

SEPT. 28th
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RADIO

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WORLD

The First and Only National Radio Weekly

392nd Consecutive Issue—EIGHTH YEAR

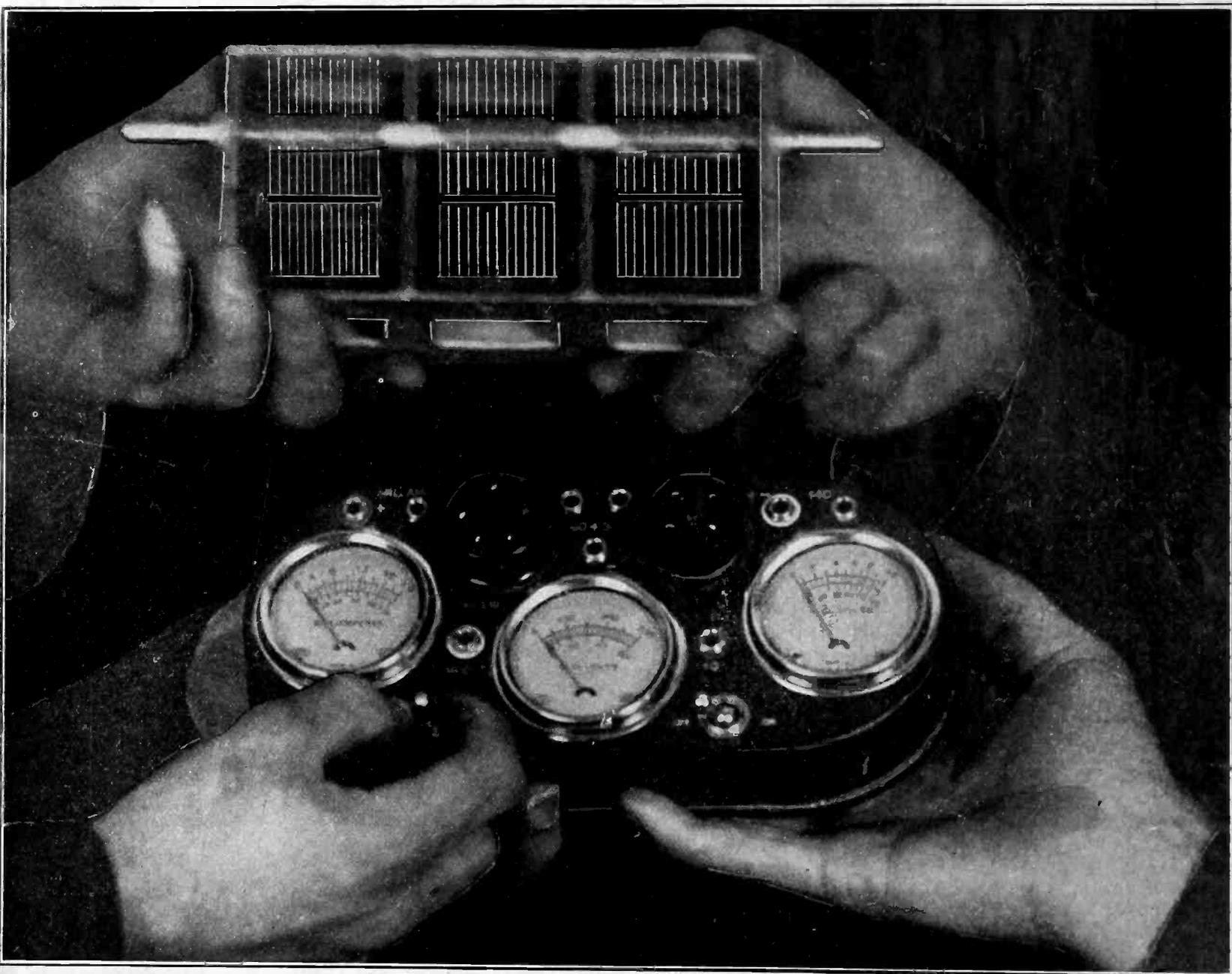
Engineers Encouraged
On Television

245 Power Amplifiers

AC Model HB Compact

Foreign Short Wave
Stations by Countries

NEW PARTS EXHIBITED



See announcement of new parts as exhibited at the New York Radio Show on page 12

New High Mu AC Tube

228 Provides Higher Amplification and is an Excellent Power Detector



228 AC High Mu Tube, with an amplification factor of 45 is an exclusive contribution to tube science by Kelly laboratories.

WHEN signals are weak in an up-to-date AC receiver using 227 tube as detector or audio amplifier, replace the 227 with the new 228 high mu AC tube and be amazed at the difference in volume.

The up-to-date receivers have high impedance primary in the first audio transformer, or have a resistor in the plate circuit, so the high mu tube is a boon indeed.

As a detector the 228 can be used with leak and condenser, with grid returned to cathode, or as a negative bias (power) detector. See table, lower left corner.

Since the 228 has the same base, same prongs and same heater voltage as the 227, it can be used for replacement and improvement, and without requiring any wiring changes or any other changes. Simply insert the 228 in the socket from which the 227 is removed.

228
\$2.50

CHARACTERISTICS OF THE 228

Heater voltage 2.5 volts AC.
Heater current 1.75 amperes.
Amplification factor 45.
Mutual conductance 1,000.
Plate voltage 180 volts.

Grid bias, detector -6 volts.
Grid bias, amplifier -2.5 volts.
Load resistance, 0.1 to 0.5 meg.
Internal plate resistance 45,000 ohms.

The plate current under normal operation is less than one milliamper. Hence the 228 tube imposes minimum load on the B supply.

The 228 is not suitable as a radio frequency amplifier.

224 at \$3.00—245 at \$2.25—227 at \$1.50—226 at 95c

The screen grid tubes have proved not only their capability but their dependability, and in AC circuits the 224 AC screen grid tube is popularly used as amplifier and detector, with the 245 as output, singly or in push-pull. Safe and satisfactory, Kelly 224 tubes are made with the same expertness and precision that characterizes the entire line of Kelly tubes. Our products are used by laboratories, technicians, experimenters and general consumers because of proven merit.

The Kelly 224 screen grid tube is not only excellent as a radio frequency amplifier but as a detector, especially applicable as a space charge detector.

A suitable high impedance load should always be in the plate circuit of any screen grid tube. For RF a large untuned primary, or a tuned primary, for detection and AF a resistor of 50,000 ohms or higher, usually considerably higher, or a high impedance inductance. You will find Kelly 224 fully meets your most exacting requirements.

The 224 and 227 are 5-prong (UY) tubes, the 245 and 226 4-prong (UX) tubes.

Battery Type Screen Grid 222 at \$3.50

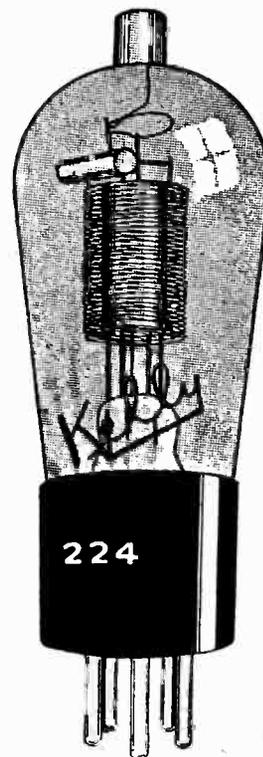
The battery operation the 222 screen grid tube is an important contribution, because enabling such high amplification that battery circuits are put on a par with AC circuits in performance. The 222 is the most popular battery-operated tube for up-to-date circuits and the Kelly model is made to produce clear reception and have exceptionally long life.

5-Day Money Back Guarantee!

You run no risk whatever when you purchase Kelly tubes. Not only are they expertly made but they are sold on a 5-day money-back guarantee. This exclusive form of protection enables you to be the ultimate judge in your own laboratory or your own home, with no appeal from your decision on our part. If you are not delighted with the performance of Kelly tubes, we are not even satisfied,

and will promptly refund your money on the foregoing 5-day basis.

If at any time after the five days expire, after receipt of tubes by you, there should develop any adverse condition for which you deem the tube at fault, you may communicate directly with us, and we will give the matter prompt attention. Our aim is to render a real service and through such efforts have we built up our volume of business.



Kelly Tube Company, 143 West 45th St., N. Y. City
Enclosed please find \$..... for which ship at once tubes marked below:

<input type="checkbox"/> 228 AC high mu. @.....\$2.50	<input type="checkbox"/> 222 battery screen grid.....\$3.50
<input type="checkbox"/> 224 AC screen grid @.....\$3.00	<input type="checkbox"/> 240 battery high mu.....\$1.25
<input type="checkbox"/> 245 AC power tube @.....\$2.25	<input type="checkbox"/> 112A battery power tube.....\$0.95
<input type="checkbox"/> 226 AC amplifier @.....\$0.95	<input type="checkbox"/> 171A battery power tube.....\$0.85
<input type="checkbox"/> 227 AC det.-amp. @.....\$1.50	<input type="checkbox"/> 201A battery tube.....\$0.65
<input type="checkbox"/> 171A AC power tube @.....\$0.95	<input type="checkbox"/> UX199 battery tube.....\$1.25
<input type="checkbox"/> 210 AC power tube @.....\$4.50	<input type="checkbox"/> Matched pair of 245s for push-pull (for both).....\$4.50
<input type="checkbox"/> 250 AC power tube @.....\$6.00	<input type="checkbox"/> Matched pair 171As for AC Push-Pull (for both).....\$1.90
<input type="checkbox"/> 280 AC rectifier @.....\$1.75	
<input type="checkbox"/> 281 AC rectifier @.....\$3.50	

ALL PRICES QUOTED ARE SELLING PRICES AND ARE NET

Name

Address

City State.....

Put cross here if C.O.D. shipment is desired.

Types of Tubes and Their Voltages

Tube	Fil. Volt	Amplifier		Detector		Remarks
		Plate Volts	Neg. Bias	Plate Volts	Neg. Bias	
228	2.5 AC	180	2.5	180	6	Heater type, 5 prongs.
224	2.5 AC	180	1.5	180	6	Heater type; SG volts, 75
245	2.5 AC	250	50.0	—	—	—
226	1.5 AC	135	9.0	—	—	—
227	2.5 AC	180	9.5	180	18-25	Heater type
171A	5ACorDC	180	40.5	—	—	—
210	7.5 AC	350	27.0	—	—	—
250	7.5 AC	450	84.0	—	—	—
280	8.0 AC	350AC	—	—	—	Full-wave rectifier
281	7.5 AC	700AC	—	—	—	Half-wave rectifier
222	3.3 DC	135	1.5	135-180	4-7	SG volts, 45
240	5.0 DC	135-180	3-4.5	135	1.5-3	—
112A	5.0 DC	135	9.0	135	Leak-cond.	—
UX199	3.3 DC	90	4.0	90	Leak-cond.	—

Surpassing Results from HB Compact!

Screen Grid Circuit for AC or Battery Operation Is a Knockout!

THE screen grid tubes, both AC and battery types, 222 and 224, promised much. They could be used to provide actual amplification of 150 per stage, as compared with 8 per stage for a general purpose tube. If only the screen grid tube could be used at full practical amplification! Then a few tubes would do the work of many! At radio frequencies it was found that tuning the plate circuit put the mule kick into the set.

Sensitivity

But the whole wave band could not be tuned in. So Herman Bernard invented a coil—the Bernard dynamic tuner—that accomplished the trick. Full amplification plus full wave-band coverage! That's why his HB Compacts, only four tubes (plus a 280 in the AC model) perform like eight-tube sets! The sensitivity is incredibly high.

It would be far short of an accomplishment to hook indifferent audio onto a grid leak-condenser detector. So in both models he used a power detector, two resistance audio stages producing undistorted volume exceeding that of any ordinary two-stage audio

Realism

amplifier, amplification sufficient to load up the power tube in each instance. And in the case of the AC model HB Compact it is a 245, with 1,600 milliwatts maximum undistorted power output, standing enough gaff for a small hall! And what tone realism! Breath-taking! Nothing in radio ever excelled this tone quality! Nothing! Absolutely nothing!

As the prices quoted in the list of component parts show, these advantages may be obtained economically. The battery model draws only 21 milliamperes of plate current, .664 amperes of filament current. Large B batteries would last a year at that rate, for average use, and a small A battery require recharging only every two months to ten weeks!

Economy

And this amazingly sensitive, most thrilling and utterly economical circuit gives you all the selectivity you will require, unless you live close to a powerful broadcasting station. So you get a super-abundance of results, in an unusual but thoroughly tried and tested, positively proven circuit!

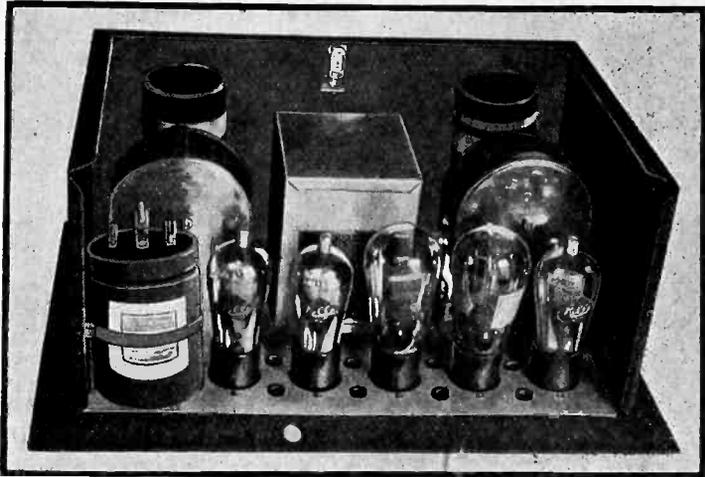
Selectivity

HB Compact, battery model, uses a 222 RF amplifier, a 240 (high mu) power detector, a 222 first audio and a 112A or 171A power tube. The RF tube's plate circuit is tuned by a new type coil that has a moving segment as part of the tuned inductance, with step-up ratio to untuned detector grid. The audio is resistance-coupled. A 7x14" front panel may be used, with baseboard, but the HB Compact Steel Cabinet, decorated brown, with satin aluminum subpanel, sockets affixed, is recommended.

HB Compact, AC model, uses a 224 RF amplifier, a 224 space charge power detector, a 224 first audio and a 245 output tube, with 280 rectifier. Except for the space charge feature, not suitable in the battery model, and the larger power tube, not economically powered by batteries, the two models are fundamentally the same. The AC model is still more sensitive, however.

The same steel cabinet is recommended for the AC model, while the aluminum subpanel has the five sockets affixed and the type of each tube (except detector) printed on each socket.

Order what individual parts you want.



View of the HB Compact AC Model, the tubes being, left to right: 224 detector, 224 first AF, 245 power tube, 280 rectifier and 224 RF. The subpanel is only 9 1/2 x 14 1/2", yet everything save the speaker is in this small space!

Component Parts for HB Compacts

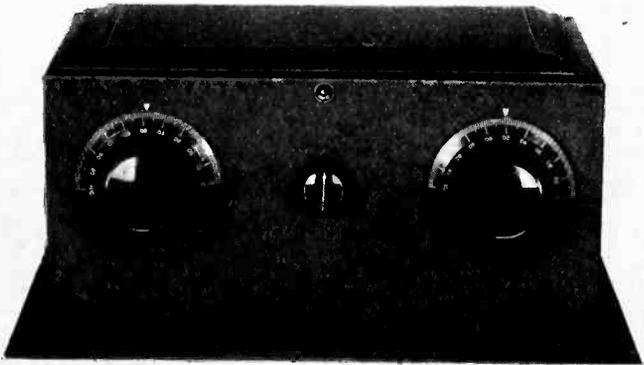
AC MODEL	
L1L2L3—Bernard Antenna Tuner BT5A.....	\$2.50
L4L5L6—Bernard Interstage Tuner BT5B.....	2.50
CT—One 80 mmfd. equalizer.....	.35
C1, C2—Two .0005 Dustproof @ \$2.50.....	5.00
C3, C4, C5—Four .01 mfd. @ .35.....	1.40
C7—One 1 mfd. 500V AC.....	.85
C8, C9, C10, C11—Mershon Q2-8, 2-18B.....	5.75
C12, C13—Two 1 mfd. 200 V. DC @ .50.....	1.00
R—One 25,000 ohm wire-wound pot.....	1.50
R1, R2, R3, R4—5, 1.0, .05 5.0 meg. @ .35.....	1.40
T1—Polo 245 Power Supply Cat. P245PS.....	10.00
2500, 4400, 774, 50, 8 (20 watt) Voltage Divider.....	1.75
PL—Bracket and 2.5 v. AC lamp.....	.70
OC, C6—Output choke, 2 mfd. 500 v. AC cond.	3.85
SP—, SP+—Two binding posts @ .10.....	.20
Three National grid clips @ .06.....	.18
F—One 1 amp. cart. fuse with base.....	.50
Aluminum socketed subpanel, 9 1/2 x 14 1/2", 8 brackets.....	3.25
Steel cabinet, crackled brown finish, 7 x 15 x 9 1/2".....	4.00
3 Insulating washers @ .03.....	.09
Two full-vision dials with pointers @ 75c.....	1.50
One AC pendant switch, double opening.....	.40
One 12 ft. length AC cable.....	.72
Two rolls Corwico braidite @ .35.....	.70
Two flexible couplers (links) @ .35.....	.70
	\$50.79

Kelly tubes: Three 224 @ \$3, one 245 @ \$2.25, one 280 @ \$1.75.....
 [National Company's coils, soon to be released Cat. BT5S, BTP5 @ \$5 each, may be used instead of BT5A and BT5B listed above @ \$2.50 each. National Velvet Vernier full-vision dials, instead of plain dials listed above, counterclockwise, @ \$1.75 each.]

BATTERY MODEL	
L1L2L3—One Bernard Tuner for antenna circuit, for .0005 mfd. tuning (BT5A of Screen Grid Coil Co.).....	\$2.50
L4L5L6—One Bernard Tuner for screen grid interstage coupling, for .0005 mfd. tuning (BT5B of Screen Grid Coil Co.).....	2.50
CT—One Hammarlund 80 mmfd. equalizing condenser.....	.35
C1, C2—Two .0005 mfd. Dustproof tuning condensers @ \$2.50.....	5.00
C3, C4, C5—Three .01 mfd. mica fixed condensers @ .35.....	1.05
R1—One .25 meg. metallized resistors.....	.30
R2, R4—Two 5.0 meg. metallized resistors @ .30.....	.60
R3—One .075 meg. metallized resistor.....	.40
R5, SW—One 75-ohm rheostat with switch attached.....	.80
R6—Two resistors, one 1.3 ohms, the other 6.5 ohms (both).....	.45
Ant., Gnd., Sp.—, Sp+. Four binding posts (all).....	.40
One drilled steel cabinet 7" high, 9 1/2" front to back, 15" wide.....	4.00
Two dials with pointers (both).....	1.50
One pilot light bracket with 6-volt DC lamp.....	.70
One 9 1/2 x 14 1/2" satin finish aluminum subpanel with sockets affixed, and supplied with insulated bushings, supporting brackets, and resistor clips.....	2.00
Two insulated links (flexible couplers) (both).....	.70
One 7-lead battery cable.....	.50
	\$23.75

Kelly tubes: Two 222, one 240, one 112A or 171A, total, \$9.20.
 [National Coils for the battery model, vernier condensers, see note under AC Model.]

[The HB Compacts were designed and built by Herman Bernard. The battery model was described in the August 24th, 31st, September 7th and 14th issues of Radio World.]
 [The AC Model is now being described. See page 6 et seq. of this issue.]



Front view of the HB Compact. The view is the same for AC or battery model. For batteries the switch is built in the rheostat. For AC a pendant switch is used at rear, in the AC cable.

Please Use This Coupon

GUARANTY RADIO GOODS CO.
 143 West 45th St., N. Y. City, Just E. of B'way.

Enclosed please find \$..... for which please send me component parts for the HB Compact as checked off above.

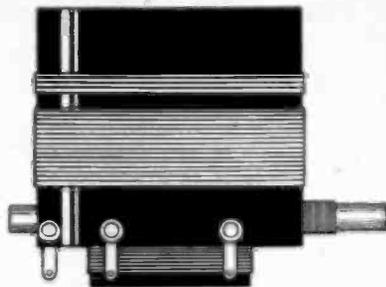
NAME.....

ADDRESS.....

CITY..... STATE.....

A NEW IDEA IN COILS!

The Bernard Tuner Works Screen Grid Tubes Up to the Hilt!

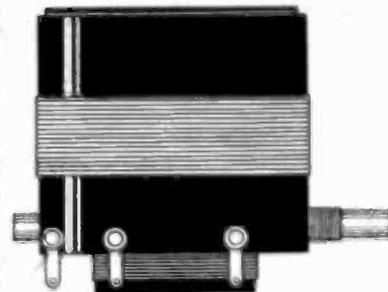


Cat. No. BT5A—\$2.50
FOR .0005 MFD. CONDENSERS
Bernard Tuner for antenna coupling, the primary being fixed and the secondary tuned. This coil is used as input to the first screen grid radio frequency tube. The double-action tuning method invented by Herman Bernard is employed. Adjust an equalizing condenser across the tuning condenser so that exactly the same dial settings prevail through all circuits. This equalizer, 90 mmfd., once set, is left thus. Cat. No. BT3A for .00035 mfd.\$2.65

FOR the first time in radio a coil has been designed that permits working the screen grid tube up to the enormous amplification level that theory long promised but practice long denied.

