resistance of the speaker. The coil has a very high inductance in comparison with the inductance with the average loudspeaker, and for that reason the alternating current, or signal, passes through the speaker rather than the choke.

Service Hints

The condensers used in the filter must be rated at least 600 volts on direct current, because the voltage across them may approach 500 volts. It will not rise as high values in the power supply as in many others when the load is removed because of the use of two voltage regulator tubes. The voltage across the tubes will never exceed 180 volts, and that regulation is a great help in preventing voltage rises on the 425 volt tap as well.

If it were not for the voltage regulator tubes it would be necessary to specify 1,000 volt condensers.

The flashlight lamp, as shown in the blueprint, which may be obtained with my compliments, has been included for the protection of the power transformer in the event of breakdown in the condensers, and has a twofold purpose.

It is difficult for the novice to distinguish between a blown condenser and a defective power transformer. This lamp, however, will indicate the approximate location of trouble, should any occur. If the first 2 mfd. condenser should puncture, the lamp will flash up brilliantly, and in the course of several minutes will act as a fuse and open the circuit.

The Flickering Lamp

If the second 2 mfd. condenser should puncture, the lamp will light brightly but will not always burn out. If the first or second 4 mfd. condenser blows, the lamp will not light quite so brightly, although it will be brighter than in normal operation.

The small type condensers have no effect upon the lamp. With the power supply operating under normal conditions using a UX 250 tube, the flashlight lamp should be slightly more than glowing. If this lamp should flicker when a loud signal is being amplified, it indicates one of two things, either the C voltage is incorrect or the signal is too great for the 250 tube to handle within its intended limits.

Should small condenser No. 1 become shorted, both voltage regulator tubes will cease to glow. Should small condenser No. 2 short, voltage regulator tube No. 5 will cease to glow. The possibility of condenser No. 3 shorting is remote.

If condenser No. 4 should short, it is possible that it may cause certain types of speakers to rattle, due to a small amount of current going through their windings. This may be checked by a DC milliameter or a DC voltmeter in series with one speaker lead while the set is in operation. There should be no indication of current flowing.

The Truvolt resistor marked No. 7 is not used with the 1929 receiver and, therefore, requires no attention. This resistor has been added for use with old types of Victoreen sets, or different makes of sets. Resistor No. 8 does not affect the potential applied to the circuit.

[The new Victoreen Power Supply for 250 output tube, an excellent design created by John A. Victoreen, and one of the finest of his many clever creations, was described in the October 6the issue last week. Intimate construction advice is given herewith, together with an additional word or two about the new AC Victoreen 8-tube receiver, described in the September 22d and 29th issues of RADIO WORLD. *Complimentary blueprints of the receiver and the power supply may be obtained by addressing the author, as follows: E. A. Benson, c/o* RADIO WORLD, *145 West 45th street, New York City.]*

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 variable Truvolt resistors 25,000 ohms (T-250).
One fixed Truvolt resistor 5,000 ohms (B-50).
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 tube.
Two UX 374 voltage regulator tubes.
One Mazda No. 31 or 6 volt flashlight lamp.

An AC Screen Grid Set

By Brewster Lee

ALL-ELECTRIC receivers have a certain fascination for radio fans. A snap of a single switch and the set is ready for signals. Another snap of the same switch at the end of a program and there is no more worry, for there are no batteries to run down, to require charging, to cause damage. There are no relays in the all-electric set to get out of order and to fail to function at critical moments. There is just that one switch.

Just as there is a great demand for all-electric sets, so there is for sets which are economical to operate as well as to build. But A C sets cannot be assembled as cheaply as DC sets, for many small parts are needed. Each one of these parts does not cost much, but in the aggregate these incidentals add up to a few dollars. But the increased first cost is more than offset by the greater economy of operation as well as by the greater convenience and dependability of the AC set.

In Fig. 1 is depicted a four-tube all-electric receiver incorporating two screen grid tubes, one -26 type tube and one type -71A tube. The screen grid tubes are of the heater type in addition to being four element tubes.

Space Charge Detector

The first tube is used as a screen grid amplifier. The grid is coupled to the antenna by means of a special screen grid radio frequency auto-transformer L1. The antenna is connected to a tap near the middle of the coil, thus insuring medium close coupling with the tuned circuit. The entire coil is tuned with a .0005 mfd. condenser C1.

The coupling device between the first tube and the detector is a special three-circuit tuner. The primary L2 of this coupler is tuned in order to put the greatest possible load on the screen grid amplifier, thus insuring a high order of amplification in the first stage. The tuning condensers are of .0005 mfd. capacity.

The secondary L3, which is untuned, contains more turns than the primary, so that there is a voltage step-up. This increases the sensitivity of the circuit still more. The tickler L4 is a generous coil which insures oscillation at all settings of the tuning condenser and by means of which the response of the weakest signals may be built up to about the same order of intensity as the stronger local signals.

C7, a condenser of .001 mfd., is necessary not only to insure oscillation but also to prevent radio frequency currents from being transmitted to the amplifier.

The second AC screen grid tube is used as a space charge detector. It is used in this manner because of its unusual sensitivity as a detector when working into a resistance load.

Transformer Coupling

The coupling resistor R3 should have the highest value which will permit oscillation. If the resistance is .1 megohm there will be oscillation in nearly all cases. If a .25 megohm resistor can be used with oscillation at all dial settings it should be used for it will transfer a much higher audio signal to the audio amplifier than the .1 megohm resistor. The coupling condenser C8 should be about .01 mfd. and the grid leak R4 should be 1 megohm or higher. If the value is too high there may be a periodic noise very much like motorboating, but this noise should not appear if the resistance is less than about 5 megohms.

The third tube in the circuit is of the -26 AC type. This tube works best when followed by a transformer and when the plate current is about 3 milliamperes. Hence a transformer T1 is used between the third and the fourth tubes.

The last tube is of the -71A type. It is coupled to the loudspeaker by means of the filter C9 and Ch. The condenser should have a value at least 4 mfd. and the choke coil an inductance of at least 30 henries when 20 milliamperes flow in the winding.

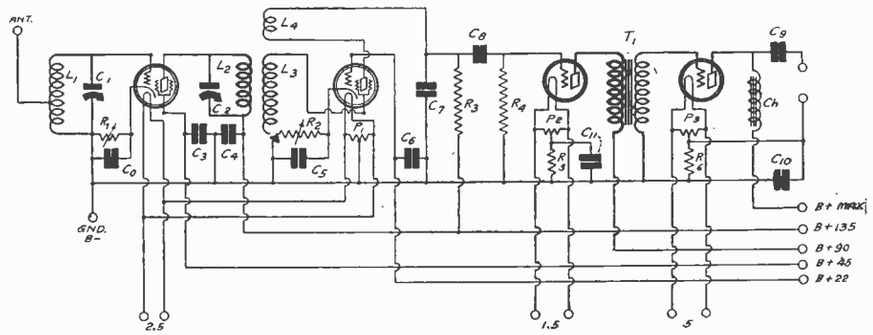


FIG. 1
A FOUR TUBE ALL-ELECTRIC RECEIVER INCORPORATING AC SCREEN GRID TUBES, ONE AS SCREEN GRID AMPLIFIER AND THE OTHER AS SPACE CHARGE DETECTOR

Grid Voltage Adjustments

The bias on the screen grid amplifier should be about 1.5 volts for optimum results. This bias is furnished by the drop in R1, which should be made variable so that the bias may be adjusted for greatest sensitivity. The correct setting of this resistance is about 750 ohms. R1 should be by-passed by a condenser C0 of .001 mfd.

The detector also requires a grid bias, which is supplied by the drop in R2. This resistor is made variable also because the bias required for greatest detecting efficiency is quite critical. R2 should have a maximum resistance of at least 10,000 ohms. It is by-passed by a 1 mfd. condenser C5.

The bias on the grid of the tube is obtained from the drop in R5, the value of which should be 2,000 ohms. A 1 mfd. by-pass condenser C11 is connected across it to prevent feed-back through the resistor. R6 is also a 2,000 ohm resistor, which supplies the bias for the power tube. A condenser C10 of 4 mfd. is connected across it. This by-pass condenser is made large because it is important to keep the heavy signal current out of the voltage supply.

Condensers C3 and C4, each of .01 mfd., and C6, a 1 mfd. unit, not only help in stabilizing the circuit but also help to reduce hum. As a further means of eliminating hum the mid-points of the heaters and the filaments are connected to ground, or minus B.

If the 2.5 volt winding is not mid-tapped an artificial mid-point may be established by connecting a center-tapped 20 ohm resistor P1 across the heater winding. If the 2.5 volt winding has a center, tap P1 is omitted and the tap on the winding is connected to the grounded bus bar.

Likewise an artificial mid-point is established for the 1.5 volt winding by connecting a center-tapped 20 ohm resistor P2 across the winding. The 5 volt winding is similarly center-tapped by a 50 ohm voltage divider P3. If the 1.5 and 5 volt windings are center-tapped the taps are connected to B minus and P2 and P3 are omitted.

The plate voltage to be used are indicated except that for the power tube. This should be 180 for a 171A tube. It is possible to use a —12A tube in the last stage if only moderate volume is desired. In that case the voltage on the plate should be 135 and the grid bias resistor R6 should be about 1,250 ohms.

The filament power consumed by this receiver is about 12 watts. The plate voltage supply will take about 10 watts more. so that with all transformer losses added the total wattage will be about 25 watts. Hence it will cost less than one cent to operate the set an average evening of four hours.

LIST OF PARTS

L1—One screen grid antenna coupler (Model A2).
L2L3L4—One screen grid three circuit tuner (Model 5HT).
C0, C1—Two .001 mfd. by-pass condensers.
C1, C2—Two .0005 mfd. tuning condensers.
C3, C4, C8—Three .01 mfd. mica dielectric condensers.
C5, C6, C11—Three 1 mfd. by-pass condensers, 200 volt test.
C9, C10—Two 4 mfd. condensers, C9 of 600 volts rating and C10 of 200 volt.
R1—One 1,000 ohm variable resistance.
R2—One 10,000 ohm variable resistor.
R3—One 100,000 (or 250,000) ohm coupling resistor.
R4—One 1 megohm grid leak, or one of higher value.
R5, R6—Two 2,000 ohm resistors.
P1, P2—Two 20 ohm center-tapped resistors.
P3—One 50 ohm center-tapped resistor.
T1—One National audio frequency transformer.
Two standard UY type sockets.
Two standard UX type sockets.
Two dials.
One tickler knob.
Two resistance mounts for R3 and R4.
Nine binding posts.
One filament transformer (5 v., 2½ v. and 1½ v. secondaries).
Two AC screen grid tubes.
One type —26 AC tube.
One type —71A tube.
One 180-volt B supply.

THE FIRST CHARACTERISTIC CURVES OF THE Space Charge 222 Tube

SHOW FINE DETECTION, GOOD AF AMPLIFICATION

By J. E. Anderson

Technical Editor

IT IS well known that the screen grid tube used as a space charge grid tube is both a good amplifier and a good detector. Many circuits have been published in which the screen grid tube functioned in this manner, and most of them have proved up satisfactorily.

Previously no curves showing the capabilities of the space charge grid tube have been published. But such curves are really necessary if circuits are to be designed for taking full advantage of the properties of the tube. Such curves are given herewith.

