

NOV. 10th

15 Cents

RADIO

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WORLD

The First and Only National Radio Weekly

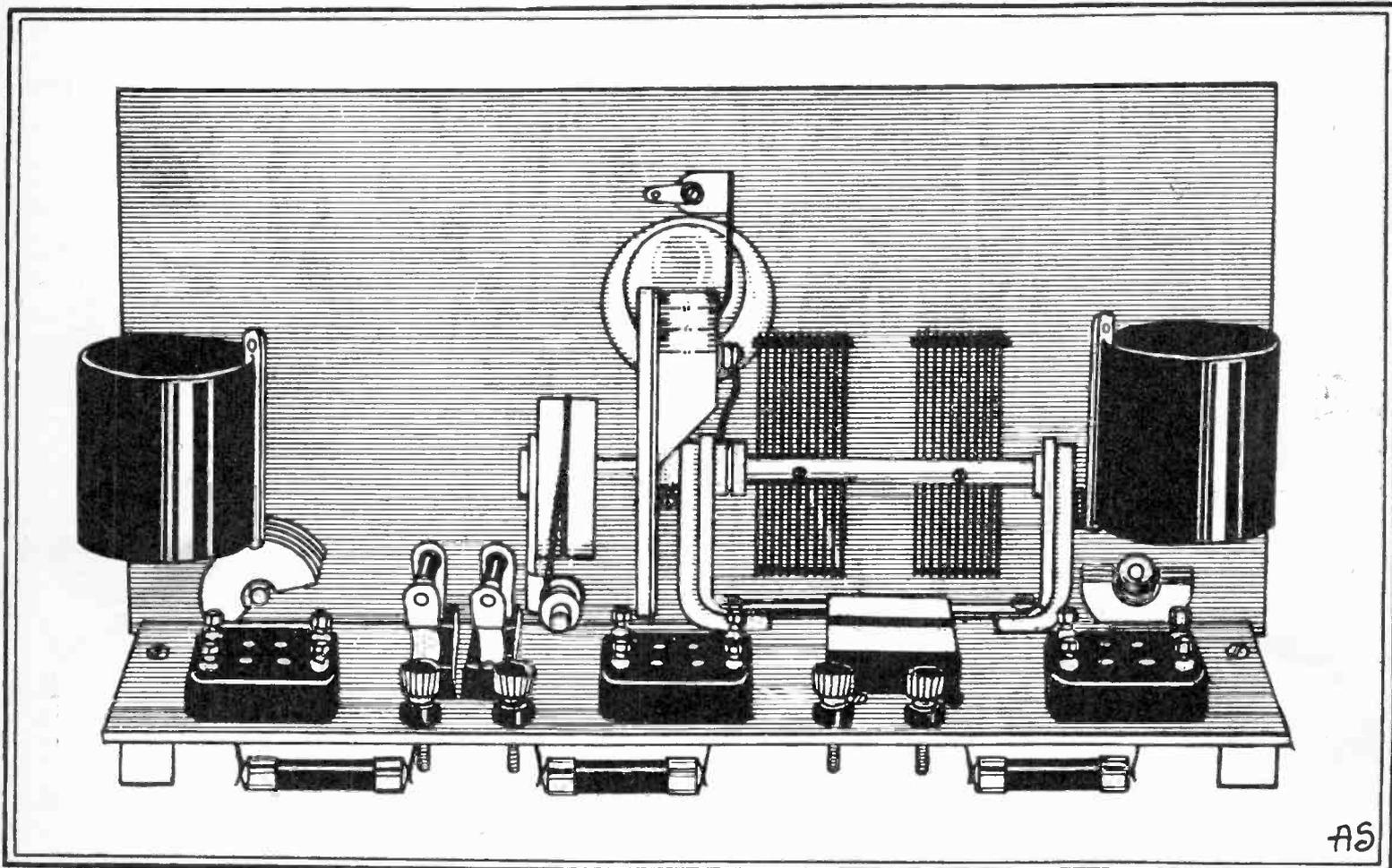
346th Consecutive Issue—Seventh Year

ALL SET FOR
REALLOCATION!

*De Forest Feedback Patent
Wins in Highest Court*

HEARING FOR WGY
PUT OFF 2 MONTHS

THE SCREEN GRID HAMMARLUND 3



A Nifty Little Set With a Big Kick—the Hammarlund 3.
See article on pages 12 and 13.

THE FERRANTI
PUSH-PULL 250
B SUPPLY and AMPLIFIER

DE LUXE SET
FOR SHORT WAVES;
FOUR TUBES

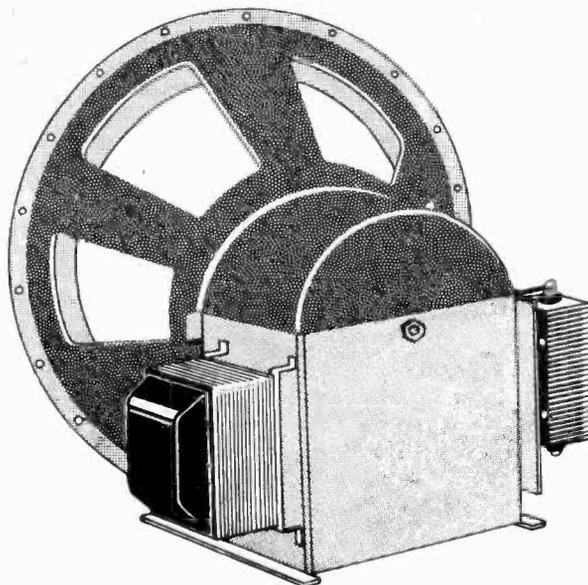
Supreme Dynamic Speaker at Merely the Price of a Fair Cone!

Great on any set that has 171, 171A, 210 or 250 power tube, or any two of these as push-pull output. Not suitable for 112, 112A and 120 power tubes, or sets that have no power tube.

110-125 Volt AC, 50-60 Cycle Dynamic Chassis R-13

This is a dynamic speaker (illustrated at right) operating direct from the alternating current (AC). It has a built-in dry rectifier and filter to supply the field coil with the necessary current and voltage. Uses only 3.5 watts from line. Also built-in is an output transformer (in the housing). No additional output transformer need be used. Supplied with 10-foot cord. Dimensions 9" wide, 9" high, 6 1/2" deep. Weight 13 1/2 lbs. Cat. R-13, list price \$40.00
Our price to you (40% and 2% off list)

\$23.52



6 Volt DC Dynamic Chassis R-14

This is our lowest priced dynamic chassis. All of our four models produce exactly the same results, in fact all are simply different powered models of the same speaker. The R-14 may be powered from a 6-volt storage battery or A eliminator. Field coil draws only 1/2 ampere at 6 volts. Output transformer is built into the housing. Supplied with 10 ft. cord. Dimensions 9" wide, 9" high, 6 1/2" deep. Weight 10 lbs. Cat. R-14, list price \$30.00
Our price to you (40% and 2% off list)

\$17.64

Rear view of R-13, the model described at left.
(Note: These dynamic chasses are licensed under both the Magnavox and the Lektophone patents.)

All Other Commercial Types of Speakers far Outclassed in Tone by the Dynamic!

FOR sheer range and fidelity of tone nothing in the commercial field today even compares with the dynamic speaker. Also, the dynamic speaker handles more volume than any other type of speaker. Supreme in tone and volume, the only things that count! Then these amazing dynamic speakers must be frightfully expensive, you might imagine! Except for the high price you'd get one right away! But the interesting reverse is true now. You can get a dynamic chassis at \$17.64, which is less than you'd pay for an indifferent cone or cloth speaker.

Four chassis models of the supreme dynamic speaker are available. It is the same speaker—tone exactly as pure, volume exactly as great—and it comes ready to play.

The chassis is built-up. It consists of the cone, supported by a ring at the edge; the diaphragm; the field coil, which magnetizes the voice coil, the two constituting the motor; the supporting frame; the built-in output transformer (not visible) and the 10-foot cord. You may place the speaker in a console or anywhere else, or enclose it in any sort of box or baffle you prefer.

It is called a chassis because it does not come in a finished wooden case. You encase it yourself, if you like and where you like. It is a built-up speaker, not a kit—and is all built up ready to play.

The Supreme Dynamic Chassis never wears out!

THE dynamic speaker plays no favorites. The soprano—oh, you've heard the jokes about the radio soprano. No more joking now. The realism is so startling you are sometimes suspicious some one has intruded into your home. Your friends will listen with you and admire your expert speaker choice. You'll have to tell them to go home. Nobody wants to stop listening to music like that, singing like that!

And it's louder than your new or old cone or cloth speaker! Purer, louder, better, less expensive!

How can you ever resist a combination like that? Hundreds of thousands haven't been able to, because they know. Put a dynamic speaker on your set by connecting the usual tipped cords to the speaker output posts of your set. In the direct current (DC) models two other wires emerge. (These go to the field coil voltage source. See the information in the corners herewith.) In the alternating current (AC) models these two extra leads also emerge, but end in a wall socket plug.

With the supreme dynamic speaker connected up, marvel at the difference between dynamic reproduction and any other you have ever heard. The low notes are strong and real. Strange you never heard them as crisp, clear and distinctive as that before or perhaps not ever at all, on that set. It wasn't the set, after all, but the speaker!

Dynamic Speakers All the Rage—Order Yours Today!

On everybody's lips, in every radio store, on the street, in homes, in automobiles and airplanes, everywhere the dynamic speaker is under discussion. Not under debate, for there's nothing to debate. Hundreds of thousands have been sold recently—the figure this year may exceed a million. The dynamic has taken the country by storm! And now is your opportunity to get a fine one at a low price!

Be a dynamic fan yourself. Order one of our dynamic chassis. If it does not give the most wonderful reproduction you ever got from your set, return the chassis in ten days, without getting our permission, ask for your money back, and your purchase money will be refunded at once in full! No questions asked. You'll be more than overjoyed, we know; but you will decide that at our risk.

110-150 Volt DC Dynamic Chassis R-15

This model may be operated from any DC source of 110-150 volts, for instance, from the house lighting socket in districts that have 110 volts direct current. Power required, about 5 watts. It may be powered from a B eliminator of sufficient current capacity. Note especially the versatile voltage range within which it works splendidly, also the low power consumption. The current is 44 milliamperes at 110 volts, 60 milliamperes at 150 volts. The resistance of the field coil is 2,500 ohms, and its inductance is 40 henrys at 40 milliamperes. Model has output transformer built into housing. Supplied with 10-ft. cord. Dimensions 9" wide, 9" high, 6 1/2" deep. Weight 10 lbs. Cat. R-15. List price \$35.00.
Our price to you (40% and 2% off list)

\$20.58

Acoustical Engineering Associates,
143 West 45th St., N. Y. City (Just E. of B'way).
Please ship at once, 10-day money back absolute guarantee.
dynamic speaker chassis as follows:
(Put cross in square below.)
 Cat. No. R-13, 110 to 125 volts AC, 50 to 60 cycles; price \$23.52.
 Cat. No. R-16, 110 to 125 volts AC, 25 to 40 cycles; price \$26.46.
 Cat. No. R-14, 6-volt DC (storage battery or A eliminator operation); price \$17.64.
 Cat. No. R-15, 110 to 150 volts DC (for DC house current connection or energy from a B eliminator); price \$20.58.
All models are the same speaker in performance, all have built-in output transformer, also 10-ft. cord, and all are exactly as described in your advertisement in RADIO WORLD.
(Also put cross in one square below)
 I am enclosing remittance of \$..... and you are to pay packing and cartage.
 Please send C.O.D. and I will pay a little extra for packing and cartage.

Name

Address

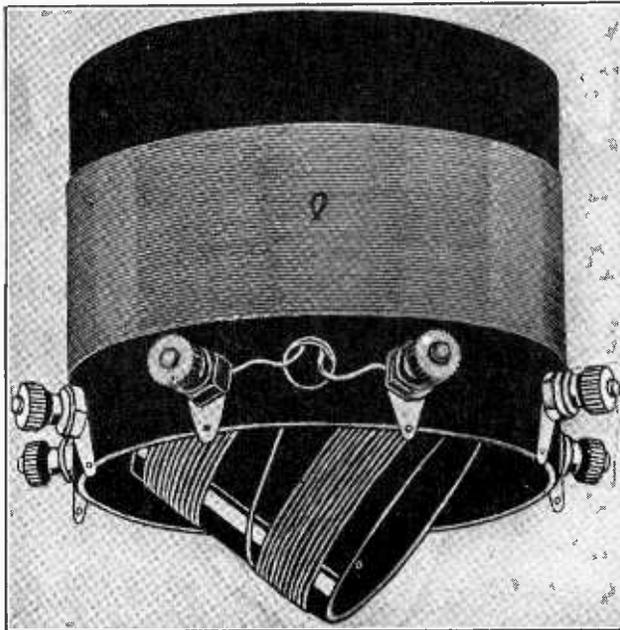
City State.....

100 to 125 Volt AC, 25 to 40 Cycles Dynamic Chassis R-16

In many districts residents desire the advantages of dynamic speaker reproduction direct from the AC house lighting socket, but instead of the usual 50-to-60 cycles they have 25-to-40 cycles. Therefore the standard AC model cannot be used. The winding about the power transformer core must be specially large—high inductance—and there must be more iron core. Therefore this 25-to-40 cycle model is the highest priced chassis. It is otherwise exactly the same as the R-13 (described at upper left), and has precisely the same appearance. Provided with 10-ft. cord and built-in output transformer. Dimensions 9" wide, 9" high, 6 1/2" deep, overall. Weight 12 1/2 lbs. Cat. R-16. List price \$45.00.
Our price to you (40% and 2% off list)

\$26.46

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 2½ x 2¼ 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 midge trimmer 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**

Model 5TP (.0005) **\$2.00**
Model 3TP (.00035) **\$2.25**

Coils for Other Than Screen Grid Tubes

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

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

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

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

STANDARD COILS

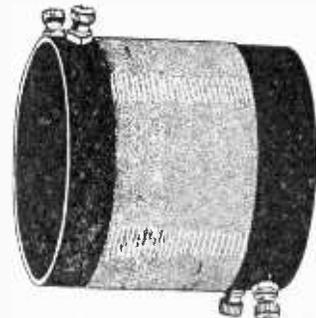
3-circuit tuner, for .0005 mfd. Secondary center-tapped for short waves. (Model T5) **\$2.25**

3-circuit tuner for .00035 mfd. Secondary center-tapped for short waves. (Model T3) **\$2.50**

TRF coil. Interstage coupler and also used as antenna coil. For .0005 mfd. Secondary center-tapped for short waves. (Model 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. **\$1.75**
(Model 5A)

SCREEN GRID COIL COMPANY

143 WEST 45th STREET
NEW YORK CITY

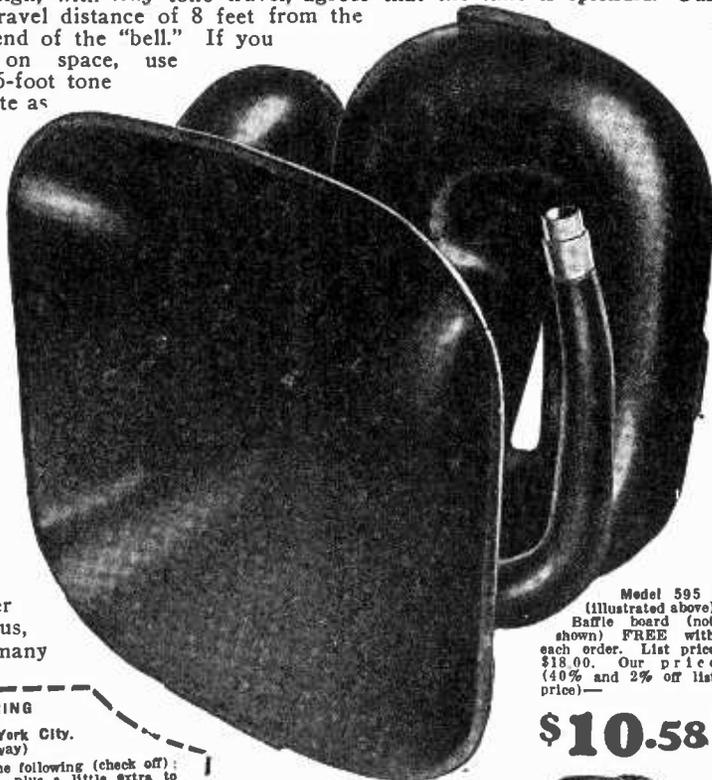
Just East of Broadway

Screen Grid Coil Co., 143 W. 45th St., N. Y. City.
Please mail me at once your following coils, for which I will pay post-
man the advertised prices, plus a few cents extra for postage.
 Model Model Model Model
 Model Model Model Model
 Name
 Address
 City
 State
 SEND NO MONEY!
 (N.Y.)

AIR COLUMN HORNS ARE SPLENDID!

Especially Those Made of Molded Wood

EVERYBODY who uses a horn loud speaker of the latest type, consisting of an air column design, with long tone travel, agrees that the tone is splendid. Our Model 595 has a travel distance of 8 feet from the unit to the large end of the "bell." If you must economize on space, use Model 570, with a 6-foot tone travel, with not quite as strong reproduction of low notes. But No. 595 is better and, if you've the room (21 1/4" high, 18" wide, 15" deep), choose that one. Every purchaser is a delighted customer. Order one of these specially moulded wood horns. Try it for 90 days. If not delighted, return it and get back your money, including any shipping charges you paid! (Note: Not a single one of these horns has ever been returned to us, though we've sold many hundreds!)