The secret lies in tuning the plate circuit of the screen grid tube, and still covering the entire broadcast band. Herman Bernard, noted radio engineer, invented the solution—a tuned coil consisting of a fixed and a rotating winding in series, the moving coil turned by the same dial that turns the tuning condenser. An insulated link physically unites condenser shaft and moving coil. Thus when the condenser plates are entirely in mesh the moving coil is set for maximum inductance, that is, it aids the other part of the tuned winding. As the condenser is turned to lower capacity setting the moving coil aids less and less, until at the middle of the dial it acts as if fixed. From then on the moving coil bucks the fixed winding, greatly reducing the total effective inductance, and thus nullifying the effect of the high starting capacity.

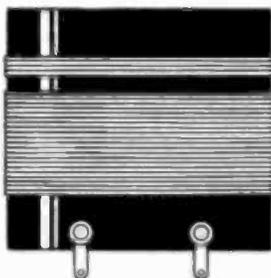
The Bernard Tuner is a two-winding coil for interstage coupling, working out of a screen grid tube, 222 or 224, and into any type tube. The tuned primary has coupled to it a still larger inductance, on separate inside form, for step-up, thus greatly increasing an already enormous amplification! This is Cat. No. BT5B for .0005 mfd., BT3B for .00035 mfd. Use BT5A or BT3A for antenna coupler, tuning the secondary, with an equalizing condenser across the antenna tuning condenser, so that the high minimum capacity of the tube's output will be duplicated at the input.



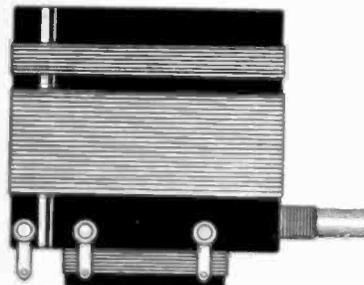
Cat. No. BT5B—\$2.50
FOR .0005 MFD. CONDENSERS
Bernard Tuner for working out of a screen grid tube, consists of a rotary coil in series with a fixed coil, the two constituting a tuned primary, for tuning the combined rotary and fixed windings to exceed the broadcast band of wavelengths. The condenser shaft and rotary coil shaft are physically coupled so one motion turns both. Develops the highest possible amplification from the screen grid tube. Cat. No. BT3B for .00035 mfd.\$2.65

The Diamond Pair

Since 1925 the Diamond of the Air has been an outstanding circuit. It has undergone few changes. When power tubes and screen grid tubes appeared these were included. When AC operation became practical, the model was described for such use. Whether battery-operated or AC-operated, the Diamond of the Air is a dependable and satisfactory circuit. It uses a screen grid RF stage, tickled detector and two stages of transformer coupled audio. The same coils are used for both models, battery or AC. The secondaries are tuned. They are matched with fine precision, to permit ganged tuning.



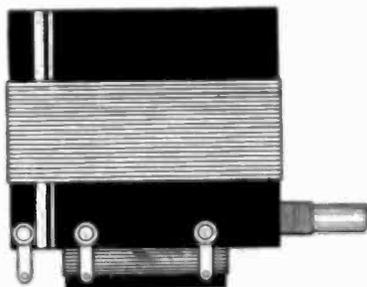
Cat. No. RF5—\$0.75
FOR .0005 MFD. CONDENSER
Antenna coil for any standard circuit, and one of the two coils constituting the Diamond Pair. The secondary is carefully wound to match the inductance of the companion coil's secondary, so equality of tuning prevails. Cat. No. RF3 for .00035 mfd.\$0.80



Cat. No. SGT5—\$1.25
FOR .0005 MFD. CONDENSER
Interstage 3-circuit coil for any hook-up where an untuned primary is in the plate circuit of a screen grid tube. This primary has a large impedance (generous number of turns), so as to afford good amplification. Used in the Diamond of the Air. SGT3 for .00035 mfd.\$1.30

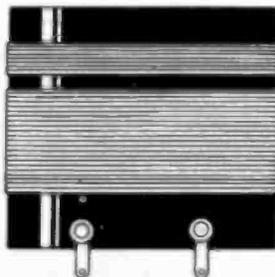
The Diamond Pair of coils for .0005 mfd. tuning are Cat. Nos. RF5 and SGT5. A circuit of excellent stability, extremely high selectivity and good sensitivity, the Diamond of the Air should be built with coils that permit full capitalization of the virtues of the circuit. Not only is the number of turns correct for this circuit on each coil, but the spacing between aperiodic primary and tuned secondary is exactly right. Note that the 3-circuit coil SGT5 (or SGT3) has a high impedance primary. This means good amplification from the screen grid tube, obtained in a manner that guarantees selectivity attainment.

ANTENNA COUPLER



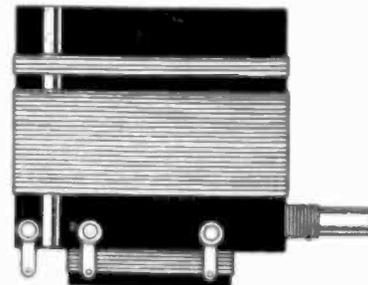
Cat. No. VA5—\$1.10
FOR .0005 MFD. CONDENSER
Moving primary and fixed secondary, for antenna coupling, adjustable from a knob at the front panel, thus providing volume control. Cat. No. VA3 for .00035 mfd.\$1.15

SG TRANSFORMER



Cat. No. SGS5—\$0.75
FOR .0005 MFD. CONDENSER
Interstage radio frequency transformer, to work out of a screen grid tube, where the generous-sized primary is in the untuned plate circuit. Cat. No. SGS3 for .00035 mfd.\$0.80

STANDARD TUNER



Cat. No. T5—\$1.25
FOR .0005 MFD. CONDENSER
Standard three-circuit tuner, for antenna stage, or interstage coupling where primary is in the plate circuit of any tube except a screen grid. Provides abundant selectivity and gives smooth tricker action. Cat. No. T3 for .00035 mfd.\$1.30

SCREEN GRID COIL COMPANY, 143 West 45th St., New York, N. Y. Just East of Broadway

Enclosed please find \$..... for which please ship at once, parcel post prepaid, the following coils:

Quantity	Cat. No.	Price									
<input type="checkbox"/>	BT5A	\$2.50	<input type="checkbox"/>	RF5	\$0.75	<input type="checkbox"/>	VA5	\$1.10	<input type="checkbox"/>	SGR5	\$0.75
<input type="checkbox"/>	BT3A	\$2.55	<input type="checkbox"/>	RF3	\$0.80	<input type="checkbox"/>	VA3	\$1.15	<input type="checkbox"/>	SGR3	\$0.80
<input type="checkbox"/>	BT5B	\$2.50	<input type="checkbox"/>	SGT5	\$1.25	<input type="checkbox"/>	T5	\$1.25	<input type="checkbox"/>	FL1	\$0.35
<input type="checkbox"/>	BT3B	\$2.55	<input type="checkbox"/>	SGT3	\$1.30	<input type="checkbox"/>	T3	\$1.30	<input type="checkbox"/>	EQ80	\$0.35

NAME

ADDRESS

CITY..... STATE.....

5-DAY MONEY-BACK GUARANTEE!

Insulated Link

A flexible coupling device to unite two independent 1/8" shafts for single dial operation of a tuning condenser and a Bernard Tuner. If the condenser has shaft protruding from the rear then the condenser may be power mounted and the coil shaft coupled by the link to either extension shaft of the condenser. If the condenser has no shaft protruding at rear, mount the Bernard Tuner on the front panel. It has shaft protruding at rear for coupling by the link to the condenser's front shaft. To make sure of insulated protection do not force the reciprocals of the link together when mounting.



FL1—\$0.35

Data on Construction

The coils are wound by machine on a bakelite form 3 1/2" wide, and the tuned windings have identical inductance for a given capacity condenser, i. e., .0005 mfd. or .00035 mfd. Full coverage of the wave band is assured. The wire is silk insulated.

All coils with a moving coil have single hole panel mounting fixture. All others have base mounting provision. The coils should be used with connection lugs at bottom, to shorten leads.

Only the Bernard Tuners have a shaft extending from rear. This feature is necessary so that physical coupling to tuning condenser shaft may be accomplished by the insulated link.

[Note: Those desiring the 90 mmfd. equalizing condenser for use with the antenna model Bernard Tuner BT5A or BT3A, should order EQ80 at \$0.35.]

SCREEN GRID COIL COMPANY
143 West 45th Street, New York City



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 September 28th, 1929
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Technical Accuracy Second to None
 Latest Circuits and News

EIGHTH YEAR

A Weekly Paper published by Hennessy Radio Publication Corporation, from Publication Office, 154 West 45th Street, New York, N. Y. (Just East of Broadway) Telephone, BRyant 0558 and 0559

TELEVISION STRESSED

By Engineers, Encouraged by Aspects

By Neal Fitzalan

VISUAL radio has been allotted the major portion of the September issue of "Proceedings of the Institute of Radio Engineers," with the Kennelly-Heaviside layer receiving nearly all the remaining space.

There are several important papers on visual radio by well-known engineers and experimenters in this field. Some of the material contained in these articles is familiar, but it has been presented in its relation to future developments and correlated with material which is not so well known. The most interesting part of these papers is that they clearly show that progress is being made in this fascinating field.

Dr. Alfred N. Goldsmith, vice-president and general engineer of RCA, introduces the subject of visual radio and outlines the problem. Then J. W. Horton, chief engineer of General Radio Company, and noted for his research work in television in the Bell Laboratories, contributes a paper on "The Electrical Transmission of Pictures and Images." He discusses in general the amount of information of any kind that can be transmitted over channels of different kinds in a given time.

Of particular interest is his analysis of the effect of the finite dimensions of the scanning area on the definition of the received image, or information, and the effect of phase shift in the transmission channel. He shows that under certain conditions the detail of the image will be shifted by as much as 180 degrees, that is, so that where there is a maximum density in the original there will be maximum luminosity in the reproduced image.

Refinements in Amplifiers

He also discusses the frequency requirements of the amplifiers used in the transmitter and the receiver to bring out the details. In this connection he shows that the distortion introduced by the finite dimensions of the scanning area can be compensated for by electrical equalizers. This correction proved to be practical in the Bell Laboratories.

The effect of frequency distortion is illustrated graphically. A square-top signal, such as would be produced by parallel black and white lines on the picture to be transmitted, is considered. To reproduce such a signal faithfully an infinite number of frequencies is required and the transmission system must retain not only the original amplitudes in proper ratio but also the original phase relations. The first distortion graph shows the effect of reducing the fundamental frequency by 20 per cent. The second shows the effect of shifting the phase of the fundamental component by 20 degrees. The phase shift produces by far the greater distortion.

In the concluding paragraph Mr. Horton says:

"The matter of fixing desirable performance limits is one which will have to be settled by extensive experimentation, and which will ultimately come within the scope of one form of the law of supply and demand. Picture transmission systems and television systems, like every other product of industry, will be built to those limits where the quality of the performance has a value identical with the cost of securing it. Scientifically the problems were all solved years ago; economically, it is just beginning to appear that a solution may be possible."

Push-Pull Photo Cells

Captain R. H. Ranger of the Radio Corporation then follows with a paper entitled "Mechanical Developments of Facsimile Equipment." The most interesting feature of this paper is the use of photocells in push-pull, a feat which had never before been done. It is credited to J. N. Whitaker of the Radio Corporation.

The object of using a push-pull arrangement, as in all cases

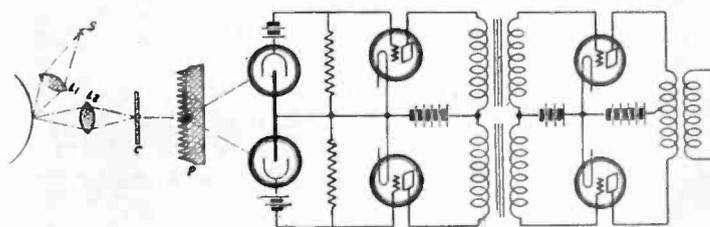


FIG. 1

DISTORTION EFFECTS IN TELEVISION SYSTEMS. (A)—ORIGINAL SQUARE-TOP SIGNAL. (B)—THE SAME SIGNAL WITH THE FUNDAMENTAL 20 PER CENT. REDUCED. (C)—DISTORTION OF THE SQUARE-TOP SIGNAL DUE TO AN ADVANCE IN PHASE OF 20 DEGREES IN THE FUNDAMENTAL.

where push-pull action is employed, is to overcome the distortion effects due to the non-linearity of the characteristics of the photocells and the amplifier tubes. To show the operation of the push-pull arrangement we reproduce a diagram which appears in the article. The principal portion of this figure is an ordinary push-pull amplifier. The input is taken from two equal photocells instead of two microphones or similar devices. So far there is really nothing unusual about the arrangement. The novelty enters in the manner in which the luminous signal from a single point on the picture is divided between the cells.

The light from a strong source S is focused sharply by means of lens L1 on the picture to be transmitted, which is represented by a section from a cylinder. The light is reflected by lens L2, which focuses it on a narrow slit in C. Interposed between the slit and the photocells is a glass disc near the circumference of which are many tiny prisms. The section of the disc and prisms through which the line beam passes is shown at P. The disc revolves at a rate of about 3,000 revolutions per minute. As the disc turns the light beam is intercepted by the prisms, falling successively in the trough, on the side, on the crest, and finally on the other side. The beam is refracted in various degrees and is sent first into one photocell and then into the other, the intensity of the light increasing in one cell and decreasing in the other. Thus the push-pull effect is produced.

The disc is driven by an air turbine under a pressure of 2 pounds and the speed is controlled within desired limits by a small governor. The object of using an air motor for driving the disc rather than an electric motor is to avoid electrical disturbances with the picture transmitter.

Another interesting point in this paper is that facsimiles can now be received in any color, or in combination of colors, at the direction of the operator of the transmitter.

Jenkins Discusses His Television

C. Francis Jenkins, inventor of television devices, gives additional details of his methods of scanning. He outlines some of the principal difficulties in television and suggests that the application of the principle of persistence of light rather than of vision will lead to a solution of the problem of inadequate illumination.

Julius Weinberger, Theodore A. Smith and George Rodwin, all of the Radio Corporation of America, recount some of the experiences and conclusions of this research organization.

AMPLIFIERS

to Be Used With These Devices

Herman

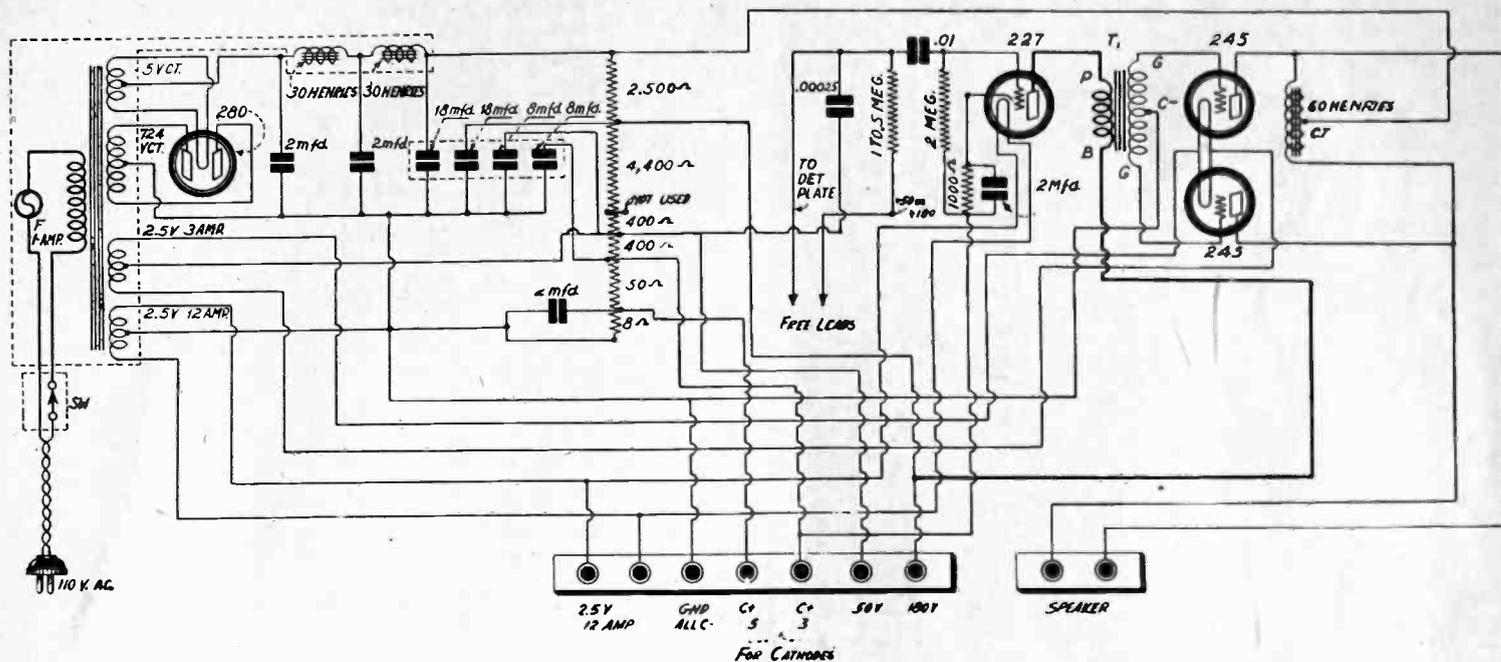


FIG. 2

THE SAME ARRANGEMENT, EXCEPT FOR THE USE OF 245 PUSH-PULL OUTPUT. THE VOLTAGE THAT READS C PLUS 5 SHOULD BE C PLUS .5 AND THE DETECTOR PLATE RESISTOR SHOULD READ .1 TO .5 MEG.

pull circuit uses a center-tapped impedance coil, such as Silver-Marshall 258. The same choke may well be used for the single-sided circuit, by ignoring the center-tap, and using simply the extreme terminals, or some other high-inductance choke may be used.

Detector Voltages

The single-sided circuit shows an output voltage divider. This may have optional posts for push-pull, as shown, where the lower resistance is used for bias with push-pull because the current is proportionately heavier and affords the same actual biasing voltage. But another way of doing the same thing is to use the same voltage divider as would serve for a single-sided output, and connect an 800-ohm resistor from the 858-ohm tap to ground.

The biasing voltages are marked at minimum, these being 0.5 volt for space charge detector on the bias detection principle, should that type be used; 3 volts for the radio frequency amplifiers; 50 volts for the power tube or tubes. In either instance the power tube negative bias voltage is available as a positive voltage for the screen grids (G posts of sockets), because of circuit independence.

If regular power detection is used with either type tube, the 50-volt tap may be used for the plate of the detector, and the 3-volt tap for the cathode of the detector, grid return being made to ground, or, in the push-pull circuit, the detector cathode may be connected to the first audio cathode, grid return to ground, and 180 volts applied to the plate. For leak-condenser detection use the 50 volts for the detector plate.

Free Leads Explained

On account of these optional detector plate voltages, the B-plus detector is shown as a free lead, and is next to the naturally free lead of the detector plate. Connect the free plate lead to the detector plate, the unconnected end of the plate resistor to plus 50 or 180 volts, as previously stated circumstances require.

A THOUGHT FOR THE WEEK

IF we are to judge by the announcements of important broadcasting stations the coming winter season will be the most interesting and important in the history of entertainment over the air. The point has been reached where it is recognized that nothing is too good for the radio audience. That's great for everybody concerned.

Constants for Circuits

For Push-Pull Output

The constants are: One Polo 245 transformer block, with chokes built in; two 2 mfd. 500 volt AC working voltage condensers; one Mershon, Q2-8, 2-18, two 2 mfd. 200 volt bypass condensers; one voltage divider; two binding post strips; one AC pendant switch with 12-ft. AC cable and wall plug; one 1 amp. cartridge fuse with holder; three UX and one UY sockets; one .00025 mfd. fixed condenser; one .01 mfd. fixed condenser; one .1 to .5 meg. plate resistor, one 2 meg. grid leak; one push-pull input transformer (Ferranti or National); one output impedance, S-M 258; one 1,000 ohm 5 watt resistor; one baseboard; four tubes.

For Single Output

For the single-sided circuit the 1,000 ohm resistor and push-pull input transformer are omitted, the positive connection of the power tube filament is moved up one post; the two audio resistors for the second stage, with their .01 mfd. isolating condenser take the place of the input transformer.

Radio Examination Book

How to Pass U. S. Government Radio License Examinations, by Rudolph L. Duncan and Charles E. Drew. Publisher, John Wiley & Sons, Inc., New York, (\$2.00).

This book is virtually a complete course in radio transmission and reception written, in the question and answer style, with special emphasis on commercial operating. The subject matter is illustrated with many line cuts of circuits and half tones of equipment.

NEEDS DETECTOR

Bernard

if the space charge method can not be made to work properly. The data on which to base these experiments were published last week.

Also five photographs were published last week that give an excellent insight into the layout of parts.

The aluminum subpanel has the five sockets affixed and all but the detector are marked with the type of tube. With the subpanel come brackets for mounting the tuning condensers. For each condenser there are one very strong main bracket and three subsidiary brackets. The subsidiaries are merely anti-sway brackets, to insure condenser rigidity during tuning. The tuning coils themselves are mounted on the front panel, which is an integral part of the steel cabinet recommended for this circuit, a cabinet 7 x 15 x 9½", small, indeed. Yet all the parts are contained therein.