The curves show the plate output voltage, or the voltage drop in the load resistor, for varying values of outer grid bias (G post) and for different values of voltage on the inner grid (cap). The applied voltage on the plate for all the curves was 180 volts and the filament terminal voltage was held constant at 3.3 volts.

The full lines in the graph were taken with a load resistance of 0.5 megohm and the dashed line with a load of 1.0 megohm. The three full lines are for inner grid (cap) voltages of A plus (that is 3.3 volts), 22 and 45 volts. The dashed line is for a voltage of 22 on the inner grid. The fifth curve in the graph is merely the calibration curve for the vacuum tube voltmeter.

Use of Curves

Three of the characteristic curves extend higher than the calibration curve. This was made possible by extending the range of the meter by connecting a battery in series with the grid of the voltmeter tube, as was explained in the September 29th issue.

A noteworthy feature of all the curves is the sharp curvature at the bottom. This indicates a very high detecting efficiency if the control grid (G post) bias be adjusted to the proper value. Suppose the inner grid (cap) be returned to A plus. Then the greatest detecting efficiency occurs at a bias of about 3 volts. Anywhere between 2.5 and 3.5 volts the efficiency is good. Now the drop in the filament ballast when the filament battery voltage is 6 and the tube draws normal current is 2.7 volts. Thus approximately the proper grid bias for maximum detecting efficiency is obtained by connecting the outer grid (G post) to A- and the inner grid (cap) to A plus. A slightly greater detecting efficiency is obtained by making the bias on the control grid 3 volts. However, by making the bias 2.7 volts and by reducing the plate voltage a little the optimum adjustment can be obtained readily.

The normal operation of the tube requires 22 volts on the inner grid (cap), 180 on the plate and 3.3 volts on the filament. This combination of voltages gives the greatest detecting efficiency at a control grid bias of 3.6 volts, but bias as high as 4.2 may be used. This is obtained by adding 1.5 volts to the drop in the filament ballast.

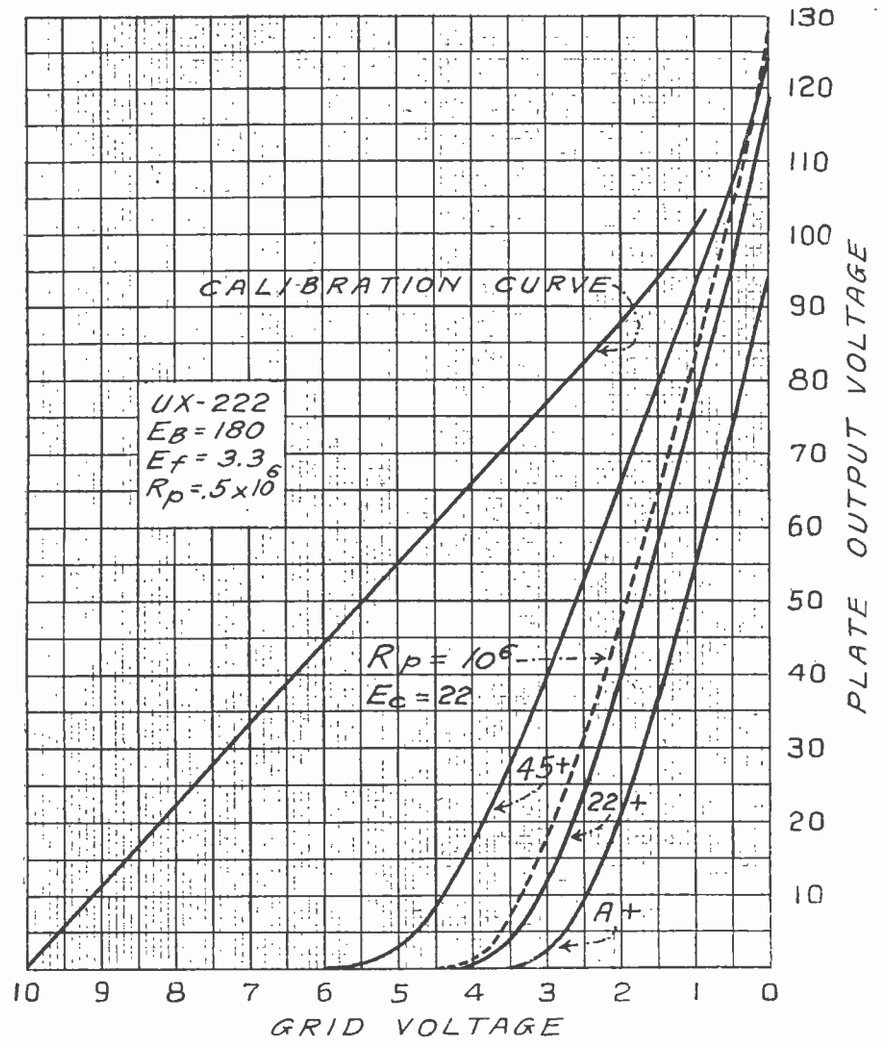


FIG. 1

GRID VOLTAGE, PLATE OUTPUT VOLTAGE CURVES TAKEN ON A 222 TUBE USED AS A SPACE CHARGE GRID TUBE. HIGH VOLTAGE AMPLIFICATION AT AUDIO FREQUENCIES AND HIGH DETECTING EFFICIENCY ARE INDICATED

Higher Bias Necessary

When the voltage on the inner grid is 45 volts the maximum detecting efficiency comes at 5 volts. This is not so easily obtained by combinations of batteries and the drop in the ballast as the others, and since the detecting efficiency is not so great as for the two other connections of the inner grid there is no object of using 45 volts.

When the load resistance is increased to 1.0 megohm the curvature at the lower bend becomes greater. Hence the detecting efficiency is greater. The maximum comes about at 3.8 volts.

When the tube is used for detection it is desirable to have a means of varying the grid bias continuously, or in very minute steps. If the required grid bias does not exceed 2.7 volts this may be done by connecting a 2,000-ohm potentiometer across the filament ballast and by returning the grid to the slider. The bias then may be varied by small fractions of a volt from zero to 2.7 volts. If a battery must be used to boost the bias the potentiometer may be connected across part of the battery to obtain the same effect.

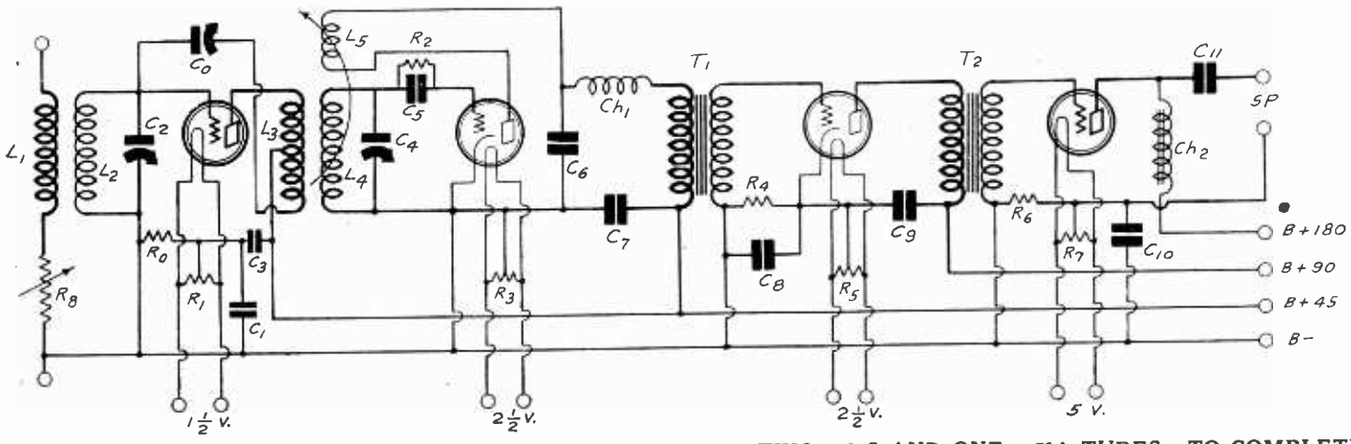
Space Charge Grid Tube Amplifier

The tube can be used as an effective voltage amplifier, as may be seen from the four curves in the graph. The A plus curve at the bias of one volt has a slope of 37 and at 0.5 volt bias a slope of 39. The slope is the voltage amplification. The slope of the 22-volt curve is about the same, but that of the 45-volt curve is somewhat less, being about 27 at a bias of 1.5 volts. Again it is better

(*Continued on next page*)

A 4-Tube AC Circuit

By Herbert E. Hayden



A FOUR TUBE ELECTRIC RECEIVER EMPLOYING ONE —26, TWO —27S AND ONE —71A TUBES. TO COMPLETE THE CIRCUIT IT IS ONLY NECESSARY TO CONNECT A B BATTERY ELIMINATOR HAVING THE REQUIRED VOLTAGES.

AN AC receiver has the outstanding advantage that the filament supply never runs down. As long as the house fuse is intact there is power available for heating the cathodes and the filaments. The receiver never stops functioning in the midst of a program for lack of adequate charge in the battery. This gives a sense of security to owners of AC receivers which owners of DC receivers do not enjoy.

The circuit depicted in Fig. 1 is well-known. The demand for such a circuit has always been great, and its popularity, apparently, will not be dimmed this Winter.

The radio frequency tube is the —26 type. The detector and the first audio tubes are of the —27, or heater type. The last is the —71A type. For these tubes a filament transformer having one 1.5 volt winding, two 2.5 volt windings and one 5 volt winding, is used.

If the filament windings are not center-tapped, low resistance potentiometers as indicated by R1, R3, R5 and R7 must be used. The first of these, R1, may be a center tapped 20-ohm resistor. R3 and R5 should be 30-ohm center-tapped resistors. R7 should be a 50-ohm center-tapped resistor. If any of the windings is center-tapped the potentiometer for the corresponding tube may be omitted and the return made to the tap on the coil, except the RF tube.

The bias on the first tube is obtained from the drop in Ro. The bias should be about 3 volts. To obtain this the resistance of Ro should be about 1,000 ohms. It may be by-passed by a .001 mfd. condenser, not shown. The grid condenser-grid leak method of detection is used in the second tube. Thus no bias is needed on the tube and the grid return is made directly to the cathode. But the cathode should be connected either to the mid-point of the 2.5 volt winding or to the mid-point on the resistance R3.

The cathode is similarly connected in the third tube. But since this tube is an amplifier it is necessary to use grid bias. About 5.5 volts should be used. This is obtained from R4, the value of which is about 750 ohms. This resistor is by-passed by a 2 mfd. condenser, C8.

The last tube normally requires a bias of 40.5 volts but when it is AC operated it should have about 43 volts, or 2.5 volts higher than for DC operation. This is to allow for the fact that grid current begins to flow when the bias becomes less than 2.5 volts. The resistor R6 is used to supply the bias. The value of this resistor when the plate current is 20 milliamperes should be 2,150 ohms, but as the plate current will be lower for the high bias the resistance should be about 2,200 ohms. It should be by-passed by a condenser C10 which is no smaller than 4 mfd.

Output Filter

The output filter consists of a 30-henry choke Ch2 and a 4 mfd. condenser C11. There are many output filters on the market any one of which may be used here. But such units usually do not admit of the connection shown in the drawing. In most of them the speaker is connected to the B plus terminal. This connection forces the signal current through the power supply before returning to the filament and this causes audio frequency regeneration.