Model 595 (Illustrated above) Baffle board (not shown) FREE with each order. List price \$18.00. Our price (40% and 2% off list price) —

\$10.58

Model 570, size 15" high by 12" wide by 12" deep, 6-foot tone travel. FREE baffle board. List price \$13.00. Our price (40% and 2% off list price) — \$7.64

Model 112 horn motor stands 250 volts without filtering (Illustrated at right). List price \$6.00. Our price (40% and 2% off list price) — \$3.53



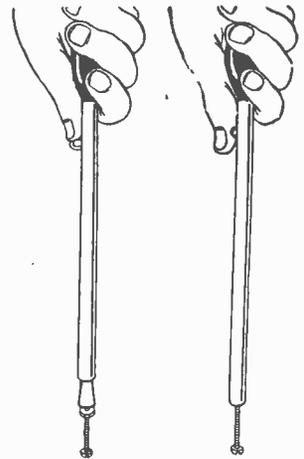
ACOUSTICAL ENGINEERING ASSOCIATES, 143 West 45th St., New York City. (Just East of Broadway)

- Please ship me at once the following (check off):
- One No. 595 at \$10.58, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
 - One No. 570 at \$7.64, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
 - One No. 112 horn motor (universal nozzle) at \$3.53, plus a few cents extra for shipping.

NAME.....
 ADDRESS.....
 CITY..... STATE.....
90-DAY MONEY-BACK GUARANTEE!

SOCKET WRENCH

FREE



Push out control lever with knob (as at left) and put wrench on nut. Push down on handle only (at right), then turn nut left or right.

ONE of the handiest tools for a custom set builder, service man or home constructor is a BERNARD socket wrench.

It consists of a 6 1/2" long metal tubing in which is a plunger, controlled by a knob. The plunger has a gripping terminal (called a socket, hence the name "socket wrench") that may be expanded or contracted to fit 6/32, 8/32 and 10/32 nuts, the most popular sized nuts in radio.

Use the knob to push out the plunger, press down on the handle to grip the nut, then turn the nut to left for removal or to right for fastening down. Total length, distended, including stained wooden handle, 10". Gets nicely into tight places. Send \$1 for 8 weeks' mail subscription for RADIO WORLD and get this wrench FREE.

No other premium with this offer. Present subscriber may extend subscription by stating he is one, and entitle himself to this FREE premium, making \$1 remittance.

RADIO WORLD
 145 WEST 45TH ST., N. Y. CITY
 A few doors east of Broadway

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

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

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

GOLD AND VAN DYKE

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

WHAT YOU GET:

At \$3.75 each, this unit represents the utmost you can obtain at anywhere near this price. Not only do you get the unit, but also a mounting bracket, apex, chuck, thumbscrew nut and 5-foot cord.



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!

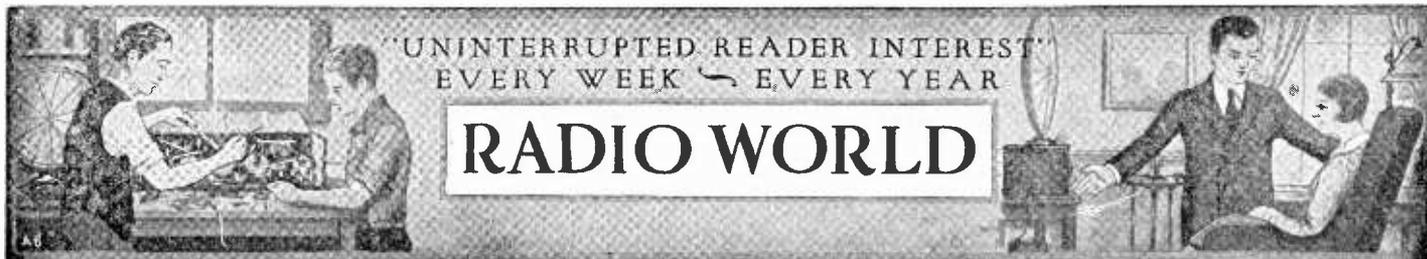
Just order one new Powertone Unit with equipment. It will be mailed at once C. O. D. You will pay postman \$3.75 plus a few cents extra for postage.

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



NOVEMBER 10, 1928
Vol. XIV. No. 8 Whole No. 346
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1922, at the post office at New York,
N. Y., under Act of March, 1879.]

Latest News and Circuits
Technical Accuracy Second to None

A Weekly Paper published by Hennessy
Radio Publications Corporation, from
Publication Office, 145 West 45th Street,
New York, N. Y.
(Just East of Broadway)
Phone: BRYant 0558 and 0559

All Set for New Waves!

Public Must Learn New Dial Settings, as Frequency Assignments Are Changed Under Reallocation Effective Sunday—Structure as a Whole Well Regarded, but Complaints of Particular Assignments Are Many—Congress May Discuss Subject

EVERYTHING is in readiness for the reallocation which will go into effect at 3 a.m., E. S. T., Sunday, November 11th. The threats of injunction suits by some stations have subsided and informal notice has been served by the Federal Radio Commission that all rumors that there will be postponement or delay are groundless.

The new shake-up will be the second one within a year, for last December there were numerous changes, but these were not generally successful, in fact, the condition that existed after the changes had been tried out led Congress to enact the Davis bill, under which the impending reallocation was formulated. This bill provides for an equal number of channels for each of the five zones, the channels in each zone being on the basis of population.

Under the reallocation there will be eight cleared channels for each zone, or forty for the entire United States, while besides there are regional channels, as well as local ones. The cleared channels are national ones, in a sense, although they do not necessarily include exclusive use by any station of the frequency to which it is assigned.

Many stations are dissatisfied with their assignment under the reallocation, a far greater number are disgruntled but have not voiced their protest officially, but the structure as a whole is generally regarded as being a good one, destined to improve quality of reception by reducing interference due to waves of two stations mixing with each other, by reducing the difficulties of receiving distant stations, and by facilitating tuning in.

The Commission is holding hearings on protests, most of which were filed by small stations. However, in some instances, as WSAI, near Cincinnati, and WGY, Schenectady, N. Y., large stations have refrained from filing formal protest, but have made known their objections to denial of a cleared channel or privilege of day-and-night broadcasting.

Willing to Give it a Trial

Most of the dissatisfied small stations are willing to try their lot under the reallocation before filing any protest, particularly as the reallocation is in reality the issue of a new license to each station. These licenses begin November 11th and expire on February 1st, 1929. The renewals thereafter will be on a ninety-day basis, so that the Commission will be able to make such changes as station performance or lack thereof may dictate.

The Federal Radio Commissioners have been under a considerable strain due to the reallocation. First there was the necessity of establishing the structure, and this absorbed much of their energies. The result of a unified plan was achieved not without disagreement among them. The chairman, Ira Robinson, a former Supreme Court Justice

of prominence, did not vote for it, while some of the Commissioners who did vote for it as a whole were opposed to particular choices which the structure itself compelled. For instance, a committee of engineers had recommended a greater number of cleared channels, and there was some inclination to follow their advice, but the forty-cleared-channel plan won out.

The hearings themselves put another heavy demand on the Commissioners, while the deluge of protests, many thousands mailed direct to the Commission, keep the clerical staffs aware that the public is not unmindful that a new set-up of waves, frequencies and power is about to be inaugurated. The protests refer to the assignments granted to particular stations, and are not lodged against the structure as a whole. No word against the structure has been uttered publicly, except that some doubt has been cast on the wisdom of providing only forty cleared channels.

Injustice to some large stations is regarded as the inevitable result of such restriction of cleared channels—frequencies intended for stations of national importance—while even some regional stations are assigned less time on the air than their listeners desire.

Congress May Discuss It

The next session of Congress, convening in December, will be a short one, and there will not be much time for consideration of radio matters, as appropriations for the conduct of the general government will absorb the legislators. However, it is expected that the reallocation will be up for some discussion, particularly as many Congressmen have been voicing objection to the treatment accorded to stations in their bailiwick.

Congress is expected to vote on the continuation of the Federal Radio Commission, however.

Listeners are showing keen interest in the reallocation. Mail received at the Commission's office, and at the offices of legislators, shows that the public wants better radio reception and is hoping that the reallocation will give it to them.

Listeners will have to learn their dial numbers all over again, because so many stations are changed as to frequency. About three-quarters of the stations in the United States have been changed in one particular at least, half of them in two or more particulars, when considering frequency, power and time on the air.

There has been no general reduction in the number of stations, it being the sense of the Commission that a well-defined structure is preferable to driving small but deserving stations off the air, since small stations serve local needs by giving a rather personal or home-like flavor to their broadcasts.

Kicks and Boosts Mix

Lafount Finds Plan Sound but Not Perfect

Washington.

Federal Radio Commissioner Harold A. Lafount, of the Fifth Zone, addressing by letter station owners and operators in that zone, said:

In answer to a number of letters recently received from broadcasters and listeners of the Fifth Zone, I am pleased to give my personal opinion as follows:

The allocation will positively go into effect November 11. No modification will be forthcoming.

As I have often said, and repeat again, Congress enacted a law creating the Federal Radio Commission, specifically describing its duties, which in their belief were to bring order out of chaos. It was thought that this could be done in a year.

Congress, however, also provided that the administration of the Radio Act be also assigned to the Commission, and at that time it appeared a rather ordinary task; but during the twenty months that have elapsed radio has developed beyond all expectations until applications for various uses of radio waves number many thousands.

The Commission now only has the major problem of properly organizing the licensing of the ether but also has the task of administering the law, which requires an office force of 65 people, mostly highly trained along the different subjects they are assigned to handle. However, in the supervising and licensing of the ether channels the Commission has not forgotten the all important obligation placed upon it.

"Without Single Critic"

Congress expects, in fact, instructed us to place radio on a firm, sound basis consistent with the law. The allocation effective November 11 is the result of months of hard work, not only by the Commission, but by dozens of experts, broadcasters, attorneys, etc., in an effort to comply with the mandate of Congress, and is now so far as I know without a single adverse critic.

Of course there is some difference of opinion as to the method of procedure. Some persons would undertake the new allocation a step at a time, some do not agree with the assignment of some particular stations, some broadcasters do not like their frequency or hours of operation; but no one yet has, to my knowledge, criticized unfavorably the basic plan or structure.

From a radio standpoint, and from the standpoint of improved reception, and benefits to the listeners, the plan is absolutely sound, but not perfect. It is one big step necessary to comply with the wishes of Congress for the benefit of the listeners.

I am happy to note that the Fifth Zone broadcasters are willing to co-operate. The only reaction from the West is fear that the order may be modified. Again, I say it will become effective November 11, as scheduled.

If mistakes have been made in the assignments of stations under the new allocation, or if applications for change of frequencies, increases in power, etc., have not received favorable action, then ample provision is afforded in the law to present your contentions to the Commission.

If dissatisfied you should apply for modification of license blanks and request a hearing. You can depend upon the Commission giving your requests or suggestions careful consideration.

Must Identify Recordings

General Order No. 16 requiring that, "While the broadcasting of music performed through the agency of mechanical reproductions, such as records or perforated rolls, is not in itself objectionable, the failure clearly to announce the nature of such broadcasting is in some instances working what is in effect a fraud upon the listening public. The Commission, therefore, hereby orders that effective August 21, 1927, all broadcasters of music performed through the agency of mechanical reproductions shall be clearly announced as such with the announcement of each and every number thus broadcast and that proved failure to make such announcement shall be deemed by the Commission cause for action under Section 32 of the Radio Act of 1927"—must be observed. Failure will result in immediate Commission action.

May I also warn you not to use your broadcasting station for conversation purposes. Remember the real test is the public service you are rendering.

No rules or regulations affecting television, synchronization, short wave broadcasting, rebroadcasting, have yet been made, but are contemplated.

I cannot urge too strongly the necessity of presenting programs of interest to the public in your community.

Movie, Radio, Vaudeville Plan Unison

A plan to create a holding company to be known as the Radio-Keith-Orpheum Corporation, with the common stock of the Keith-Albee-Orpheum Corporation and the capital stock of the Film Booking Office Productions, Inc., turned in for stock in the new corporation, is now before stockholders of K.-A.-O. and F.B.O.

The plan includes a contractual arrangement with the Radio Corporation of America, through its subsidiary, Photophone, Inc., and its associated concern, the National Broadcasting Company, for use of the Photophone "talkies" in theatres of the K.-A.-O. chain, comprising about 250 vaudeville, and movie and combination theatres, and some arrangement for co-operative booking of artists.

The R.C.A. would obtain 500,000 shares of stock in the new corporation for issuing a non-exclusive license to use Photophone sound-recording equipment for fifteen years and for priority delivery of merchandise, as well as for an agreement between the N.B.C. and K.-A.-O. for co-operative booking of artists. Details of such co-operative booking have not yet been perfected.

Control of Radio-Keith-Orpheum would be vested in the stockholders of K.-A.-O., as a group, because 1,100,000 shares of the new corporation would go to K.-A.-O., 500,000 to the R.C.A., and 200,000 to F.B.O.

The assets of Radio-Keith-Orpheum, not all proprietary, however, since the corporation would own none of R.C.A.'s tangibles, would be about \$100,000,000.

David Sarnoff, vice-president and general manager of R.C.A., is being discussed for chairman of the board of Radio-Keith-Orpheum.

Joseph P. Kennedy, of F.B.O., who has had large financial experience, conducted most of the negotiations with R.C.A. and K.-A.-O. He has been appointed, with E. F. Albee, president of K.-A.-O.; Walter Cooke, Maurice Goodman, Marcus Heiman, B. B. Kahane and J. J. Murdock on a committee to act under a deposit agreement of Keith-Albee Orpheum. Stock in favor of the plan must be deposited on or before November 15th, and the consent of at least 51 per cent. of the stock will be necessary to make the plan effective.

WGY HEARING PUT OFF TILL AFTER FEB. 1

Washington

WGY having attempted to obtain a hearing on its plea for a cleared channel, only to be foiled on a technicality, filed a second application, but this, while being granted, is deferred for hearing until "after February 1st."

The first attempt was based on a plea to retain for the Schenectady station its 790 kc. frequency (380 meters), so long enjoyed by it, but which the reallocation plan gave primarily to KGO, Oakland, Calif., while WGY got the same channel as a "supplementary" consideration. The effect was to deprive WGY of vertically all broadcasting at night, on this wave.

Both WGY and KGO are owned and operated by the General Electric Company.

WGY's license expired November 1st, and its second application was filed about a week earlier.

Commenting on the application, Louis G. Caldwell, general counsel of the Commission, stated that there was no occasion for the application for renewal, as the station, under the reallocation to go into effect November 11th, is given a new assignment to be effective until February 1st.

General Counsel Caldwell stated he had written the station informing it that its

new application is not in order but that the Commission will keep it on file until such time as it can be taken up by the Commission to be considered as an application for renewal after February 1st.

The General Electric Company previously filed with the Commission an application for modification of its license under the allocation, which in addition to a cleared channel, requested 150,000 watts of operating power. The Commission refused to allow a hearing on this application declaring that it did not conform with the "rules and regulations" of the Commission, which required WGY to select a frequency assigned to Zone 1.

Ready for New Waves!

5 to 20 Stations for All, Each Night, is Promise

By Harold A. Lafount

The new allocation of radio broadcasting stations will positively go into effect November 11th at 3 a. m.

It is an arrangement of the stations in such a way as to provide the American public with good radio reception, as well as a variety of programs.

Equal distribution of the nation's radio facilities has been provided each radio Zone, and an equitable distribution of the Zones quota has been provided for each State, based on population.

This has been done on the basis of stations in existence or in contemplation.

Some localities have entirely too many broadcast stations while others have none. However, it is believed that every citizen, regardless of his residence, will, with an average tube receiving set, be able to hear from five to twenty programs each Winter evening, and the number will be greatly increased in most sections of the country.

Good Reception is Object

The sole object and desire of the Commission, however, is to make possible good reception of the wonderful programs being broadcast in this country.

The listener has received every consideration in the new allocation. The interest of the broadcaster has also been carefully considered.

The smaller stations will no longer have to compete with powerful stations on the same frequency. Their interests have been carefully safe-guarded so that each locality may have an opportunity of expression, or transmission by radio, as well as good reception from outside stations.

A rather unfortunate situation exists as to broadcasters. Because there are only 90 points on the dial of your receiving set, or 90 frequencies available for broadcasting, there is actually only room for 90 broadcasters in this country operating full time and using more than 1,000 watts power.

615 Stations in U. S.

It is, therefore, obvious that the 615 stations now broadcasting cannot all be granted high power and unlimited hours of operation.

Of necessity some must be stations of very limited power to permit duplication on certain frequencies.

The question is: Shall the present high-powered stations, with their hundreds of thousands of dollars invested, be allowed to continue the use of their equipment and to operate on the frequencies assigned them, or shall the 100-watt stations be allowed to become 10,000-watt plants to take the place of the high-powered stations now in existence?

The new allocation provides for many powerful stations and an increased number of local or low-powered stations. It also provides ways and means by which a new applicant or the owner of a small station, may at a public hearing apply for, and upon proper showing, be assigned high power and the frequency previously assigned and being used by another.

Expansion Limited

Ordinarily there is room for all business and professional men to expand their busi-

ness, have pointed out, the broadcaster is not so fortunate. If his business grows, or if his station is to become a powerful one, it must be done at the expense of another.