Constructional Advice

Looking at the back of the cabinet, with subpanel in place inside, the four Mershon condensers in one copper container are at left, and there are holes in the subpanel to accommodate the Mershon brackets, as well as one hole in the base flange of the steel cabinet to enable the same screw that holds one side of the Mershon bracket to be utilized for securing the subpanel to the cabinet flange at one point. This cabinet, by the way, has a handsome brown crackled finish, and is fittingly ornamented even in a luxurious room.

With coils, volume control and pilot light on the front panel, and tuning condensers, Mershon sockets, brackets and voltage divider on the subpanel, the principal remaining considerations are the power transformer (Po'o Cat. No. P245-PS), the paper dielectric filter condensers and, if a magnetic or inductor speaker is used, the output filter as well. There is room under the left-hand tuning coil (remembering the rear of the cabinet is before you) to place the output choke and the 2 mfd. condenser that, in combination, constitute the speaker filter. If a dynamic speaker is used, this output filter should be omitted. If a speaker is to be purchased, the inductor type is recommended. This is available in chassis form, so all you need extra is a cabinet in which to put the speaker. The model to use, which is a Far-land inductor, is Cat. N12G, which means a 12' outside diameter of the ring, and a "green" model speaker because this model matches the impedance of the 245 tube and hence gives better tone and greater volume.

The inductor is one of the most sensitive speakers so far developed and its tonal performance is second to none.

Mounting of Parts

The remaining paper dielectric condensers are 1 mfd. each, and there are three of them, but their voltage ratings differ. The condenser C7, next to the rectifier, is optional. If included, notice the high voltage rating, 500 volts AC, rms. The two remaining 1 mfd. condensers may be of any low-voltage type, as neither of them is across more than 6 volts. C6, if used for the speaker filter circuit, must be of the 500-volt AC type, never of the low.

These condensers are placed under the tuning coil at right.

One object of mounting the coils "upside down," that is, with tickler at bottom, is to gain room on the subpanel below, as otherwise the coil form would intrude too far down to make the subpanel space immediately underneath of much value for accommodation of parts.

The voltage divider is located between the front panel and the Polo block. This block is centered between extreme left and right, but is nearer the front panel than the back.

Everything is cut to fit. The front panel has the holes already drilled. Also, insulating washers are provided, in the event National Company's coils are to be used in the circuit. In any event, the volume control must be insulated. Place an insulator in front and in back of the hole, put the shaft of the coil or volume control through, and tighten the nut when the shaft is clear of the panel. Test for clearance by using an indicating device, such as a meter and a dry cell. There should be no deflection when the leads are connected to the shaft and the front panel.

Big Feet!

If the Screen Grid Coil Company's inductances are used it is not necessary to insulate them, as their shafts are no part of the electrical circuit. But the volume control must be insulated nevertheless.

The Polo transformer block has mounting feet on it. These feet may be loose, by the way. When you put the block in

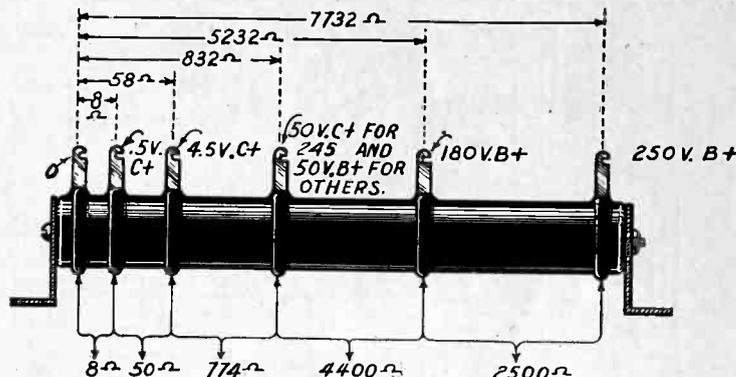


FIG. 8

THE VOLTAGE DIVIDER, WITH RESISTANCE BETWEEN TAPS AND BETWEEN ANY TAP AND GROUND, SHOWN WITH EQUIVALENT VOLTAGES.

place and tighten the nuts from underneath, the mounting feet, which are threaded machine screws, become tightened inside the container.

[Next week, issue of October 5th, a graphical representation of the layout of parts will be published and the constructional phase of this series will be completed. Following this, in the October 12th issue, tuning and trouble-shooting will be discussed.—Editor.]

LIST OF PARTS

- L1, L2, L3—One Bernard dynamic tuner for antenna stage (BTS5 of National Co., or BT5A of Screen Grid Coil Co.).
- L4, L5, L6—One Bernard dynamic tuner for screen grid interstate coupling (BTP5 of National Co., BT5B of Screen Grid Coil Co.).
- CT—One 80 mmfd. equalizer.
- C1, C2—Two .0005 mfd. Dustproof tuning condensers
- C, C3, C4, C5—Four .01 mfd. mica dielectric condensers.
- C7—One 1 mfd. filter condenser, 500 volts AC, working voltage, 800 volts DC [This condenser is optional].
- C8, C9, C10, C11—Four Mershon electrolytic condensers two 8 mfd., two 18 mfd., in one copper case, with bracket (Q2-8, 2-18B)
- C12, C13—Two 1 mfd. condensers, 200 volt DC working voltage
- R—One Electrad 25,000-ohm wire wound potentiometer, with knob
- R1—One 0.5 meg. Lynch metallized resistor
- R2—One 1.0 meg. Lynch metallized resistor
- R3—One .05 meg. (50,000 ohm) Lynch metallized resistor
- R4—One 5.0 meg. Lynch metallized resistor
- T1—One Polo 245 Power Supply, Cat. P245PS, with chokes built in (110V50-60 cycle primary; 2.5 volt at 3 amperes, 2.5 at 12 amperes; 5 volts at 2 amperes; and 724 volt (362-362) secondaries; with two 30 henry chokes, all built into a steel container. All windings center-tapped except primary
- 2,500, 4,400, 774, 50, 8—One voltage divider of 7,732 ohms, apportioned as stated; 774-to-0 to carry 100 ma. at 50 v. (20 watt commercial rating); resistor has insulated mounting right angular feet.
- PL—One pilot bracket with 2.5 volt AC bulb
- OC, C6—One speaker filter choke with 2 mfd. 500 volt AC working voltage condenser, neither required if a dynamic speaker is to be worked
- SP-, SP+—Two binding posts
- Three National grid clips for caps of 224 tubes
- F—One 1 ampere cartridge fuse with fuse holder
- SW—One AC pendant switch with front and back openings; 250 watts
- One aluminum subpanel, 14¼ x 9½ in., with five sockets affixed; subpanel drilled and insulated where necessary; hardware, including resistor mounting clips, two main brackets for condensers, and six subsidiary brackets
- One HB Compact AC brown crackle finish steel cabinet, drilled; insulating washers for front
- Two full-vision dials, with pointers
- Two flexible couplers or links
- One 12 ft. length AC cable
- Two rolls Corwico Braidite
- Five Kelly tubes: three 224, one 245, one 280

CORRECT CO-ORDINATION AF AND

Proper Filtration Solves and Other Para By J. E. Anderson

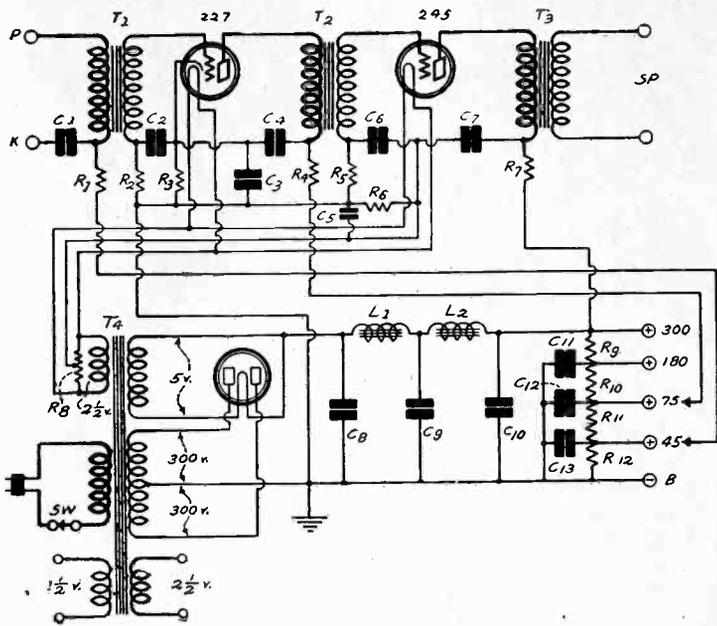


FIG. 97
A COMPLETE SINGLE-SIDED, TWO-STAGE, TRANSFORMER-COUPLED AMPLIFIER WITH ADEQUATE POWER SUPPLY

[This article is an instalment of "Power Amplifiers," a book being published serially, prior to its publication in book form.—Editor.]

One of the advantages of a detector of this type is that the relation between the radio frequency voltage and the output voltage is substantially linear. This, of course, means that it is distortionless. Another advantage is that there is practically no limitation to the voltage that may be impressed. The high resistance in series with the tube prevents tube saturation for all reasonable voltages that may be impressed. It is entirely possible to impress such a high voltage on the tube that the output voltage will be sufficient to overload the largest power tube now employed in receivers. The linear relationship between the input and output will be maintained, and it will be better the higher the load resistance on the tube. It is only for small input voltages that there is a slight departure from linearity.

In order to illustrate the relationship between the input and output voltages, the curve in Fig. 96 is reproduced. This was taken with DC in the circuit to take the place of the signal. The output voltage across the half megohm resistor R was measured with a vacuum tube voltmeter adjusted to draw no current.

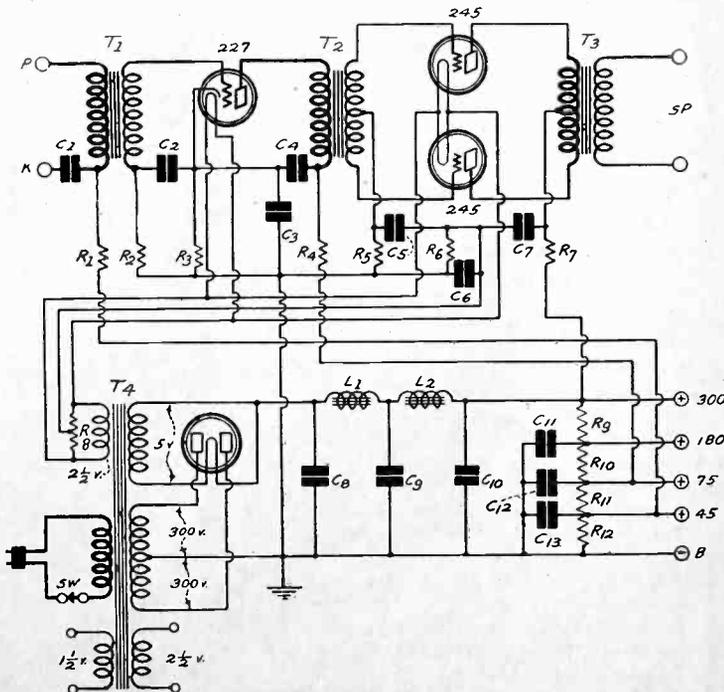


FIG. 98
A COMPLETE AMPLIFIER SIMILAR TO THAT IN FIG. 97 EXCEPT THAT THE OUTPUT STAGE IS PUSH-PULL

It will be observed that the output voltage is very nearly equal to the input voltage and that the curve is straight except for a small region near zero. The curve was only carried up to an input of 12 volts, but the linearity extends many times that distance. It will also be observed that the curve is similar to the curve shown in Fig. 91, which is for grid bias detection. The curve in Fig. 96, however, is not limited by grid current, like the curve in Fig. 91, because in this instance the load resistance does not change.

There is one disadvantage of detection by rectification, and that is the absence of amplification in the detector tube. But this can be offset easily by increasing the amplification ahead of the rectifier. When power detection is involved, this must be done anyway. The tube preceding the rectifier should be operated as a power amplifier, but it need not necessarily be a power tube. A general purpose tube should be quite adequate to operate the rectifier and maintain the voltage across the resistance R.

Although the load resistance may be replaced by a high inductance audio choke coil, this is not recommended. The linearity will be better preserved with a pure resistance. Neither is a transformer load recommended, although it can be used as in ordinary detectors, provided the primary impedance is high.

While the principle of this rectifying detector is the same as that of the Fleming oscillation valve, it is used under different conditions and is no longer subject to the objections of that detector. Selectivity can be secured ahead of the rectifier, that is, ahead of the tuned input to the circuit. Adequate amplification can be obtained also at radio frequency, and the power drawn from the rectifier is not so great as that required to operate the headphones.

Power Amplifiers

In preceding sections we have discussed the principles of power amplifiers and explained the functions and operation of the various components. We are now ready to exemplify the principles and coordinate the various parts into complete amplifiers. In view of the detailed discussions already made, it will not be necessary to repeat explanations in general but only to give specific data and suggestions.

In Fig. 97 is shown a two-stage, transformer-coupled amplifier together with a suitable B supply. The circuit contains one 227 type voltage amplifier, one 245 type power amplifier and one 280 type rectifier.

The voltage divider has been tapped to supply the voltage for a 224 screen grid tube, so that the amplifier may be used in conjunction with a radio frequency amplifier and detector incorporating one or more of this type of tube. Since the plate return of the tube ahead of this amplifier is connected to the B supply, the cathode of that tube should be connected to B minus in order to complete the plate circuit of this tube. The terminal marked P should be connected to the plate of the tube ahead and K to the cathode.

In the event the amplifier is to be used with a phonograph pick-up, the terminals of this unit should be connected between P and the upper part of R1, that is, to the lower terminal of the transformer T1.

No center-taps are shown on the power transformer and consequently the center-tapped resistor R8 is used to provide a symmetrical return. If the transformer used has center-taps they should be used in place of R8, or in place of similar center-tapped resistors connected across the other windings. No center-tap is needed for the rectifier filament, but if the transformer is provided with one, it is better to use it.

The voltages indicated on the high voltage winding on the power transformer are nominal. A transformer should be selected having sufficient voltage to produce a voltage of 300

PROBLEMS OF RESISTANCE

B SUPPLY

Problems of Motorboating and Distortive Conditions

and Herman Bernard

volts across the output of the rectifier when the rectifier is operating under full load. Inasmuch as the higher three voltages indicated are the maximum that should be used on the tubes employed, no harm will result if the output voltage falls below 300 volts by as much as 10 per cent.

In Fig. 98 is given a two-stage, transformer-coupled amplifier in which the output stage is push-pull. The power supply circuit is the same as that for the single-sided circuit in Fig. 97, and all the parts are also the same, except as noted in the list of parts.

The circuit in Fig. 98 will draw nearly twice as much current from the power supply as that in Fig. 97. Hence it is to be expected that the output voltages will be slightly lower, since there will be a greater drop in the rectifier tube and the filter coils. This, however, does not prevent the push-pull circuit from giving greater output and less distortion than the single-sided circuit. With the same voltages applied the push-pull is capable of about four times as much undistorted output as the single-sided circuit, and the voltages at worst will be only a few per cent lower.

While an amplifier employing two 245 tubes in push-pull in the final stage will give more volume than can be used in any home with comfort, there are places where a much greater output is desirable. For example, in a small dance hall, a restaurant, a small auditorium, or picture house, the circuit shown in Fig. 98 may not give sufficient undistorted sound to reach everybody. The same applies to small outdoor assemblies.

In such cases a circuit like that shown in Fig. 99 is suitable. This comprises two push-pull stages, the first employing 227 tubes and the final stage 250s. If the signal voltage impressed on this circuit is sufficiently high, the output power will be as high as 20 watts without appreciable distortion. If the input is taken from a power detector it will be ample to load up the amplifier. Also, if it is taken from a phonograph pick-up of good sensitivity, it will be ample. However, if it is taken from an ordinary detector, for example, one using the grid leak and condenser method of detection, the detector will load up long before the amplifier. In such cases it is necessary to interpose another amplifier between the detector and the first push-pull stage.

If the input is taken from a pick-up unit, its terminals should be connected between P and the junction of C1, R1 and the primary of T1. If the amplifier is used with a radio set, or if there is another amplifier ahead of T1, the pick-up terminals can be connected in the grid circuit of the tube ahead of the amplifier shown. The proper methods of connection have been explained.

Since the amplifier sketched in Fig. 99 takes over 100 milliamperes, a B supply of greater capacity than that shown for the two previous circuits is required. The rectifier should contain two 281 tubes and the filter coils should have a greater current rating.

The power transformer should have one 7.5-volt winding, 5-volt winding, one 2.5-volt winding, and one 1,200-volt winding, all center-tapped. The primary winding should be for 110 volts, 60 cycles. If there is another 2.5-volt winding on the power transformer selected, this should be used for the radio frequency amplifier. The arrows associated with the 2.5- and 7.5-volt windings indicate that they belong to transformer T4.

Note that the plate lead resistors have been omitted from the two push-pull stages in this amplifier. The reason for the omission is that in a push-pull stage which is well balanced there is practically no signal current in the common plate lead and therefore there is very little feedback. But it may happen that the tubes are considerably different and that motorboating or appreciable distortion will occur. In that event the resistors should be used. R7 in Fig. 98 shows how the resistors should be connected relatively to the by-pass condenser C7 or C4. R4

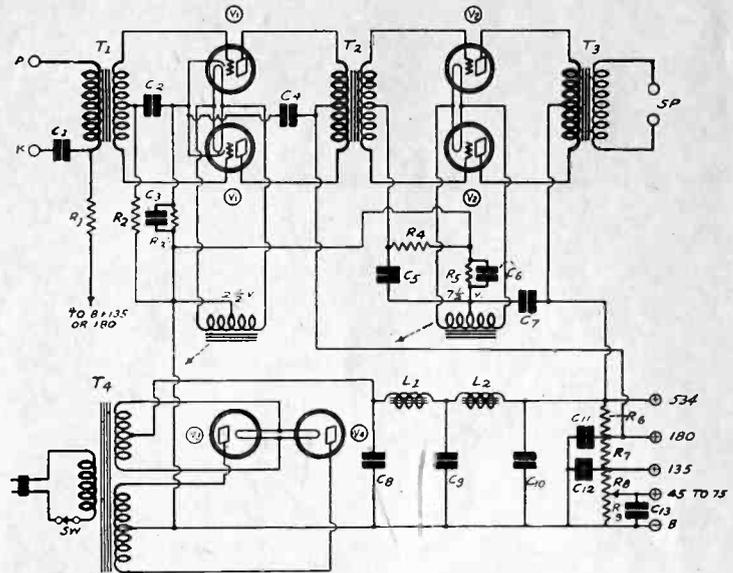


FIG. 99
HIGH POWER, TWO-STAGE, PUSH-PULL AMPLIFIER
WITH ADEQUATE POWER SUPPLY

in Fig. 99 should be about 2,000 ohms and R7 not more than 1,000 ohms. It is rarely necessary to use R7 in this circuit.

LIST OF PARTS

- T1—One Ferranti AF-5 audio transformer
- T2—One Ferranti AF-3 audio transformer
- T3—One Ferranti OP-1 standard output transformer
- T4—One Polo 245 Power Supply, including two chokes
- C1, C2, C3, C4, C6, C7—Six Flechtheim 2 mfd. by-pass condensers, 600 volt test.
- C5—One Flechtheim 4 mfd. by-pass condenser, low voltage test.
- C8—One Flechtheim 2 mfd. by-pass condenser, 1,000 volt test
- C9—One Flechtheim 4 mfd. by-pass condenser, 1,000 volt test
- C10—One Flechtheim 8 mfd. by-pass condenser, 1,000 volt test
- C11, C12, C13—Three Flechtheim 2 mfd. by-pass condensers, 600 volt test
- (All condensers may be made larger except C8)
- R1, R4, R7—Three Ferranti 10,000-ohm resistors
- R2, R5—Two Ferranti 20,000-ohm resistors
- R3—One Electrad wire-wound 1,000-ohm resistor
- R6—One Electrad wire-wound 750-ohm resistor
- R8—One Electrad 30-ohm Humdinger center-tapped resistor used if there is no center-tap on 2.5-volt winding
- One voltage divider strip consisting of the following resistors: R9, 3,333 ohms, R10, 4,000 ohms, R11, 1,430 ohms, and R12, 2,250 ohms.

These resistances add up to 11,031 ohms, and they are based on the assumption that the bleeder current is 20 ma. and that the currents drawn from the various taps are as follows: 1 ma. to the 45-volt tap; 5 ma. to the 75-volt tap; 10 ma. to the 180-volt tap. It not necessary to adhere to these values closely provided that the ratios are maintained. For example, a total resistance of 9,000 ohms can be used. It is desirable to have movable taps so that the voltages can be adjusted as any particular circuit may require.

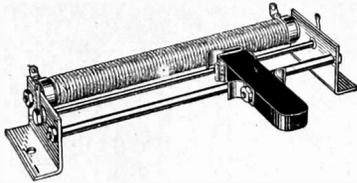
Additional parts required:

- Sw—One snap switch in the 110 volt line
- Two standard X-type tube sockets (four prong)
- One standard Y-type socket (five prong)
- One 227 type tube
- One 245 type tube
- One 280 type rectifier tube
- Nine binding posts
- One wooden or metal baseboard, the dimensions of which are to be determined by the size of the parts obtained.
- The following parts apply to Fig. 98
- T2—One Ferranti AF-3C push-pull input transformer
- T3—One Ferranti OP-8C push-pull output transformer
- R6—One 375-ohm resistor, to carry 64 milliamperes
- R7—One 5,000-ohm resistor, to carry 64 milliamperes
- One additional 245 tube with one UX socket.