Condensers C7 and C9, each of which is 2 mfd., serve to by-pass the signal currents in the plate circuit and keep them from entering the power supply. These condensers are quite necessary when a B Battery eliminator is used as without them the signal is not clear.

There are two volume controls in the receiver. The first is the 2,000 ohm variable resistance R8 in the antenna circuit. This control should be preferred. In selecting this resistance care should be taken that its resistance can be made zero. The second volume control is the tickler, which should be used more for building up weak signals than for cutting down on the strength of the strong.

The eliminator used with the circuit should have a total output of 220 volts when all the tubes are working.

(Continued from preceding page)

to use 22 volts on the inner grid (cap) than higher values.

When the load resistance is increased to 1.0 megohm the slope of the curve is increased a little. At a bias of one volt the slope is about 39 volts output per volt input.

When the tube is to be used as an amplifier the entire voltage drop in the filament ballast cannot be used. The grid return should be made to a tap suitably placed on the ballast. Thus when the inner grid voltage is 22 volts the tap might be placed at the middle point of the ballast.

Curvature Throughout

Performance curves taken on three-element tubes with high resistance load in the plate circuits show a region in which there is practically no curvature. But the curves of the screen grid tube show curvature throughout. **Thus with the space charge grid tube absolutely distortionless amplification is not possible.**

One reason for this is that the internal resistance of the screen grid tube is higher than that of ordinary tubes. If the external load resistance could be increased so as to make the internal resistance small in comparison, the curves for the space charge grid tube would be practically straight.

If the tube be used in a push-pull circuit in which the two opposing tubes were well matched the distortion would be practically zero, for the even harmonics introduced by the curvature would be balanced out.

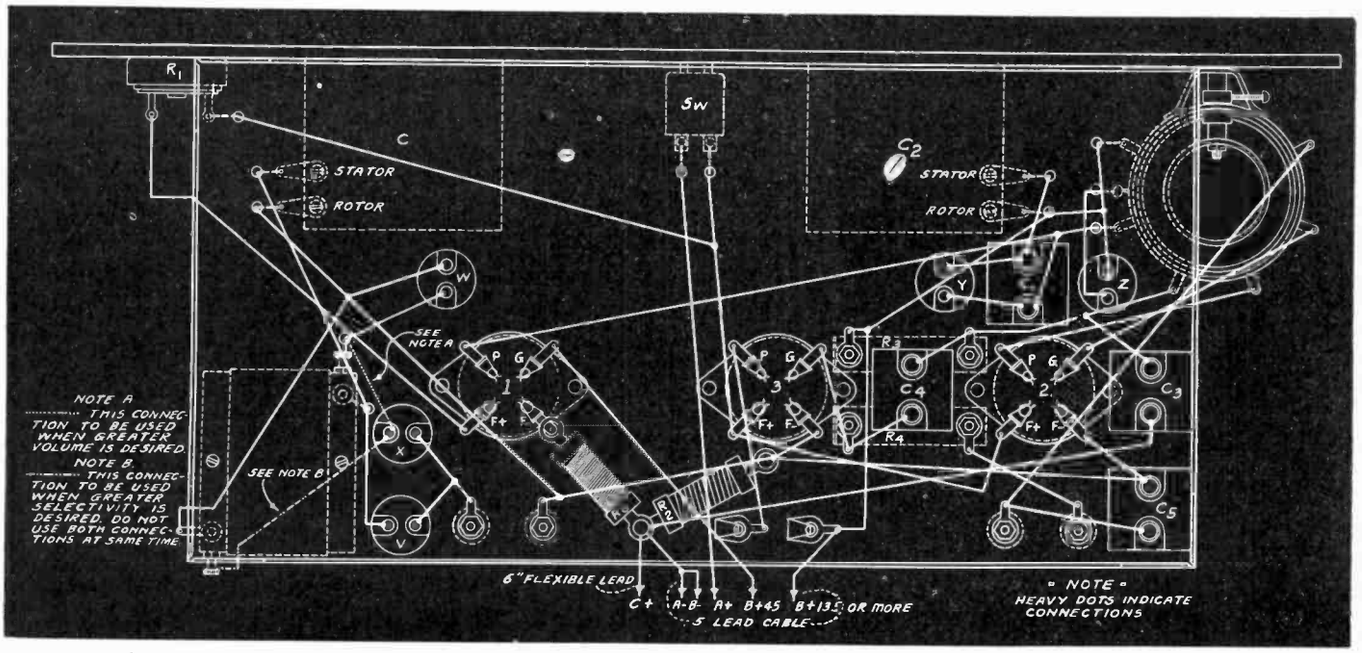
As far as the curves show, it is better to operate a screen grid tube in space charge fashion than in screen grid fashion as a detector or audio amplifier.

LIST OF PARTS

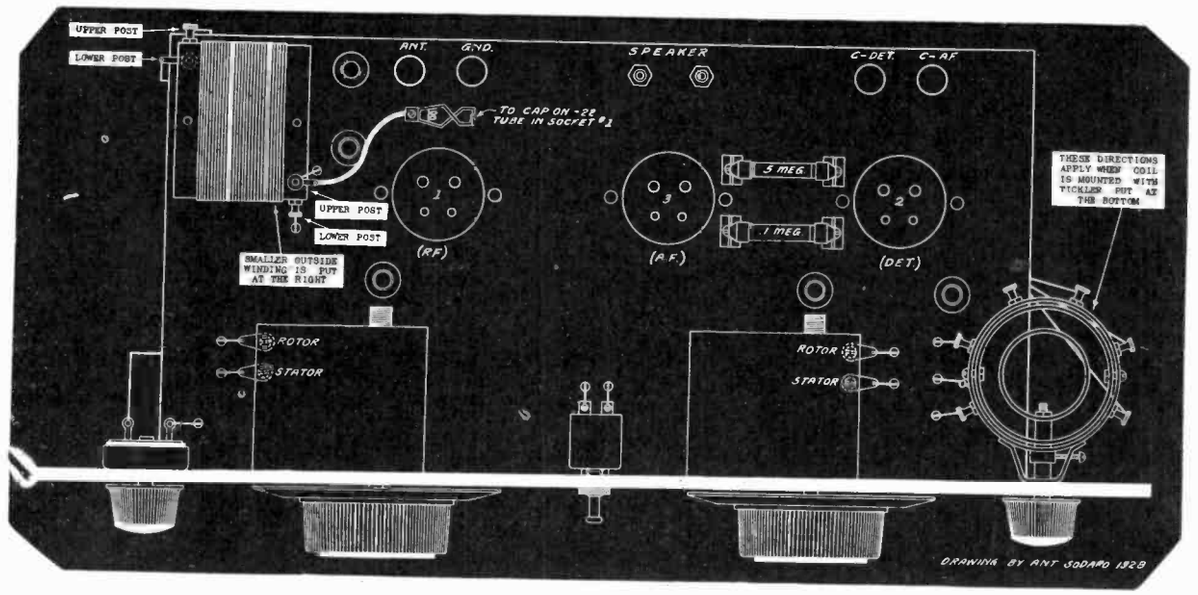
L1, L2—One antenna coupler for .0005 mfd. condenser.
L3, L4, L5—One three circuit tuner for .0005 mfd.
Ch1—One 85 millihenry choke coil.
Ch2, C11—One output filter.
T1, T2—Two audio transformers.
Co—One midget condenser.
C1, C3—Two .01 mfd. by-pass condensers.
C2, C4—Two .0005 mfd. condensers.
C5—One .00025 mfd. condenser with grid leak clips.
C6—One .0005 mfd. fixed condenser.
C7, C9—Two 2 mfd. by-pass condensers, 400 volt test.
C8—One 1 mfd. by-pass condenser, 200 volt test.
C10—One 4 mfd. by-pass condenser, 200 volt test.
Ro—One 1,000-ohm register.
R1—One 20-ohm center-tapped resistor.
R2—One 2-megohm grid leak.
R3, R5—Two 30-ohm center-tapped resistors.
R4—One 2,200-ohm resistor.
R6—One 2,200-ohm resistor.
R7—One 50-ohm center-tapped resistor.
R8—One 2,000-ohm variable resistance.
Four standard sockets.
Eight binding posts.
One —26 type tube.
Two —27 type tubes.
One —71A type tube.
One tickler knob.
Two dials.
One filament transformer.

The Economy Three

By Herman Bernard



BOTTOM VIEW OF THE ECONOMY THREE SHOWING ALL CONNECTIONS AND LEADS. FULL LINES INDICATE THAT THE PARTS OR WIRES ARE UNDER THE PANEL AND DOTTED LINES THAT THEY ARE ON TOP.



TOP VIEW OF THE SUB-PANEL SHOWING THE ARRANGEMENT OF THE PARTS AND THE CONNECTIONS. ALL LEADS TERMINATE WHERE THEY PASS THROUGH THE SUB-PANEL.

WIRING diagrams of receivers utilizing sub-panel wiring which show the leads as if they were seen through the sub-panel from above are of little use in wiring the set because when the sub-panel is turned the leads are no longer in the same order as they are shown on the diagram. They are reversed.

This often causes a great deal of confusion among those who rely on the point-to-point wiring diagram for connecting up a set.

Better Way

A much more satisfactory wiring diagram is one drawn from the bottom point of view, or from the same point of view as the builder when he is wiring under the sub-panel. All the leads then will have the same relative positions on the job as on the drawing, and there is little chance of making a mistake, or even of hesitating as to which connection is correct. The upper figure is an example of the beter sort of sub-panel wiring diagram.

How Leads Continue

All the leads there are shown in the proper relation to the parts under the sub-panel and all terminate where they pass through a hole in the baseboard or where they pass under it from the sides. If they are continued they go on as dotted lines, which connect with dotted parts on the top of the baseboard.

Little Top Wiring

The lower diagram shows the top view of the same receiver, that is the Economy Three. Only a few leads are shown on this drawing because they terminate where they pass under the baseboard, and they do so near the parts to which they are connected in order to leave the top of the sub-panel as neat as possible.

The Birth of the Tube

By Dr. Lee DeForest

HOW did I come to invent the present-day vacuum tube? Was it just a lucky accident? Did I simply take the impractical two-element tube or Fleming valve and add the grid to make that device really useful? Do I believe better vacuum tubes can be produced? What of the future of radio?

So often are such questions asked that I shall answer them.

Follow me back to 1900. At that time I was engaged during the day as associate editor of the "Western Electrician." Evenings found me in a hall bedroom in Chicago, experimenting with a toy called wireless telegraphy. Among proud possessions was a spark coil which gave vent to a wicked, crashing spark that never failed to thrill and spur me on to greater experimental efforts.

A Peculiar Happening

Now a peculiar thing happened when I operated that spark coil in my hall bedroom. The Welsbach gas light would dim while the spark was on, only to resume full brilliancy the instant the spark ceased. A trivial occurrence, no doubt; but then an experimenter must ever be interested in trivial things that seem out of the ordinary. I was puzzled. What caused the dimming of that light? My first thought was that the electromagnetic or wireless waves, given off as the result of the spark discharge, had a mysterious yet positive influence on the heated gas particles of the Welsbach burner. All of which led to further experiments.

It was soon proven that the startling effect I had observed was only the result of sound waves, and not at all electric.