Licenses are issued for only 90 days, so that if a broadcaster owning a powerful station and licensed to use a cleared channel fails to operate in the public interest, at the expiration of the license period, and upon proper showing, he may be denied a renewal, and another station assigned to the frequency.

Competition will be stimulated by the new plan, and an equal opportunity given to all broadcasters, regardless of the size or wealth to almost limitless bounds, but, as I

of their stations, although, as suggested, all stations cannot be given high power and cleared channels.

Many have suggested reduction in the number of stations. Others would have only a few high powered stations and more small, local plants. It is, however, my opinion that the new allocation divides the classes of stations in such a way as to provide the listener with good reception and a variety of programs. I am, therefore, extremely anxious for November 11th to arrive in order that the listeners may enjoy improved radio reception as contemplated by Congress.

New Corporations

Magna Radio Co.—Atty., Konta, Kirchway & Engle, 7 East 44th St., New York.

The Potter Co., radio instruments—Atty., Corp. Trust Co. of America, Wilmington, Del.

Theo Specialties Co., radio apparatus—Atty., J. G. Turnbull, 50 Broadway, New York, N. Y.

Tittering Terminology Suggests Poetic Origin

When alternating current flows in a circuit having resistance and reactance, either inductive or condensive, there are two components of the power involved. One of these is expressed by the square of the effective value of the current multiplied by the resistance. This represents power lost or used. The other component is expressed by the square of the effective value of the current multiplied by the reactance. This is the reactive component of the power. It is not lost or used, but is merely tossed back and forth in the circuit.

The reactive component of the power has been termed the "wattless" power. Yet it is measured in watts. Somebody once made a catchy mistake and everybody has committed it ever since. And the term does not seem absolutely ridiculous until the number of wattless watts is given.

Many writers and speakers on electrical subjects employ the term "ohmic resistance." Just who first took this liberty with common sense is not known, but the suggestion that it must have been a poet in search of rhythm is supported by the lines:

*"And instead of an ohmic resistance so large,
"An inductance of adequate value will serve."*

Whenever we find a resistance which cannot be measured in ohms, and hence a non-ohmic, we shall distinguish it by calling it Draic or pachycephalic resistance.

The man who first had that poetic inspiration of calling resistance ohmic may be excused on the ground of poetic license, but not those who rushed into print and speech with the same nonsense lest they be regarded as behind the times on electric terminology.

Atheist Group Seeks Station in New York

Washington.

The American Association for the Advancement of Atheism, Inc., desires to establish a broadcasting station in New York to "disseminate the philosophy of Atheism," according to a letter received by Carl H. Butman, secretary of the Federal Radio Commission, from Charles Smith, president of the Association.

Mr. Butman, in reply, stated that radio channels in the vicinity of New York City are greatly overcrowded and that because of these conditions the Commission cannot grant any additional licenses to any applicant. The full text of his reply follows:

"The channels for New York State and particularly those in the vicinity of New York City are greatly overcrowded, so

that it is necessary for a number of stations to share each wave length.

"Under these circumstances, the Commission has deemed it necessary to license no new stations in the metropolitan area, and has consistently followed this practice from the day of its taking office. The Commission, therefore, cannot grant any additional licenses to any applicant.

"If you desire to broadcast, my suggestion would be that you purchase time on some existing station, or that you make arrangements to purchase outright some existing station and apply for permission from the Federal Radio Commission to have such station license transferred to you; which can be done upon proof that the public interest will be served as well as before.

DeForest Recalls the Early Days

He was First to Do Many Things in Broadcasting

By Dr. Lee DeForest

MY TOPIC takes the form of reminiscences of early broadcasting, and so I must ask you to turn back the hands of time to 1907, when I was designing and manufacturing radio telephone sets for the U. S. Navy ships that were to sail around the world under the command of the later Admiral "Fighting Bob" Evans.

My shop was in the old Parker Building, at 19th Street and Fourth Avenue, in New York City. Incidentally, the present-day three-element vacuum antenna born in that same building. At that early date, however, I was compelled to utilize the Poulson arc for generating the radio carrier wave. This arc consisted of a pair of carbon electrodes between which played the flickering electric arc in an atmosphere of hydrogen.

Now, in order to test these radio telephones, I made use of a phonograph which played directly into the mouthpiece of my transmitter. Then in another room, I listened not so much to what the radio waves were saying as to how they were saying it.

At the time George Davis was chief electrician at the New York Navy Yard, in Brooklyn, just a few miles away, as radio waves travel. Davis heard the testing, and he became greatly excited over the idea of transmitting music through the air. Until then, of course, there was nothing on the air but the incessant dots and dashes of radio telegraphy.

Other wireless operators around New York City heard these radio telephone concerts, if they can be dignified with that name, and likewise became greatly excited.

It was their opinion, rather than my own at the time, which forced me to the conclusion that here was a means of providing entertainment to many scattered listeners.

Thought of Ships First

At the time the marine radio field was the most highly developed in the commercial sense, so I immediately thought of radio telephony as a means of supplying programs and news directly to the passengers on shipboard. I even entertained visions of transmitting operatic performances directly from New York to ships in mid-ocean.

In short, at that time, I changed my views on radio telephony from a means of point-to-point or private communication to a means of mass communication.

March of 1908 found me in Paris, ready to demonstrate my wireless telephone system to the French Government with a view to equipping ships of the French Navy. At first I was permitted to use an antenna reaching up to just the first balcony of the lofty Eiffel Tower. On one occasion, however, I was permitted to utilize an antenna reaching to the top of that tallest structure in the world, to see just what I might do in the way of long-distance communication.

With everything in readiness for the tests, word was sent to French radio stations and vessels to listen in on our radio telephone transmission.

The results were more than satisfactory. We succeeded in reaching Mery-sur-Mer, near Marseilles, on the Mediterranean, at a distance of some 550 miles. I was still using the arc generator. My microphone took the form of a battery of four

microphones arranged in a sound chamber of funnel shape so as to have a small mouthpiece into which the speaker could shout. The microphones were connected in parallel.

Microphones Gave Trouble

Early in 1909, I was back once more in the States, still following my radio telephone hobby. I received permission to install a radio telephone transmitter in the attic of the Metropolitan Opera House in New York, as well as microphones on the stage. To obtain sufficiently sensitive microphones to pick up music and voices at a distance, I had to use the acousticon microphones, such as are employed for the deaf. These microphones were operated by a battery, and their output led to a receiver in the attic, pressed against the microphone of the radio telephone transmitter. We did not have the tube amplifier in those days. Our transmitter microphone was placed in the ground lead of the sending apparatus, carrying the full force of our transmitted energy. Obviously, we spent much time and money replacing microphones.

Caruso Broadcasts

My long-sought opportunity to attain the heights of air showmanship came when the late Enrico Caruso sang the "Siciliana" aria in the opera *Cavallera Rusticana*. This song is sung behind the scenes, before the rise of the curtains, making it peculiarly effective for the audience out front and even more so at the time for our audience out back. We were thus permitted to move our microphones close up to Caruso, as he sang building up sound values. We were then apparatus just as the curtain went up.

Technically, we could say we broadcast from the stage; actually, we picked up the song under almost studio conditions. I have always felt that a confession was in order, and now I feel relieved that I have made it. Our attempts at picking up the stage performance with the distant microphones were far from satisfactory. The microphones at that time were crude, and we had no amplifying means at our disposal.

A few listeners, mostly wireless operators on ship-board, heard Caruso broadcasting. It was the first and, so far, the last time that the Metropolitan Opera Company has participated in such broadcasting. Whether this is complimentary or otherwise, I do not profess to know.

Had to Give Up for a While

Later the same year (1909) I began with the broadcast studio idea, firmly convinced that talent should be brought to our microphones, with ideal operating conditions, rather than to take our microphones to the talent.

Our studio was at 103 Park Avenue, while our transmitting tower was on the roof of that building. At the time Oscar Hammerstein was competing with the Metropolitan Opera Company; and, profiting by this little argument, I obtained Madame Mazarin, a noted French contralto, for our microphones. She came to our studio, where she rendered the well-known Habanera from the opera "Carmen," for the entertainment of those who might be tuned in.

Yet my artistic ambitions, so it seemed, were far in advance of the technical means at my disposal. The arc generator was very crude inefficient, and unreliable. The microphones were not capable of picking up sounds unless virtually on top of the sound source. There was no suitable means of magnifying or amplifying the weak electric current of the microphones, so that these might be properly impressed on the outgoing carrier wave. And so I was forced to abandon my broadcasting efforts until the day when better technical means could be placed at my disposal, and a larger radio audience should exist.

Records Broadcast

By 1916 we had the oscillion or oscillating tube, capable of generating high-frequency current suitable for the carrier wave of radio telephony. We also had the tube amplifier, or satisfactory means of coupling one circuit with the next in building up sound values. We were then building $\frac{1}{4}$ kilowatt tubes for use as oscillators or transmitting tubes.

I succeeded in interesting the Columbia Phonograph Company in broadcasting the latest Columbia records, with the result that a radio telephone transmitter was installed in their New York recording studio. Three afternoons each week the latest Columbia records were put on the air.

Desiring more space for larger transmitting equipment, we soon moved to our High Bridge plant. There we inaugurated a nightly broadcasting service, consisting mostly of new phonograph records. Between records we announced the products of the DeForest Radio Company, mostly the radio parts, with catalogue and price list.

Our operating staff consisted of engineers and others of our organization, selected or, might we say, drafted, for the necessary overtime. Broadcasting was not considered any special honor for those who had to stay and do the work. No Graham McNamees and Louis A. Whittens had then arrived.

The First Dance

My recollection of the first radio dance goes back to those days when we put on a program of dance records in order that a dance might be held at Elizabeth, N. J. The weak-voiced loudspeakers of that time, intended to relieve the radio operator of wearing head-phones when not handling traffic but standing-by for a call, were used in furnishing music for the dancers.

The first election returns to be broadcast were those of the Hughes-Wilson contest in 1916, sent out from our High Bridge station in November. The New York American ran wire lines into our offices so as to have the up-to-the-minute reports. I served as one of the announcers. At 11 o'clock that night we signed off, after assuring our invisible audience that Hughes had been elected. The next morning we learned of our slight error—Wilson had won. However, ours was a pardonable error. Many newspapers had kept us company in our premature decision.

And then came the ban on wireless, with America's entry into the World War.

We waited until 1919, when radio activities were sanctioned once more.

Chain Talent Sets the Pace

Local Artists Good, but Can't Come up to the Others

By John L. Clark

Program Director of WBZ-WBZA who was chief announcer at KYW in Chicago

Boston.
WHEN Kipling wrote "East is East and West is West, and never the twain shall meet," he most assuredly did not have radio in mind! Coming as I do from the West, it is natural folks should ask me how Chicago and Boston programs differ. Here and there differences are noticed, but in general, broadcasting treatment is much the same.

This can be explained by two words—Chain Features. Surely you remember the first flickering movies, when we used to watch cops chase robbers over roofs?

When the films would always snap at the most dramatic moment, and a slide would be flashed on the screen with the legend "one moment please; the operator is fixing the machine."

Then came the better stories in film, and elaborate musical accompaniment to the pictures, the development of stage shows, and finally the talking films where voice and music are photographed on the celluloid in one of the most marvelous developments of the age.

The Old Days

Radio has passed through much the same evolution, but all within eight years—instead of 20.

When you were first tinkering with solder and wires and trick hook-ups with many and sundry assorted dials—the more dials the better—radio entertainment was in the cop-and-robber stage.

For example, a chummy-voiced announcer would be heard to say "And now, folks, little Minnie Glutz is here—and she will sing—What is that you're going to sing—oh, yes, 'The Last Rose of Summer.' Stop right up to the microphone, Minnie."

Then Minnie would sing. And oh, how marvelous that terrible voice would sound coming from the trick set you had just completed!

That was back in radio's early day when entertainment was secondary to fishing for call letters, when distant stations had a drone like African tom-toms, and tuning in was a matter of patience and great skill.

These days gave way to better sets, and dials began to stay stationary. DX had lost much of its thrill. Programs began to reveal more thoughtful preparation, operas were broadcast, symphony concerts, and the great problem of how to meet the cost of broadcasting was being solved. Stations found that they had built up vast audiences and friendly audiences, too. Advertisers were prevailed upon to give radio a trial for they were assured thousands of listeners.

The first efforts, groping as they were in many instances, showed surprising response, and sponsored programs soon became associated in the listener's mind with good talent.

Local Effort Often Lagged

Independent commercial stations forged ahead. This was as true in Chicago as it was in the East.

Then came the National Broadcasting Company with its staff of musical experts, engineers and continuity writers, and the dream of network radio became a reality.

The moment programs were flashed over the network—bringing with them the best in entertainment placed in effective

word-settings, and announced by pleasing, specially trained and chosen voices—program effort, wherever these features touched, had a definitely progressive effect.

Local effort, I suppose in Boston as out West, in many instances proved far behind in comparison. Immediately all along the line, rapid changes were made to bring such entertainment more nearly up to the chain standard.

Influence of Key Stations

Naturally, this has given rise to uniformity of program treatment, since the chain stations have the New York standard as their guide. This does not mean that there has not been much original and good work done by local stations. There has! But this fact remains: Programs in Boston and in Chicago have been influenced by the key stations.

Radio is now in the phase which corresponds to the motion picture with elaborate stage shows, music and synchronizing voice and action. It is only a question of time when radio will have made television a commercial success.

Then radio will simply be talking movies right in the home.

As we prepare for greater efforts in the

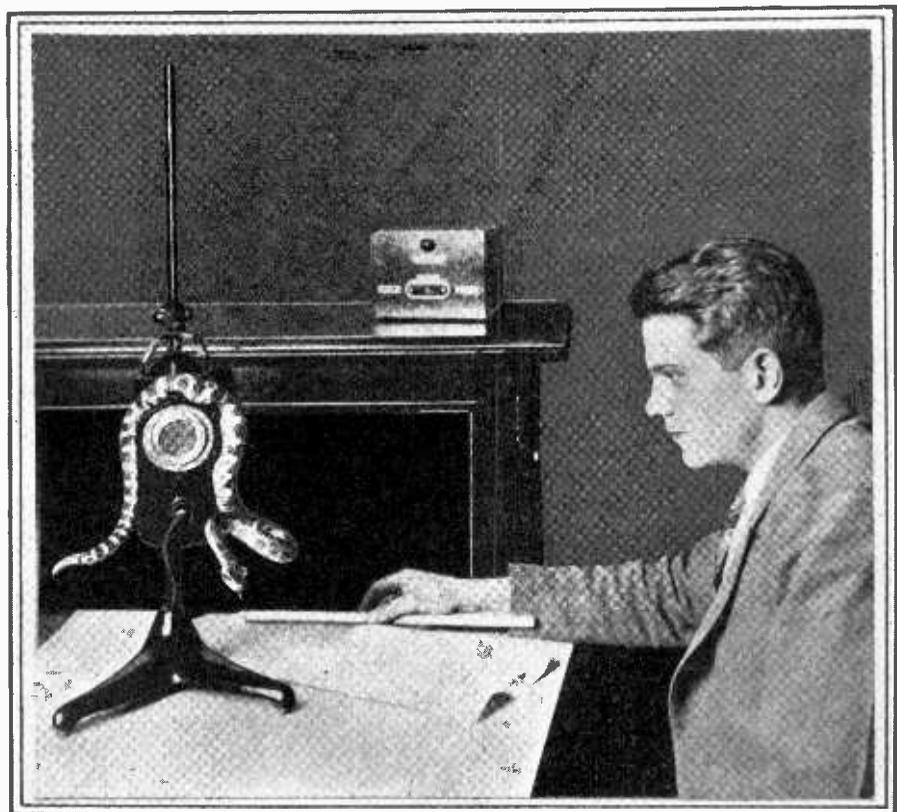
radio field, let us not forget in the array of talent that comes into our homes nightly the early efforts of the chummy announcer, Minnie Glutz and the harmonica players, when home-made sets were the last word in entertainment and the enemies of sleep!

New Violinist Joins

WGBS String Four

A change has been made in the personnel of the WGBS String Quartette. The re-organization is due to the resignation of Anthony Borello, its former violinist, now on tour with Eddie Brown. He has been replaced by another talented young artist, Albino Di Janni, Jr., who now plays regularly with the ensemble. The WGBS String Quartette is under the leadership of Ivan Argay, first violinist, and its other two members are John Kokes, second violinist, and Frederick Camellia, cellist. The Quartette is one of the station's most popular sustaining features. WGBS is owned by and located in the Gimbel Bros. department store in New York City.

RATTLER'S RATTLE DISTINGUISHED



(Henry Miller News Picture)

A CICADA MAKES A RATTLE VERY MUCH LIKE THAT OF A RATTLE-SNAKE. TO ACQUAINT THE FARMERS OF THE WEST WITH THE DIFFERENCE, PROF. T. I. STORER, OF THE ZOOLOGY DEPARTMENT OF THE UNIVERSITY OF CALIFORNIA, HAS BROADCAST BOTH RATTLES. WHEN ONE HAS HEARD BOTH THERE IS A SURPRISING DIFFERENCE, ESPECIALLY IN THE PSYCHOLOGIC REACTIONS. PROF. STORER IS SHOWN WITH A RATTLESNAKE IN THE ACT OF BROADCASTING

A Push-Pu with Separate

By Clifford

LIST OF PARTS

(For Straight Line Amplifier)

T1—One Ferranti type AF5 or AF3 transformer.

T2—One Ferranti type AF5C or AF3C transformer.