To obtain 375 ohms either two 750-ohm resistors can be connected in parallel, or a variable resistance can be used. Likewise to obtain 5,000 ohms for R7, either two fixed 10,000-ohm resistors can be connected in parallel or a variable resistor having a suitable range can be employed.

Electrad, Inc.

Electrad, Inc., 175 Varick Street, New York City, has released a variety of new parts. Among them are a Truvolt sliding contact resistance. This is a patented air-cooled resistance unit mounted with slid-



Resistor With Sliding Contact

ing contact arm and is made particularly for general laboratory use to control line voltages, speed of small motors and a variety of other uses. It is made on order to any resistance value up to 5,000 ohms maximum. Overall length, 7 1/8 inches. List price \$4.75.

New Truvolt air-cooled resistance banks, types 250B3 and 245B2, contain type C units mounted on an insulated bracket for use as voltage divider with any 210 or 250 amplifier or heavy-duty plate supply device. Adjustable taps provide required voltages. Eight resistance sections, 250B3, 21,000 ohms total, listed at \$5.00. The second, 245B2, consists of two two type C units and is for use with any receiver or power amplifier using the new 245 type tubes.



250B3 Bank

Seven resistance sections, 14,700 ohms total resistance. List, \$3.50.

Electrad Table Tonatrol is an especially designed volume control for use with phonograph pickups. Bakelite case provides ease of access, mounting on phonograph turntable or wherever else desired. It is a handy and smoothly operating device, listing at \$2.50.

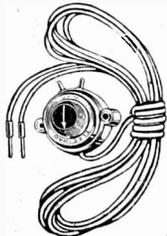
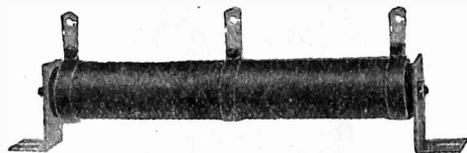


Table Tonatrol

Wire Wound Grid Leaks for Transmitters are of unique construction allowing for wire of larger diameter than is used in other types of enameled wire wound resistors. The contacts between lugs are positive, and they are guaranteed not to develop noise or open circuits under use.

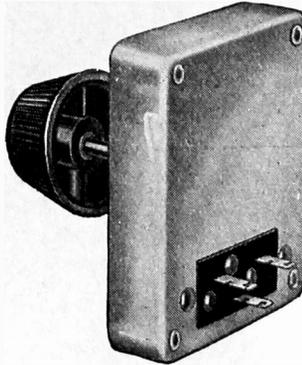


Transmitter Leak, Wire-wound

Type TG (100 Watt) 1 1/4 x 10", in six different numbers ranging in total resistance from 5,000 to 50,000 ohms, from \$3.00 to \$5.50.

The new Super Tonatrol is a volume control that will handle heavy currents and will safely dissipate 5 watts. It uses a special resistance element fused to the surface of a vitreous enameled steel plate. Metal cover and moving contact are of sterling silver. It is claimed to be remarkably smooth in operation and practically immune to temperature changes. There are seven types, types Nos. 1 to 6 listing at \$2.40, and type No. 7 at \$3.50 list. Another addition to the line is a new layer-wound high resistance for use as plate resistor, multiplier for voltmeters and for general laboratory work. Nichrome resistance wire is wound in generously insulated layers around a selected refractory tube. The wire is covered with a heavy coating of moisture-proof enamel and has contact bands and soldering lug of Monel metal. It is made with resistance ranges rating from 10,000

New Parts



Super Tonatrol

to 250,000 ohms and lists at from \$1.50 to \$5.00.

Silver-Marshall, Inc.

Silver-Marshall, Inc., 6401 West 65th Street, Chicago, announces new component-parts circuits for the new season.

The new 712 Band Selector Tuner is an improved model of the Sargent-Rayment 710, and is intended for operation with a separate power amplifier and power supply. This amplifier, type 677, is a two-stage, socket-power, push-pull unit, furnishing all A, B and C power, the unit employing push-pull 245 tubes in the output stage. This combination represents the highest-priced and finest-performing of three new S-M receivers. Parts are \$40.90 net for the tuner.

The second receiver, 722, a band selector, is a 6-1, AC operated receiver, comparable in cost to the lowest-priced screen-grid sets now in the market. Parts are priced at \$52.90 net.

The third receiver, 735, is a combination short-wave and broadcast band receiver, AC-operated. Its wavelength range is from 17 to 650 meters and on short waves it is said to be distinctly sensitive. In the broadcast band, the receiver's performance is extremely creditable, although not comparable either in distance range or in selectivity to either the 712 or 722. Parts for the 735, are \$44.90, net.

The S-M 677 power amplifier is a two-storage, light socket operated unit. It employs a 227 first-stage audio and a pair of 245 tubes in push-pull in the second stage. Clough system transformer is used, the new 255R input and a 257 push-pull inter-stage transformer between the first and second stages. No output transformer or choke is included as it is assumed that the amplifier will be used with any standard type of dynamic speaker of 90 volt (1900 to 2000 ohm) field having an output transformer equipped with a center tapped primary. Parts are \$43.40 net.

Carrier Pigeons Lose Their Jobs in Navy

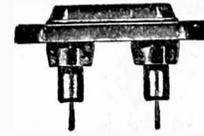
Washington. The carrier pigeon has at last become the victim of the progress of radio. All naval shore stations, with the exception of the naval air station at Lakehurst, N. J., and the naval base in Guam, after October 1st, will abandon the use of the carrier pigeon, according to an order issued by Secretary of the Navy Adams.

It has been found that the powerful naval radio stations have afforded more dependable service.

Yaxley Manufacturing Co.

The varied Yaxley line for 1930 includes a line of Molded Twin Tip Jacks, the single hole mounting designated as the 401, which comes in four types marked, "speaker," "phone," "field," and "plus," respectively and listing at 25 cents each.

The double hole mounting is the 410, with also the same markings in four types, listing at 25 cents apiece. In addition there is a line of specially molded and expertly designed, of insulated tip jacks colored red and black for positive and negative. These red and black caps list at 25 cents per pair and for manufacturing purposes may be had in additional colors, green, blue and brown. The new radio convenience outlet is also ready and is shown below mounted on a walnut board having a wooden easel with metal hinges for dealer display. These convenience outlets are available in a dozen different types, prices ranging from \$1 to \$3. Yaxley has produced a new Program Switch for wired radio whereby hotels or apartment houses may have the choice of as many as five or six programs. The Yaxley has moved factory and sales office to 1528 West Adams Street, Chicago, Ill. Application to them at this new address will bring information and a complete catalog of new parts.



Ferranti, Inc.

One of the newest items of Ferranti, Inc., 130 West 42d Street, New York City, is a large filter choke designed for use in filter systems where the current loads do not exceed 160 ma's. This new choke coil has the same construction as the Ferranti audio transformers, said to result in the lowest distributed capacity value of any choke of similar electrical characteristics.

This choke coil is tested 2,000 volts AC, between coils and case. The DC resistance of the coil is 40 ohms at 25 degrees Centigrade. Actual tests of the efficiency of filter circuits using this new Ferranti choke coil in place of coils of standard layer-wound assembly show a reduction of 50% in hum voltage, even when capacity in the filter condensers has been reduced from 8 mfd. to 4 mfd.

The new Ferranti choke is completely enclosed in a sturdy, well-finished case of the same general appearance as the Ferranti transformer. The unit weighs 5 lbs., 4 oz., actual copper and steel, there being no compound in the choke. List price is \$17.50.

Synchronization Test Proposed by WCAU

Washington.

An application has been filed by WCAU, Philadelphia, with the Radio Commission, asking that between the hours of 1 A. M. and 5 A. M., it be allowed to operate on 860 kilocycles with WABC, New York City, for the purpose of synchronization.

WOR PROMOTES NEFF

Newark, N. J.

Walter J. Neff, formerly chief announcer of WOR, has been made assistant to A. A. Cormier, commercial manager of the Bamberger station. In this capacity he will be responsible for commercial accounts. Mr. Neff has previously been connected with stations WMSG, WFBH, WPCH, WMCA and WAHG (now WABC).

Foreign Short Wave Stations

Grouped by Countries, With Frequencies and Waves

AFRICA			
JP	Johannesburg	11,992	25.00
7 LO	Nairobi, Kenya	8,949	33.50
8 KR	Constantine, Tunis	7,005	42.80
AIN	Casablanca, Morocco	5,878	51.00
AUSTRALIA			
6 AG	Perth, West Australia	9,051	32.90
6 WF	Perth	2,869	104.50
AGAG	Perth	7,237	41.70
2 BL	Sydney	9,231	32.50
2 FC	Sydney	1,052	28.50
2 ME	Sydney	1,052	28.50
3 LO	Melbourne	9,509	31.55
3 AR	Melbourne	5,633	55.00
AUSTRIA			
OHK2	Vienna	4,283	70.00
EATH	Vienna	8,108	37.00
BELGIUM			
EB4A2	Brussels	7,138	42.00
BRITISH GUIANA			
BZL	Georgetown	6,845	43.80
CANADA			
CJRX	Winnipeg, Manitoba	11,720	25.58
CF	Drummondville, Quebec	9,370	32.00
VAS	Louisburg, Nova Scotia	10,707	28.00
COSTA RICA			
NRH	Heredia	8,898	30.30
DANTZIG			
EK4ZZZ	Dantzig	7,495	40.00
DENMARK			
D7RL	Copenhagen	7,115	42.12
		3,559	84.24
D7MK	Copenhagen	9,354	32.05
ENGLAND			
2 NM	Caterham	9,231	32.50
5 SW	Chelmsford	11,751	25.53
GBS	Rugby	12,287	24.40
FRANCE			
FL	Eiffel Tower, Paris	9,231	32.50
F 8GC	Paris	4,195	61.00
F 8AV	Nogent	6,747	80.00
YR	Lyons	7,458	40.20
YN	Lyons	5,168	58.00
FW 4	St. Assissee	12,237	24.50
GERMANY			
HEA	Nauen	27,256	11.00
AGJ	Nauen	5,287	56.70
AGK	Nauen	27,256	11.00
POF	Nauen	27,256	11.00
POZ	Nauen	1,656	18.10
AFI	Königswusterhausen	21,414	14.00
AFT	Königswusterhausen	21,414	14.00
AFU	Königswusterhausen	21,414	14.00
AFL	Hamburg	4,283	70.00
		59,964	52.00
AFK	Doberitz (Berlin)	8,532	37.56
AGC	Berlin	3,987	75.36
LA	Langenberg	1,743	17.20
		6,829	43.90
HOLLAND			
PCKK	Kootwijk	18,738	16.00
PCL	Kootwijk	16,300	18.4
		7,895	38.8
PCPP	Kootwijk	18,170	16.50
PCRR	Kootwijk	8,108	37.00
PCTT	Kootwijk	14,277	21.00
PCJ	Eindhoven	9,548	31.4
PCMM	Ymuiden	6,468	46.50
PCUU	The Hague	8,108	37.00
PHOHI	Huize	17,779	16.88
ITALY			
IAY	Placenza	14,991	20.00
		6,662	45.00
11 AX	Rome	14,991	20.00
		7,495	40.00
JAPAN			
JIPP	Tokio	14,991	20.00
JKZB	Tokio	14,991	20.00
JOAK	Tokio	9,994	30.00
		4,997	60.00
		8,566	35.00
		4,283	70.00
IFAB	Taipeh (Formosa)	7,590	39.50
IHBB	Ibarakiken (Hirasio)	7,994	37.50
IAA	Iwatsuki	7,495	40.00
JAVA			
PLF, PLE	Bandoeng	19,048	15.74
		17,636	17.00
MEXICO			
XC 51	Mexico City	6,768	44.00
NORWAY			
LGN	Bergen	9,594	30.00
LCHO	Oslo	9,979	30.00
		9,085	33.00
RUSSIA (U. S. S. R.)			
RFN	Moscow	5,996	50.00
RDW	Moscow	3,612	83.00
RDRL	Leningrad	10,520	28.50
RFM	Khabarovsk (Siberia)	4,262	70.20
RA19	Tomsk (Siberia)	8,108	37.00
SPAIN			
EAM	Madrid	9,853	30.70
SWEDEN			
SAJ	Karlsborg	6,379	47.00
SAS	Karlsborg	5,728	52.50
SMHA	Stockholm	7,312	41.00
SAA	Karlskrona	6,776	44.40
SWITZERLAND			
EH90C	Befne	9,370	32.00
EH9xD	Zurich	3,527	85.00
		9,370	32.00

Right or Wrong?

(1)—The "Edison effect" is the same as the photoelectric effect and is the underlying principle of all vacuum tubes.

(2)—Hertz, the discoverer of electromagnetic waves, was the first to observe the photoelectric effect.

(3)—A photoelectric cell is equally responsive to all light waves, regardless of color.

(4)—A photoelectric cell containing inert gas is more sensitive than a hard vacuum tube cell because high speed electrons collide with the gas atoms and produce other electrons, thus increasing the current.

(5)—The more sensitive a meter the less expensive because it is easier to make a meter that will indicate a small current than one which will indicate a large current.

(6)—A galvanometer is an instrument used in galvanizing iron.

(7)—Most voltmeters and ammeters are really spring balances in which the force of the electrical current is weighed against the stiffness of the spring.

(8)—The meaning of linear detection is that the rectified voltage is directly proportional to the amplitude of the radio frequency voltage impressed on the detector.

(9)—A clockwise dial must be used with a left-handed condenser, that is, one in which the capacity increases as the condenser is turned to the left.

(10)—The most satisfactory movement in a current meter is the D'Arsonval, or moving coil type.

ANSWERS

(1)—Wrong. The Edison effect relates to the release of electrons from a heated filament. The photoelectric effect relates to the release of electrons by light.

(2)—Right. He observed during the course of experiments

that a charged conductor lost its charge when ultra-violet light fell on it and that it retained the charge while the conductor was in the dark.

(3)—Wrong. The cell is more responsive to light of short wave lengths than to that of long.

(4)—Right. The current is much greater for a given illumination when the cell contains a small amount of gas than when it is highly evacuated. There must be a high voltage battery in series with the circuit to supply the energy necessary to produce the ionization.

(5)—Wrong. The opposite is true. This is one reason why voltmeters having a high resistance per volt are very expensive. Another reason is that such voltmeters require expensive resistors.

(6)—Wrong. A galvanometer has nothing to do with galvanizing. It is an instrument for measuring very small currents, usually one which is not permanently calibrated.

(7)—Right. The stiffness, or rather the opposite, the compliance, of the spring is one of the factors which determine the sensitive of the meter.

(8)—Right. The reason for calling it linear is that when the radio frequency voltage is plotted against the output voltage on cross section paper, the resulting graph is a straight line.

(9)—Right. If the numbers on the dial run in the clockwise direction, the zero is at the left and the numbers increase as the dial is turned in the counterclockwise direction. This corresponds with the direction of increase in capacity.

(10)—Right. Most of the portable electrical instruments as well as most of the accurate and sensitive laboratory instruments are of this type. The D'Arsonval movement is similar to the movement in a dynamic type speaker.

Of course if the screen grid voltage is far below par then the current may be smaller than would be easily legible. An extra series resistor will enable you to test B voltages up to 600 volts. This resistor is J-106 Multiplier and costs 88 cents

Ohm's Law

PLEASE define and explain Ohm's law.—G. F.
Ohm's law expresses the relationship between resistance, voltage and current in a circuit and makes possible the ascertainment of the unknown quantity when the two others are known. The voltage equals the product of the current and resistance, the resistance equals the voltage divided by the current, and the current equals the voltage divided by the resistance. All terms must be expressed in volts, amperes and ohms, or, if constants are fractional, they may be expressed decimally. See the September 21st issue for a complete two-full-page discussion entitled, "Ohm's and Kirchoff's Laws Expounded." Kirchoff's laws come to the rescue when otherwise complex problems would not be soluble by Ohm's law.

AC Circuit for External B

AS I have a B supply I would like the design of a four tube AC circuit to which I could apply this B voltage. I would like to use single control.—G. Z.

Fig. 786 shows such a design. Single control is feasible. The common rotor is returned to grounded negative lead of the B supply, which serves as C minus. The trimming condenser across the first tuned circuit is for adjustment to a capacity equal to that present in L3 the capacity, effect in the second tuned circuit will be somewhat larger than otherwise. The trimmer may be a 70, 80 or 90 mfd. equalizer. Coil data: L1 may have 14 turns, L2 52 turns, L3 have 24 to 36 turns, L4 have 52 turns, and L5 have 20 turns. The diameters for L1 L2 and L3 L4 are 2 1/2", the wire No. 24 insulated. The tickler form is 1 3/4" and its wire may be No. 24 or finer, even to No. 32, but should be insulated. The tuning condensers are .0005 mfd., gauged. The first tube is a 224 screen grid, the second and third are 227s and the output may be a 245, if you have enough B voltage. Around 200 volts will do. The bypass condensers are .01 mfd., except C7, which is .00025 mfd., and C10, which is 4 mfd. R2 is 400 ohms. R3 is 50,000 ohms, R4 is 800 ohms and R5 is 800 ohms, but of 5 watts for a 245 output and 1,500 ohms, 5 watts, for a 171A. On all plates save the last tube 180 volts are applied, unless the last tube is a 171A, when it too gets 180 volts. The screen grid voltage is 45 to 75. The volume control in the antenna circuit is 5,000 ohms and has switch attached.

Wavelength of WJBI

WHAT is the wavelength of WJBI, Red Bank, N. J.?—J. S.
WJBI is on 247.8 meters. The complete list of stations, with frequency and wavelength, was published in the September 21st issue, alphabetically by call letters, and again numerically by wavelengths and frequencies.

Effect of Distributed Capacity

IS distributed capacity harmful to a tuned circuit?—O. T. D.
Not as mere capacity. But it may be so large as to defeat coverage of the broadcast band of wavelengths, and that certainly would be detrimental. Whether the capacity in a circuit is lumped, as in a tuning condenser, or distributed, as in a coil, it is equally effective for equal values. The distributed capacity is in parallel with the tuning capacity.

Push-Pull Output

CAN you suggest some better way of obtaining an output from a push-pull stage than using a center-tapped choke, with tap to B plus, and extreme ends to the plates and the speaker cord? I doubt very much whether signals would be produced this way.—J. D.

We can suggest no better way of taking the output from push-pull. Signals certainly will be produced. If you don't believe it, why not try it? The method works in many, many thousands of receivers now in use, and has worked for nearly sixteen years.

Resistance Per Volt

IF the current drawn by a voltmeter at full-scale deflection is known, can the resistance per volt be estimated?—G. B.
Divide the current in milliamperes at full-scale deflection into the number one.

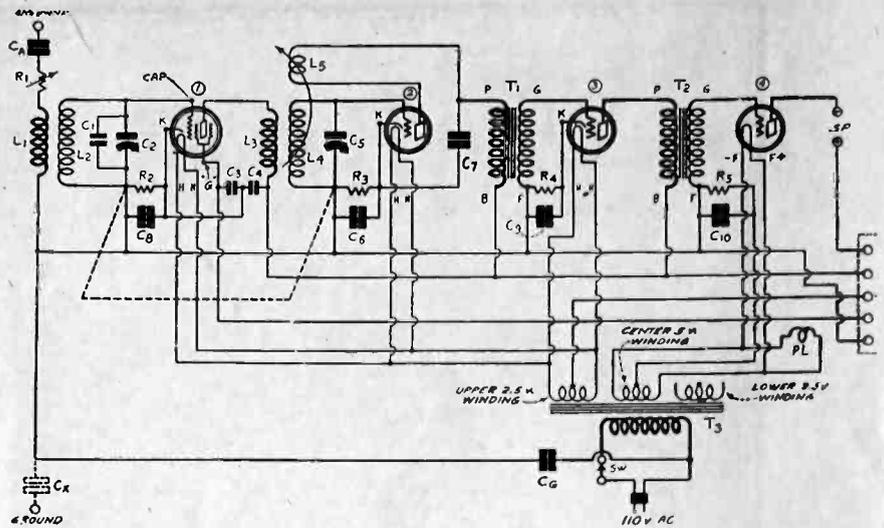


FIG. 786.

DESIGN OF AN AC RECEIVER TO BE WORKED FROM A B SUPPLY THAT THE INQUIRER ALREADY POSSESSES. THE VALUES OF THE CONSTANTS ARE GIVEN IN THE TEXT.

Data on Mershon Condensers

HAVE the Mershon electrolytic condensers a distinctive polarity? If there are several condensers in one copper casing, how can one tell which capacity is the larger, since they are not distinguished? How much voltage will the Mershons stand?—H. F. D.

Electrolytic condensers have polarity. The Mershons' copper case is negative. The lugs at top, known as anodes, are positive. The smaller capacity is nearer the outer edge or can. The voltage rating is 400 volts DC working voltage. Electrolytic condensers can not be used for AC. In B supplies the voltage after the rectifier is DC, hence Mershons are useful. They offer high capacity in compact form, are self-healing and may be easily mounted with a single bracket.