However, I had become convinced that the phenomenon of the gas flame nevertheless might be employed in the detection of wireless signals.

At that time we had only crude wireless detectors and I was experimenting with an electrolytic type of detector as an improvement on the coherer.

Two Platinum Wires Used

My first attempt at producing a new wireless detector based on my observations on the flickering gas flame took the form of two platinum wires placed at different points in the blue flame of a Bunsen gas burner.

The platinum wires were connected with the antenna and the ground, respectively. Also, across the two wires was a combination of sensitive telephone receivers and a battery. The arrangement worked well enough, in fact, to encourage further experiments. The first heated gas wireless detector was constructed in 1903.

But this gas flame detector was nothing more than a laboratory set-up. It could not be employed in commercial work. On shipboard, which was then the most promising sphere of wireless, we did not have gas. I thought of the electric arc, but that proved too noisy. Finally, I decided to enclose my heated gas in a glass bulb, using a filament as the source of heat.

A Successful Hunt

No simple matter was it to obtain the services of a good glass blower at that time. The big lamp companies were not interested in this far-fetched experiment. Finally, after long and patient search, I got the co-operation of Mr. McCandless, who manufactured miniature incandescent lamps in New York City. McCandless made up some experimental tubes for me, with carbon filaments and platinum plates.

With the antenna connected to the platinum plate, and the ground to the filament, together with telephones and battery connected across plate and filament, I was confronted with the shunting or by-passing of much of the signal energy through the telephone and battery circuit, with considerable loss of efficiency.

As a solution of this difficulty, I conceived of a third element. At first this took the form of a tinfoil band wrapped around the outside of the bulb, but that had little influence on the action of the tube. Next, I tried a coiled wire inside the glass bulb. After various arrangements, I decided upon a zigzag length of wire, placed directly in the path between filament and plate. Because of its shape, I named it the grid.

He Names the Batteries

Three sets of batteries were required to operate this device, and these I named A, B and C batteries, for want of better terms.

And so I worked out the first practical vacuum tube or audion. This first three-electrode vacuum tube dates from 1906.

Simple as this device was, with its filament, grid and plate in an evacuated glass bulb, for we had learned then that it was a vacuum and not a gaseous content that was required, it soon displayed marvelous capabilities. For one thing, it was a relay of perfectly amazing performance. The slightest impulse could be made to control a powerful current accordingly, just as the slight tug on the lanyard of a great gun may unleash a ton of destruction on a distant target.

At first I made use of the audion as a super-detector for wireless reception. Soon its remarkable relay possibilities led me to develop the audion amplifier, first patented in 1907. In the Fall of 1912 I demonstrated this device to the Bell System engineers, and gave permission to McCandless, my tube maker, to produce experimental audions for the Bell System engineers.

Engineers' Feat

By 1915, utilizing audions as repeaters or voice relays, these far-sighted engineers succeeded in establishing the first transcontinental telephone service between New York and San Francisco. Later in the same year, with the use of some 150 large amplifier tubes, the Bell System engineers spoke by radio telephone from Arlington, near Washington, D. C., to the Eiffel Tower in Paris, and then to Pearl Harbor in Hawaii, almost 8,000 miles away.

Long before this, or ever since 1906, I had been undertaking wireless telephone experiments. With the troublesome and uncertain electric arc for producing the wireless or radio waves, I had succeeded in establishing wireless telephone service for the Navy, for commercial concerns and even for trains.

In 1910 I undertook broadcasting on an experimental scale, from an office building near the Grand Central Terminal in New York City.

Opera Broadcast

Early in 1909 I essayed the broadcasting of an opera performance direct from the stage of the Metropolitan Opera House. I had the vision of broadcasting, but, at that time, lacked the technical tools for practical success. It remained for the World War and the amazing mobilization of American scientific efiorts to develop the audion and its possibilities to the necessary degree for everyday purposes.

The remainder of the story is too new and too familiar to require telling at this time. With the advent of scheduled broadcasting, radio telephony became everybody's concern. The vacuum tube or audion became an everyday commodity, soon found in every home. Radio programs became part and parcel of the life of the American people.

And no one has received greater pleasure from the miraculous growth of broadcasting than myself. In the present-day achievements of this young art I see reflected my fondest dreams come true.

Back In Old Smock

And so it is with keen, wholehearted interest that I have returned once more to my old playmate—the audion. During the past few months I have delved once more into the intricacies of electrons and high vacuums and gases and rare metals.

In company with my staff of research workers and engineers, I am digging down deep to the very foundations. From our laboratory work we have gone to improved production methods. We have developed special filaments capable of long and sustained life. We have obtained greater rigidity and uniformity through improved mechanical structure. We have developed improved exhausting and sealing methods, resulting in high vacuums heretofore believed unattainable in economic production.

All of which has formed the basis for the new audions, to which I have gladly lent my name, for I am convinced we have scored a decided step ahead in the radio art.

Important Developments Due

And yet—well, we have hardly scratched the surface. All we have done has been by way of refinements and greater care. And daily we are learning more about what goes on within the glass bulb of this simple though marvelous mechanism. We are on the eve of important developments.

New audions or vacuum tubes of untold possibilities are within sight in our research laboratories. Indeed, the radio of to-morrow promises to be just as far ahead of to-day as to-day is ahead of the wireless days when my Welsbach gas lamp grew dim in that hall bedroom back in Chicago.

BOARD AIDS DEFENSE

Washington

The Federal Radio Commission will aid the Federal District Attorney in Chicago in combating the complaint filed by Clinton R. White, owner of WCRW. Donald D. Hughes of the legal section of the Commission has left for Chicago on this mission.

Which Tube is W

THE LAST ONE SHOULD BE, TO MINIMIZE

By James H.

Contributing Editor; Associate,

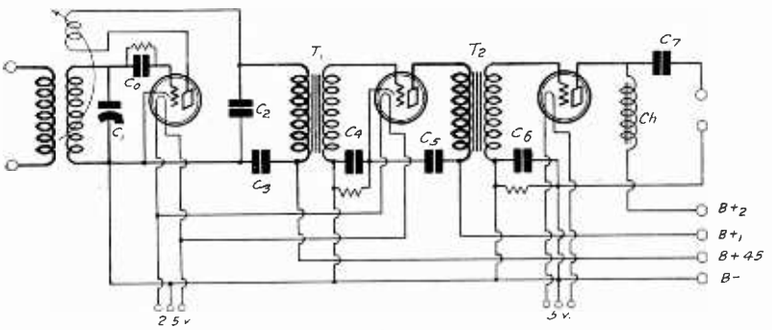


FIG. 1

A TWO-STAGE TRANSFORMER-COUPLED AMPLIFIER, ILLUSTRATING THE METHOD OF DESIGN TO AVOID WAVE FORM DISTORTION.

WHICH tube in your receiver is the weakest link? Which tube becomes overloaded first? If the last tube is loaded up to the limit to obtain from it the maximum undistorted output, can the tube preceding it deliver an undistorted output of the required magnitude? And can the detector tube deliver an undistorted signal large enough to load up the intermediate tube?

There is no object of putting a large power tube in the last stage if the preceding tubes become overloaded long before the last tube is loaded up to the limit. Distortion is just as bad if it enters into the detector or the first audio amplifier as if it enters in the last stage. To insure that a minimum of distortion enters into the amplifier the last tube should be the weakest link. That is, it should be the first tube in the circuit to become overloaded.

Working Backwards

This point should be checked up every time a receiver it designed. And to do it, it is best to work backwards. For example, suppose that the last tube is a —71A. If this tube is biased with 40.5 volts on the grid and supplied with a plate voltage of 180 volts, it can stand a signal voltage amplitude of 40 volts. Further suppose that the second audio transformer T_2, Fig. 1, has a ratio of 1-to-3, and that the intermediate audio amplifier is a —27 tube. The actual voltage amplification of this combination is approximately 12, that is, one-half the product of the amplification constant of the —27 tube and the step-up ratio of the transformer.

Hence to get a signal amplitude of 40 volts on the last tube the signal amplitude on the —27 amplifier must be 40/12, or 3.33 volts. Can this signal be impressed on the —27 tube without overloading? It can, if the grid bias on the tube exceeds 3.33 volts and if the plate voltage is high enough. If this tube is given a plate voltage of 90 volts its proper bias is 4.5 volts. Lower plate and grid voltages cannot be used safely, for on the lowest notes the amplification will be less than that assumed and the amplitudes required on the intermediate tube will be greater. The 4.5 volt bias gives a suitable margin of safety.

Detector Output

Now, in the interest of purity of signal it is best to regard the maximum input to the intermediate tube to be 4.5 volts instead of 3.33 volts. If the first transformer T1 also has a 1-to-3 ratio, the voltage across the primary must be 4.5/3, or 1.5 volts. That is higher than the detector can deliver without distortion. It has been estimated that the voltage should not be more than .05 volt, but if this were true no receiver would be capable of tolerable output.

If the plate bend method of rectification is used a detected output of 1.5 volts can be obtained without much distortion but with grid detection there will be considerable distortion. Hence more audio frequency amplification should be used.

Suppose that the second audio transformer T2 has a ratio of 1-to-6. Then the voltage across the primary of the first transformer would have to be only .75 volt. The distortion in the detector would be only one-fourth as great as in the previous case.

Three Stages of Audio

If another audio stage having an effective voltage amplification of 12 be added, the signal amplitude across the first transformer primary would have to be only .125 volt, assuming all the transformers were of the 1-to-3 ratio type. This would reduce the harmonic distortion in the detector output to a very small fraction of its value when two stages were used, but additional distortion would be introduced by the added transformer and tube. This added distortion would be mostly of the frequency type. Since this type is not so readily appreciated by the ear there would be some gain in quality.

It must be remembered in connection with the two-stage amplifier that maximum undistorted output is required only on very loud passages and on the lowest notes. The fact that many two-stage amplifiers give very good quality indicates that considerable distortion is tolerable provided it occurs only momentarily and occasionally.

The statement is often made that a second harmonic distortion of 5 percent of the signal is entirely negligible and that such distortion becomes noticeable only when it gets up to 10 percent., and then only by careful listening. That is the total second harmonic distortion.

If both the detector and the power tube are overloaded the total distortion is likely to be much higher, so it will not do to allow the 10 percent. distortion in each. Once the distortion has entered the signal it cannot be removed, except that the distortion introduced in one tube is partly neutralized by the succeeding tube, provided that the distortion introduced in one tube is opposite in phase to that introduced in the next. This is not often the case in transformer coupled circuits.

Design of Resistance Coupled Circuits

The same principles of design apply to resistance coupling as to transformer coupling. Supose the last tube is of the —71A type and the voltage applied to the plate is 180 volts. The bias should be 40.5 volts, which will allow a signal amplitude of about 40 volts. If the tube preceding the power tube is of the mu 30 type and if suitable values for the resistors R5 and R6 be used a voltage amplification of 16 is readily obtainable.

Then the signal amplitude on the high mu tube should be 2.5 volts. Thus the bias on this tube must be at least 3 volts if distortion is to be avoided. To permit this bias and an output amplitude of 40 volts the plate voltage on the high mu tube should be 180 volts.

The necessity of using a high plate voltage on the last high mu tube in a resistance coupled amplifier is not generally appreciated. Often a voltage of 135 volts is used on this tube, and this is not enough.