T3—One Ferranti type OP8C transformer for magnetic speakers or type OP4C for dynamic speakers.

C1, C2, C3—Three 2 mfd. Ferranti type C2 condensers.

C4—Two 2 mfd. Ferranti type C2 condensers.

R1—One Tobe Veritas 50,000 ohm, 2 watt resistor.

R2—One Tobe Veritas 20,000 ohm, 2 watt resistor.

R3—One Tobe Veritas 25,000 ohm, 2 watt resistor.

R4—One Tobe Veritas 10,000 ohm, 2 watt resistor.

R5—One Carter 100-ohm center tapped resistor.

R6—One Carter 20-ohm potentiometer.

S—One Carter No. 22 Imp. short jack switch.

DF—One filament switch and dial light.

M—One O-200 milliammeter, flush type.

Four Lynch resistor mounting clips.

Three Benjamin sockets.

Eighteen binding posts.

One set of Bakelite panels as follows:

One 12x10½x½ inches for top.

One 12x10½x½ inches for base.

Two 11¾x4x½ inches for ends.

built on the unit method of construction. That is, the audio amplifier is built in one unit, the power supply in another, and the radio amplifier, when desired, in still another. The audio amplifier and the power supply are independent units but are so coordinated that they fit together in a compact assembly with short leads connecting them.

This method of construction is rapidly gaining in favor among engineers as it simplifies replacement and makes possible the elimination of inductive interaction between the units. Particularly, it makes the elimination of hum a simple matter.

This amplifier and power supply is especially intended for electrically playing phonograph records and for use with old radio receivers in which the radio fre-

available, or any tube which may be produced in the future.

Feedback Prevented

In an ideal amplifier, oscillations resulting from feedback should be entirely suppressed. This has been accomplished by the use of resistance-capacity filters which effectively block such oscillations, but allow the proper D. C. potentials to be applied to the plates and grids, and motorboating is thus prevented. The results in conjunction with highly efficient transformers are surprising. If the voltages applied to the first audio stage is not correct, it is very easy to obtain the proper values by the substitution of a different size resistor.

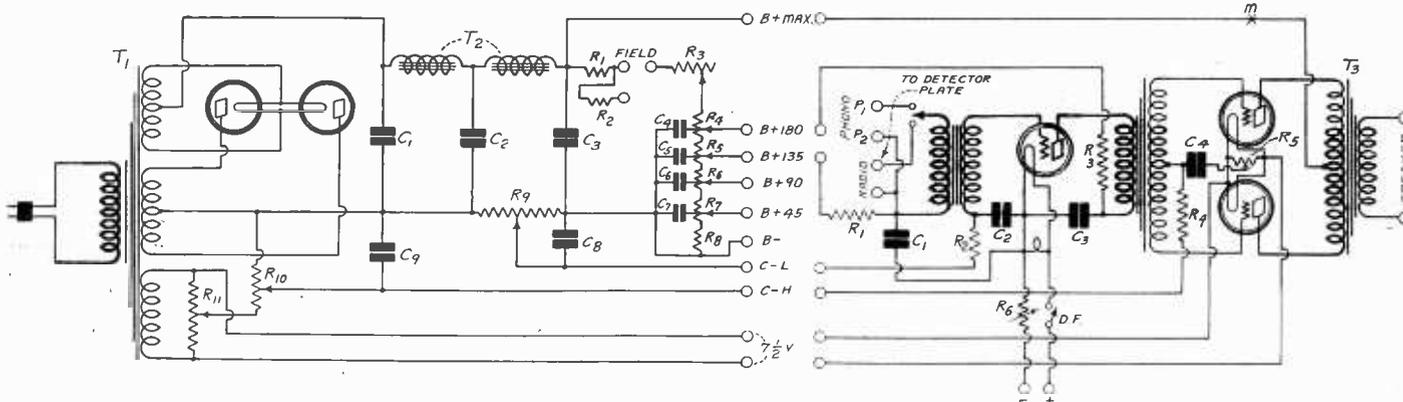


FIG. 1
CIRCUIT DIAGRAM OF THE STRAIGHT LINE AMPLIFIER AND THE POWER SUPPLY UNIT.

GREAT volume with lifelike realism is the demand at present in both radio reception and in electric phonograph reproduction. Much volume has been used for many years in radio receivers, but there was little else. The amplifier tubes used were not large enough to handle all the volume desired and the result was distortion. The power supply devices used with these receivers also were inadequate to provide the current and voltage and the result was feedback, motorboating and more distortion. All this has been changed by the design of amplifiers which are true to the signal, power tubes that can handle almost any desired signal-voltage, and power supply devices which can drive the amplifiers satisfactorily even when high power tubes are used.

Unit Method of Construction

One amplifier system which has particular interest because of its novel method of eliminating feedback is the Ferranti Straight Line Push-Pull Power Amplifier. The feedback through the power supply has been eliminated in this unit by the effective isolation of plate circuits. This is done by the use of a resistance-capacity filter in each plate supply line.

The amplifier and the power supply are

quency portion is first class but in which the power supply and the audio amplifier are deficient in power capacity and in tonal range.

The amplifier is designed so that tubes may be used in push-pull or singly, and so that different sizes of tubes may be used. It is particularly designed so that it can handle two 250 tubes in push-pull in the last stage, with a single 112 tube in the first stage. With the -50 type tubes in push-pull in the last stage the circuit will deliver from six to eight watts of undistorted signal power, depending on the voltage used on the tubes.

So far as possible every detail has been made to suit a universal purpose so that with proper voltages applied, it will give equally good results with any type of tube for either push-pull or standard amplification. One of the push-pull tubes may be removed resulting in standard amplification and if with a single tube, more amplification is desired, the positive feed and negative C connections may be changed from the center post of their respective windings to the outside connections, thereby using the entire winding which doubles the ratio and grid swing. From the above it may be seen that the thought behind the design is to provide a neat up-to-date amplifier to last for a long time and to utilize correctly with only minor changes, any tube now

The amplifier is built into a bakelite case 12" long, 10½" wide, and 4" high, which allows for the proper placing of all components and proper ventilation for the tubes. A milliammeter is recommended as an aid in determining the proper bias on the grids of the output tubes and as a means of detecting distortion. Provision is made so that by throwing a small switch at the right hand side of the top of the amplifier instant change can be made from phonograph pickup to radio without disconnecting any wires. The connecting post for all circuits are placed on the back panel and with them any series of voltages to suit various tubes, may be applied. Output transformers are employed and several types are available for use with magnetic or dynamic speakers. It is apparent that the flexibility of the unit is such that any plate supply type of speaker or tube may be employed.

The power supply unit recommended for use with the Straight Line Amplifier employs full wave rectification and has been designed for a maximum utility. When operating with the 81 type rectifying tubes, it will successfully operate the amplifier with any type of tube up to and including the 250 type tube used in push-pull and at the same time furnish B supply for almost any type of radio receiver using D. C. tubes. Nothing has been

11 Amplifier 250 B Supply

Denton

spared to make the power unit efficient and flexible.

All voltages are adjustable within a wide range, except the high plate voltage which is fixed by the transformer and load. A 4,000 ohm variable resistor in series with the bleeder circuit provides means of compensating for voltage variations. The power unit will furnish 50 milliamperes D. C. for the field of a 110 volt dynamic cone speaker unit by means of a removable link, which when taken out, cuts 2,000 ohms out of the circuit, to compensate for the field resistance. All resistors are rated at 25 watts continuous duty so that there is no danger of burn-out under the maximum load with 250 type tubes used in push-pull. The power unit has been especially designed for use with the 'Straight Line Push-pull Amplifier and with it, will give excellent results.

Construction of Amplifier

After securing the parts listed for the amplifier, the following black bakelite panels should be obtained:

- 1 12"x10½"x⅛" for top.
- 1 12"x10½"x⅛" for base.
- 2 11¾"x4"x⅛" for front and back.
- 2 10"x4"x⅛" for ends.

Place the base on a bench or table and lay on it all equipment and arrange as

shown in photo figure 2, taking care that sockets are located to register with centre of tube holes on top. With the equipment properly located, mark all holes and drill with ⅛ inch drill. Four extra holes are drilled in the base near corners to take rubber foot buttons.

Lay out the top panel for the three tube holes, which are symmetrical about the centre line, 2¾ inches in diameter and on 3¼ inches between centres. Lay out and drill holes for the filament switch and phonograph switch ⅜ inches in diameter and 2¼ inches centre to centre and 2 inches to centre from the back edge of the panel.

Lay out and drill the back panel with 10⅞ inch holes on 1 inch centres, ¾ inch from the top of the panel and 8⅞ inch holes on 1 inch centres 1 inch from bottom of panel, all symmetrically located, and 1⅜ inch hole located half way between the A minus and B minus posts and the right hand input post, for the filament control rheostat.

The front panel is now drilled with a large hole for the milliammeter, which is located symmetrically about the centre of the panel, and with three holes for supporting bolts as per template with meter.

The case is assembled by means of angle brackets and the corner drilling

LIST OF PARTS

(For the power unit)

T1—One Thordarson No. T2950 power transformer.

T2—One Thordarson double choke, No. 3100.

C1—One Acme Parvolt 2 mfd., series 1,000 condenser.

C2, C3—Two Acme Parvolt 4 mfd., series 600 condensers.

C4, C5, C6, C7, C8—Five Acme Parvolt 2 mfd., series 200 condensers.

C9—One Acme Parvolt 4 mfd., series 200 condenser.

R1, R2—Two 2,000 ohm Electrad Truvolt resistors, B20.

R3—One 4,000 ohm Electrad Truvolt resistor, T 40.

R4—One 1,500 ohm Electrad Truvolt resistor, T15.

R5, R6, R7, R10—Four 1,000 ohm Electrad Truvolt resistors, T10.

R8—One 500 ohm Electrad Truvolt resistor, B5.

R9—One 400 ohm Electrad Truvolt resistor, T4.

R11—One 200 ohm Carter potentiometer, M200.

Thirteen binding posts, engraved as required.

One set of Bakelite panels as follows:

One 12x10½x⅛ inches for baseboard.

One 12x5½x⅛ inches for top.

Two 5¼x6⅞x⅛ inches for sides.

One 11¼x6⅞x⅛ inches for front.

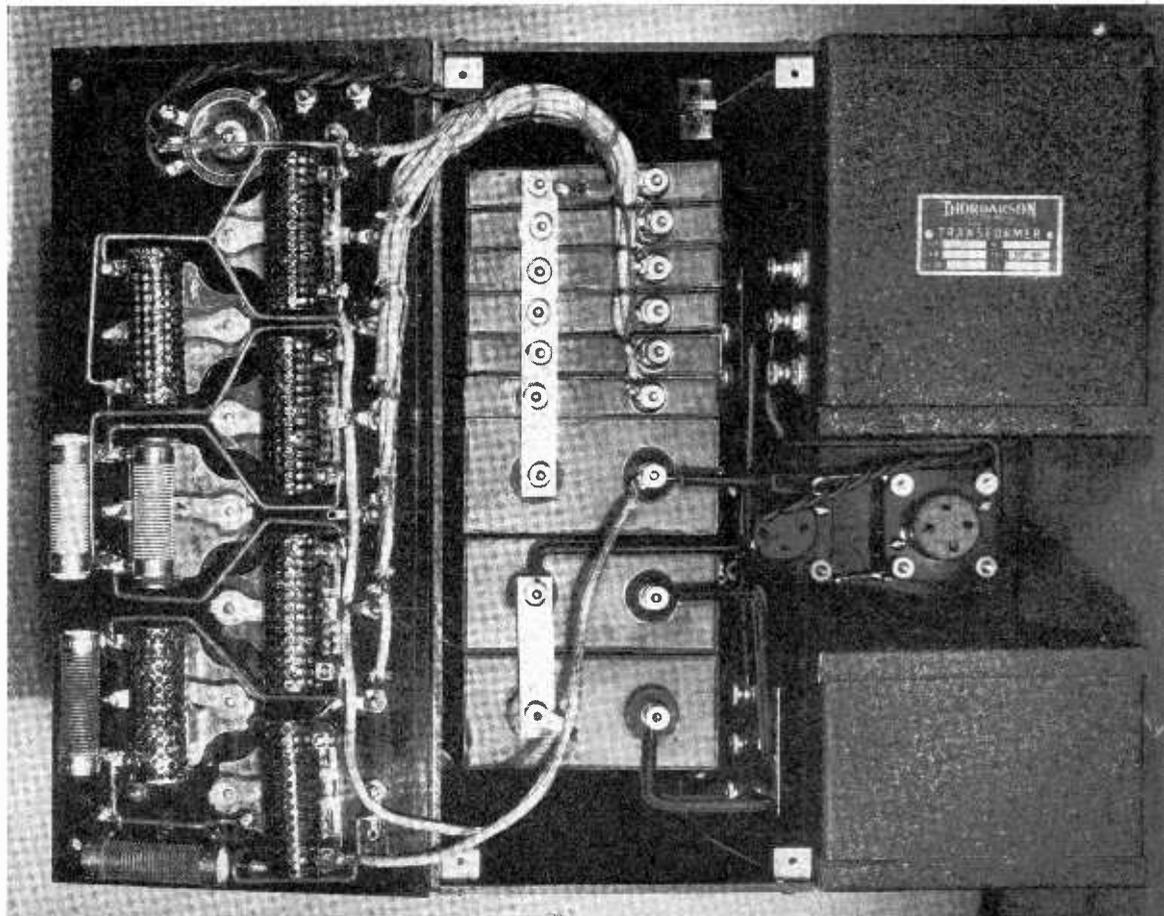
Two Benjamin UX sockets.

will depend on the type of bracket available. Sixteen heavy brackets about ½ inch size are required, 8 for holding sides together and 8 for holding on the top and bottom. All brackets may be bolted on except the 4 for holding down the top and these must be tapped in one hole to provide means for screwing down the cover. The drilling will be evident when brackets are laid out on the panels.

(Continued next week)

FIG. 2

Top view of the Ferranti power supply unit, showing the transformers and the rectifier tubes at the right, the by-pass condensers in the middle, and the voltage divider at the left. The left portion is the lid which covers the condensers when the unit is closed.



Points That Will Govern Sensitivity

ONE of the most attractive small receivers possible to build is the Hammarlund Three. It uses the new Hammarlund drum dial, the new Hammarlund screen grid coils and the new Hammarlund double condenser. These are the foundation of the circuit. Indeed, there is little else needed to build this receiver, one of the slickest "little fellows" you ever laid eyes on.

It is selective beyond the average circuit that possesses a stage of tuned radio frequency amplification and a detector, with regeneration.

It is louder—much louder—than you would imagine, merely by looking at the circuit diagram. There is only a single stage of resistance coupled audio amplification. Yet this is sufficient to give moderate speaker volume on local stations. It is not enough audio amplification to give good speaker volume on distant stations, therefore the DX hounds will want to work this splendid receiver into a power pack. Such a pack usually consists of a B supply and a transformer stage of audio. This stage may be a single tube or two tubes in push-pull.

It Gets DX

The circuit surely does bring in distance, and those who have a fancy for such reception will get a great deal of joy out of the receiver. Those content to listen to locals do not need the extra audio stage.

On the quality reckoning it is inconceivable that the performance of this receiver can be exceeded at present, as with regeneration a little retarded, as it should be, side bands are not trimmed, and besides there is virtually no distortion due to audio coupling.

It so happens that the first station tuned in when the fourth model of this receiver was completed was WLW, Cincinnati, Ohio, using 50,000 watts experimentally, on its proposed new frequency. The point of reception was New York City. Reception was enjoyed on ear-phones. When an extra transformer stage of audio was cut in, the signals came in loud on the speaker.

Distant reception, easily attained at the upper end of the wavelength spectrum, attests to the sensitivity of a receiver, since the amplification, hence sensitivity, is greater at the higher frequencies, due to electrical phenomena. In other words, if you get a distant station high up on the dial, you will get ever so much more distance lower down. And such expected result was obtained with the Hammarlund Three.

Not too Many or too Few

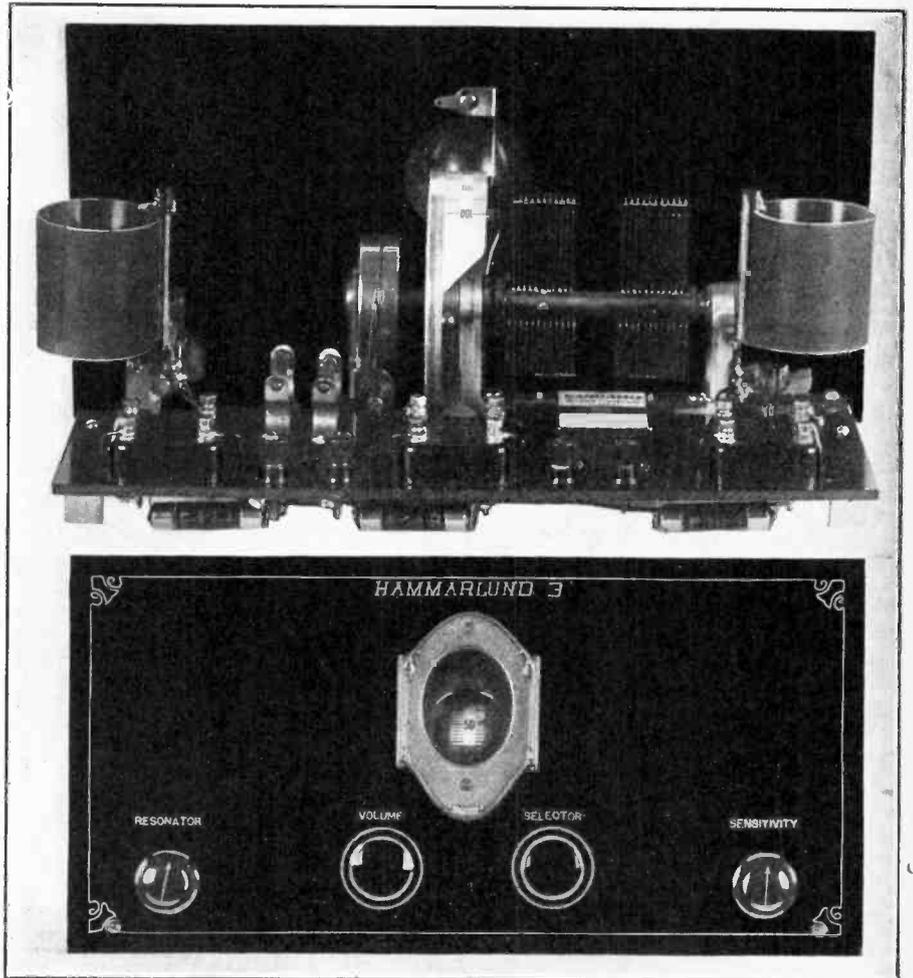
All unnecessary parts are absent from this receiver, yet no essential part is omitted. Let us investigate the identity, constants and purposes of the principal parts.