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WIRING THE SCHOOLBOY

Commercial Appearance Results from Chassis Construction

By James H. Dyer

[The first instalment of this two-part article on how to build the Schoolboy's One-Tube DX Set was published last week in the September 21st issue. Herewith the picture diagram of the wiring is published, as well as a dimensional drawing for the front panel. While the present instalment concludes this series on the one-tube set, be sure to read next week's issue of RADIO WORLD, October 5th, for other circuit information of extreme interest to schoolboys. The parts for the one-tube set cost only \$4.28, and it will be found that all parts for all circuits in the schoolboy series will be most moderately priced.—Editor.]

EVERY novice in radio who has not built any set, should start with a one-tube set. The reason is that when he has finished it and puts on the ear-phones he will be delighted with the results. He will get not only local stations, separating them well enough, but distant stations, too, especially after the locals sign off. Some nights he will be permitted to be up that late and then he will have his own private fun.

In former days the first circuit to build was the crystal receiver. But it is not rational to suggest that a crystal set be built now. In the first place, its sensitivity is very low; secondly, its selectivity hardly is worthy of the name. We used to hear of selective crystal sets, and thereby was meant that the receiver would separate local stations. In those days, however, there were far fewer stations, and the term selectivity as used in that connection is relative.

Enough was published about this one-tube set last week, in the September 21st issue, to get you started. This week is the wind-up. You can see the picture diagram of the wiring spread out before you on these pages, every lead shown. You will see solid lines and dotted lines representing wiring. The solid lines represent wires that are run in full view, while the dotted lines represent other wires, or other parts of the previous wires, run underneath something, so that in reality you could not see these underneath wires from the top.

Remember that you are engaging on what is called chassis construction, since the front panel has attached to it, by brackets, a shelf or elevated subpanel, with socket affixed. This extra touch is one you will appreciate, as the finished receiver will have a factory-made appearance, if only you will solder the wires carefully and run them in neat directions, not every which way.

The Odd A Plus Lead

It is not vital to follow the actual route of the wires as shown in the pictorial diagram. The reason why the lines are as they are

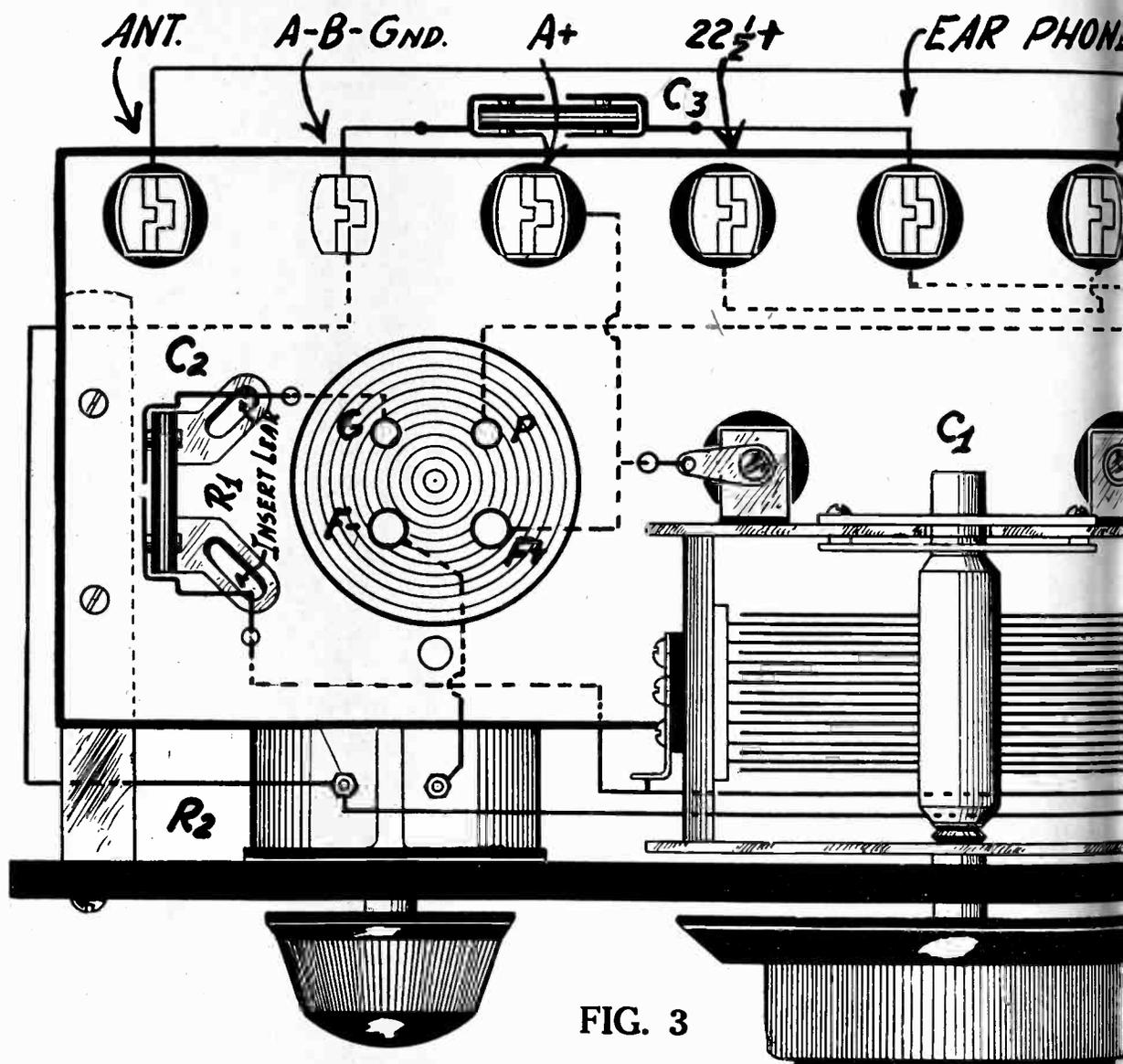


FIG. 3

Full-sized pictorial diagram of the Schoolboy's One-Tube Set, as described in the September 21st issue.

The dotted lines represent wires under the subpanel, the solid lines represent wires on top.

The black rings on the aluminum subpanel are for the ear-phones.

is to avoid confusion, so that decent separation exists between leads, and the eye can more readily read the diagram. After all, the main purpose of the diagram is that it should be fully readable.

You need be careful of course to carry each wire from its proper source to its proper destination, but not necessarily by the exact route shown in the pictorial layout. You can exercise some ingenuity of your own, or, if you prefer not to risk that, you can make the leads a copy of the pictorial diagram not only in point of connection but in actual position of the route of each lead.

There is one point that may seem confusing. The tuning condenser has a metal frame that is the same electrical connection as the moving plates or so-called rotor. These moving plates were represented by an arrow in the schematic diagram published last week, and are represented this week in the pictorial diagram by the connections made to the mounting feet of the condenser by means of two lugs.

Since the condenser frame is metal, and as the metal is a conductor of electricity in this instance, one may use the width of the condenser frame at rear as if it were a piece of wire, to continue a lead. This is actually what is done. The connections made to the

BOY'S ONE-TUBE SET

Basic Construction With Aluminum Panels

by Jack Tully

STRIPED PHONE CORD HERE

REVERSE THESE CONNECTIONS IF REGENERATION FAILS

MOUNT COIL WITH TICKLER AT BOTTOM

L₁L₂L₃

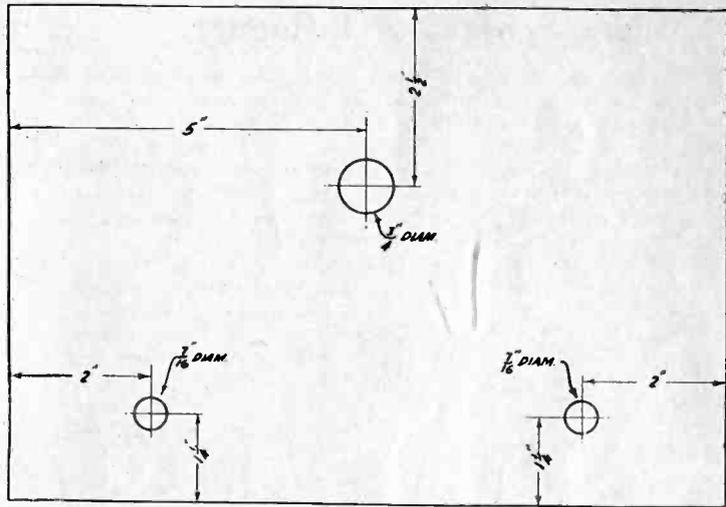


FIG. 4 FRONT PANEL, 7 x 10'', WITH HOLES MARKED

Speaking of neatness, I am sure that all my readers will prefer to build this job, using an aluminum subpanel or shelf, and an aluminum front panel. Therefore the two metal pieces are grounded A minus, and no insulation is provided for the binding post at rear for these two leads, to which post are connected ground, A minus and B minus. All other binding posts are insulated. Also the tuning condenser is insulated, since its frame connects to A plus, and if insulation were lacking there the A battery would be short-circuited. The same point would be connected both to A plus through the condenser and to A minus through the subpanel and front panel, and that's a short circuit, isn't it?

The arrangement of the front panel is easy enough. If you want to use a bakelite front panel, at extra cost, you may do so, but the inexpensive aluminum front panel will satisfy you immensely, and besides it comes already drilled. The central hole is large indeed, 1/2 inch, but this is to enable a nut on the tuning condenser shaft-hardware to pass through. This nut is not to be used for front panel mounting of the tuning condenser because, as you know, the tuning condenser is mounted on the subpanel, and has three mounting feet for that purpose, two in back and one in front.

Dummy Screw at Right

At left is a bracket that helps support the subpanel, at rear are two more brackets. The front panel bracket requires a hole on the front panel, and at right another hole is drilled just for the eye effect to match up the other hole. Nothing is put in this small right-hand hole except the same kind of a screw as was used in the other equivalent position. This screw has a nut fastened at back, to anchor it, but the right-hand screw is, as you see, a "dummy."

The grid condenser has clips on it, and the bypass condenser for the telephones, which is of the same capacity, .00025 mfd. (triple-oh-two five mfd.) has the same clips. In the case of the bypass condenser the clips are not used, but the extension lugs are bent flat and the condenser connected from plate binding post to A minus binding post, being put in such position that when you look down at the subpanel from the top the bypass condenser is completely hidden. It should not stick out at back, but is shown that way in the diagram this week just to make the connection very clear to you.

Dope on Tuning

Tune the set by turning the large central dial to get different stations. If you hear a few squeals you know that the rotary coil or tickler is properly connected. If no squeals ever are heard, then reverse the tickler connections. When tuning in, you will soon learn to avoid unintentional squealing by keeping the tickler in a position that permits the tube to be considerably under the oscillation point. When you need extra sensitivity, as when a signal is weak, as is true of a far-distant one, then you can advance

(Continued on page 21)

Precautions on Precision

Everything will fit nicely, but you must understand that slight differences sometimes make panels and subpanels sit crooked, as the saying is. Therefore observe the caution of putting the mounting feet of the tuning condenser right flush against the insulators on the subpanel, and put the lug on top of (not beneath) the mounting foot. Then the condenser will not be elevated even by the extra thickness of the lug, tiny as that is.

Designed by Jack Tully, himself a schoolboy.

Wires not hidden from a top view.

Use insulators.

Secondary of the tuning coil are to grid condenser and A plus respectively. The connection to the grid condenser is shown at left, the lead then running to the lug at front left of the tuning condenser and on to the binding post of the coil at right. But the other secondary connection that goes to A plus reaches that by a route encompassing the tuning condenser. The coil binding post is connected to the condenser by soldering to a lug placed right under the head of the screw, and the actual connection to A plus is made from the other end of the condenser frame, by using the same lug-and-screw arrangement at the new point.

RADIO WORLD

The First and Only National Radio Weekly

Eighth Year

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Wider Spheres of Influence

THE development of broadcasting from cheap entertainment to good entertainment progressed slowly, compared with the rapid advance in radio technical development during the same period. Now the educational and informational branches of broadcasting are growing, and the President of the United States has interested himself in this work, by appointing a committee to report the facts on educational broadcasting, so that the future possibilities may be weighed.

How deeply the stations appreciate their public obligation is hard to estimate, because of the conflicting evidence. Certainly some of the larger stations, and the chains particularly, recognize the value of radio as an educational instrumentality, something that enters so vitally into the lives of the listeners as to be a potent agency for public advancement. Surely no one who has listened to the best educational and informational broadcasts, or even to some of them, throughout a year, has failed to improve himself intellectually. But a great deal more can be done by stations than has been done, although it will require that the stations divest themselves of the cloak of impersonality that is worn by so many of them, and even branch into welfare work.

All media for the expression of the thoughts of the day and the era are bound to become engulfed in controversial affairs. Stations like to keep the complaint mail down to a minimum, but most of them know that nothing can be broadcast, not even a simple plea by the American Legion that all Americans be patriotic, without evoking complaints. Some surely will write in, saying that the inferential encouragement of large armed forces and warlike traits did not escape unnoticed, and the letters will end up with the familiar tirade against the station and all its works.

Stations will learn, therefore, that merely "diplomatic" non-committal positions that they take bring quantity of abuse, if the stations are not convinced of it already, and they will therefore reach the conclusion that by taking decisive stands on matters of public importance, their positions always determined by their best judgment as to representation of the public interest, they will be entering the field of noble service.

Up to now the mere suggestion of anything savoring of an editorial nature is abhorrent to most stations, although a few, like WEVD, the Socialist station, WCFL, the Chicago Federation of Labor station, and WLWL, the Roman Catholic station, are constituted to serve the causes and beliefs for which they stand. Stations not dedicated to any creed or cause, however, will find themselves instituting an editorial policy at no far-distant time, and some may even become recognized organs of party politics, just as most newspapers are.

This is not abhorrent. It is inevitable. The chief distinction cited between a newspaper and a broadcasting station is that one has to buy the newspaper to read it, and carries it into the home, whereas the radio program pops up right amid the sanctity of the home, free of any tax or charge, a happy or dire intrusion.

Receivers are spoken of in terms of their selectivity, and this ought to be convincing that a selection is made in the instance of radio stations no less than in the choice of a daily newspaper. Great public causes do not prosper because of want of champions, and if broadcasting is the greatest medium for the dissemination of intelligence, then it is bound to become the greatest force in the molding of public opinion, even in an age and a country where such molding becomes more and more difficult, either because people think for themselves, as some do, or for exactly the opposite reason, that is, they accumulate early in life an immobile body of prejudices that stay with them as long as there's life.

There are great problems, enough of them to assure all that much work is ahead if these problems are to be solved with reasonable expedition and with reasonable success. How to use radio as an instrumentality of instruction and education of the literate is one of these problems, but not the leading problem by any means.

There are 5,000,000 illiterate adults in the United States, and how to lead them from the darkness of the mind, by whatever means, is well worthy of thought. If they learn to read and write they become happier human beings, they gain more pros-

perity, live better, give their children better opportunities, and add to the wealth of the nation, not alone its material wealth, but wealth in the sense of the product of work. This product is often social, ethical and psychological. Money, goods, chattels and realty do not alone measure this wealth.

On the score of illiteracy it may be argued that broadcasting offers an excellent substitute for obtaining information and entertainment through literate means, hence indirectly and unwittingly encourages illiteracy. Messages advocating the attainment of literacy by all illiterate persons, no matter of what age, and explaining the benefits to be derived, are well within the province of broadcasting stations, and these messages well may be presented in dramatized form. But we have yet to know of one station that has done anything like this, although we can think of stations that sent out raw jokes, that used their facilities to utter billingsgate against other stations, that pilfered wavelengths assigned not only to other stations but to stations of another nation, thus creating international illwill, and of stations that fanatically oppose all organized religion or some particular religion.

Something, but not much, has been done by stations to aid the plight of the blind. To those thus afflicted surely the radio is a most precious jewel. Why not more programs dedicated to the blind, and especially created to encourage and cheer those for whom the world is steeped in everlasting darkness?

The deaf have fared better, but the difficulty is greater. The words spoken do not reach the ears where they would do the most good. Some one must listen in, then report in writing or sign language to the intended recipient. But radio offers opportunities to the deaf, too. Some persons, otherwise deaf, can hear radio programs tolerably well. This is probably because the volume level in the ears, which are closely coupled to the clamped headpiece, is so many times greater than that of music or conversation as ordinarily rendered. It is true, nevertheless, that the deaf are usually deaf to radio as well, but enough of them could listen to a program dedicated to them, to enjoy it with special delight, and of course could communicate this delight to others who share their handicap.

One of the chief obstacles to the correction of deafness in those stages when help is possible is due to the reticence or pride of the afflicted. It is a scientific fact that deafness in most instances comes on gradually, but the person growing deaf tries to hide the fact, and reaches that stage where improving the condition, much less curing it, becomes virtually impossible. Why can not radio be used to encourage the incipient deaf to heed the warning, and receive expert attention during those stages when at least progression of the ailment may be halted?

Hygiene and health are topics not infrequently discussed on the air, but nearly always as the means used by some electric refrigerator manufacturer or life insurance company to publicize its own wares. This commercial aspect is not unwholesome. But did it never occur to the stations that human life deserves better consideration than to be a subject jerkily treated by a paying client? A co-ordinated and comprehensive revelation of how to take best care of the human body, the most interesting subject that ever existed, is desperately needed. The rash diets that are the fad with men and women, offering an unbalanced hence injurious menu, obviously need some corrective force stronger than any now effective. Another illustration of the need of dissemination of correct health information is that only a small percentage of mothers or grandmothers have any knowledge of whether a baby of less than six months old should wear stockings on a day that is intolerably hot for adults, and if so, why.

These subjects are important, but therefore must they be dull? Radio continuities written from thin air have proved interesting enough—why can not continuities bring home vital facts, if the jazz mayonnaise really is so necessary to the popularization of the nourishing morsels?

The toothed steel trap, that maims without directly killing, is one of man's sinister devices, and some day is due to be outlawed, but why can not stations help expedite that day? Nearly everywhere on earth it is legal to set a trap that maims an animal, and not illegal to refrain from ever seeing whether there is anything in the trap. The result is that in such traps animal skeletons are not uncommonly found. Any one with imagination must recoil on realization of this state of facts. Some day stations may develop such righteous imagination, and lend their powerful efforts to the correction of ills and abuses the world over, doing it just as interestingly as they now dote on night club nonsense, and thus will help make this earth a still happier abode. Besides versatility the stations will acquire vitality, and there will be an infiltration of humanitarianism, instead of a mere preponderance of showmanship.

The Cry of Wolf

EVERY so often some one pops up with a claim of ownership of an invention said to be infringed by almost the entire radio industry, and forthwith states that every generous impulse exists in the claimant's breast to license reputable concerns on a fair and equitable basis. The fairness is to be commended, but the inevitable insistence that the industry must come across or perish smacks just a little too much of arrogance.

The One and Only

WHY all this furor over circuits, this and that kind, when there is only one circuit necessary? I will tell you what it is, so you'll know. Two stages of tuned screen grid RF amplification, each stage individually shielded with power detector, all stages tuned by a three-gang condenser; with first audio stage resistance-coupled and second audio stage transformer-coupled, feeding 245s in push-pull. That is the circuit, the one and only, and I'm for it from now until the Jordan freezes over. Get wise to yourself.

JACK H. ROSE,
Birmingham, Ala.

* * *

Youth Will Be Served

I GO to school. Once in a while I buy RADIO WORLD from the newsdealer, when I have the money. I saw in your paper last week a one-tube circuit for a schoolboy, and the parts were so reasonable. I like this kind of printing. Put more articles in your paper for us young fellows. We like our radio, too, like to build sets, and we learn a lot. But the magazines have not been publishing much for our benefit. RADIO WORLD published little that a beginner could get much out of, anyway a schoolboy. But now you've reformed. I'm glad of that. If I get any more fifteen centses I'll buy some more RADIO WORLDS from now on.

JIMMY FARRINGTON,
Dubuque, Ia.

* * *

Easily Satisfied

I ENJOYED the September 21st issue heartily. The lists of stations were great. There they were—U. S. broadcasting stations by frequencies and waves, and then again alphabetically by call letters, not to mention the list of U. S. short wave stations, and the time schedule of foreign short wave stations. Listing the Columbia and National chains by their

Forum

stations, with locations, waves and frequencies, was a good idea. The list of Canadian stations was all right, too. I don't mean to infer I didn't like the rest of the contents. The new parts were interesting, and the circuit dope in the front pages was good stuff, too.

CHARLES FRY,
Poughkeepsie, N. Y.

* * *

Heavy Creditors Enthusiastic

IT IS refreshing to pick up RADIO WORLD each week and read its attractive contents. I am interested in circuits. I like to read all about them, learn to distinguish them, and I even like to experiment with those I do not intend to build on any permanent basis. I erect some parts on brackets on a baseboard and try two out of every three circuits you publish. I don't have to get new parts for them, but I keep using what I have. Sometimes I get stuck on (never by) a circuit and I stick to it. Up she goes in dolliest dress, finest parts, and all, and I know I have a real receiver.

In that way I came to build the Diamond of the Air, then six more such for friends, then two more for persons who said they were friends, but proved they weren't by not paying for the receivers. That part I don't blame you for, you understand.

Now I am trying out the HB Compact, battery model, and I can say from what I've built so far, that the Bernard dynamic tuning system is a wow and then some. I used to fear only two tuned stages on account of not-so-good selectivity I experienced in other circuits, but for selectivity (and sensitivity) I can commend the HB Compact, without any reservations or amendments.