The voltage in the plate circuit of the last high mu tube must be considerably greater than twice the value of the bias on the power tube.

Just how much larger it should be depends on the coupling resistors. If the effective value of the parallel combination of the plate resistance and the grid leak is of the order of 250,000 ohms the plate voltage applied should be at least four times the value of the bias on the power tube.

Requirements of First Stage

Since a bias of 3 volts is provided for the second high mu tube a signal amplitude of that value should also be provided

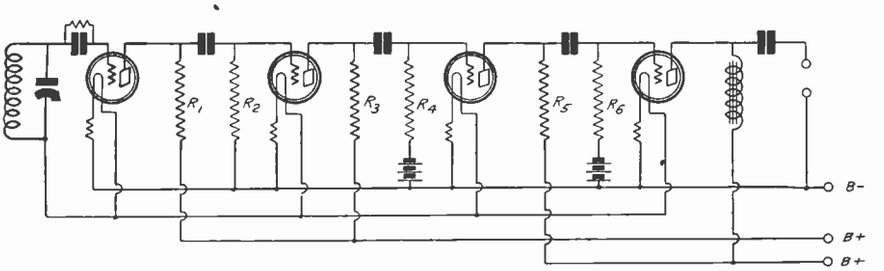


FIG .2

A THREE-STAGE RESISTANCE COUPLED AMPLIFIER, ILLUSTRATING THE PRINCIPLES OF DESIGN USED IN DESIGNING TO SECURE A MINIMUM OF WAVE FORM DISTORTION.

eakest?

DISTORTION

Carroll

Institute of Radio Engineers

for. As before, the amplification may be assumed to be 16. Thus the signal amplitude on the first high mu tube will be 3/16 volt. Thus the one volt bias obtained from the drop in the filament ballast is ample.

The plate voltage applied to the first high mu tube need not be more than 45 volts, but higher values will give more faithful amplification. The same plate voltage as is applied to the detector may well be used.

An output voltage of 3/16 volt can be obtained from either a plate bend or a grid circuit detector without appreciable distortion when the load resistance is of the order of 250,000 ohms. Hence not only will the resistance coupled amplifier give a good frequency characteristic but also a good wave form characteristic.

The wave form characteristic in a resistance coupled amplifier is improved by the fact that the distortion in one tube is partly neutralized by that of the next, because the phase of the output voltage in one tube is opposite to that of the next tube.

Another Freshman Enters Set Field

The Martwel Corporation, from its office in the Paramount Building, New York City, announces that it has been granted exclusive sales rights on the new President receivers for the New England states, New Jersey, Pennsylvania, Maryland, Washington, D. C., and the key cities east of Chicago.

The President all-electric radio is manufactured by the S. Freshman Company of Chicago. There are two models at present: a table model listing at $60 and a console with built-in Utah Dynamic Speaker listing at $149.50.

The set is licensed by the Radio Corporation of America, Hogan, and others. It embodies features demanded in current electric radios, among which are push-pull amplification, shielding, one control, electric phonograph pickup, Miesner filter circuit cutting down AC hum, etc. The set employs eight tubes including the rectifier.

The principals of the Martwel Corporation are Martin Zatulove, who served as supervisor of sales for five years for the Chas. Freshman Company, and Paul S. Weil who was associated directly and indirectly with the same organization as advertising and sales promotion manager for seven years. Martwel also handles Magnatron tubes.

Big Year Predicted

Arty Kissner, one of the pioneer salesmen in radio, predicts one of the best years that radio has ever known, basing this on the interest shown at the recent Radio World's Fair by fans, dealers and jobbers and by the trend of their talk. He represents McPhilbin-Keator, Inc., one of the oldest distributing firms in phonograph and radio, with offices in New York City and headquarters in Bush Terminal, Brooklyn, N. Y. The corporation handles the entire Kolster line, R. C. A. tube, Eveready batteries and its own line of custom-built cabinets.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., New York City.

When writing for information give your Radio University subscription number.

WHAT IS the reason arc lights are not used in television receivers? It seems to me that much more light can be obtained on the screen by using such a source of illumination.

(2)—Is it not possible to modulate the light by means of a shutter similar to that used in a photographic camera, that is, by an iris diaphragm?

(3)—What is the main advantage of the neon lamp in television? It seems to me that the light is not intense enough.

FRANKLIN MORSE,
Boston, Mass.

(1)—Arc lights do not "go out" fast enough. The intensity of the light cannot be varied rapidly enough to follow the television signal.

(2)—This has been tried, but a shutter of this type cannot be made to operate rapidly enough. It can be made to follow the slower changes in the signal intensity but not the more rapid. The frequency limit is about 3,000 cycles, whereas the signal requires that it follow 10,000 cycles.

(3)—The main advantage of the neon lamp is that it "goes out" instantaneously. That is, it follows the intensity variations accurately without any time lag. It is true that the intensity of the light is not great.

* * *

WHAT DOES the mu of a tube mean? The mutual conductance?

(2)—What does ampliture of a wave mean?

(3)—Please explain the meaning of peak voltage, effective voltage, root mean square voltage.

AMBROSE BLATCHFORD,
Portland, Oregon.

(1)—The mu of a tube is the voltage amplification factor of that tube. For example, if the mu of the tube is 30 a change of one volt on the grid of the tube will produce a change of 30 volts in the plate circuit of the tube. The mutual conductance of a tube is the current change in the plate circuit which will result from a change of the grid voltage of one volt. The mutual conductance is the mu of the tube divided by the plate resistance. Thus if the plate resistance is 2,000 ohms and the mu of the tube is 3, the mutual conductance is 1,500 microhms.

(2)—The amplitude of a wave is the widest swing of the wave. For example, the amplitude of a water wave is the distance from the still water level to the crest of the wave.

(3)—The peak voltage of a voltage wave is the same as the amplitude voltage. The effective voltage of a voltage wave is .707 times the peak voltage. The root mean square is essentially the same as the effective voltage.

* * *

WHICH TYPE of coupling resistor is the most nearly constant? I have measured several types and there is considerable variation in the resistance values as obtained on the same resistor at different times and under different conditions.

ROBERT SAUER,
Tulsa, Okla.

(1)—Wire wound resistors made of Manganin are constant in value, or resistors wound with wire having the same characteristics. All other resistors vary with temperature, and hence with the current flowing in them. A little variation in the resistance does no harm when a resistor is used for grid leak or coupling unit. The operating resistance is very nearly that corresponding to the steady plate current, or grid current, flowing in it.

* * *

I HAVE a 0-1 milliammeter which, I have been told, can be used as a high resistance voltmeter if a resistance is connected in series with it. If this is correct please tell what value of resistance to use.

(2)—What voltage range can be measured with such a meter?

(3)—What type of resistor is best to use?

BURTON A. LEWIS,
Jacksonville, Fla.

(1)—It is just this milliammeter which is used in all 1,000 ohms per volt voltmeters. It is converted to a voltmeter by connecting a suitable resistance in series with it. To determine the resistance required multiply the voltage range by 1,000. For example, if it is desired to construct a voltmeter having a range of 0-10 volts the resistance should be 10,000 ohms.

(2)—Any desired range can be obtained. If it is desired to make the voltage range 0-750 volts the resistance should be 750,000 ohms.

(3)—The resistance used should be wire-wound, preferably of manganin or similar wire. Any fine resistance wire may be used if a high degree of accuracy is not necessary.

Lily of Reallocation Gilded by Capt. Hill

Washington.

The new allocation of radio broadcasting stations and facilities, which becomes effective November 11, "positively will give the country a greatly improved broadcasting system," Capt. Guy Hill, engineer in charge of broadcasting of the Federal Radio Commission, declared in a statement.

The full text of the statement follows:

The average listener will be interested to know just what improvement he may expect from the coming broadcasting allocation. The gain to the general public, and especially for the remote listener and farmer, will be that many more stations can be received clearly, without any heterodyne whistles or cross-talk.

More Without Interference

The increase in the number of stations received will, of course, vary due to time of year and location of the listener, but the listener will be delighted in discovering the number of stations he can receive without interference being present.

Those listeners who like to try to pick up distant stations will find that there will be a large number of such stations that can be received without any interference, as there will be 40 such stations on different frequencies and with no other stations on these frequencies to cause trouble.

Not So Many Repeats

Another important improvement will be that the listener as he tunes in to different stations will not get the same program repeated as often as at present, since the new allocation will require that stations on cleared channels must not give the same program on any two stations that are less than 300 miles apart.

The Federal Radio Commission was instructed by law to make the radio broadcasting facilities equal for each of the five zones into which the country is divided.

The law has been both an aid and a hindrance in working out a satisfactory allocation. On the whole, I consider the good points in the law far outweigh the poor features.

Laws Defects

The great aid given by the law is the requirement of equality; this forms a definite basis on which to build an allocation and without such requirement it would have been very difficult to have made any satisfactory allocation.

The principal defect of the law is that the zones into which the country is divided are not based on any principles of radio engineering and that in making a reallocation to comply with the law, an unscientific zone arrangement proved a rather bothersome obstacle.

The new allocation complies with the spirit and letter of the law as the zones are given equal treatment and within the zones the States are assigned stations in accordance with the population as far as practical, some variation in this respect being allowed by the law to meet existing conditions.

Greatly Improved System

The new allocation positively will give the country a greatly improved broadcasting system. If all broadcasting stations will co-operate to the fullest extent with each other and with the Radio Commission, the success of the new allocation as regards the benefits to the broadcasting stations will be so great that they will be amply paid for their co-operation.

In making the new allocation, the Commission decided that they should work to produce the greatest good to the greatest number of listeners. This will, of course, also produce the greatest good to the broadcasting stations considered as a unit; some individual stations have to suffer a loss for the common good.

Wants Whole Judged

No one can make a worthwhile or intelligent criticism of the new allocation without giving careful consideration to the entire allocation and the principles of the allocation and conditions that had to be complied with must be understood.

The effect of the new allocation, whether favorable or unfavorable, on some specific broadcasting station, locally, or individual listener, should not outweigh to any fairminded person the total effect produced on the country as a whole.

A large majority of the listeners of the country would be greatly benefited by the new allocation. Confirmation of this improvement of course cannot be obtained until the allocation is in effect, but the average listener should look with confidence to the improvement he will get, especially during the winter months.

While to some extent the allocation is a compromise, in general the only questions that had to be settled by compromise were the relative number of the various classes of channels and the power to be allowed on the cleared channels.

Complex Considerations

These questions involved engineering, practical considerations, and questions of policy. The final result as embodied in the allocation due to a compromise of the questions is probably more satisfactory, when all things are considered, than if pure engineering only had been regarded.

The question of power on cleared channels will settle itself and the advocates of high power will ultimately undoubtedly be allowed to use as much power as demonstration shows can be without injury to the rights of others.

The question of the number of stations to be on the air at any one time was chosen with the view to work as little hardship as possible on existing stations and yet produce satisfactory radio.

Suggests More Divisions

If any change were to be made in the allocation, the change should be to require further time divisions and the canceling of some licenses. This is not because the broadcasting stations have conducted their stations in an unsatisfactory manner, but merely that even with the reduction of power and time on the air made in the new allocation, certain localities will have more stations than can be used and give the best possible radio. While a further reproduction is not recommended, every broadcasting station which is not satisfied with its new assignment should understand that the reductions made by the Commission have not been too drastic but rather too lenient. A study of any complete allocation will demonstrate this without question.