The antenna coil is of the two-winding variety, affording primary taps, to accommodate the input to the demands of the location. The circuit is selective enough to enable you to take the full pickup across the entire primary, represented by the extreme lugs on the Hammarlund antenna coil. The other taps may be used, by those who so desire, simply by short-circuiting from the ground connection to one of the other lugs. Whichever connection proves best is retained. The grid return of the SG tube

The Hammarlund

Remarkable in Performance,

By James



MADE OF AS FEW PARTS AS ARE POSSIBLE IN THE CONSTRUCTION OF A GOOD RECEIVER TO WORK A SPEAKER, THE HAMMARLUND THREE NEVERTHELESS PERFORMS ADMIRABLY AND PRESENTS A PLEASING, COMPACT APPEARANCE.

is made to minus filament of the detector and audio tubes, the two filaments at equal potential. In this way exactly the correct negative grid bias is obtained for the screen grid tube without requiring connection to any biasing battery. This well-tried method obtaining 1.7 volts negative grid bias for the screen grid tube is an exclusive feature of RADIO WORLD circuits.

Maximum RF Amplification

The output of the screen grid tube is taken in full-impedance fashion. The outside winding, usually the secondary, is here used as the primary, and is tuned. Thus at resonance you get the greatest possible impedance, and the screen grid tube depends for its full amplification on just such high impedance.

The Hammarlund double condenser has a common shaft, and as the rotor has been connected to minus filament of succeeding tubes—the novel grid return previously explained—it follows that the condenser section tuning the plate circuit of the screen grid tube likewise is already connected to the same point. But the coil in

the plate circuit must go to 135 volts positive.

There isn't a reason in the world why the condenser can not go to one point at ground potential, while the coil it tunes goes to another point at nearly ground potential, the only necessary precaution being that a large bypass condenser (.5 mfd.) must bridge the gap. A small one might act somewhat as a series condenser and molest the uniformity of tuning. A large bypass condenser has virtually no such effect.

Since the regeneration condenser, C4, also has a trimming effect, and as there is a real trimmer across the other tuning condenser, perfection of tuning results. There is no possibility of any baffling anti-resonance or consequent loss of amplification or sensitivity.

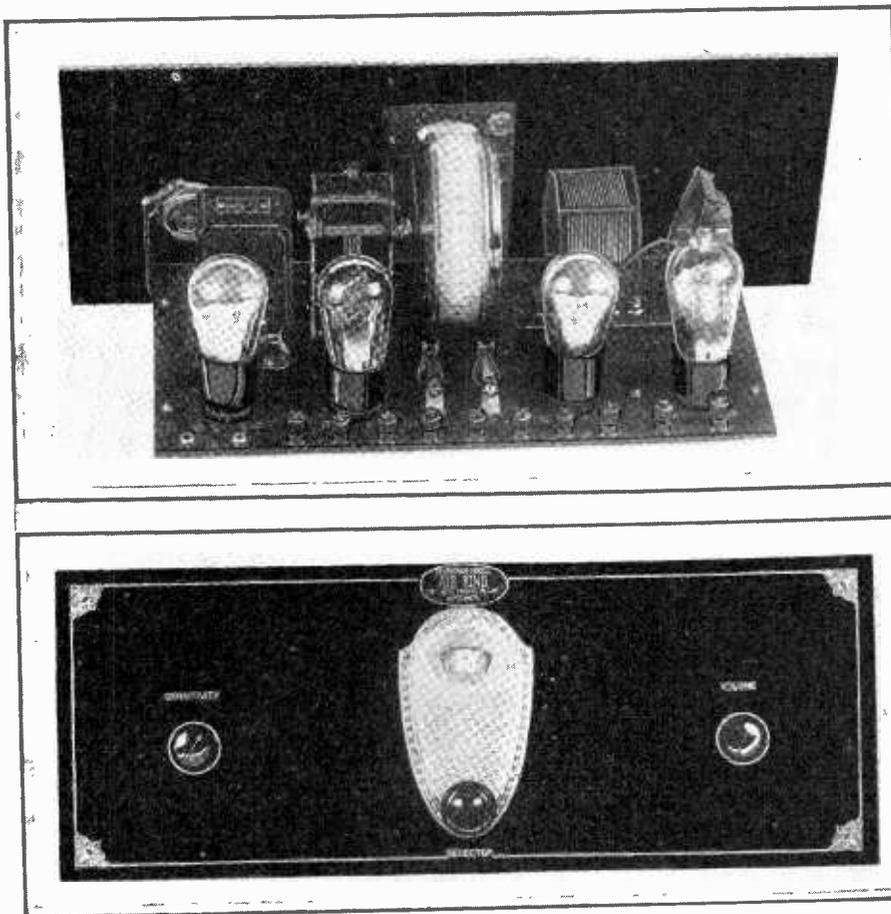
The .5 mfd. bypass condenser is an Acme Parvult 200-volt type, shown as C6.

Grid Bias Detection

An isolating condenser, C8, keeps the positive plate potential off the detector grid. By the way, this grid is returned to C minus, thus affording grid bias detec-

A De Luxe Short Waver

By Jasper Jellicoe



LIST OF PARTS

- L1—One RF choke. (18 to 130 meters.)
- L2, L3, L4—One set Air King short wave coils, 18 to 130 meters.
- C1, C2—Two .1 mfd Tobe condensers.
- C3—One .00025 mfd. tuning condenser.
- C4—One .0001 mfd. midget variable condenser.
- C5—One .00025 Tiny-tube condenser.
- C6—One .01 Tiny-tube condenser.
- C7—One 1 mfd. Tobe by-pass condenser.
- R1—One 622 Amperite.
- R2—One Electrad Royalty 500,000 ohm potentiometer with switch, SW.
- R3—One Lynch 2 megohm grid leak with mount.
- R4, R5—Two 1A Amperites.
- R6—One Lynch .1 megohm resistor with mount.
- R7—One Lynch 1.0 megohm grid leak with mount.
- T—One National A100 audio transformer.
- Four standard sockets.
- Eleven binding posts.
- One National drum dial.
- PTJ—Two Frost phone tip jacks.

C. These two ticklers are connected in parallel.

As a means of preventing oscillation in the first tube by-pass condensers C₁ and C₂ are used.

The detector operates on the grid bias principle, and for that reason a high mu tube, followed by resistance coupling, is used. An audio stage with transformer coupling is employed to increase the output for loud speaker operation.

The receiver uses three Air-King plug-in coils, which are wound of enameled wire on a skeleton frame.

IN CONJUNCTION with the two-part article on the Pilot "Wasp" short wave set recently featured in RADIO WORLD, Harvey Sampson, proprietor of Harvey's Radio Shop, 100 West 43rd Street, New York City, ran a two weeks' display of the set, the kit and component parts in one of his show windows.

THE POLYMET Manufacturing Corporation is operating a full night force. Large commitment orders for electric set parts received from many of the largest radio manufacturers in the field have made this more necessary.

THE effectiveness of a screen grid tube as a voltage amplifier depends on two factors: the adjustment of the four different voltages and the impedance in its load circuit. The adjustment of the grid bias, the filament voltage and the plate voltage is not difficult, because not critical. The plate voltage may be 135 volts. Small variations such as would result from the gradual exhaustion of the battery are not important.

The grid voltage can be adjusted to the proper value by suitably returning the grid circuit to the filament circuit. In the circuit shown in Fig. 1 the return has been made to negative end of the filament of the last tube. The voltage at this point with respect to the negative end of the filament of the screen grid tube is 2.7 less 1 volt, or 1.7 volts. That value gives optimum amplification when the plate voltage is 135 volts and the screen grid voltage is 45 volts.

A Little More Critical

The screen grid voltage is a bit more critical, because it depends on the grid and plate voltage used. Hence, if an adjustable feature is introduced into the circuit by means of which the screen grid voltage can be varied, the correct value can be found for the particular combination of grid bias and plate voltage used. This means that, although the grid bias in the circuit is not quite right, it can be made so by a simple change of the screen grid voltage.

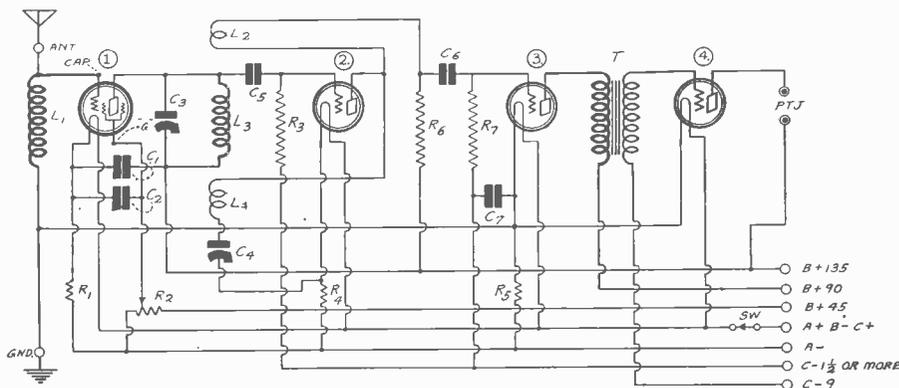
In the accompanying circuit diagram of a very swell short-wave receiver a high resistance potentiometer has been connected across the 45-volt section of the plate battery and the lead from the screen grid tube has been connected to its slider. Thus any

voltage between zero and 45 volts can be obtained for the screen grid. The plate voltage and the grid bias have been chosen so that the correct screen grid voltage will be found in this range.

High Impedance Obtained

The condition of high selective impedance in the plate circuit is satisfied by the use of tuned impedance coupling. As a means of increasing the tuned impedance regeneration is used. By advancing the tickler the effective impedance can be increased almost without limit. The voltage amplification and the selectivity increase at the same time.

Since the regeneration is critical near the oscillating point, two separate controls are used and two ticklers. The regular tickler L₂ is controlled by a knob and the auxiliary tickler L₁ is controlled by a condenser



The Victoreen Duplex

By E. A. Benson

[Part I of this article was published last week. Part II, the conclusion, follows.]

AS a means of further minimizing any possible voltage changes a 2 mfd. condenser C4 is connected across the 180 volt section, a 1 mfd. condenser C5 across the 90 volt section and another 1 mfd. condenser C6 across the variable section.

The 450 and 180 volt taps are connected by a fixed resistor R1, Fig. 3, of 5,000 ohms. A variable resistor R2 of 25,000 ohms is connected in series with the 90 volt tap to supply a variable voltage less than 90 volts to the radio frequency tubes in the receiver.

Heaters Biased

Note that the center-tap on the 2.5 volt winding is connected to the 90 volt tap on the voltage divider. This places a 90 volt bias on the heaters of the -27 tubes with respect to the cathodes. This connection is used to eliminate hum.

It is well to ground the points marked K in the three circuits. These of course will be connected together when the amplifier is complete. A good ground always leads to stability of a circuit.

The C battery eliminator is an economic, convenient and unfailing source of grid bias for use with all amplifiers requiring a negative grid bias up to 90 volts. The unit delivers four different voltages, two fixed of 45 and 90 volts and two variable with ranges from zero to 45 and from 45 to 90 volts.

A unit such as this has many advantages over the resistor method of obtaining bias. It does not introduce interstage coupling, which causes distortion and oscillation. It takes practically no power to operate. In fact it takes only a very small fraction of the power required to maintain an equivalent voltage drop in a resistor in a high power amplifier circuit. It will not run down, as the only part that has a finite life is the rectifier tube, and that should last for several years, for it delivers practically no current.

Wiring the Circuit

The two by-pass condensers in the Victoreen 516 C supply unit are filter condensers. Only one of these, the 2 mfd. unit, serves also to by-pass the output, as will be seen on the circuit diagram. When the unit is used to deliver several

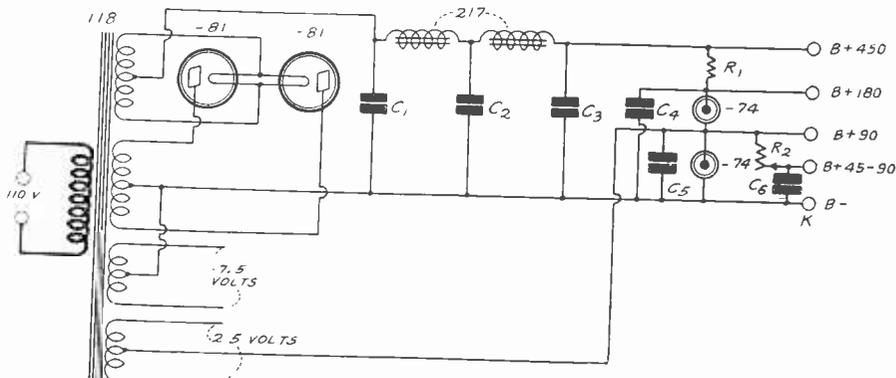


FIG. 3
THE CIRCUIT DIAGRAM OF THE VICTOREEN PLATE CURRENT SUPPLY UNIT USED WITH THE DUPLEX POWER AMPLIFIER

different grid voltages to different tubes all the binding posts should be by-passed. This by-passing is preferably done in the receiver. For example, if a bias of 45 volts is required for a 171A tube in the set there should be a 1 mfd. condenser, or larger, from the filament to the C- binding posts in the set. Similarly for the others, except the 90 volt post, which is by-passed in the grid voltage supply unit.

If this by-passing is not done there may be some feed-back through the grid bias supply unit. While this feed-back is not enough to cause any appreciable change in the quality of the amplifier it is well to eliminate as much as possible. The need for this by-passing is greater in direct coupled circuits than in transformer coupled amplifiers.

DAVE SCHLOSS, manager of City Radio Co. store at 42 Cortlandt Street, New York City, announces that the store has been enlarged and improved. The newest in parts, accessories, electric sets and dynamic speakers, Dave has stocked, also types of tubes that are in demand and hard to get. Henry Beran is also on the job at this store. Roy French, coal man from Brooklyn, is a steady customer. Roy holds several DX records in his locality, besides holding several blue ribbons for quality tone production from his dynamic.—J. H. C.

Los Angeles to Test Radio

Washington. The Department of the Navy has decided to use the "Los Angeles" for an experimental ship from a radio standpoint in determining the proper design for the radio equipment with which the new 6,500,000-cubic-foot dirigibles will be equipped.

With this in view, steps are being taken to develop equipment which will replace that now installed on the "Los Angeles." Both the intermediate frequency sets will be replaced and the present wind-driven power source will be removed and engine-driven power units substituted therefor.

The present radio compass will be allowed to remain intact as it has given very satisfactory service, though it is possible that the receiving equipment for same may be replaced by some of more modern design.

It is the Department's desire that the new airships be equipped with apparatus which will have a communication range equal to their cruising radius, which will exceed 8,000 miles. Experimental equipment will be built before starting construction on the sets to be installed on the new dirigibles ZR-4 and ZR-5.