Next I am going to try the AC model,

because the author says it is even a little more sensitive than the other. Build one or the other, would be my suggestion to all, except to myself, as my advice to me is build both!

JACOB L. CRUISE,
Bangor, Me.

* * *

Fully Propitiated

I FIND my appetite for radio knowledge fully appeased by RADIO WORLD.

Hence I am sticking to your publication as a steady diet after off-and-on reading of it for a year or more.

HEYWOOD HELLER,
Seattle, Wash.

* * *

Send the Six Bucks Anyway

YOUR magazine is interesting, but that platitude is killing, and I suppose you'd rather have some one tell you it is not (interesting), just to relieve the monotony. But I have one complaint, at least, and will save my other complaints for a later day.

You are the only publication in the radio field that has the facilities, due to timeliness and a wide group of correspondents, to publish the news of radio when it is news, so why on earth do you print such skimpy news items, instead of running news generously, as you used to do before you fell into a news doze? You're wide awake on the circuit end of your business, new tubes, new this, new that, but not new news, so get busy and I'll send you \$6 for another year's subscription, my fifth annual, if you please.

J. H. GONZALES,
Berkeley, Calif.

NEW BRITISH SET

London.

A recent announcement by Louis Sterling, managing director of the Columbia Graphophone Company, stated that the Columbia company was entering the radio set manufacturing business in England.

Circuit Standardization

A BETTER approach toward circuit standardization has been recently established than ever before existed in radio. When the screen grid tubes arrived the tendency began, and as soon as the AC models were thoroughly tested, and thereupon approved, the 245 was available as output tube. The 227 was retained as detector, but the 226 receded as an amplifier. The standardization looked toward the heater type tube, because the hum problem thereby was more easily solved.

Now there is some uncertainty surrounding the detector in AC circuits. Still the 227 is in the lead. But the screen grid tube is being used as a power detector, and some day may replace the 227. But in transformer-coupled audio circuits the use and need of the 227 are apparent.

This tendency toward standardization does not rob radio of the rich asset of circuit variety. The screen grid tube alone opens enough fields. Methods of using it most effectively both at radio and audio frequencies constitute a most engrossing as well as extensive topic. Focusing attention on this outstanding tube will develop more real technique and valuable circuit assets than pottering around with a whole mess of various tubes.

As the 227, 224, 228 (high mu AC) and the 245 all take the same filament or heater voltage, we are getting back to the standard-voltage stage that characterized battery-operated receivers. There the voltage was 5 or 3.3 volts on the filaments throughout.

In the output stage a single 245 tube will handle plenty of volume to satisfy all home needs, although the more fastidious may use 245s in push-pull, thereby approximately doubling the maximum undistorted power output. Such doubling, however, requires that the circuit be so arranged that the preceding audio tube handles enough undistorted voltage to load up the push-pull pair.

In the output stage the popular choice therefore is between single or push-pull 245s. Orthodox circuits exist for this stage and are susceptible of very little variety. You may have a

center-tapped output impedance coil, with positive voltage applied to the taps, the extreme ends going to plates of the respective tubes and to the speaker cords, or you may have an output transformer. Although a dynamic speaker has a built-in transformer, either type of output works into the dynamic's transformer, and indeed some push-pull output is required in the circuit, as the speaker transformer is not usually built for direct connection to push-pull.

Circuit formation is not much simplified by the trend toward standardization, but concentration on given types of tubes leads to more intensive and more effective scientific development, the attainment of greater receiver results at less cost.

Traffic Manual

Radio Traffic Manual and Operating Regulations, by Rudolph L. Duncan and Charles E. Drew. John Wiley & Sons, Inc. (\$2.00).

A helpful volume to students, amateurs, and radio operators in the Army and Navy who contemplate entering the commercial field and who have little if any opportunity of acquiring knowledge of the various classes of commercial traffic. The chapters deal with: Acquiring the Code—Use of "Q" Signals; Operating Rules and Regulations of the Radiomarine Corporation of America; International Radiotelegraph Convention; U. S. Radio Act of 1927; Ship Act of July 23, 1912; Regulations Governing the Issuance of Radio Operators' Licenses. The book contains 183 pages and is well indexed.

Admiralty List

The Admiralty List of Wireless Signals, including Details of Direction Finding, Fog Signals, Weather Bulletins, Storm and Navigational Warnings, Time Signal Stations, &c. (1929). (\$1.70 plus postage.) The British Library of Information, 5 East 45th Street, New York. The book contains 719 pages, 6x9.5 inches and includes marine and air navigational aids throughout the world.

300,000 VISIT N. Y. SHOW, SEE 1930 DESIGNS

The sixth annual RADIO WORLD'S Fair in Madison Square Garden, New York City, marked the beginning of the tenth radio season. More than 300 manufacturers of radio receiving sets, parts and accessories exhibited their latest products to 300,000 eager fans who thronged the great exhibition halls daily throughout the week.

The equipment displayed was valued at over \$1,000,000, which included more than 1,500 radio sets of models ranging from inexpensive table types to elaborate consoles, as well as loudspeakers and accessory equipment.

Crystal Studio a Feature

During the exposition the visiting public was entertained by music and other programs emanating from the Crystal Studio, a specially constructed glass studio centrally located in the main exhibition hall, through which the public could watch the performers before the microphone. The sound from the studio was distributed on the three floors occupied by the exhibition by newly developed loudspeakers of the condenser type. The programs were also broadcast by station WEF and a chain of more than twenty associated stations. Artists broadcast throughout the day and evening. Programs were broadcast by both the National Broadcasting and the Columbia chain.

Only one television set was shown, an apparatus developed by the engineers of the Radio Corporation.

Television Demonstrated

The pictures were shown on a ground glass screen one foot square, and the spectators not only saw the actors sing and act but they heard their voices as well. The voices of the actors were picked up by a microphone and transmitted to a loudspeaker near the television screen.

The stage of the actors and the screen were so arranged that the spectators could compare the original scene and the received image to enable them to judge of the progress that has been made. The system is due to Dr. E. F. W. Alexander, consulting engineer of the General Electric Company and the Radio Corporation of America.

Olive Shea, WABC soprano and dramatic artist, was the guest of the management of the exhibition, having been selected as the most beautiful staff radio artist in America from among more than 150 entries covering the entire country.

The judges in this contest were Florenz Ziegfeld, theatrical showman; McClelland Barclay, New York artist; Victor Frisch, sculptor; Jesse Hawley, former football coach and now vice-president of the United Reproducers Corporation, Rochester, and Morris Metcalf, treasurer of the American Bosch Magneto Corporation, Springfield, Mass.

Government Forum Is Urged by Nye

Washington.

Information regarding Government activities should be sent over a Government-owned radio station, according to Senator Nye, who introduced a bill in the Senate advocating the establishment of a Government station.

He also states that debates of matters of wide interest held in the Senate or in Congress should be transmitted.

The station should be under the direction of the Secretary of Commerce, he suggests, and located in Washington, D. C., additional stations to be established in other parts to guarantee reception in every part of the country.

He also points out that such a station is important for political purposes.

"In recent campaigns enormous sums were spent for radio," he says. "Obviously the candidate backed by the largest campaign fund has the best opportunity to get his message to the voter."

MOBILE SENDER USED FOR NEWS

The portable transmitter developed for use by parachute jumpers to describe sensations while falling has been made standard equipment for WEF and WJZ. It is to be used for reporting news and sporting events such as polo matches and football games.

The new device, which is carried on the back of the announcer, weighs only twenty-four pounds and is operated with batteries.

The range of the transmitter is about one mile, but this can be increased by increasing the voltage of the batteries.

At present, the antenna is held aloft by two small poles carried by assistants to the announcer, but in the future it is planned to use a small balloon for holding the antenna vertically.

The signals from the portable transmitter are picked up by a shortwave receiver located nearby from which they are sent to the regular broadcasting stations.

KDKA'S Poles Striped For Aviation Safety

The antenna poles of KDKA on the hill above East Pittsburgh have taken on a candy-stick appearance as the result of ever-increasing air traffic.

To make them easily visible to passing planes they have been painted black and chrome yellow in stripes. This is the standard color and design recommended by the Department of Commerce. All Westinghouse radio antenna poles will be subjected to this treatment in the future, according to Walter C. Evans, superintendent of radio operations.

MUSIC FEE UP, STATION SUES FOR OLD RATE

The music copyright fee imposed on stations by the American Society of Composers, Authors and Publishers, has cropped up again in a controversy, this time WCAU, Philadelphia, through the Universal Broadcasting Company, has started suit to prevent the society from interfering with programs.

WCAU was charged an annual fee of \$2,500. This has been raised to \$5,000. WCAU calls the doubled price exorbitant and refuses to pay more than \$2,500.

Getting Unbearable

"While we feel that we should pay for the use of copyrighted music," said Dr. Leon Levy, president of the Universal Broadcasting Company, "we do not feel the Society has a right to increase the fee 100 per cent. It has been the practice of this society to raise their fees annually and it has indicated that it will continue to do so.

"It is reaching a very oppressive point and if we all sit by idly, the Society will make it impossible for any broadcasting stations to operate, because of the exorbitant charges."

Fee Just, Says Mills

E. C. Mills, of the Society, said:

"The WCAU is strictly in line with fees charged other stations operating under like conditions. The station operates at 5,000 watts at full time on 256 meters. It sells time to advertisers at \$250 an hour. It uses not less than 2,000 hours of musical programs per annum and serves an area with a population of over 11,000,000 people within a radius of 100 miles.

"The station has held license of the society since September 1st, 1926. During the first year, when the station was undergoing the experimental period of being established, it was charged \$1,500 per annum. During the second and third years, after it had become established a power input of 500 watts, it was charged \$2,500 per annum. It has now increased its power input from 500 watts to 5,000 watts."

General Motors Plans To Make Receivers

Conferences are being held by representatives of General Motors and RCA for the licensing of the automotive corporation to manufacture radio receivers.

David Sarnoff, vice-president and general manager of RCA, said:

"Articles have recently appeared in the public press to the effect that arrangements have been made whereby the General Motors Company will distribute the products of the Radio-Victor Corporation.

"For the benefit of our trade channels, it is hereby stated that we have no plans for changing our present channels of distribution through which products of the Radio-Victor Corporation, including Radiolas, Radiotrons and Victor instruments, are supplied to the public.

"Discussions are in progress between the Radio Corporation of America and the General Motors Company in connection with a licensing arrangement for the manufacture by the General Motors Company of radio receiving sets under patents of the Radio Corporation of America."

PUBLISHERS CAN SUPPLY ALL 1929 SUMMER COPIES OF RADIO WORLD

If you have missed any copies of Radio World for the summer of 1929 and want to complete your file, let us know what issues you are short and we will mail them to you at 15c a copy, or any seven issues for \$1.00, mailed postpaid.

Circulation Dept., Radio World, 145 W. 45th St., N. Y. City.

SETS NOW USED REACH A TOTAL OF 21,629,107

Washington.

Lawrence D. Batson, of the electrical equipment division of the Department of Commerce, said that the tendency in Europe is for complete government control of broadcasting.

With one or two exceptions, he continued, one large central station is operated as the center of the broadcasting system, with numerous smaller systems connected with it to form a chain.

Recent indications are that Italy is expanding its broadcasting system more rapidly than other European countries, he said. In January and February, Italy imported more receiving sets than in any previous year. All broadcasting is controlled by the government.

Germany Owns Stations

In Germany all the stations are owned by the government through possession of controlling shares of the stock, Mr. Batson stated. There are ten central stations, each surrounded by smaller stations in that particular section. There was a hook-up of this entire system for the reception of the airship "Graf Zeppelin" in Los Angeles.

A tax of 10 shillings (\$2.42) per cent on all owners of receiving sets is the method used in the United Kingdom to maintain the government controlled and operated broadcasting stations, it was explained.

A peculiar situation exists in Danzig, it was stated. The League of Nations has prohibited broadcasting, which prohibition does not seem to be effective. However, the Department of Commerce has been unable to obtain definite reports regarding the situation there, he added.

Distribution of Sets

According to the electrical equipment division of the Department of Commerce, the estimated value of receiving set installations for the world is \$1,843,750,000 and the value of broadcasting installations is estimated at \$22,682,222.

There are 21,629,107 receiving sets in use in the world, of which the estimation shows the United States has 10,250,000 and Europe, aside from Russia and Turkey, has 9,139,824, says "The United States Daily." On the basis of the above compilations there is one receiving set for approximately every 88 people in the world, one set for every 53 people in Europe, and one set for every 12½ people in the United States.

Vreeland Gets New Selector Patent

An additional patent on the Vreeland band receiving system has been issued to Dr. Frederick K. Vreeland. The new patent, No. 1,725,433, covers the "band selector." It is one of a group of patents on the Vreeland inventions, which also includes the spaced band amplifier.

According to Dr. Vreeland the band selector is a simple circuit network of two tuned elements coupled by a common reactance which makes the circuit resonant to a band of frequencies instead of to a single frequency is in the ordinary tuned circuit.

It permits tuning simultaneously and equally to all frequencies sent out by the broadcasting transmitter and cutting off sharply all interfering frequencies.

A spaced band amplifier is usually used with the band selector in the Vreeland system.

The space band amplifier passes the modulation frequency indistortedly.

SCREEN SHOWS SOUND WAVES

The perfection of a device called "projection osiso," whereby musicians are enabled to see the sound waves they produce, has been announced by Westinghouse Electric and Manufacturing Company. The sound waves are caught by a microphone and are transmitted electrically to an osiso, which consists essentially of a combination of mirrors. A beam of light falls on a delicately suspended mirror which is oscillated in unison with the received sound waves. This mirror directs the beam to a system of revolving mirrors, which, in turn, project the beam on a screen, upon which observers may view the sound waves.

When no sound falls on the microphone, there is a long white line across the screen. When low pitch, pure tones fall on the microphone, this white line undulates, or assumes a wavy form. This form corresponds to the form of the sound wave. When complex sounds fall on the microphone, such as noises or musical chords, the white line assumes jagged appearance.

The device was developed by C. Anderson, engineer of the Westinghouse Electric & Manufacturing Company of Newark, in collaboration with William Braid White, acoustic engineer of the American Steel & Wire Company, a subsidiary of the United States Steel Corporation.

DISC PROGRAM TO RULE ETHER, SAYS BELLOWS

Washington.

The belief that mechanical reproductions eventually will supplant original talent in broadcasting programs and that stations of moderate power throughout the country will employ "canned" programs on a regular basis was expressed by Henry A. Bellows, of Minneapolis, former Federal Radio Commissioner.

Mr. Bellows declared he was optimistic about the success of "canned" programs. He said that mechanical reproduction of music and other program material now is so accurate that experienced radio listeners cannot detect the difference between them and original programs.

Recordings Are Excellent

The former Commissioner explained that electrical transcriptions now are being made which embody entire programs. That is, he said, the announcements of the stations as well as the program material itself, are recorded on the discs, which are actually phonograph recordings, but cannot be reproduced on an ordinary phonograph.

Radio advertisers, he predicted, gradually will go over to the mechanical reproduction method, whereby they may send the "copies" of their programs to stations throughout the country and obtain a more widespread listener coverage with a minimum investment. It is the way in which radio can be commercialized, he said.

5,000 Watts Enough

Regarding maximum power for broadcasting stations, Mr. Bellows declared he was convinced that the best service could be provided radio listeners with the power limit set at 5,000 watts instead of the present 50,000 watts. Transmitters like WOR, in Newark, N. J., and WMAQ, in Chicago, both of which use 5,000 watts, he declared, are rendering unquestionably good service.

Mr. Bellows, who is managing director of WCCO, has filed with the Commission as application for consent to transfer the license of the station from the Washburn-Crosby Co., Inc., to a newly formed subsidiary.

VENEZUELA RATIFIES PACT

Washington.

An announcement recently made by the Department of Commerce stated that Venezuela has ratified the international telegraphic convention, which was signed at Washington, November 25, 1927.

Either 199 or 201A Used in Schoolboy's Circuit

(Continued from page 17)

the tickler, that is, increase both volume and sensitivity. But you should learn to do this without producing squeals, as these enter the sets of neighbors, sometimes for a mile distant and more, certainly for a few squares. The receiver when squealing this way is like a broadcast station, in that it acts as a transmitter, but instead of sending sweet music it sends ugly squeals. These you hear at the same time the others hear them, but even if you don't mind them, remember that the neighbors may be listening to a delightful program, and if you tune in awkwardly or carelessly or indifferently you may cause them much displeasure, which you surely do not want to do.

The rheostat is used as switch to turn the set on and off, also as a volume control in addition to the tickler, should you desire to decrease volume. You may use the batteries as shown last week—two three No. 6 dry cells at 1.5 volts each and one 22½ volt B battery—to operate either a 199 or a 201A tube, even though the 199 calls for 3.3 volts on the filament and the 201A calls for 5 volts.

The reason is that the rheostat will reduce the filament voltage

for the 199 to the desired amount, and you will learn what the correct position of the rheostat is from ear test of the tube performance and from visual observation of the position of the rheostat knob. The tube should be operated far under maximum brightness.

The rheostat's resistance is totally cut out, by turning the knob to extreme position, to provide the full 4.5 volts to the filament if a 201A tube is used. This filament voltage is enough for detection, 5 volts not being necessary, indeed 4½ volts often gives better detection. Many may prefer the 201A because it is a better tube and costs less, being purchasable for 65 cents. It draws .25 ampere, whereas the 199, which costs more initially, draws .06 amperes, but the dry cells will last several months, even when a 201A is used, and the plate battery will last six months or more with either tube.

Remember to connect a wire from A minus to B minus and run this to the first binding post. The ground lead should be connected directly to the same post, rather than to either battery. A pictorial diagram last week showed the battery connections.

CLASSES IN 20 SCHOOLS LEARN THROUGH RADIO

With the opening of the fall school term the radio loudspeaker took its place beside the time-honored blackboard as a modern aid to teaching. According to Quinton Adams, vice-president of the Radio-Victor Corporation, twenty schools in various parts of the country began the new term equipped with centralized radio apparatus for the distribution of educational programs to the classrooms, and between sixty and seventy other schools are planning similar installations in the near future.

Of the twenty schools equipped with centralized radio, eleven are in New York State, five in New Jersey, two in Ohio, one in Wisconsin, and one in California. The number of loudspeaker outlets in classrooms varies from four in the Oyster Bay High School, Oyster Bay, N. Y., to fifty-one in the Floral Park Central High School, North Hempstead, N. Y.

What Comprises System

The centralized radio system consists of one or more receiving units mounted in standard switchboard fashion, and is not to be confused with the usual radio receiver and amplifier connected to scattered loudspeakers and headphones. One receiver, with amplifying, distributing and outlet equipment, constitutes one channel. As many as four channels may be used, giving listeners in various rooms a choice from four programs. Either the usual or the built-in wall type of loudspeaker may be used. There are similar installations for hotels, hospitals and apartment houses.

School authorities are closely watching this new adjunct to teaching with a view to applying it to the regular curricula, Mr. Adams said. Recently, Secretary of the Interior Wilbur, at the instance of President Hoover, appointed an advisory committee of outstanding educators to study the possibilities of education by radio.

Has Special Division

The Radio-Victor Corporation of America maintains a special division of education in charge of Alice Keith, who is also a member of Secretary Wilbur's committee. Last year this company sponsored a series of educational programs under the direction of Walter Damrosch, broadcast to hundreds of thousands of school-children over a nationwide radio network.

Loftin-White Sell Some Patents to RCA

The Loftin-White Laboratory of New York City has sold a group of radio patents and applications owned by Edward H. Loftin and S. Young White to the Radio Corporation of America.

The sale includes the non-reactive plate circuit patent. Optional rights to the constant coupling patent was also a part of the transaction.

POOLE WITH COIL FIRM

William C. Poole, formerly connected with the Federal-Brandes Corporation, recently was appointed chief electrical engineer of Transcontinental Coil, Inc., 5-7 Kirk Place, Newark, N. J., manufacturers of radio frequency coils. The Friedman-Snyder Company, 15 Park Place, New York City, has been appointed Eastern Sales representative.

Bat in Condenser Silences WEA F

A bat's decision to rest among the condenser plates of the power house of station WEA F in Belmore, N. Y., silenced the station for eight hours recently. The bat was shocked to death. His body fell across the plates, shortening the condenser.

Six hours elapsed before the bat was found and two hours were spent rebuilding the condenser.

ENGINEERS EYE TWO NEW BILLS

Washington.

So that legislation involving radio and wire control now pending in Congress may be studied, a committee of experts has been appointed by the American Engineering Council. The chairman of the committee is Edwin F. Wendt, of Washington, D. C. Other members are O. H. Caldwell, former Federal Radio Commissioner, of New York; Dean Dexter S. Kimbal, of Cornell University; Frank A. Scott, of Cleveland, and Charles B. Hawley, of Washington, D. C.

"Fundamental questions are involved in the bills of Senators Watson and Couzens, now pending in Congress," said Arthur W. Berresford, president of the American Engineering Council.

"The ultimate purpose of both is to establish a Commission somewhat like the Interstate Commerce Commission, but which would have supervision of radio, telephone and telegraph. Do such media of communication required by public interest need additional supervision and regulation? Is it in the public interest to create another Commission?"