Aimone Radio Furniture

The Aimone Furniture Company, of Jersey City, makers of fine furniture since 1848, is now making a line of radio tables and consoles, including four models of tables made of selected wood, beautifully finished. They come in sizes to take any model of the new factory-built sets and to harmonize with the cabinets and furnishings of the modern home. This line is now being represented by Pat Kiley, Room 519, 30 Church Street, New York City, and full information may be had by addressing him there. Mention RADIO WORLD.—J. H. C.

QUESTION OF DYNAMICS

It takes about 40 milliamperes to run a dynamic speaker of the 90-volt rectified DC type. This current actuates the field coil. AC models have built-in rectifiers. The other model is of the 6-volt DC type, operated from a storage battery. All models have a "voice coil," too.

Everybody's Ambition Is to Be Announcer

Everybody wants to be a radio announcer, judging by the experience of WLW. An offer was made of tryouts to select an announcer for the recent Press Night sponsored by the four Cincinnati daily papers and broadcast from the Cincinnati Radio Show.

Sixty-eight aspirants for the announcer's position went to the Crosley studios. Four were selected for the final elimination. Of these, two already had had experience as announcers. One was owner of a small radio station. The other, who finally won the contest, had been associated with the Stuart Walker stock company and had done part time announcing at one of the smaller local stations.

All Professions Included

The ambition to be an announcer was confined to no class. Included among the tryouts were a minister who for several years had given radio sermons at WLW; a bus driver; a lathe hand and several other factory workmen; an auto mechanic; a law student; a music student; a chemist; an efficiency engineer; the vice president of a large manufacturing concern; a newspaperman; a journalist; a writer; several clerks; and a great number of salesmen who said they had "just dropped in" because they had some extra time.

Although it had been expressly stated that only a man could have the Press Night position, one woman presented herself at the tryout. She stayed to listen.

Musical Terms Are Pitfalls

As a microphone test, the would-be announcers were given a series of announcements to be read while a committee of five judges in a closed office listened on a loud speaker.

The announcements included those for serious programs, ridiculous ones as tests of poise, time announcements, and several in which were classical names and musical terms. Each one contained call letters to test enunciation and accuracy.

Musical terms and call letters caused the downfall of most of the aspirants. "Delibes" was pronounced in six different ways. "Scherzo" vanquished all those who hadn't gone down on the composer's names. The call letters WLWL eliminated a number of others who read as WLW.

Board Hears WGY, KGO on Channel

Washington.

Representatives of WGY, Schenectady, N. Y., and KGO, Oakland, Calif., both owned by the General Electric Company, conferred with the Federal Radio Commission respecting the assignments given these stations under the Commission's allocation plan, which becomes effective at 3 A. M., November 11th. The conference was behind closed doors.

Martin P. Rice, in charge of broadcasting for the General Electric Company, stated orally after the conference that the company sought to have the allocation changed so that both of the stations would be assigned cleared channels, instead of the present plans to have both operate on the same channel.

He declared that the Commission took the matter under advisement.

Board's Suggestion

Discussing the cases of stations WGY and KGO, Mr. Rice declared that the Commission suggested that both stations were under the same ownership and might continue to operate WGY on its present schedule up until 10 P. M. each evening by shutting down KGO from sunset until 8 o'clock each evening.

"Shutting down KGO for three and a half hours or so would seriously cripple the broadcasting service to people in that zone," he declared.

This, he added, is not provided in the law or regulations, which "clearly specify that cleared channels in any zone are intended for 24-hour operation in that zone. Either the Pacific Coast does nothing at all," he said, referring to the fact that both stations are on the same channel.

"Spontaneous Protests"

The effect that the reallocation would have upon WGY has brought "spontaneous protests from lower Canada, New York, New Hampshire, Maine, Vermont, Massachusetts and Connecticut," Mr. Rice said.

DX to Be Restored, Says Gordon Sleeper

The reallocation of broadcasting stations will increase interest in radio reception, said Gordon C. Sleeper, president of the Sleeper Radio & Mfg. Corp. of Long Island City.

"In spite of the fact that there are almost always good programs from all of the big cities nearby, it cannot be denied that the picking up of distant stations is far more interesting and thrilling," he said.

"The chaotic air conditions in the big cities will be remedied and with forty first-class stations on different frequencies, with no other stations on these frequencies to cause trouble, it should be possible to tune in on distanct stations with selective receivers at almost any time of the night. It seems to me that the listeners are at last going to be able to get their programs without an assortment of howls and squeals."

Big Chains and Trade Protest Link Ruling

Washington.

It was announced orally at the Commission that the National Broadcasting Company, the Columbia Broadcasting System, and the Radio Manufacturers' Association have applied to the Commission for amendment of the chain broadcasting order promulgated by the Commission.

This order, to become effective with the new allocation plan, specifies that stations broadcasting chain programs on cleared channels, within 300 miles of one another, may not continue this service, and that a minimum of 300 miles separation must be maintained.

KSL ON NATIONAL CHAIN

KSL, Salt Lake City, Utah, the most powerful transmitter between Denver and the Pacific Coast, has become a special addition to the National Broadcasting Company's system. KSL is owned and operated by the Radio Service Corporation of Utah. It operates on 302.8 meters, 990 kilocycles.

Davis Law Is Unsound to Caldwell

Washington.

The "restrictive" features of the Radio Act of 1928, making mandatory the equal division of radio facilities among the five radio zones, regardless of their geographical proportions, and the basis of the plan for reallocation of broadcasting stations promulgated by the Federal Radio Commission are "unsound, unscientific and wasteful, and should be amended at the coming session of Congress," according to Commissioner O. H. Caldwell, of the Radio Commission.

"Wasteful Restrictions"

Commissioner Caldwell suggested the elimination of the "wasteful restrictions" of the present equalizing law. Declaring that the equalizing of wavelengths is fundamentally sound, the Commissioner said, however, that the Davis-Dill amendment had been carried too far.

"Had the Davis-Dill clause been limited to equalizing the assignment of wavelengths only—for the wavelengths are the only communal possession of the people of the United States—no objection could be raised to its operation on economic grounds," he said.

South and West Suffer

The Southern, or Third Zone, and the Pacific, or Fifth Zone, are those adversely affected by the "restrictive clause," said the Commissioner.

Both of these zones cover broad expanses of territory, he explained, and yet they can have no more broadcasting stations or time on the air than can be operated in the compact First, or Northeastern, Zone without interference.

TUBE PRICES REDUCED

The Radio Corporation of America reduced the suggested list price of UX112-A to $2.75, of UX171-A to $2.75, of UX226 to $2.25, of UY227 to $4.00, of UX280 to $4.25 and of UX250 to $11.50.

Cadman Becomes N.B.C. Staff Preacher

Dr. S. Parkes Cadman, pastor of the Central Congregational Church of Brooklyn, has been invited to engage in religious programs over nation-wide radio networks, to the virtual exclusion of all other duties, the Federal Council of the Churches of Christ in America announced. His acceptance was announced.

"Dr. Cadman has been engaged to some extent in radio work for three years," said Frank C. Goodman, secretary of the Federal Council of the Churches of Christ in America. "He was first presented by the Bedford Branch of the Y. M. C. A. in Brooklyn, and his broadcasts have been growing increasingly popular and increasingly productive.

"His broad but courageous treatment of basic religious questions, his striking radio personality, his sympathetic understanding of the problem of addressing a vast invisible audience, have made him the logical person and personality to become the first 'radio preacher.'

"Through the generosity of the National Broadcasting Company, Dr. Cadman is to be enabled to carry on and to extend his radio work to greater and greater audiences."

M. H. Aylesworth, President of the National Broadcasting Company, said: "Radio has now been demonstrated to be the logical agency to carry the influence of religion to audiences vast in proportion and into each stratum of life. Broadcasting opens wide agencies to bring religion into the home, thus helping to solve a problem that has deeply concerned persons seeking practical methods to promote the cause of religion.

"The radio service is not designed as a substitute for the churches, in fact it is, as thousands of ministers will testify, a powerful stimulus to church attendance and support.

"This is generally recognized."

Notice to the Publicity Promoters of Radio Set and Parts Manufacturers, Broadcasting Stations, etc.:

Radio has grown to such importance in the activities of American life and its various angles so affect business life, that RADIO WORLD, after mature reflection, has decided to increase the value, volume and comprehensiveness of the news of the trade and stations in its columns.

RADIO WORLD will, therefore, starting with its next issue, give at greater length the news of radio developments in Washington and other large centers throughout the country, and announcements of new lines of manufactures, changes in policies, rates, terms to the trade, and other things of interest.

Those interested in the radio trade constitute a big public, and it shall be our endeavor to serve them to the best of our ability. Send us stories or items covering actual news of your concerns, and everything received will have the careful attention of our News Editor.

Address News Editor, RADIO WORLD,
145 West 45th St., New York City.

A THOUGHT FOR THIS WEEK

TELEVISION is moving apace. But don't expect in the near future to be able to sit in your cushioned Morris chair in Portland, Me., and hear and see Aunt Eliza giving advice and a dose of Mellins to little Nephew Hebediah down in Houston, Texas.

These things take time, brother; they take time!

RADIO WORLD

The First and Only National Radio Weekly

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

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Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

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General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 8½" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
⅛ Page, 4½" S. C.	57 lines	37.50
1 Column, 2⅛"x11"	154 lines	100.00
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CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities, 10 cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1923, at the Post Office at New York, N. Y., under the Act of March 3, 1879

Short Wave Adapter Wins Popularity

The Air-King short wave adapter is a compact device encased in a box only 3x5½x8 ins. It comes supplied with three plug-in coils covering the range between 18 and 78 meters. It is tuned with one vernier condenser and is provided with one condenser for volume or oscillation control. A tuning chart is provided for each of the coils, so that when you know the wave length you know the dial setting. A list of domestic and foreign short wave stations is furnished.

The adapter is also provided with an 18 inch cord and plug for insertion in the detector socket of any radio receiver.

SHORT-WAVE ADAPTERS ARE ALL THE RAGE. PLUG INTO THE DETECTOR SOCKET OF YOUR RECEIVER AND PUT THE DETECTOR TUBE IN THE ADAPER. THAT'S ALL.

The detector tube is transferred to the tube socket on the adapter and the plug is inserted in the vacant detector socket of the broadcast receiver. The set is then ready to tune in stations within the 18 to 78 meter range.

The adapter may be had for both AC and DC installations.

The tuning is calibrated, eliminating guesswork. The same coils and condenser are used in each model.

The audio amplifier in the broadcast receiver automatically becomes the audio amplifier for the short wave set and gives short wave reproduction on your speaker.

Short-wave adapters are usually designed on the assumption that the coupling between the detector and the first audio tube is by transformer. But there are many radio receivers in use in which the coupling is by resistance or impedance. When the coupling device is a choke coil or double impedance the short wave adapter works the same as if the coupling were by transformer. But when the coupling device is a resistance the adapter may not always work because the effective plate voltage is not enough to make the tube oscillate, and without oscillation CW code cannot be received. This may be remedied by reducing the coupling resistor or by raising the plate voltage on the detector.

Complete information will be furnished by the manufacturer, Air-King Products Company, 216 Wallabout Street, Brooklyn, N. Y., if you mention RADIO WORLD.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Radio World, published weekly at New York N. Y., for October 1, 1928.