A GOOD MAKESHIFT

By Anthony Sodaro



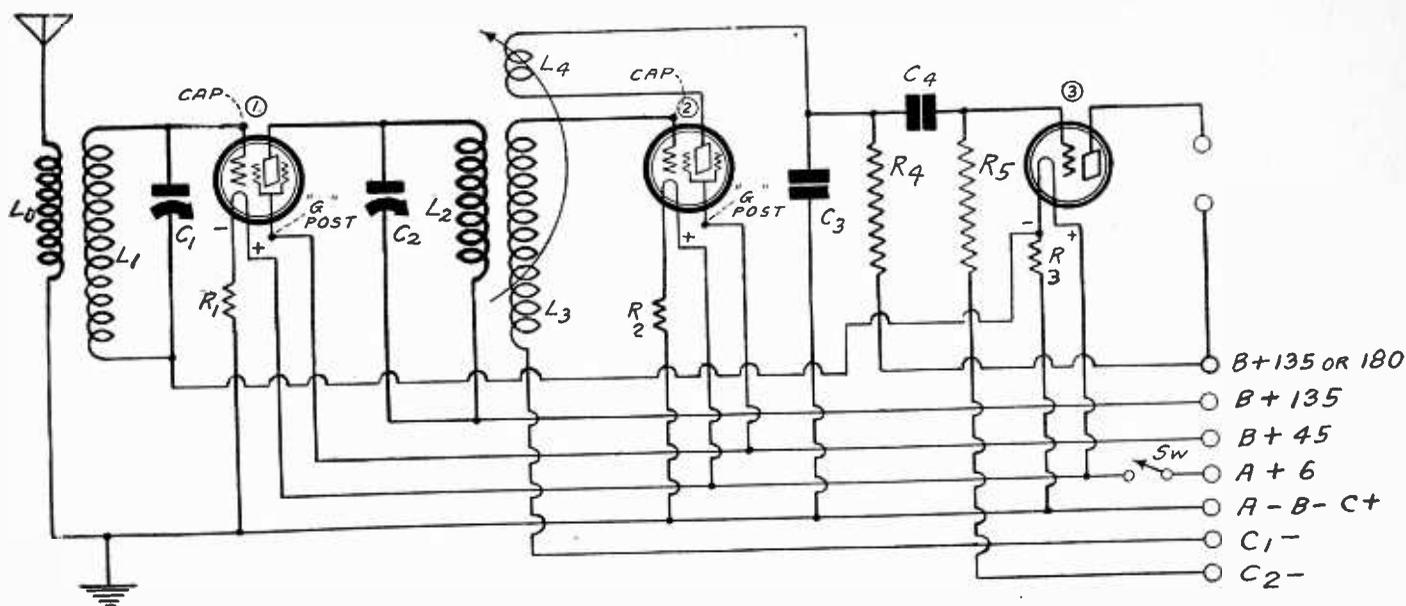


FIG. 714
THE CIRCUIT DIAGRAM OF A SENSITIVE RECEIVER THAT MAY BE USED TO FEED A POWER TUBE IN THE POWER PACK. REQUESTED BY THOMAS P. WILLIAMS.

Radio University

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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.

PLEASE PUBLISH the diagram of a four-tube circuit employing one screen grid RF amplifier, a regenerative detector and two stages of resistance coupled audio, to be used with a power tube built into the B battery eliminator.

(2)—Also please publish a sensitive circuit employing one screen grid tube, a regenerative detector and one stage of resistance coupling which can be used with the same power amplifier.

(3)—Can the four-tube resistance coupled circuit be used successfully on the B battery eliminator, or will there be motorboating?

(4)—Will the three tube circuit ahead of the power tube better than the four tube circuit?

THOMAS P. WILLIAMS,
Dallas, Tex.

1)—Fig. 715, next week, will show the 4-tube hookup.

2)—The circuit is shown in Fig. 714.

3)—If the B battery eliminator is well by-passed and is able to supply the neces-

sary current and voltage there should be no motorboating. The circuit will be stable, essentially, but there may be slow motorboating.

(4)—It is doubtful that this combination will work as well for the circuit will be essentially unstable. But again it depends on the plate voltage supply.

DOES A DETECTOR employing the grid leak and condenser detect all audio frequencies equally well or does it discriminate?

(2)—Does the grid bias method of detection have any advantages over the other method?

(3)—Why is the grid leak-condenser method of detection more sensitive than the grid bias method?

J. J. MORAN,
Gary, Ind.

(1)—The grid condenser and leak method of detection detects low audio frequencies better than high frequencies. The amount of suppression depends on

the values of the grid leak and the condenser.

(2)—The grid bias method of detection does not discriminate but detects all audio frequencies equally well. Also, this method makes the tuner more selective. But this fact also results in high frequency suppression so that the difference between the two methods is not so great as might be expected.

(3)—The grid condenser and leak method of detection is more sensitive because the tube not only acts as a detector but also as an amplifier of the detected signals.

* * *

WHY DOES sharp tuning suppress the higher audio frequencies? Does not the carrier frequency carry through all frequencies equally well whether the tuning is sharp or broad?

WILLIAM SOPER,
Evanston, Ill.

(1)—The signal does not consist of the carrier alone but of many frequencies both higher and lower than the carrier. These are suppressed by the sharp tuner. And these other frequencies interacting with the carrier produce the audio signal. The weaker the side frequencies are in respect to the carrier the weaker will be the reproduced audio frequency. Hence the side frequencies which are suppressed the most are reproduced the weakest and they are the high audio frequencies.

* * *

I HAVE a 30 cycle super-heterodyne which is very sensitive and selective, but the signal is not clean-cut. There is much growling and whistling in it. What causes these noises?

(2)—Would a different intermediary frequency be better in this respect?

(3)—Can I change the intermediary frequency to a high value by putting condensers across the intermediary transformers?

FRANKLIN JONES,
Germantown, Pa.

(1)—The cause of this noise is interference by other stations. The whistling is due to heterodyning with stations operating on a frequency which differs by 60 kc from the station tuned in. The growling is due to a similar cause but in this case the harmonics heterodyne.

(2)—Some improvement would be effected by increasing the intermediate frequency to more than 45 kc. It should preferably be from 90 kc to about 180 kc.

(3)—The frequency cannot be increased by connecting condensers across the windings of the intermediate transformers.

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Alaska Aids Weather Work

Washington.

Weather observations, reported twice daily from the station recently established by the Army Signal Corps at Point Barrow, Alaska, have proved important in preparing the weather forecasts for the United States, the Department of Agriculture stated. The full text of the Department's statement follows:

A new Weather Bureau station was recently established at Point Barrow, Alaska, where the Signal Corps of the War Department has a radio station available for transmitting weather reports. Two daily observations are sent to Seattle by radio, and from there distributed to forecast centers requiring them.

As early as 1907 weather reports were received by telegraph from Alaska. Since that time, extensions of the field of observation in that region and in northern Canada have gradually been made, although progress has been slow because of the lack of telegraphic communication.

In more recent years radio has permitted an extension and in the last year valuable reports have been received from the McKenzie Basin and from the Hudson Straits region. The most recent addition to current knowledge of these regions is from this station at Point Barrow, Alaska, from which reports are now being received regularly.

These reports are not only valuable in daily forecast work but in the weekly weather outlooks which are made on Saturday for the coming week. As a specific instance:

The cold waves that affect the North Central States and the lake region precede the southeast movement of high-pressure areas advancing southeastward from the McKenzie Valley. With reports from Fort Simpson in the McKenzie Valley and the report from Point Barrow, Alaska, the Weather Bureau will be in a position to indicate, two, or maybe three, days ahead that a cold wave is expected in the lake region or North Central States, whereas without such information the advance notice

Highest Court Gives Feedback to DeForest

Washington

The legal controversy, lasting eleven years, between Major Edwin H. Armstrong and Dr. Lee De Forest on the feedback or regenerative patent has finally been settled by a decision of the United States Supreme Court in favor of Dr. De Forest's claims. The court upheld judgments of the Circuit Court of Appeals of the Third Circuit (Philadelphia) and of the Court of Appeals of the District of Columbia.

The question at issue had to do with the priority of invention of the regenerative circuit. Major Armstrong devised and described a feedback amplifier and Dr. De Forest devised and described a feedback oscillator, both of which are basically the same.

Two cases were disposed of in the present decision. One was entitled Westinghouse Electric and Manufacturing Company, petitioner, vs. De Forest Radio Telephone Company, respondent. The other

was entitled Westinghouse Electric and Manufacturing Company and Edwin H. Armstrong, petitioners, vs. the United States of America and Alexander Meissner, General Electric Company and Irving Langmuir, De Forest Radio and Telegraph Company, Lee De Forest and American Telephone and Telegraph Company, respondents.

No royalties are involved in the decision because the Westinghouse Electric and Manufacturing Company is licensed, without royalties, to use the De Forest patent through rights acquired from De Forest by the American Telephone and Telegraph Company. The General Electric Company and the Radio Corporation of America are also licensed on the same basis. The only effect of the decision is that the Westinghouse company no longer has sole control of the regenerative patent, hence the R. C. A.'s license thereunder is non-exclusive

Output Transformer Announced by R. C. A.

To insure the proper application of loudspeakers to any type receiver or power amplifier, a special output transformer has been introduced by the Radio Corporation of America.

The output transformer, is intended as a coupling means for outputs in excess of 10 milliamperes of direct current. It serves to by-pass the direct current component with minimum resistance so as to operate the power tube at highest efficiency while transferring the alternating current component to the loudspeaker. In this manner the delicate coil windings and mechanism of the loudspeaker are protected from damage against excessive direct current, which might

result in demagnetization and even burn-outs when the loudspeaker is connected directly to power tubes or multiple tube amplifiers.

With this output transformer it is unnecessary to try out the polarity of the loudspeaker cord.

LIST OF STATIONS EFFECTIVE SUNDAY

The fully corrected list of reallocations of stations effective Sunday, November 11th, appeared in RADIO WORLD dated November 3d. The call letters, frequency, owner and location are given by States. Fifteen cents a copy. Or send \$1.00 for trial subscription of eight weeks, and this issue will be sent FREE.

Radio World, 145 W. 45th St., N. Y. C.

8 Stations on Same Wave at Same Time

Washington.

Synchronization of radio waves, whereby two or more stations may broadcast on the same frequency without interference, is being utilized with a high degree of success in Great Britain, according to Col. A. G. Lee, assistant engineer to chief of the British Post Office Department, in charge of radio and telegraphy.

Mr. Lee is in this country, with four other British postal officials, primarily to study the American land telegraphic system, says "The United States Daily."

Discussing radio orally with officials of the Federal Radio Commission, Colonel Lee stated that eight stations at present are being synchronized successfully on a single wavelength. Each of the stations is of 250 watts power. The stations give the same programs at night, and under good conditions, are able to broadcast different individual programs during the day.

Great Britain's twenty radio stations, said Colonel Lee, are operated by the British Broadcasting Corporation, a government organization. There is no advertising of any nature broadcast over the stations, he declared, explaining that the programs were maintained through license fees collected from listeners.

"Every man with a receiver gets his

broadcasting license from the Post Office Department for ten shillings (\$2.50) for a year," he declared. "The greater portion goes to the broadcasting stations for programs.

\$5,000,000 Collected

"More than \$5,000,000 was collected last

year from listeners. There are about 2,500,000 sets in use in Great Britain. No charge is made for licenses for blind listeners."

Colonel Lee explained that his party will inspect the telegraphic systems of the commercial companies in the United States with a view to improving the British service, operated by the Post Office Department. He is accompanied by L. Simon, Assistant Secretary of the Post Office Department; J. Stuart Jones, Comptroller, Central Telegraph Office, London; G. T. Archibald, Inspector of Traffic, and A. E. Stone, Engineer, Post Office Department.

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A THOUGHT FOR THE WEEK

THE major political parties may disagree on various things that affect the conduct of large affairs in this country, but on one point they fully agree—that is, the value of radio in reaching folk in all walks of life.

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Radio Is Neglected in Schools, He Says

Oakland, Calif.

"Radio is being neglected by the school system," James McLafferty declared in a recent talk over KGO. "Many of the boys employed in radio shops are working because they could not obtain the radio instruction they wanted at school."

A petition is being circulated in Oakland to have a course in radio technique and mechanism added to the school curriculum. The Oakland Mothers' Club and prominent business men throughout the city have given their approval and KGO

Some of the backers of the movement say the success of experimental radio depends on proper early instruction, not only satisfying interest in radio technique, but creating it.

Full Chance Gained By Women In Radio

The demand for women in radio is increasing, and the pioneer stage of radio gives men and women equal opportunities, according to Bertha Brainard, Eastern program director of the National Broadcasting Company, who contributes the chapter on radio to "An Outline of Careers for Women," edited by Doris E. Fleischman and just published by Doubleday Doran and Company. Miss Fleischman is a public relations counsel, associated in this work with her husband, Edward L. Bernays, and writes on public relations as a career for women.

"From the day that women's features were first put on the air," says Miss Brainard, "executives of the radio broadcasting world have called on women to help them create and arrange these programs so that they would please other women. And the need for women in radio seems to be increasing, now that the great majority of radio stations all over the United States are broadcasting women's programs every week.

How Equality Arises

"The National Broadcasting Company has established a department in charge of women's programs, every member of which, including its superintendent, is a woman."

It is the pioneer stage of the radio world which gives men and women equal opportunities, according to Miss Brainard, and there is less discrimination

against women in radio work than in practically any other. "Many of those at the top in radio," she says, "have come from the newspaper office, the theater and other spheres where women often receive as much of the hard work and money as men do, so they do not begrudge girls this equality in the radio station. In fact, they boast of the service which women are rendering to radio."

Lists Opportunities

Miss Brainard lists the fields in which beginners can get a foothold.

"The more powerful stations," she says, "have, in addition to their chief executive, announcers, entertainers, program managers, staff accompanists, secretaries, manuscript writers, research workers who keep up-to-date lists of available entertainment and check over the "fan mail" to ascertain the public's likes and dislikes, and engineers and solicitors, who seek to sell the hours, during which the station is allowed to broadcast, to advertisers or other purchasers of broadcasting rights.

"The smaller stations may have only a manager-announcer, an engineer and a part-time staff accompanist, but even in such staff the ambitious woman can see, first, the possibility of starting as accompanist, or, second, the opportunity to make a job for herself, such as program manager."

Bungalow Built for WBBM Workers

Chicago.

A new seven-room brick bungalow is nearing completion to house the enlarged operating and engineering staff of WBBM. Although the present quarters were sufficient when the station was built, just a year ago, increased activities necessitated a considerable increase in the personnel.

The station is located twenty-five miles northwest of Chicago, so it is necessary that a considerable portion of the staff live at the station.

WBAL Names Cooke Orchestral Arranger

Baltimore.

Edmund Cooke, staff violist at WBAL, has been appointed orchestral arranger, to be in charge of arranging compositions for all musical units included on the broadcaster's staff.

Mr. Cooke went to WBAL a few months ago as violist for the WBAL String Quartet. Soon his talent for making orchestral arrangements was noted.

Two Football Games On Air Saturday

The National Broadcasting Company chain will send out descriptions of two football games Saturday, November 10th.

The Navy-University of Michigan game at Baltimore at 2:15 p.m., e.s.t., will be described by Graham McNamee over WJZ, WBAL, WHAM, KWK, KYW and KPRC.

The Army-Notre Dame game at Yankee Stadium, New York City, at 1:30 p.m., e.s.t., will be announced by Phillips Carlin announcing over WEA, WTIC, WRC, WGY, WGR, WCAE, WGN, KSD and WOC.

Plan to Link Amateurs Meets Official Rebuff

Washington.

The Radio Commission is receiving complaints in connection with the organization of a company known as the Motion Picture Radio Communications Corporation and the relations of that company with certain amateur radio operators. The complaints connect station WHN of New York with the new corporation.

According to information sent to the Commission, the company is sending out contracts to amateur operators in an effort to procure their stations for experimentation in point-to-point short wave communication, television, land and aircraft communication. This, it is claimed, is contrary to the terms of the amateur license. Already from fifteen to twenty amateurs are said to have signed the contract. Officials said that it appears from the contract that the corporation intends to apply for an experimental license for each amateur station used.

The originator of the plan is said to be George Schubel, former owner of WHN.

Mr. Schubel denied any such efforts were undertaken as the complainants said.

Four in Radio Field Lead Charity Drive

Max Landay, Myron Goldsoll, Alex Eisemann and Charles Izenstark are at the head of the Radio Television and Musical Instruments division of the Business Men's Council of the Federation for the support of Jewish Philanthropic Societies of New York City, which has launched its 1928 campaign for \$5,300,000 to meet the budgetary requirements of its ninety-one constituent institutions.

The quota for this division has been set at \$20,000.

TRADIOGRAMS

THE AMERICAN SALES CO., 21 Warren Street, New York City, is handling the new Gould Kathanode Uni-power, an automatic A power unit with built-in relay which throws the charger off and on and controls the B eliminator. Also the company sells the Uni-Rectron Power amplifier, using the 210 tube and the 216B or 281 tube for rectifier also the Timmons combination amplifier and B supply. Full information may be had from American Sales Co. Mention RADIO WORLD.

* * *

IN ADDITION to their line of coils and short wave kits, the Aero Products Co. has a new audio transformer. Bert Smith showed this transformer recently. The entire Aero line may be seen and heard at Moore Radio Co., 72 Cortlandt Street, New York City. Full information may be obtained from Bert Smith, care Aero Products Co., 4611 East Ravenswood Ave., Chicago, Ill. Mention RADIO WORLD.

* * *

HENRY A. BELLOWs, of WCCO, Minneapolis-St. Paul, has been elected a director of the National Association of Broadcasters, to fill an unexpired term.

* * *

THE METROPOLITAN FACTORY representatives for Sylvania Products Co., with factories at Emporium, Pa., are Wiedenbach-Brown Co., Inc., 118-120 East 25th Street, New York City. N. D. Brown is sales manager of Wiedenbach-Brown. Sylvania makes a full line of tubes for every radio purpose. Address Mr. Brown. Mention RADIO WORLD.

* * *

JOHN Q. GAUBERT has been placed in charge of the production of the International Resistance Company. Mr. Gaubert was connected with the Ward Leonard Electric Company, and with the Westinghouse Electric & Mfg. Company.

* * *

J. WARREN HORTON has become chief engineer of the General Radio Company, Cambridge, Mass. After graduating from the Massachusetts Institute of Technology in 1914 he remained there for two years as an instructor in physics, going from there to the Bell Telephone Laboratories, New York City.

* * *

J. PAUL ENCK of Lebanon, Pa., uses a large motor truck containing all of the models of radio sets he sells, and calls on housewives to give them demonstrations. At night he gets entire families, invites them to be seated in his truck, plugs in his cable to an electric switch nearby and provides them with a half hour or so of radio entertainment. He covers the entire county of Lebanon in this manner.