"The purpose of the Couzens bill is to regulate all forms of interstate and foreign radio transmission communication within the United States, its territories, and possessions. This is to be accomplished through a commission of five men."

Speakers in Cathedral Raise the Audibility

London.

The difficulty of hearing services in the nave of Winchester Cathedral, the longest cathedral in England, has at last been remedied. Tests have shown that the public address system will do the trick. So speakers and microphones costing more than \$1,500 will be installed.

Ten speakers will be placed on each side of the nave, while others will be placed in places where there are dead spots. The speakers will all be connected with the pulpit microphone.

HAMMARLUND ENLARGES

The Hammarlund Manufacturing Company, 424 West 33rd Street, New York City, has taken an extra floor in the same building, which will add 13,000 square feet to its space, Lewis Winner, director of press relations, announced.

TEMPLE APPOINTS LATHAM

Gene M. Latham, of New York City, formerly with Atwater-Kent and the Victor Talking Machine Company, has been appointed district sales manager of the Temple Corporation of Chicago.

MONOPOLY WAR ON IN BUFFALO; BOARD TO ACT

Buffalo, N. Y.

An unusual case which tests many important aspects of the radio broadcasting situation will come before the Federal Radio Commission when the Buffalo "Evening News" in October presents its case for permission to build a station and operate it on 900 kilocycles.

The channel which will be applied for is now occupied by WMAK, one of the four stations operated by the Buffalo Broadcasting Corporation, which the Rev. Clinton H. Churchill heads. By merger this same company also controls WKBW, a 5,000 watt station, which uses some phonograph records for broadcasting, and WGR and WKEN.

It is contended that a monopoly of stations exists in Buffalo, and that if the Commission upholds the right of this monopoly, to the exclusion of effective competition, it paves the way for formation of similar local monopolies elsewhere. These it is also held would pave the way for the formation of inter-city combinations.

Another point to be raised is whether the Radio Commission will sanction the transmission of phonograph records over a 5,000 watt station.

Gloria Swanson Sings; Radio, Talkies Benefit

The handmaiden to the talking picture, radio, advanced the sound screen to new heights recently, when Gloria Swanson's singing voice was carried through the air from London to New York, rebroadcast through the nation, simultaneously being recorded on the RCA Phonophone talking film in New York.

Miss Swanson's voice originated in the London studio of 5 SW. It was then sent to the powerful short wave transmitter of this station at Chelmsford, which in turn transmitted the voice across the Atlantic. Special receiving stations in Riverhead picked it up. Wires carried the selection to the National Broadcasting Company headquarters at 711 Fifth Avenue, New York City, and then by wire again to the RCA photophone headquarters at 411 Fifth Avenue, where it was finally recorded on the film.

WNYC Asks Full Time In Appeal From Board

Washington.

A brief in the appeal of the New York municipal broadcaster, WNYC, against the decision of the Radio Commission making the station share time with WMCA, of Hoboken, N. J., has been filed by counsel for the city in the Court of Appeals in the District of Columbia.

The Commission ordered WNYC to operate with 500 watts on a frequency of 570 kilocycles. WNYC requests full time on the air.

HYVAC TUBE ISSUES STOCK

A new issue of 38,000 shares of stock of the Hyvac Radio Tube Corporation has just been made. The stock will be listed on the New York Curb Exchange.

LAW REQUIRES REVISION SAYS EXPERT GROUP

Washington.

In a report recently filed by the standing committee on radio law of the American Bar Association, of which Louis G. Caldwell, the former general counsel of the Federal Radio Commission, is chairman, repeal of the monopoly provisions of the radio act of 1927 as well as many other revisions is advocated.

Foreign Threat

"Because of section 13," the report says, "there is a constant threat to the foreign communication system of the United States. This section makes it possible for a larger proportion of the very valuable short waves which the United States has assigned for use by American stations to be thrown back into the international grab-bag, open to registration by other nations."

Another grave error in the act is Section 17, according to the report, "as this section rests upon a misconception as to the nature of radio and its relation to wire communication." These two means of communication, the report contends, should be permitted to combine under proper conditions. This would benefit the public greatly.

Wants Separated Authority

The report also states that the existing uncertainty and separation of authority in radio administration should be eliminated by putting radio registration definitely in the hands of either the Federal Radio Commission or the Department of Commerce.

The report advises that the Davis amendment of March 28th, 1928, which required the Commission to allocate all broadcasting facilities equally as between the zones and in proportion to population as between the States in each zone, be repealed. It also advocates the repeal of the provision dividing the country into zones and the repeal of the section which states that construction permits are needed before a station can be constructed.

Unified Engineering Planned by Big Three

Steps are being taken to combine the radio engineering departments of the General Electric Company, the Westinghouse Electric and Manufacturing Company and the Radio-Victor Talking Machine Company. The engineering staffs would be located in Camden, N. J., the central offices of Radio-Victor.

The merger would reduce the sales cost, because of the royalty fee saving. Now these fees total about 20% of the sales. The consolidation would reduce it to about 10%.

RCA Message Station Asks 80,000 Watts

Washington.

A license for a station to be known as WAZ and located at New Brunswick, N. J., to operate with 80,000 watts power on 14,429 kilocycles was recently requested of the Radio Commission by Radio Corporation of America Communications, Inc.

KDKA Imitates Sound of Big Ben

Synthetic reproduction now enables the listeners of KDKA, the Westinghouse station in Pittsburgh, to hear the voice of London's famous clock, Big Ben, every day.

KDKA first introduced the sound of the great old timekeeper to its listeners by relaying it from London through a short-wave receiving set. Hearing these mellow sounds coming from his speaker, Dr. Frank Conrad, assistant chief engineer of the Westinghouse Company, conceived the idea of reproducing the same sound artificially.

He turned his idea over to V. E. Trounant, radio engineer, and as a result the duplicate of Big Ben is broadcast by KDKA exact'y upon the hour. The sound is not mentioned by the announcer. It simply is a note in the background of the program. At periods when the time is given by an announcer the synthetic bell is not used.

The tone is created by a number of oscillators, each one giving a certain frequency. These frequencies were selected through an analysis of Big Ben's tones. By combining the frequencies the same signal is carried to the transmitter and sent out on the air as would be produced by sounding the bell itself into a microphone.

ATOMS BOOM FROM SPEAKERS

With the aid of special amplifying apparatus, sounds known to scientists as the "smallest voices"—explosions of atoms of uranium—were broadcast over WEAf and its network. So high'y amplified were these explosions that they resembled the rapid fire of a machine gun.

The experiments were conducted in the research laboratories of the General Electric Company in Schenectady, N. Y.

What is known as the Geiger counter, which resembles a radio receiver with a small tube projecting from one end, was used to obtain the explosive effect, according to L. A. Hawkins, engineer of the research laboratory, who conducted the experiment.

A small piece of the radio-active uranium, a relatively sluggish element, was placed before this tube with the consequent explosions occurring. These in turn discharged electrons which were amplified until audible.

The sounds of the atomic explosions of a small piece of radium were transmitted also. Radium being a far more active element, the explosions were far more rapid. Mr. Hawkins pointed out that the radium compound as large as a pencil point would permit the continuance of this atomic explosion experiment for about 1,500 years.

TROPICS' RECEPTION ILLS

In a recent report of preliminary research in tropical and equatorial problems, Harry W. Wells, radio research engineer with the All-American Lyric Expedition to Dutch Borneo, stated that moisture and static are the two worst enemies in the tropics.

50 NEW AIRWAY BEACONS

Washington.

The Department of Commerce recently announced that fifty new directional radio beacons will be installed soon on airways throughout the country.

EACH MEMBER OF BOARD GETS HIS OWN TASKS

Washington.

A general reorganization of the Federal Radio Commission was recent'y made, with the naming of new committees and the assignments of individual members to special duties.

Committees have been appointed to oversee such subjects as planning and publicity, hearings, courts, legislation, budget and personnel. Individual members have been placed in charge of distinct divisions.

Hearings ordinarily will be conducted by a member of the hearings committee, or by an examiner assigned to do this. The Commissioner or examiner will report the evidence for decision by the full membership of the Commission. Eugene O. Sykes was appointed chairman of this committee. Heretofore as many members attended the meetings as could be present.

Commissioner Sykes will also be in charge of the newly-formed legal division. Commissioner Salzman will take care of the engineering division, while Commissioner Starbuck will act as a liaison member. Commissioner Lafount will take care of special field investigations.

Press Wireless Asks For Wave Monopoly

Washington.

The Federal Radio Commission recently has received applications from Press Wireless, Inc., a public utility corporation, asking to take over the frequencies assigned to the press of the country and to build twenty-six radio stations each of 10,000 watts power in various parts of the United States.

Two stations each would be built in Little Neck, N. Y., New Orleans, Chicago, San Francisco, Los Angeles, Washington, D. C., and Newton Upper Falls, Mass., and one station each at Cleveland, Detroit, Philadelphia, Atlanta, Dallas, Miami, Memphis, Kansas City, Mo., Minneapolis, Denver, Seattle and Salt Lake City.

Wise Joins Sylvania As Chief Engineer

Roger M. Wise, for seven years chief engineer of E. T. Cunningham, Inc., was recently appointed chief engineer of the Sylvania Products Company, tube makers, of Emporium, Pa.

Mr. Wise for the past fifteen years has engaged in every phase of radio engineering. He is an electrical engineering graduate of the University of California. During the World War, he was chief radio electrician in the Naval Air Service. He was last with the tube division of Grigsby-Grunow Company, makers of Majestic tubes.

TUBE COURSE CONTINUES

S. Gordon Taylor, at the College of the City of New York, 140th Street and Convent Avenue, New York City, will continue his radio tube course through the Fall Term, beginning October 1st, for sixteen weeks. The class will be strictly limited in number and the instructional work will consist of two hours of lectures and discussion and one hour of laboratory work each week.

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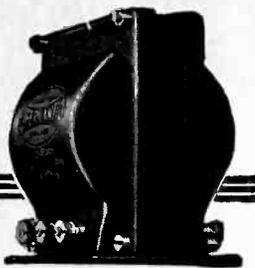
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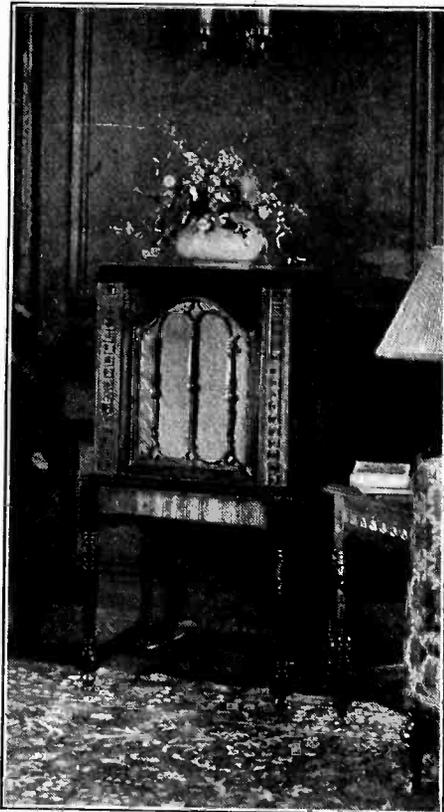
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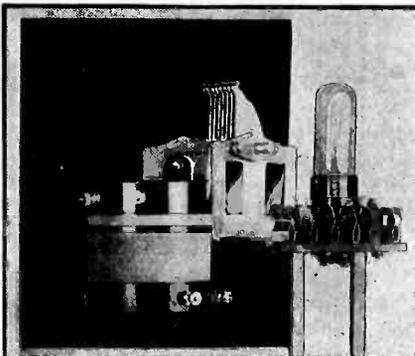
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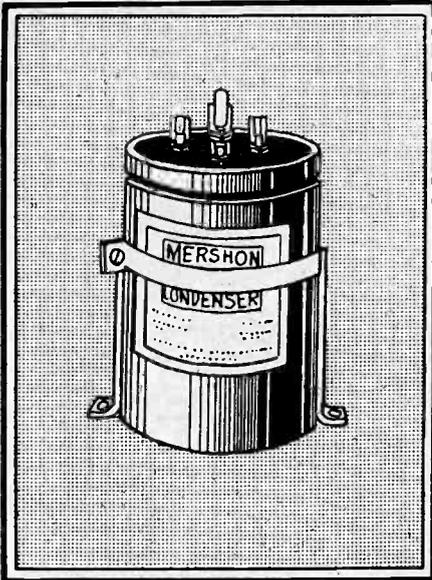
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- Cat. No. S-72. list price \$10.00; net, \$5.88
- Cat. No. D-8. list price \$5.25; net, \$3.08
- Cat. No. D-9. list price \$5.75; net, \$3.38
- Cat. No. D-18. list price, \$6.15; net, \$3.62
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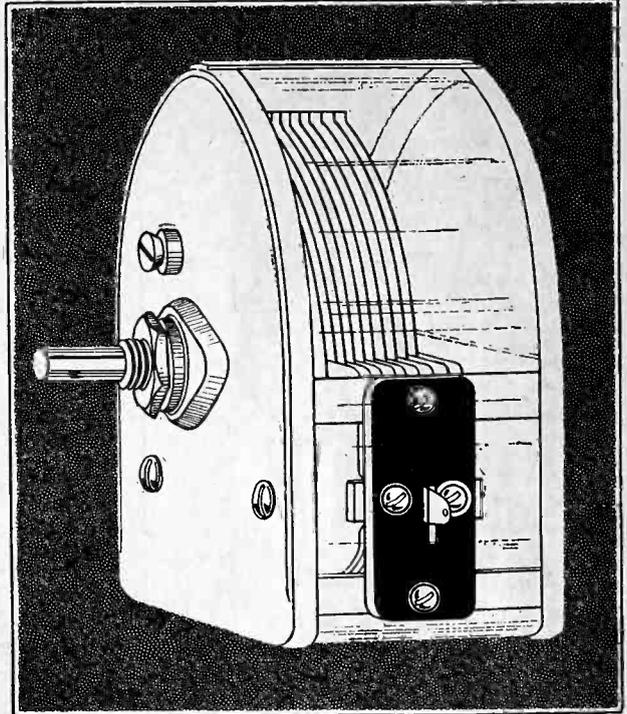
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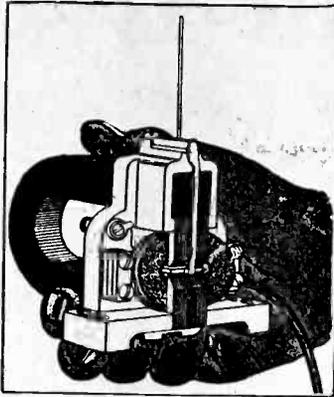
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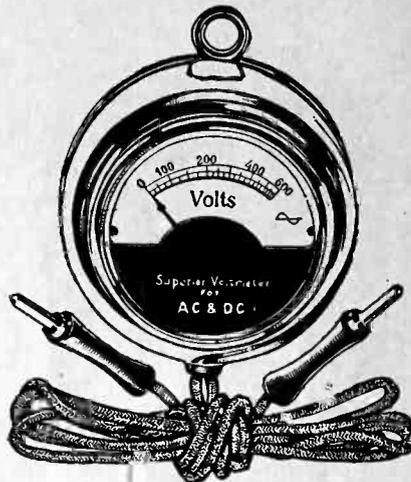
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Here is a meter that serves an abundance of uses, because it has a wide voltage range, 0 to 600 volts, and measures voltage of alternating current and direct current, and is accurate to 1%. In a meter it's accuracy that counts.

You can measure not only the DC voltages of B eliminators, power packs and B batteries, with easily legible readings of 20 volts per division of the scale, with wide divisions between 100 and 400 volts, so that you can easily see to within 5 volts, but you can also measure the AC voltage across high-voltage power transformer secondaries. If full-wave rectification is used, you measure each of the two sections of the transformer secondary and add the voltages. Thus up to 1,200 total volts across the secondary may be read. For half-wave rectification, a secondary up to 600 volts is read across the total winding. You find out at once whether this winding is open or shorted, since no reading then would be obtained, or find out whether the voltage is right, or too high or too low. In all instances the AC voltage across the secondary should read higher than the desired DC output, due to the voltage drop in the tube and to the current in the entire voltage divider and its sections. The normal deduction from the AC voltage, to obtain the DC voltage, is at least 10%.

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Often service men, experimenters and students must know not only the transformer high voltage, but also whether the AC line voltage is the rated 110 volts or not. This meter tells you. Connect it across the 110-volt line. By reading this voltage and the voltage of the high-voltage secondary you can also determine the step-up ratio, by dividing the smaller reading into the larger.

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Only a high-resistance meter can accurately measure the DC voltage of a B eliminator. Other meters draw so much current that the reading may be 50 volts less than what it should be, or still more inaccurate, and you could almost guess the voltage more accurately than a low-resistance meter would read.

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This meter is sold on a 5-day money-back guaranty. Buy one, try it, test it thoroughly, compare it with other meters in performance and appearance. If not fully satisfied, send it back and your money will be promptly refunded.

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This meter, which is of the moving vane type, is made in Germany and represents finest workmanship.

Cat. M600 AC-DC \$6.00

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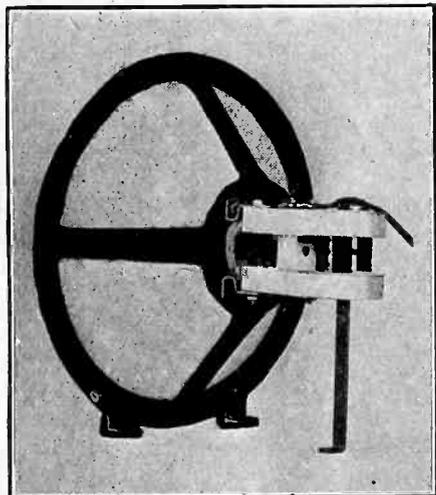
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A new principle is involved in the Inductor Chassis. The armature moves up and down, in a wide gap, instead of from side to side in a tiny gap. Hence the armature does not strike the pole pieces.

The chassis is offered at professional discounts, the prices quoted being net. The outside diameters of the two different sized models are 9" and 12" respectively. The speaker should be selected, no matter which size, that matches the impedance of the output tube or tubes. See the list below.

For single 112, 112A or 210 output tube, 9" diameter, order Cat. N9R. For 171, 171A, 245 or 250 single output, or ANY push-pull output where you have an output transformer or midtapped impedance order Cat. N9G @ \$11.95 net.

Same as above, only 12" outside diameter, N12R for tubes in previous "R" Model, and N12G for tubes to previous "G" Model @ \$12.95 net.

For push-pull, where you have no output transformer or midtapped impedance, order N12PP at \$15.25 net, and the speaker is its own output device.

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Completely built up, for any type dynamic chassis. State what make dynamic you want it for. Cone sides, open back. Do luxe finish. Size, 24x24 inches..... **\$12.00**

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A Delight to Radioists

was the Show Number of RADIO WORLD, dated September 21st, and containing a fascinating assortment of features.

The first instalment of the constructional article on the AC Model HB Compact, five tubes, including rectifier, was published in that issue, with five photographic illustrations that clarify the layout of parts, and with an exceptionally brilliant exposition of the functioning of the Bernard Dynamic Tuners used in the circuit. Read every word of this description by Herman Bernard and become convinced that these coils perform wonderfully in this screen grid circuit.

The first instalment of the article on how to build the Schoolboy's One-Tube DX Set, by Jack Tully, is what every youngster wants to read, especially as the parts cost only \$4.28, and there is no end of fun experimenting with this circuit.

Coupling of screen grid tubes at radio frequencies is an important subject, and is treated in a most interesting manner by J. E. Anderson, technical editor, in his article, "Up Goes the Volume." He reveals the secrets of obtaining highest amplification from the screen grid tube as radio frequency amplifier.

"First Presentation of Detection by Linear Rectifier," by J. E. Anderson and Herman Bernard, being an instalment of their serially-published book, "Power Amplifiers," shows how to filter the plate circuit so as to get rid of the carrier frequency. The same principles applied to filtering a B supply to get rid of hum are used to eliminate the carrier and leave only the audio component, thus achieving detection with great selectivity and unlimited volume.

"Ohm's and Kirchoff's Laws Expounded." This is certainly an attractive subject, since one simply must not only know these two laws, but how to apply them. Bryant Holworthy has treated the subject masterfully.

STATIONS! STATIONS!

You are certainly interested in an up-to-date list of stations. How would you like several such lists? They're in the September 21st issue. There's the list of broadcasting stations by call letters, alphabetically arranged; the list of stations by frequencies and wavelengths; a list of U. S. short wave stations; a list of some foreign short wave stations, but the hours on the air of all of those published are included; then the lists of stations of the two big chains, with call letters, locations, frequencies and waves—the Columbia Broadcasting System and the National Broadcasting Company. And also there's a list of Canadian stations, with hours on the air!

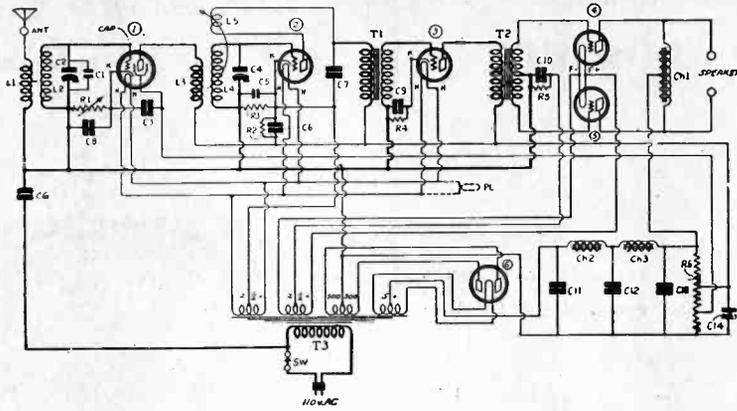
Two full pages, with thirteen illustrations, reveal the new parts for the 1930 season, an attractive subject to all constructors.