State of New York,
County of New York, ss:

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared Roland Burke Hennessy, who, having been duly sworn according to law, deposes and says that he is the Editor of the Radio World, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, Hennessy Radio Publications Corp., 145 W. 45th St., N. Y. C. Editor Roland Burke Hennessy, 145 W. 45th St., N. Y. C. Managing Editor Herman Bernard, 145 W. 45th St., N. Y. C. Business Manager Herman Bernard, 145 W. 45th St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of the stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Hennesy Radio Publications Corp., 145 W. 45th St., N. Y. C. Roland Burke Hennessy, 145 W. 45th St., N. Y. C. Mrs. Mary J. McArthur, 1940 E. 82d St., Cleveland, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent, or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers, during the six months preceding the date shown above is ..... weekly. (This information is required from daily publications only.)

ROLAND BURKE HENNESSY

Sworn to and subscribed before me this 28th day of September, 1928.

HARRY GERSTEN.

Notary Public, Kings Co. Clks. No. 136, Reg. 247. N. Y. Co. Clks. No. 528, Reg. No. 0-364. Term expires March 30, 1930.

Note.—This statement must be made in duplicate and both copies delivered by the publisher to the postmaster, who shall send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office. The publisher must publish a copy of this statement in the second issue printed next after its filing.

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THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

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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.

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Crosley Is Elected to DeForest Co. Board

At the annual stockholders' meeting held by the DeForest Radio Company, three men were added to the Board of Directors: Powel Crosley, Jr., president, Crosley, Radio Corporation, Cincinnati, O.; Vincent Bendix, president, Bendix Corporation, South Bend, Ind., and P. Chauncey Anderson, of the law firm of Pendleton, Anderson, Iselin & Riggs, New York. The other board members are:

A. J. Drexel Biddle, Jr., trustee, Duke Endowment, chairman of the board; Victor C. Bell, vice-president, A. D. Mendes & Co., New York; James I. Bush, vice-president, Equitable Trust Co., New York; P. L. Deutsch, president, Sonora Phonograph Co., New York; James W. Garside, president, DeForest Radio Company, Jersey City, N. J.; Orlando P. Metcalf, of Metcalf, McInnes, Allen & Hubbard, New York; Wiley R. Reynolds, chairman of board, Reynolds Spring Co., Jackson, Mich.; Harris Hammond, president, Mexican Seaboard Oil Co., New York, and Arthur B. Westervelt, vice-president, American Trust Co., New York.

New Corporations

Automatic Radio Corp. of New Jersey, East Orange, N. J. Attys., Brennan & Brown, Orange, N. J.

Motion Picture Radio Communication Corp., New York City, to protect persons in radio business. Corp. Trust Co. of Am., Wilmington, Del.

Mercantile Radio Corp. Atty., M. Koses, 133 Broadway, New York, N. Y.

Brighton Shop, radios. Attys., Monfried & Warner, 1440 Broadway, New York.

Scott Radio Corp., Wilmington, radio research, experimental, sales. Atty., Franklin L. Mettler, Wilmington, Del.

Chautauqua Awning & Radio Corp., Jamestown. Attys., Carlson & Alessi, Jamestown, N. Y.

United Radio Stores Corp., Wilmington. Atty., Corp. Trust Co. of America, Wilmington, Del.

Waltham Radio Corp. Atty., L. D. Schwartz, 15 Nassau St., New York.

Park Radio & Electric Shop, Inc., Union City, N. J. Attys., Isaac & Gunther, Newark, N. J.

Marine Radio & Electric Co. Atty, H. Kaufman, 1440 Broadway, New York, N. Y.

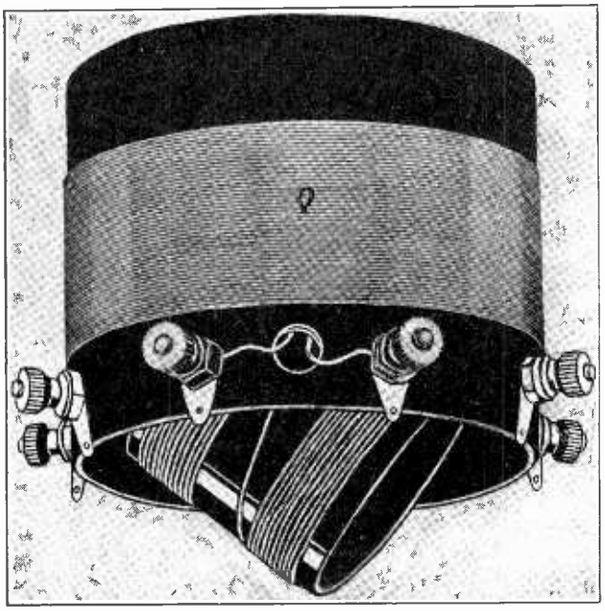
WHITING THANKS DEALERS

In a letter to the radio dealers of the country Secretary of Commerce William F. Whiting stresses the importance of radio statistics and expresses his appreciation of their co-operation in furnishing information regarding radio stocks on hand and other data.

R. M. A. IN NEW OFFICES

The Radio Manufacturers' Association has moved to the Salmon Tower, room 1390, 11 West 42d Street, New York Cty.

New Coils Produce *Revolutionary* Results!



High Impedance Screen Grid Tuner, three windings. Primary center-tapped for short waves. Single hole panel mount. (Model 5HT)..... **$3.00**

ENORMOUS VOLTAGE GAIN! MORE VOLUME! MORE DX! THE SHORT AND LONG WAVES WITHOUT CHANGING COILS!

WORKING out of a screen grid tube, the High Impedance Tuner develops incredible voltage.

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?*

The secondary has a step-up ratio of about 2-to-1, the first time a voltage increase by radio frequency coupling ever has been made available with a tuned primary. The secondary is wound on a separate form and riveted inside the primary form.

The third winding is rotatable inside the secondary form, from a front panel knob, and has a variety of uses.

Bakelite forms are used exclusively.

It is inconceivable the revolutionary effect this coil has—volume so great you would never imagine it possible—greatly increased sensitivity, often 100 times greater than an ordinary TRF coil—more distant reception, much more, in fact—and—short waves may be tuned in by shorting out half of the primary, without change of coil or condenser.

Mount coil upside down for short leads. All terminals are then on bottom.

High Impedance Screen Grid Tuner Primary Center—tapped for short waves. Single hole panel mount (for .0005 mfd.). Model 5HT $3.00

For .00035 mfd. Model 3HT.....$3.25

Wonders of Screen Grid Tubes Fully Capitalized for First Time

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 5A) $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 2½x 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 2RS3, 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.

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

Please mail me at once your following coils, for which I will pay postman the advertised prices, plus a few cents extra for postage. [Specify Quantity in the Squares]

☐ Model..... ☐ Model..... ☐ Model..... ☐ Model..... ☐ Model..... ☐ Model.....

Name .....

Address .....

City .....

State .....

SEND NO ..... (RW)

STANDARD COILS

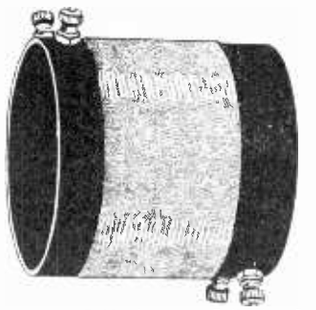
3-circuit tuner, for .0005 mfd. Secondary center-tapped for short waves. (Model T5) $2.25

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 RF5) $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.*]



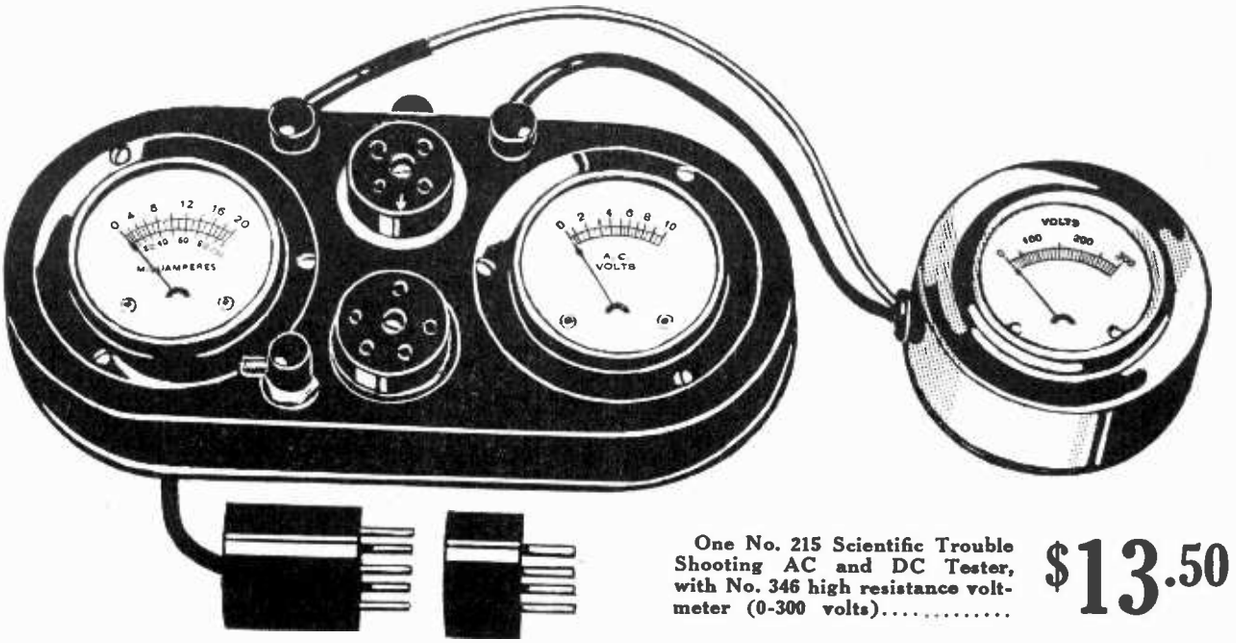
Screen Grid Antenna Coil, for Input to any Screen Grid RF Amplifier. Tapped once for short waves. (Model 5A) **$1.75**

SCREEN GRID COIL COMPANY
143 WEST 45th STREET
NEW YORK CITY
Just East of Broadway

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.

Amply 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 milliampere up to 100 milliamperes; (3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly any 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 cuts 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:

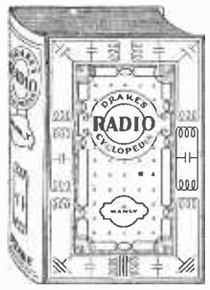
(1) One two-in-one 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale specially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
(2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is 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

GUARANTY RADIO GOODS CO.
145 West 45th Street
New York City Just East of Broadway

YOU *MUST* GET THIS BOOK!



DRAKE'S RADIO CYCLOPEDIA
(New Edition)

has been developed to answer the questions of service men, custom set builders and home constructors, of experimenters, students, salesmen and operators of receiving equipment and to allow all these to have instant access to the information they want. The author, Harold P. Manly, has collected and translated into plain English the material formerly obtainable only from dozens of scattered sources.

Each rule, fact, method, plan, layout and diagram is instantly picked out and separated from everything else by placing all subjects in alphabetical order with cross references for every imaginable name under which the information might be classed.