* * *

THE WARD LEONARD ELECTRIC CO., has a Vitrohm Adjustat, consisting of two fixed resistance sections each connected with an adjustable section. Sixteen adjustable resistance steps are covered by each of two moving contact arms, yielding a range of intermediate voltages for all types of receivers and amplifiers. The new lines includes two types of dual adjustats, for 200 volt and 400 volt uses; two Adjustats for bias purposes, one for single 112, 171 and 210 tubes, another unit of the same type for single and push pull 250, push pull 210 and push pull 171 tubes; and a center tapped 20 ohm unit. Full information on the line may be had from Frank Logan, care Ward Leonard Electric Company, 31 South street, Mount Vernon, N. Y. Mention RADIO WORLD.—J. H. C.

Literature Wanted

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.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name

Address

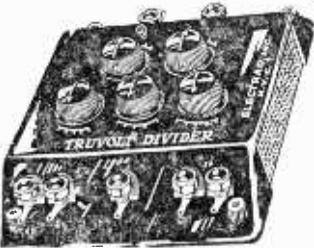
City or town

State

- Edward Holy, 3562 E. 135th St., Cleveland, Ohio
- Chas. C. M. Harris, Box 335, Hobart, Okla.
- J. D. Ferguson, P.O. Box 565, Wichita Falls, Texas
- J. W. Fidler, Box 31, Laredo, Texas
- J. F. Keller, 560 Quimby St., Portland, Ore.
- G. H. Fraser, Tecumseh, Ontario, Can.
- James R. Wylie, 30 Devine Ave., Lowell, Mass.
- Eric S. King, 5118 Delaware, Eagle Rock, Los Angeles, Cal.
- W. F. Davis, 608 Jenks St., St. Paul, Minn.
- E. N. Dodd, 2023 Kingman Blvd., Des Moines, Iowa
- M. McTimmis, R. D. No. 3 Box 162, Johnstown, Pa.
- D. T. Detmers, 55 College Ave., Poughkeepsie, N. Y.
- George E. Stevenson, 60 Welker St., Buffalo, N.Y.
- Radio Repairing & Building, 8240 John R. St., Detroit, Mich.
- Ralph L. Swanson, P.O. Box 101, Jupiter, Fla.
- Stephen H. Williams, 1648 3rd St., Rensselaer, N.Y.
- Bank of Bay Biscayne, Miami, Florida
- H. Boelard, 184 Gladstone Ave., Ottawa, Ont., Can.
- J. M. Spielman, 114 Lewis St., N. Y. C.
- Arthur R. Mitchell, 30 Duglins St., Montreal, P. Que.
- Charles A. Cary, Radio University, 1221 Ashland Ave., Baltimore, Md.
- Raymond L. Green, 555 Norman St., Bridgeport, Conn.
- J. Higile, Goshen, N. Y.
- J. B. Sweeney, Pearsall, Texas
- Chatham National Co., 170 Broadway, New York
- Nicholas J. Tonner, 620 Courtlandt Ave., New York City.
- William Todd, Ogden, Utah
- Elmer I. Ritz, Wm. Arthur Clark & Co., Public Ledger Bldg., Phila., Pa.
- H. Bradpkaw, 19 Parkview Ave., Buffalo, N. Y.
- Independent Film Exchange, 177 Golden Gate Ave., San Francisco, Cal.
- Hotel Chapman, 4707 Malden St., Chicago, Ill.
- Mountain View Vineyards, Red 276, R. 1, Kirkland, Wash.
- E. C. Painter, Box 462, Homer, La.
- Dr. B. Richard Simons, 942 Market St., Phila, Pa.
- G. Arthur Carter, 257 E. Columbus St., Detroit, Mich.
- Leland L. Howard, 519 Irving Ave., Wheaton, Ill.
- Rialto Theatre Bldg., Leominster, Mass. (Jack Levine)
- Robert Hutean, Lufkin, Texas
- George Zebley, 1213 Market St., Wilmington, Del.
- A. D. Webster, 50 Loop Road, Kingfield, Woking, Surrey, England
- G. J. Anello, 5429 19th Ave., Bklyn, N. Y.
- Leland L. Howard, 519 Irving Ave., Wheaton, Ill.
- Alex B. Tennant, Goodman, Wis.
- J. O. Kohler, 250 Superior St., Marion, Ohio
- A. C. Sycher, 139 Vista Ave., Daly City, Cal.
- L. A. Dowd, 728 Chestnut St., Oakland, Cal.
- C. J. Anello, 5429 19th Ave., Bklyn., N. Y.
- Ira Winbigler, St. Joseph & Ormsby, Mt. Clemens, Mich.
- G. L. Gordon, 541 Superior Ave., Cleveland, Ohio
- Thomea Johnston, 40 Progress St., Pawtucket, R. I.
- E. S. Maguire, 4312 N. Carlisle St., Phila., Pa.
- James McCord, 3115 N. 15th St., Phila, Pa.
- R. C. Ballard, 414 Ella St., Wilkingsburg, Penna.
- J. D. Miller, 1816 Cleveland Ave., Niagara Falls, N. Y.
- Harold Kelly, 743 12th Ave., San Francisco, Calif.
- Tom O. Lara, 345 W. 43rd St., N. Y. C.
- B. McCarter, 236 Mangum St., Atlanta, Ga.
- C. E. Grebel, Rte. 2, Box 580, Wauwatosa, Wis.
- M. T. Lyman, Route 2, Corpus Christie, Texas.
- A. Peregra, 4260 Griscom St., Phila, Pa.
- O. H. Peterson, 819 W. 21st St., Kansas City, Mo.
- C. J. Werlla, 1315 Main St., Denison, Texas
- C. S. Edwards, 736 College St., Clarksville, Tenn.
- Mark Swartz, Hershey, Pa.
- Henry McKowen, Altoona, Iowa.
- Geo. E. Strong, 807 No. Kingsley Dr., Los Angeles, Cal.
- Wm. H. Block Co., 463 Seventh Ave., N. Y. C.
- Edwards Hardware Co., Muncy, Penna.
- Leo G. Weyknechl, 330 W. 24th St., N. Y. C.
- C. W. Riley, Jr., 2109 Union Central ldg., Cincinnati, Ohio
- Harry F. Kline, 750 Brookridge Dr., Atlanta, Ga.
- Carl Hamilton, 228 Walnut St., Winsted, Conn.
- Philip R. Dixon, 7 Fox St., Fairview Heights, Cincinnati, Ohio
- W. Hansell, 116 E. Main St., Ottumwa, Ia.
- L. J. McAtee, 513 Main St., Pendleton, Ore.
- L. W. Haase, 430 Fourth Ave., Wauwatosa, Wis.
- F. D. Elis, W. V. Ry. Co., Oregon City, Ore.

- J. S. Brusstar, 639 12 W. 48th St., Los Angeles, Cal.
- J. Teichman, 8081 Rowland Ave., Phila., Pa.
- W. K. Hayes, 4820 Warnack, Phila., Pa.
- Alonzo Henderson, Mossy Rock, Lewis County, Wash.
- R. J. Dickinson, Presidio of 4th MR Bn, San Francisco, Cal.
- Fred A. Wimer, 568 S. Henry, Coquille, Ore.
- G. McLean, 5317 1/2 Monte Vista St., Los Angeles, Cal.
- Colin D. Murdoch, 501 City Hall, Tacoma, Wash.
- J. G. Greer, 3021 S. Norton Ave., Los Angeles, Cal.
- Mr. William Kaul, Box 484, Chelan, Wash.
- Julius E. Herman, 3759 102nd St., Corona, L. I.
- Arthur L. Barlow, 304 Continental Ave., Detroit, Mich.
- James W. Fields, Jr., 218 W. 23rd St., Chicago, Ill.
- R. E. Cordes, 7513 Dexter Blvd., Detroit, Mich.
- Mr. E. J. Morgan, 411 1/2 No. Ervay St., Dallas, Tex.
- Geo. W. Wiesner, Gervais, Ore.
- I. W. Logoman, 221 Fifth St., N.W., Oilwein, Iowa
- Dr. Eric G. Lilienkrantz, 1109 Mansana Blvd., Oakland, Cal.
- Mr. Earle E. Hazelton, 201 Fir St., Westwood, Cal.
- Radio-Electric Service Co., 403 Mills St., El Paso, Texas
- John Zagury, 5 Hillton St., Montclair, N. J.
- Harry E. Hauck, 1805 Pine St., San Francisco, Cal.
- Frank R. Jarvis, Ritz Carlton Hotel, Phila., Pa.
- W. C. Cassell, 416 N. Elizabeth St., Pittsburgh, Pa.
- The Kansas Power Co., Topeka, Kansas.
- Chas. Johnson, 36 Farrin St., Bath, Maine
- Edward A. Horner, 113 Walnut St., Pottstown, Pa.
- J. A. DeFonso, 624 Reynolds St., New Castle, Pa.
- J. C. Denison, 601 S. Sycamore St., Santa Ana, Cal.
- Frank E. Burger, 60 Fifth Ave., Long Island City
- Fred. M. Spencer, 160 N. E. 19th Terrace, Miami, Fla.
- J. A. Bogart, 33 Ridgeland Terrace, Rye, N. Y.
- Edward E. Votey, 6028 Palmetto St., Brooklyn, N. Y.
- M. Ross, 2690 University Ave., Bronx, N. Y.
- Frank S. Myers, P. O. Box 194, Berkeley, Cal.
- M. W. Sallins, 440 Elm St., Arlington, N. J.
- J. Laveng, 56 Mechanic St., New Haven, Conn.
- Richard E. Henry, Box 146, Madisonville, Ky.
- W. Hawton, Stewards, Dept., 54 N. River Pier, W. 14th St., N. Y. City
- Leroy Scott, 507 Ferry St., Detroit, Mich.
- A. Noel, Pando, Colorado
- Edward L. Kane, Crosstown Station, Memphis, Tenn.
- M. A. Richardson, Box 732, Ticonderoga, N. Y.
- G. T. Burch, 3710 Ridgecroft Rd., Gardenville, Baltimore, Md.
- W. A. Shaw, 722 No. Hayworth Ave., Los Angeles, Cal.
- Cotter Randall, care Bontell Bros., Minn., Minn.
- Charles Herrick, 376 E. 142nd St., N. Y. C.
- Leo Serenbetz, 107-41 92nd St., Ozone Pk., L. I.
- D. D. Baer, 71 Garrison Ave., Jersey City, N. J.
- The Crandall Pharmacy, 178 Hazle Ave., Wilkes-Barre, Pa.
- C. G. Schlegel, Kenesaw, Neb.
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- Rolland R. Stone, 429 Bockem, Mochto, Cal.
- O. Welander, 116 St., Troy, N. Y.
- T. Douglas Jones, 406 Cham. of Com. Bldg., Pittsburgh, Pa.
- T. J. Hielscher, 580 Magnolia Ave., Beaumont, Texas
- Chesley Spracklin, N. S. Sanatorium, Kentville, Nova Scotia, Canada
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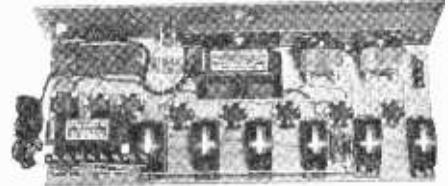
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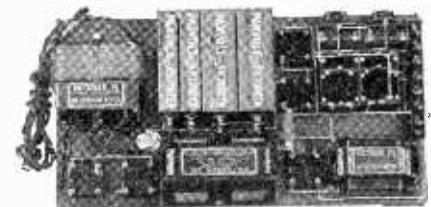
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Leslie J. Piles

Blown condensers mean burned-out transformers and tubes. It's economy to buy the best.



9 Acme Parvolts are specified for the Ferranti 250 B Power Supply in this issue.

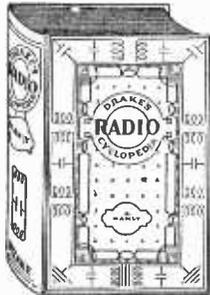
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Each rule, fact, method, plan, layout and diagram is instantly picked out and separated from everything else by placing all subjects in alphabetical order with cross references for every imaginable name under which the information might be classed.

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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.

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159 concern service men, 129 help the set builder, 162 help the experimenter, 153 interest the student, 75 assist in sales work, 73 interest set owners.

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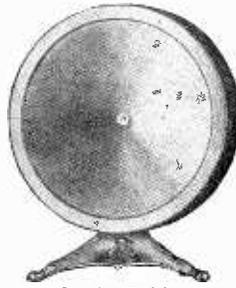
145 W. 45th St., New York, N. Y. (Just E. of B'way)
Gentlemen: Please mail me at once the new (second) edition of "Drake's Radio Cyclopedia," by Harold P. Manly, just published, with all the latest technical information in it. I will pay the postman \$6.00 plus a few cents extra for postage. If I am not delighted, I may return the book in five days and you will promptly refund my purchase money.

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Ideal for multi-tube high-power sets, and is the perfect Speaker for Electric Receivers in every price class.

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4-Tube Screen Grid Diamond of the Air Blueprint, full sized picture wiring diagram; also schematic diagram and panel layout.

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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.

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Select any TWO of these four publications, each of which will be sent to you (at only one address, however) each month for twelve months—in other words, 24 issues—if you will send in now your subscription for RADIO WORLD for two years (104 numbers) at \$10.00. RADIO WORLD'S subscription price for one year is \$6.00, so you gain the extra dollar by taking advantage of the liberal offer for two-year subscriptions; and, besides, you get a subscription for each of the TWO other magazines selected from the enumerated list, making a total of 128 numbers for \$10.00.

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These offers are rightly regarded as among the most liberal ever made, but as they are limited as to expiration date (see notice below) you must act now.

Please use the attached coupon.

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RADIO WORLD, 145 West 45th Street, New York City (Just East of Broadway):
Enclosed please find \$10.00, for which send me RADIO WORLD each week for two years (104 numbers), and also send me, without extra cost, each month for one year each of the following TWO magazines—total, 24 issues—grand total, 128 numbers:

- | | |
|--|--|
| <input type="checkbox"/> RADIO NEWS | <input type="checkbox"/> RADIO (San Francisco) |
| <input type="checkbox"/> SCIENCE AND INVENTION | <input type="checkbox"/> BOYS' LIFE |

If you want one of each, put a cross in a square next to the name of each of the two other magazines. If you want a two-year subscription for ONE of the above magazines, with the two-year subscription for RADIO WORLD (same grand total of 128 numbers), put two crosses before the name of one magazine.

If you prefer to pay \$6.00 for only one year's subscription for RADIO WORLD (52 numbers) and get one of the other magazines for one year, without extra cost, put one cross in one square in front of the name of one magazine.

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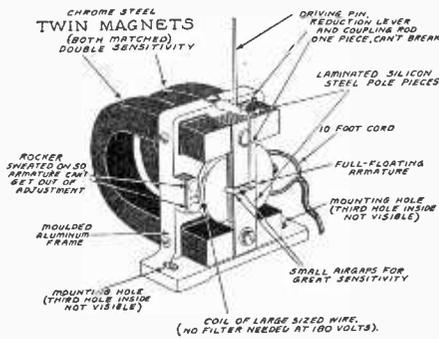
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THIS OFFER EXPIRES AT NOON ON DECEMBER 15TH, 1928

MOST REMARKABLE OFFER!



THE POLO Duo-Magnetic Unit has been acclaimed the outstanding unit.

Satisfy yourself it is louder, clearer, stronger, purer, better. Compare it with anything else in the world. Take **NINETY DAYS** for your trial: At the end of that time, if you want to keep the unit—and you will—then send the extra \$4. Otherwise return the unit in 90 days and get your \$6 back.

Polo Unit (With Bracket, Cord, Apex, Chuck and Hardware)
List Price, \$10.⁰⁰

Just think of it! **NINETY-day trial!**

Compare!

Make your comparisons all-inclusive, even against dynamic speakers. If you have a 171, 171A, 210, or 250 output tube, or any of these in push-pull, there won't be so much difference between the \$10 Polo Unit and the considerably more expensive dynamic speakers. But if you use 112, 112A, 120 or other similar power tube, or no power tube, the Polo Unit, with any cone or cloth speaker, will far outclass even the dynamic.

Take immediate advantage of our liberal offer. You must use attached coupon. Send \$6 and try out this marvelous Polo Unit at **OUR** risk.

We guarantee immediate shipment.

YOU MUST USE THIS COUPON

POLO ENGINEERING LABORATORIES
(Tel. Cortlandt 5112)
57 Day Street, New York City

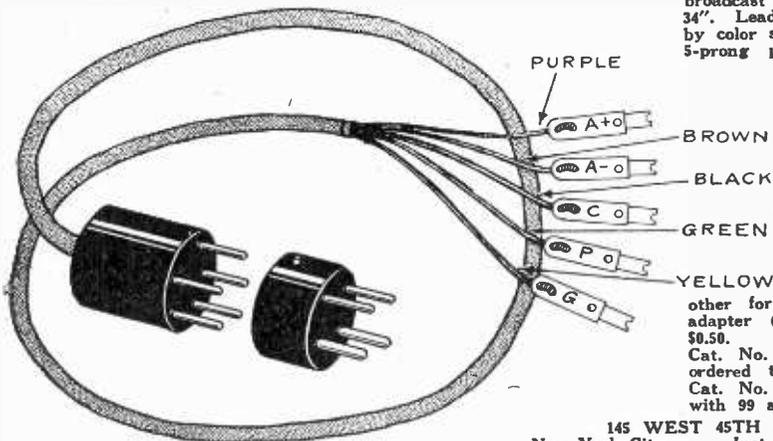
Enclosed please find \$6.00 on account, for which please send me at once one Polo Duo-Magnetic Unit, mounting bracket, 10-ft. cord, apex, chuck and hardware. I will send you the extra \$4 (making total of \$10) within 90 days after your date of shipment, to complete the purchase; or within 90 days will return the unit for complete, quick refund of purchase money.

Name.....
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NINETY-DAY Money-Back Guarantee

PLUG AND CABLE for any SHORT WAVE ADAPTER

Handiest thing for ANY short-wave adapter. Put detector tube of your present set in socket of any short-wave adapter you build, put plug in detector socket of your broadcast receiver. Cable, 34". Leads identified both by color scheme and tags. 5-prong plug and 5-lead cable for AC short wave adapter. May be used as 5-lead battery cable plug with UY socket. (Cat. No. 21AC) \$1.50. 4-prong extra plug only, necessary addition to other for DC short-wave adapter (Cat. No. 21DC) \$0.50. Cat. No. 21AC and 21DC ordered together \$1.75. Cat. No. 21AC and 21DC with 99 adapter \$2.25.



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Bakelite Front and Aluminum Subpanel

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4-Tube Screen Grid

DIAMOND OF THE AIR - -

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

GUARANTY RADIO GOODS CO.

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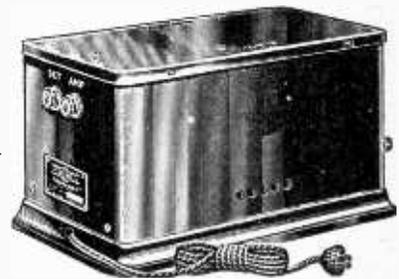
NEW YORK, N. Y.

\$5.00

ELIMINATE BATTERIES!

**NO Change in Set Wiring
NO Change in Tubes**

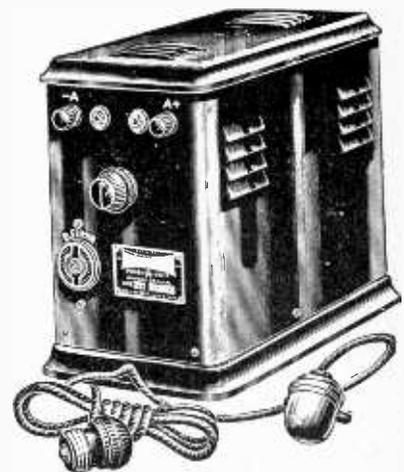
"B" Eliminator, Using Raytheon Tube, Replaces "B" Batteries and Gives Great Satisfaction.



No. B16—"B" Eliminator for 50 to 60 cycle, 105 to 125-volt AC house current. Max. voltage, 180, with one variable detector and one variable intermediate voltage. Weight 16 lbs. Size, 6 x 6 1/4 x 11 1/2". Quiet, economical. Requires no attention. Sold only with Raytheon tube. Price, including Raytheon BH125 mill. tube and built in connector cord and plug. **\$16**

Famous Raytheon Tube With Each "B" Eliminator

"A" Eliminator, Using Dry Plate Rectification, Current Well Filtered; Replaces "A" Battery.



No. A22—"A" Eliminator. Supplies up to 2 1/2 amperes at 6 volts. Variable resistance permits adjustment to number of tubes in set. Supplies A current and voltage to sets using from 4 to 10 quarter ampere tubes, or equivalent current drawn by any other combinations. Tip jacks for voltmeter readings. Receptacle for "B" eliminator plug. Pendant switch controls everything. Set switch needn't be touched. Device requires no attention. Uses no tube. Size: 10 1/2" high, 6 1/2" wide, 11 1/2" long. Shipping weight, 27 lbs. **\$22**

POLO ENGINEERING LABORATORIES,
57 Day St., N. Y. City
Please ship at once—

- One 180-volt maximum "B" eliminator, with variable detector and variable intermediate voltage (three different voltages in all); equipped with one Raytheon BH tube, 125 milliamperes rating. I will pay \$18, plus a little extra for freight, on receipt of goods, which are to be on approval for ten days (money back, if desired after 10-day trial).
- One "A" eliminator, 2 1/2-ampere maximum at 6 volts, using dry plate rectification, large choke and large capacity condenser. AC switch, receptacle for any "B" eliminator plug, variable resistor, all built in for which I will pay \$22, plus a little extra for freight.
- Both the "B" eliminator and the "A" eliminator, at total of \$36, on same approval basis.

Note: If fast express shipment is preferred, rather than slower freight, put a cross here

Name.....
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ALL SHIPMENTS MADE ON APPROVAL FOR TEN DAYS

All prices quoted are NET!

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RADIO TUBES

201A	\$1.06
200A	2.00
112A	2.00
171A	2.00
112	1.85
171	1.85
UX199	1.25
UV199	1.25
UV199 (standard socket)	.....	1.25
226AC	.....	2.00
227AC	3.50
240	1.50
222	3.50
280	3.50
281	5.00
210	6.50
250	6.50

KELLY TUBE COMPANY
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SPEAKERELAY

Cat. No. 121

\$2



For connecting two speakers by turn of knob so that at No. 1, left, you operate one speaker alone; at No. 2 you operate both speakers together; at No. 1, right, you operate the other speaker alone. Excellent for store demonstrations or home use. Earphones may be substituted for one speaker.

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BROOKLYN, N. Y.

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Manufacturers of highest quality condensers and resistors that are—
Built to Endure!

AEROVOX
72 WASHINGTON ST., BROOKLYN, N.Y.

Write for the Research Worker, a free monthly publication.

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.

The New HBH

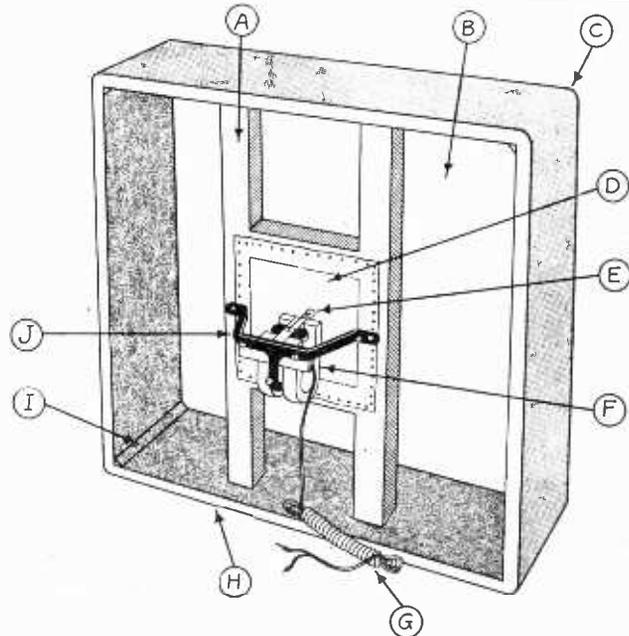
Irish-Linen Diaphragm Speaker

DeLuxe Finish; Built-up, Ready to Play

(Cat. A No. 1DLB)

\$19.50

Beautiful to Eye and Ear



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—Pole Unit.
- G—10-Foot Cord.
- H—Rigid DeLuxe Frame, 24x24"
- I—Splice Jointed.
- J—Moulded Metal Bracket.

Enjoy the Big Thrill!

THE new HBH Irish-Linen Diaphragm Loud-speaker, 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 diaphragm, tightly stretched on a rigid baffle and properly "doped," produces the outstanding results.

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, and we will refund your money at once. No delay! No questions asked!

GUARANTY RADIO GOODS CO.
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(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.

Name

Address

City State

SEND NO MONEY!

Strikingly Beautiful

THE mottled finish on the splice-jointed (not nailed) frame, in mellow tones, with conservative gold edging, plus the gracefully rounded corners, makes the speaker beautiful to behold. A thrown-together appearance characterized such speakers in the past, but here is one so different you'll be proud to exhibit. The woman of the house will appreciate its beauty, too.

The mechanical construction is perfect.

PARTS PRICE LIST

Cat. A No. 1. DLNB. Entirely complete kit for same speaker, with Polo Unit, dope, constructed de luxe frame, linen, etc.	.....	\$17.50
Cat. A No. 1. DLF. Built-up, high-grade round-edged de luxe frame, splice-jointed, not nailed; size 24x24 inches with moulding; also H-shaped upright support, splice-jointed; also hardware for attaching upright to frame.	.....	5.50
Cat. A No. 5. Thinnest Irish linen for front diaphragm, 26x26 inches	.....	2.00
Cat. A No. 6. Airplane cloth 8x8 inches for rear piece	.....	.25
Cat. A No. 7. Polo Duo-Magnetic Unit, with factory-adjusted and sealed armature, apex, thumbscrew, nut, 10-foot cord, moulded mounting bracket	.....	10.00
Cat. A No. 9. One can finest "dope" (good for three thin coats)	.....	1.25
Cat. A No. 10. Two cans "dope" (for five good coats)	.....	2.00
Cat. A No. 11. Apex, chuck, thumbscrew, nut	.....	.25

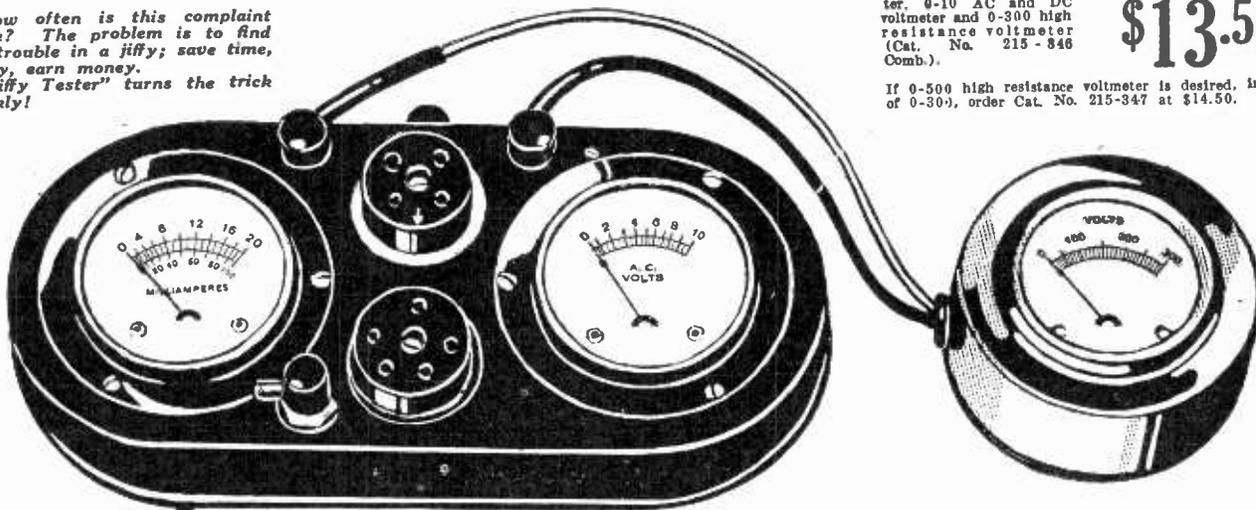
"JIFFY TESTER" Pays You Profits!

"Something wrong with my set!"
 How often is this complaint made? The problem is to find the trouble in a jiffy; save time, worry, earn money. "Jiffy Tester" turns the trick quickly!

Jiffy Tube and Set Tester, consisting of 0-20, 0-100 combination milliammeter, 0-10 AC and DC voltmeter and 0-300 high resistance voltmeter (Cat. No. 215-346 Comb.).

\$13.50

If 0-500 high resistance voltmeter is desired, instead of 0-300, order Cat. No. 215-347 at \$14.50.



The 5-prong plug fits 5-prong AC tube socket of receiver. The 4-prong adapter converts the plug for tests of 4-prong tubes.

The 215 Jiffy Tester makes twelve vital tests in 4 1/2 minutes, locates trouble, ends fuss, saves you time and nerves, and makes money for you, because you get the same pay for doing the same job quickly and scientifically as you can get for doing it slowly and unscientifically. The Tester is built to withstand hard knocks and rough usage.

Even More Accurate than Your Work Requires

The meters are accurate to 5% plus or minus, which is more than ample for service work, home experimenting, and all other needs, except commercial laboratory testing.

Twice as great accuracy costs four times as much. Note how extremely low the price is. You cannot buy any other such Tester at anywhere near that price. Great production makes possible our low price.

- Cat. No. 215-346 Comb. Consists of:
- (1) One newly-designed Two-in-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1/2 to 7/2 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" 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.

[Note: A pair of adapters for UV199 tubes, Cat. No. 999, at \$1 extra. These are not sold except with 215-346 Comb. on 215-347 Comb.]

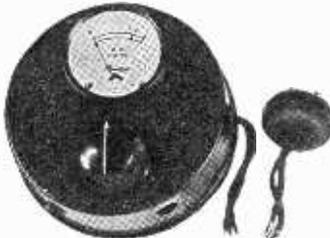
Individual Meters for Portable or Panel Use



0-300 high resistance voltmeter, for testing all B voltages up to 300. 30" tipped cord. Nickel finished case. Cat. No. 346 \$4.50



Cat. No. 326 The panel voltmeter Cat. No. 326 reads DC voltages, 0-6. Put one on any set you build, using DC tubes.....\$1.65
 The panel milliammeter, Cat. No. 390, reads 0-100. This is much more current than any set is likely to draw, so you can read the total B current drain of any set.....\$1.65



Cat. No. 218 Voltage Regulator, to save life of AC tubes.....\$5.00

POCKET AND PORTABLE VOLTMETERS

- No. 8—For testing A batteries, dry or storage, 0-8 volts DC scale.....\$1.65
- No. 10—For testing A batteries, dry or storage, 0-10 volts DC scale..... 1.65
- No. 13—For testing A batteries, dry or storage, 0-16 volts DC scale..... 1.65
- No. 50—For testing B batteries, dry or storage, but not for B eliminators, 0-50 volts DC scale 1.65
- No. 39—For testing B batteries, dry or storage, but not for B eliminators, 0-100 volts DC scale 1.85
- No. 40—For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale.. 2.25
- No. 42—For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale 2.00
- No. 346—For testing B voltage, including eliminators. High resistance water 0-300 volts DC scale 4.50
- No. 347—Same as No. 346, except that scale is 0-500 volts..... 5.50
- No. 348—For testing AC current supply line, portable, 0-150 volts..... 4.50

PANEL AC VOLTMETERS

- (Panel meters take 2-5/64" hole)
- No. 351—For reading 0-15 volts AC.....\$2.25
 - No. 352—For reading 0-10 volts AC..... 2.25
 - No. 353—For reading 0-6 volts AC..... 2.25
- (See No. 348 under "Pocket and Portable Voltmeters.")

PANEL VOLTMETERS

- No. 335—For reading DC voltages, 0-8 volts, \$1.65
- No. 310—For reading DC voltages, 0-10 volts, 1.65
- No. 316—For reading DC voltages, 0-16 volts, 1.65
- No. 326—For reading DC voltages, 0-6 volts, 1.65
- No. 337—For reading DC voltages, 0-50 volts, 1.65
- No. 339—For reading DC voltages, 0-100 volts, 1.75
- No. 342—For reading DC voltages, 0-150 volts, 1.75
- No. 340—For reading DC voltages, double reading, 0-8 volts, 0-100 volts..... 2.25

VOLTMETERS

- No. 18—For testing amperage of dry cell A batteries and voltage of dry or storage A batteries, double reading, 0-8 volts, and 0-40 amperes DC\$1.85
- No. 35—For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC 2.00

PANEL MILLIAMMETERS

- No. 311—For reading 0-10 milliamperes DC..\$1.95
- No. 325—For reading 0-25 milliamperes DC.. 1.85
- No. 350—For reading 0-50 milliamperes DC.. 1.65
- No. 390—For reading 0-100 milliamperes DC.. 1.65
- No. 399—For reading 0-300 milliamperes DC.. 1.65
- No. 394—For reading 0-400 milliamperes DC.. 1.65

VOLTAGE REGULATOR

- No. 218—For preventing excess voltage on the filament and cathode of AC tubes, by compensating for excess line voltage.....\$5.00

POCKET AMMETER

No. 1—For testing dry cells, 0-40 ampere DC scale pocket meter\$1.50

DC PIN JACK VOLTMETERS

- No. 306—For Radiolas No. 25 and 28, 0-6 volts DC\$2.50
- No. 308—For No. 20 Radiola, 0-6 volts DC.. 2.50
- No. 307—Desk type voltmeter with cord, 0-6 volts DC 2.50

6-VOLT A BATTERY CHARGE TESTER

No. 23—For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times.....\$1.85

PANEL AMMETER

No. 338—For reading amperage, 0-10 amperes DC\$1.65

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

- Please send me at once, by parcel post, on a 10-day money-back guaranty, one Jiffy Test Outfit, consisting of one No. 215 and one No. 346 combination, for which I will pay the postman \$13.50, plus a few cents extra for postage.
- If 0-500 volts, 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.

Send me the following individual meters (quantity in square):

- Cat. No. Cat. No. Cat. No.
- Cat. No. Cat. No. Cat. No.

NAME

ADDRESS

CITY STATE.....
 TEN-DAY MONEY-BACK ABSOLUTE GUARANTY!