BOOK IS 2½" THICK, WEIGHS 3¾ LBS., 1,025 ILLUSTRATIONS.

This alphabetical arrangement lets the experienced worker refer directly to the one thing in which he is interested at the moment without hunting through non-essentials. The needs of the beginner are cared for.

The important articles deal primarily with receivers and reception. They do not stop with the electrical end, but go also into the mechanics of construction. Every new thing in radio is covered in detail.

1,680 Alphabetical Headings from A-battery to Zero Beat
1025 Illustrations, Diagrams, Layouts and Graphs
920 Pages Each 6 by 9 Inches
240 Combinations for Receiver Layouts

OF THE PRINCIPAL ARTICLES

159 concern service men, 129 help the set builder, 162 help the experimenter, 155 interest the student, 75 assist in sales work, 73 interest set owners.

Radio World: "The most suitable volume for those who want the facts stripped as far as possible of intricacies. Useful addition to any library."

Radio Broadcast: "The reviewer does not believe that a more satisfactory addition to the experimenter's library in any one volume can be made."

QST: "The information is so put as to be of most immediate use to the constructor and repair man, and, remarkably enough, includes apparatus of most recent origin."

Radio: "Seldom is any subject so comprehensively and practically explained."

GUARANTY RADIO GOODS CO.,
145 W. 45th St., New York, N. Y. (just E. of B'way)

Gentlemen: Please mail me at once the new (second) edition of "Drake's Radio Cyclopedia," by Harold P. Manly, just published, with all the latest technical information in it. I will pay the postman $6.00 plus a few cents extra for postage. If I am not delighted, I may return the book in five days and you will promptly refund my purchase money.

Name .....

Address .....

City ..... State .....

5-DAY MONEY-BACK GUARANTY!

SUBSCRIBERS!

Look at the Expiration Date on Your Wrapper

Please look at the subscription date stamped on your last wrapper, and if that date indicates that your subscription is about to expire, please send remittance to cover your renewal.

In this way you will get your copies without interruption and keep your file complete.

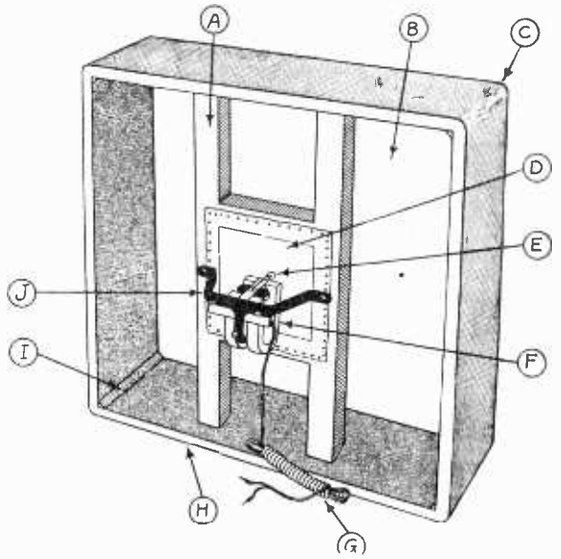
SUBSCRIPTION DEPARTMENT
Radio World, 145 W. 45th St., N. Y. City

COMPLETE ADVANCE STATION LIST—Sept. 22 issue of RADIO WORLD contained complete advance list of stations compiled according to the new allocation plan of the Federal Radio Commission, effective Nov. 11. Mailed for 15 cents a copy, or send $1.00 for trial subscription of 8 weeks, including Sept. 22 issue. RADIO WORLD, 145 W. 45th Street, New York City.

Enjoy the BIG THR-RILL!

The New HBH

Irish-Linen Diaphragm Speaker



Symbolic Rear View of the New HBH Speaker

A—Upright "H" Support.
B—Front Cloth (thinnest linen).
C—Rounded Edges.
D—Rear Cloth (airplane cloth).
E—Apex.
F—Polo Unit.
G—10-Foot Cord.
H—Rigid Frame, 24x24".
I—Splice Jointed.
J—Moulded Metal Bracket.

BUILD IT IN ONE HOUR!

Enjoy the *Big Thrill!*

THE new HBH Irish-Linen Diaphragm Loudspeaker, using the new Polo Unit, is designed to produce *more volume* and handle *more power* than any other electro-magnetic type speaker!

The volume is so stupendous as to be utterly amazing. You would think you had added a couple of more audio stages, whereas all you did was to substitute the HBH Speaker for some other type.

The tone is pure throughout the audio range, and the low notes get specially favorable treatment, to equalize their final intensity with that of the higher audio frequencies.

Matching the finest unit with the finest daphragm, tightly stretched on a rigid baffle and properly "doped," produces the outstanding results.

Buy at kit. Put the Speaker together in one hour (most of this time is devoted to waiting for the successive coats of "dope" to dry.) Then listen to this speaker and *enjoy the big thrill of your radio life!*

If the results are not louder, clearer, better than anything else you have heard in this line, using your own individual judgment, in five days return the speaker, even in its built-up condition, and we will refund your entire money, besides paying shipping charges both ways! Money right back! No delay! No questions asked!

GUARANTY RADIO GOODS CO.,
145 W. 45 St., N. Y. City.
(Just East of Broadway).

Please ship at once C.O.D. express, at advertised price plus little extra for cartage, the following, on 5-day money-back guaranty, including refund of cartage cost:

☐Cat. A No.. ☐Cat. A No.. ☐Cat. A No..
☐Cat. A No.. ☐Cat. A No.. ☐Cat. A No..
☐If built-up speaker, ready to play, is desired add cross here.

Name .....

Address .....

City ..... State .....

SEND NO MONEY!

CAT. A-No. 1-DL
Price $17.50
Consists of the following complete kit:

One 24x24" erected frame, with artistic finish in mottled blue-and-brown gold edging, and four strips of moulding for front.
One upright support "H" piece, same artistic finish, with hardware.
One Polo Unit.
One 10-Foot Cord.
One Apex.
One Chuck.
One Thumbscrew.
One Nut.
One 26x26" thinnest Irish-linen diaphragm cloth.
One 8x8" airplane cloth.

CAT, A-No. 1-DL, BUILT-UP, ready to play **$19.50**

PRICE LIST

Cat. A No. 1 DL (described above).....$17.50
Cat. A No. 1 (same as A No. 1 DL, except that frame and upright undecorated 16.00
Cat. A No. 2 (same as Cat. A No. 1, except that new Powertone Unit is supplied instead of Polo Unit)..... 12.00
Cat. A No. 2 DL (same as Cat. A No. 2, except that the de luxe finish is on frame and upright)..... 13.50
Any of above, built-up, ready to play, $2.00 extra.
Cat. A No. 3. Built-up, high-grade, round-edged wooden frame, splice-jointed not nailed; size 24x24 inches, with moulding; also H-shaped upright support, splice-jointed; also hardware for attaching upright to frame..... 3.50
Cat. A No. 4. Above with de luxe finish 5.00
Cat. A No. 5. Thinnest Irish linen for front diaphragm, 26x26 inches..... 2.00
Cat. A No. 6. Airplane cloth 8x8 inches .25
Cat. A No. 7. Polo Duo-Magnetic Unit, with factory-adjusted and sealed armature; apex, thumbscrew, chuck, nut, 10-foot cord, moulded mounting bracket..... 10.00
Cat. A No. 8. Powertone 1929 model adjustable armature unit, with apex, thumbscrew, chuck, nut, 5-foot cord, mounting bracket 3.75
Cat. A No. 9. One pint can Aerolac "dope" (good for three thin coats)..... 1.00
Cat. A No. 10. Two pint cans Aerolac "dope" (one quart for 5 good coats).... 1.75
Cat. A No. 11 Apex, chuck, thumbscrew, nut ..... .25

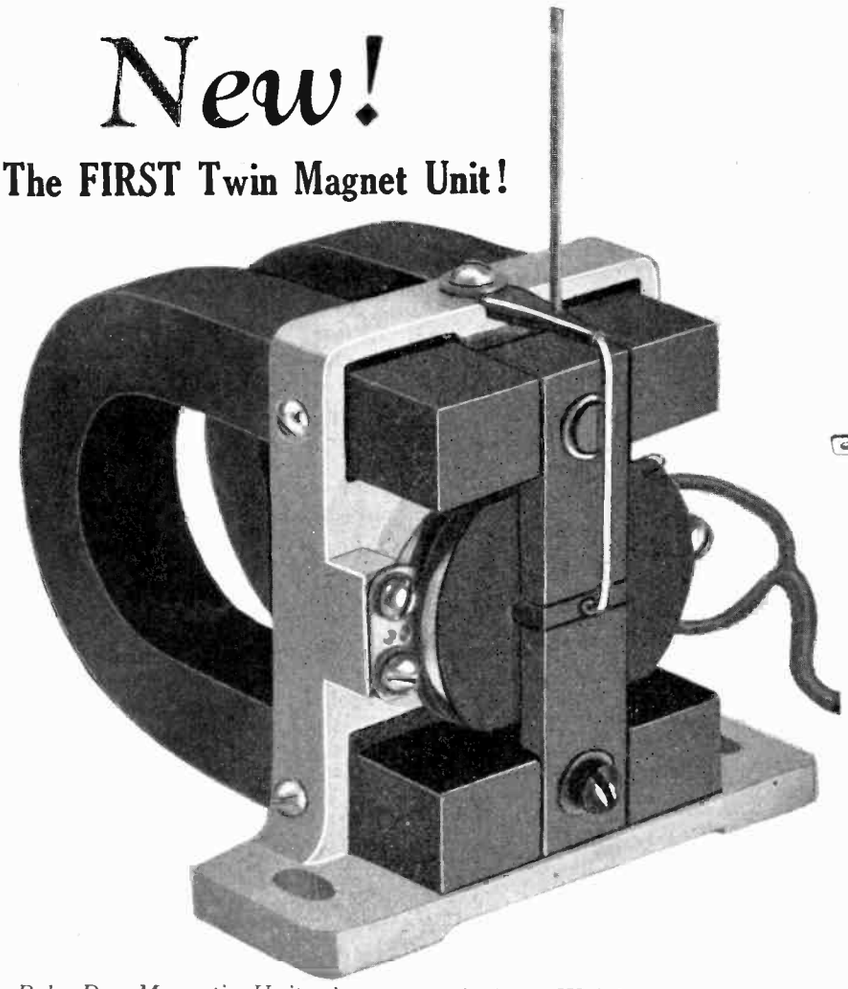
POLO

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.

POLO ENGINEERING LABORATORIES

57 Dey Street (Suite 6), Corner Greenwich Street Tel. CORtland 5112 **New York, N. Y.**

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.

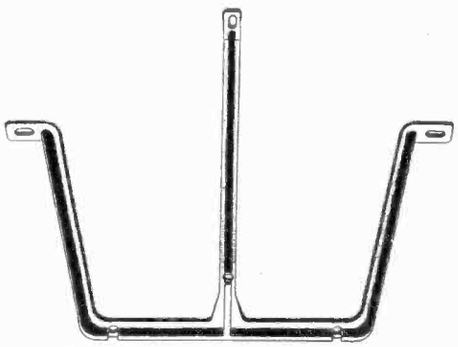
(2) Magnets are of chrome steel.

(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.

NAME .....

ADDRESS .....

CITY ....STATE.....

IMMEDIATE DELIVERY