Besides these, there's an editorial page and two full pages of Radio University, where technical questions are answered. The tuning curves of the HB Compact, either battery or AC model, are published in Radio University, and you can thereby tell just how to tune in the stations at the right dial settings. Other questions on the HB Compact are answered.

Send 15c for a copy of the September 21st issue, or start your subscription with that issue.

RADIO WORLD,
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PARTS FOR PUSH-PULL DIAMOND



Circuit Diagram of AC Screen Grid Push-Pull Diamond of the Air

- | | | | |
|---|----------|---|-------|
| L1, L2—One antenna coil (Cat. AC5)..... | \$0.75 | R5—One 800 ohm Electrad resistance strip.. | .20 |
| L3, L4, L5—One SG 3-circuit tuner (Cat. SGT5) | 1.25 | R6—One Aerovox Pyrohm type B (750, 750, 2,800, 3,000) | 1.00 |
| C1—One Hammarlund equalizer, 70 mmd.... | .35 | T1—One National A100 audio transformer... | 5.70 |
| C2, C4—One Hammarlund dual condenser, .0005 (Cat. MLD23)..... | 5.50 | T2—One National push-pull input transformer | 5.70 |
| C3, C5, C6, C8, C9—Six Aerovox .02 mfd. fixed condensers..... | each .80 | T3—One power transformer (5, 2.5, 2.5, 300, 300v.) | 10.00 |
| C7—One Aerovox .0005 mfd. fixed condenser | .20 | Ch1—One push-pull output choke..... | 5.00 |
| C10—One Aerovox 4 mfd. bypass condenser | 1.50 | Ch2, Ch3—One S-M Unichoke 331..... | 4.80 |
| C11, C12, C13, C14—Mershon 8-18-18-8..... | 5.76 | Ant., Gnd., Speaker—, Speaker+—four binding posts | .15 |
| R1—One Electrad Royalty variable resistor, 5,000 ohms, with 110-volt AC switch..... | 1.50 | One 7 x 21" front panel..... | 1.65 |
| R2, R3—One 25,000 ohm Electrad resistor type B (with 3 terminals)..... | .75 | One flat type dial, with dial pointer..... | .95 |
| R4—One 1,000 ohm Electrad resistance strip | .20 | Two knobs | .20 |
| | | One roll Corwico Braidite..... | .35 |
| | | One 2.5v AC pilot light, with bracket..... | .60 |

Above is complete, less baseboard, sockets, tubes and cabinet.

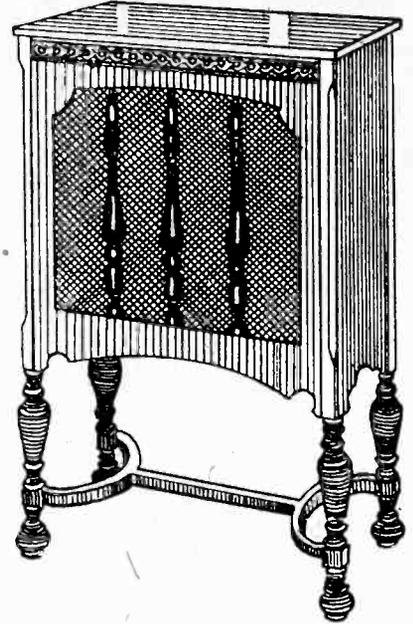
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Complete details on the theory and construction of the HB Compact were published in a four-part article in Radio World, written by Herman Bernard, designer of the circuit and inventor of the Bernard Dynamic Tuners used in the circuit. Full details on how to wind your own coils. Full-size pictorial diagram of the wiring. Order the August 24th, 31st, September 7th and 14th issues, 60c—RADIO WORLD, 145 West 45th Street, New York, N. Y.

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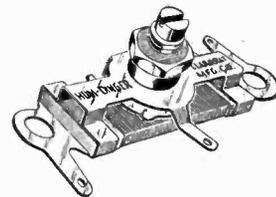
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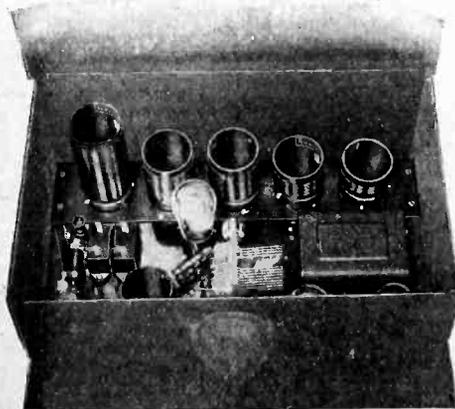
In AC circuits accuracy of the electrical center, particularly with power tubes, is easily obtained through a fixed resistor with adjustable center tap. Then hum due to unbalance in the filament circuit is dispelled. Use the 30-ohm Humdinger, adjustable with knife or screw driver. Connect extreme ends across filament winding, biasing resistor to center lug. Then adjust. Also useful as 30-ohm filament resistor in battery sets, using extreme terminals, or 4 to 15 ohms adjustable, from center to one extreme terminal. Special!

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Polo 245 Power Supply

Scientifically Engineered, It Insures Superb Performance

THE Polo 245 Power Supply consists of a filament transformer, a high-voltage (plate) winding and two separate chokes, all built in a single cadmium-plated steel casing, for powering 224, 227, 228 and 245 tubes. The output may be a single 245 or two 245s in push-pull, because the chokes are large enough and strong enough to handle 100 milliamperes, while the power tube filament winding will easily take care of the two 245s. The entire supply is exceedingly compact and will fit in a cabinet that has the usual 7" high front panel. The high-voltage winding is of sufficiently high AC voltage to produce full 300 volts when the maximum direct current through any part of a voltage-dividing resistor is 80 ma. Of the 300 volts 250 are applied to the output tube's plate and 50 to its grid for negative bias.

All windings except the primary (110 volts, 50 to 60 cycles) are center-tapped, including the 5-volt winding for the 280 rectifier tube. The impedance bridge method is used for establishing the electrical center. Taking the positive rectifier voltage from the center of the 5-volt winding, instead of from either side of the filament, is a small extra advantage, but shows an extra stroke of careful workmanship to insure superb performance.

Another interesting point is that the high-current winding for all the 2.5-volt AC tubes to be used in a receiver or amplifier is rated at 12 amperes. This means that six heater type tubes may be worked well within the limits of the winding (total of 10.5 amperes used), while seven tubes may be used with the permissible excess of only .25 ampere over the rating (total 12.25 amperes). Of course the two or three other tubes (280, 245) are additionally supplied, from their individual windings. Hence a total of ten tubes may be worked (including 245 push-pull and 280 rectifier).

This is no mere estimate, but a scientific fact. The wire used on this 12-ampere winding is the equivalent of No. 9. Please read our chief engineer's report herewith.

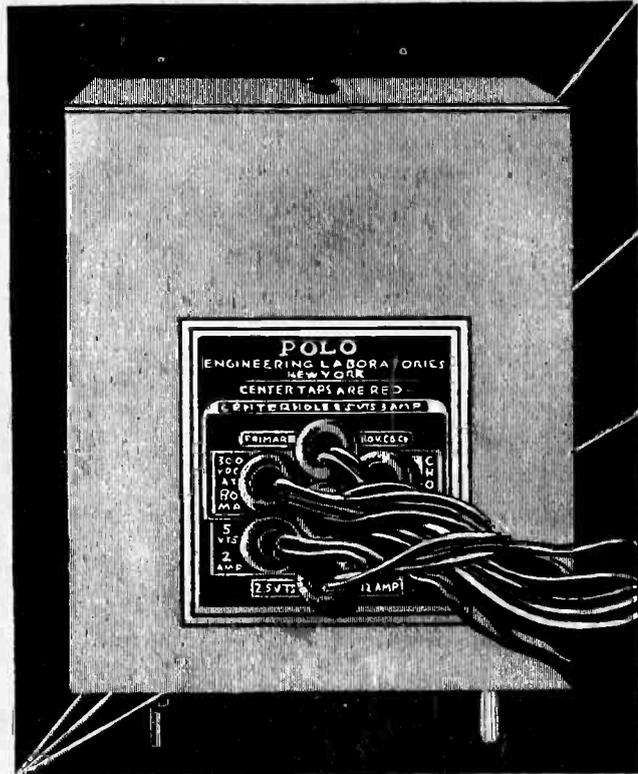
The two chokes are 50 henries each, and each choke is on a separate core.

The 245 Power Supply weighs 16 pounds. The shipping weight is 17 pounds.

For 40-cycle current, 110 volts, a special supply 2" higher, is made. Cat. P245, S40 (Code Cyclone). Price \$13.50.

The 245 Power Supply, with chokes, is made also for 25 cycles, 110 volts. Only this particular combination is made for 25 cycles, although the filament-plate supply (less chokes) and the filament supply (less chokes and high-voltage winding) are made for 40 cycles.

For 25 cycles order Cat. No. P245 S 25 4 5/8" wide x 5 1/8" front to back x 9 1/8" high. Shipping weight 25 lbs. (Code Cypress) at.....\$14.50



Polo 245 Power Supply, including two chokes built in, size 4 5/8" wide x 5 1/8" front to back, 6 1/8" high. Cat. No. P245 PS 110 volts, 50-60 cycles (code Cyclops).....\$10.00
 Cat. No. P245, S40, for 40 cycles, 110 volts; size 4 5/8" wide x 5 1/8" front to back, by 8 1/8" high (code Cyclone).....\$13.50

Chief Engineer's Report on Polo 245 Power Supply

By Walter J. McCord, Chief Engineer

Every precaution has been taken to produce a 245 power supply of superb performance, and in proof thereof I take pleasure in submitting for close study by engineering minds the specifications followed, with advice to novices.

(1)—Overall dimensions of the casing, 4 5/8" wide x 5 1/8" front to back x 6 1/8" high.

(2)—Filament and plate secondary windings as follows: 724 volts at 100 ma, center tapped at 362; 5 volts at 2 amperes, center tapped; 2.5 volts at 3 amperes, center tapped; 2.5 volts at 12 amperes, center tapped.

(3)—Two 50-henry chokes, DC resistance of each, 420 ohms.

(4)—Primary draw with all secondaries worked at maximum, 88 watts.

(5)—One transformer core with 1" x 1 3/4" cross-section; window opening 2 1/8" x 3/4". Two choke cores with 3/8" x 1 3/4" cross-section; window

opening 1/2" x 1 3/4"; .014" air gap. The laminations are stamped from high-grade Silicon sheet steel having 1.92 watts loss per pound. The joints in the transformer are all overlapping, holding the magnetic leakage to a minimum.

(6)—Size of wire and resistance of each winding as follows: Primary—No. 24 wire, DC resistance, 5.2 ohms. Plate Sec.—No. 30 wire, DC resistance, 104.5 ohms. 5 v.—No. 18 wire, DC resistance, .102 ohms. 2 1/2 v., 3 a.—No. 18 wire, DC resistance, .051 ohm. 2 1/2 v., 12 a.—.059 x .180 rectangular wire (equals approximately No. 9 wire), DC resistance, .008 ohm.

(7)—Total weight of block 16 lbs.

(8)—Casing is made of sheet steel and is cadmium plated. Four 3/4" mounting screws are placed in the bottom, permitting the block to be mounted to the base, in a very small space, as no space is required for mounting flanges.

(9)—Care should be taken in connecting the leads so that none of the secondaries is shorted. A shorted secondary, either a direct short or through a defective condenser, soon will burn out a transformer. Care should be taken also in connecting the primary to the proper current. The primary should be connected to 110 v. 50-60 cycles AC, never to 220 volts, neither should it be operated on a line voltage of 130 or over.

FILAMENT-PLATE SUPPLY

The Polo 245 Power Supply, less the two built-in chokes, is available to those desiring to utilize chokes they now have, and who do not find the compactness afforded by the consolidated unit absolutely necessary.

The Filament-Plate Supply has the same voltages on the secondaries, at the same ratings, as does the unit that includes the chokes.

Polo Filament-Plate Supply, consisting of five windings; primary 110 v., 50-60 cycles. Cat. No. PFPS (code Cymbal), \$7.50.

Same as above, except for 40 cycles 110 v. AC, and a little greater height. Cat. P40 FPS (code Cylinder), \$10.00.

FILAMENT SUPPLY

A filament transformer only, in a smaller container than any of the others, but with the same voltage and current ratings, provides 2.5 v. at 3 amperes, 2.5 v. at 12 amperes, 5 v. at 2 amperes.

The Polo Filament Transformer, consisting of four windings as described; primary, 110 v. 50-60 cycles. Cat. No. PFT (code Cyclist) \$4.25. Same as above, except for 40 cycle, 110 v. AC, Cat. P40 FT (code Cyanide), \$6.25.



Polo 245 Filament Plate Supply (less chokes) is 4 1/2" wide, 5" high, 4" front to back. Weight 9 lbs.

NO C. O. D. ORDERS.

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P245 S40 (code Cyclone).....	13.50
P245 S25 (Code Cypress).....	14.50
PFT (code Cyclist).....	4.25
P40 FT (code Cyanide).....	6.25
PFPS (code Cymbal).....	7.50
P40 FPS (code Cylinder).....	10.00

In ordering by telegraph use code designations.

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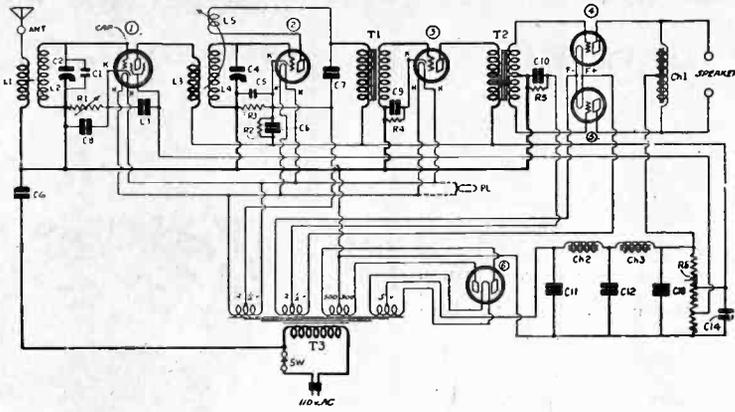
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PARTS FOR PUSH-PULL DIAMOND



Circuit Diagram of AC Screen Grid Push-Pull Diamond of the Air

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| L3, L4, L5—One SG 3-circuit tuner (Cat. SGT5) | 1.25 | R6—One Aerovox Pyrohm type B (750, 750, 2,800, 3,000) | 1.00 |
| C1—One Hammarlund equalizer, 70 mfd.... | .35 | T1—One National A100 audio transformer... | 5.70 |
| C2, C4—One Hammarlund dual condenser, .0005 (Cat. MLD23)..... | 5.50 | T2—One National push-pull input transformer | 5.70 |
| C3, C5, C6, C8, C9—Six Aerovox .02 mfd. fixed condensers..... | each .80 | T3—One power transformer (5, 2.5, 2.5, 300, 300v.) | 10.00 |
| C7—One Aerovox .0005 mfd. fixed condenser | .20 | Ch1—One push-pull output choke..... | 5.00 |
| C10—One Aerovox 4 mfd. bypass condenser | 1.50 | Ch2, Ch3—One S-M Unichoke 331..... | 4.80 |
| C11, C12, C13, C14—Merphon 8-18-18-8..... | 5.76 | Ant., Gnd., Speaker—, Speaker—four binding posts | each .15 |
| R1—One Electrad Royalty variable resistor, 5,000 ohms, with 110-volt AC switch.... | 1.50 | One 7 x 21" front panel..... | 1.65 |
| R2, R3—One 25,000 ohm Electrad resistor type B (with 3 terminals)..... | .75 | One flat type dial, with dial pointer..... | .95 |
| R4—One 1,000 ohm Electrad resistance strip | .20 | Two knobs..... | each .20 |
| | | One roll Corwico Braidite..... | .35 |
| | | One 2.5v AC pilot light, with bracket..... | .60 |

Above is complete, less baseboard, sockets, tubes and cabinet.

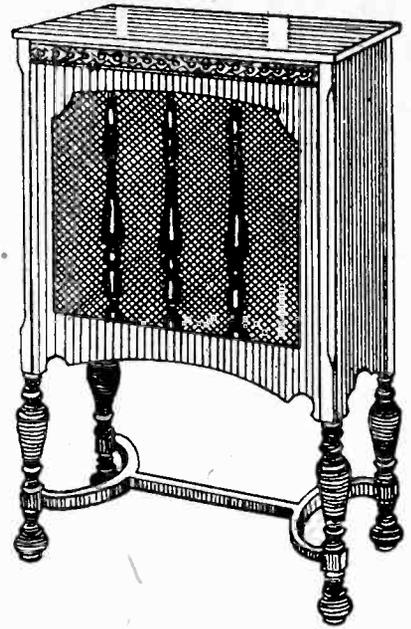
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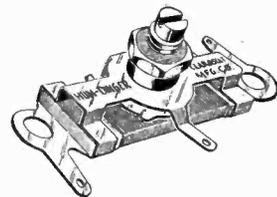
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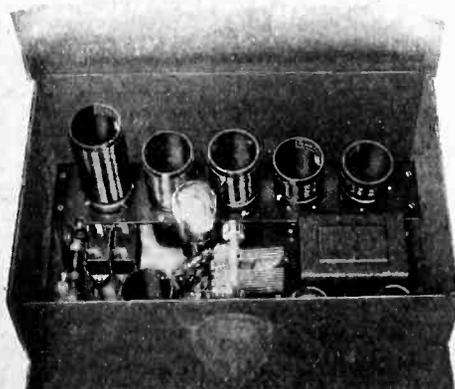
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Scientifically Engineered, It Insures Superb Performance

THE Polo 245 Power Supply consists of a filament transformer, a high-voltage (plate) winding and two separate chokes, all built in a single cadmium-plated steel casing, for powering 224, 227, 228 and 245 tubes. The output may be a single 245 or two 245s in push-pull, because the chokes are large enough and strong enough to handle 100 milliamperes, while the power tube filament winding will easily take care of the two 245s. The entire supply is exceedingly compact and will fit in a cabinet that has the usual 7" high front panel. The high-voltage winding is of sufficiently high AC voltage to produce full 300 volts when the maximum direct current through any part of a voltage-dividing resistor is 80 ma. Of the 300 volts 250 are applied to the output tube's plate and 50 to its grid for negative bias.

All windings except the primary (110 volts, 50 to 60 cycles) are center-tapped, including the 5-volt winding for the 280 rectifier tube. The impedance bridge method is used for establishing the electrical center. Taking the positive rectifier voltage from the center of the 5-volt winding, instead of from either side of the filament, is a small extra advantage, but shows an extra stroke of careful workmanship to insure superb performance.

Another interesting point is that the high-current winding for all the 2.5-volt AC tubes to be used in a receiver or amplifier is rated at 12 amperes. This means that six heater type tubes may be worked well within the limits of the winding (total of 10.5 amperes used), while seven tubes may be used with the permissible excess of only .25 ampere over the rating (total 12.25 amperes). Of course the two or three other tubes (280, 245) are additionally supplied, from their individual windings. Hence a total of ten tubes may be worked (including 245 push-pull and 280 rectifier).

This is no mere estimate, but a scientific fact. The wire used on this 12-ampere winding is the equivalent of No. 9. Please read our chief engineer's report herewith.

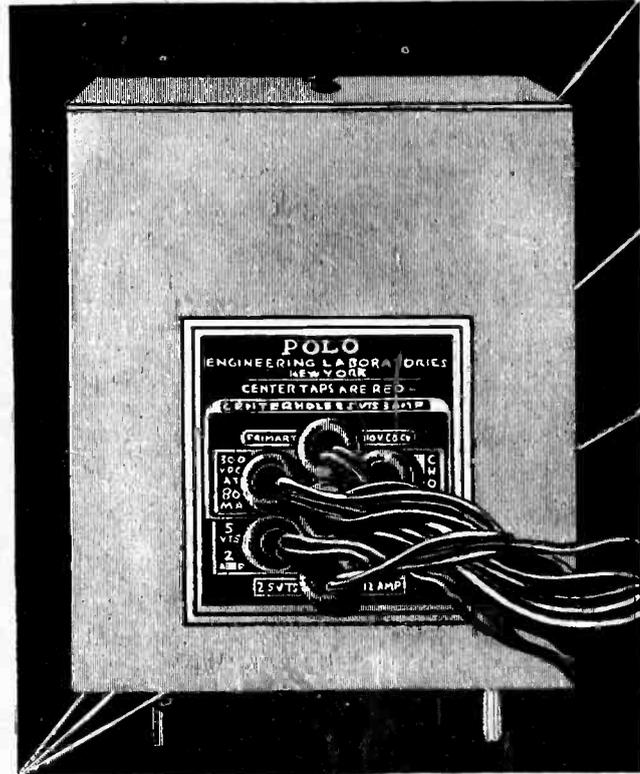
The two chokes are 50 henries each, and each choke is on a separate core.

The 245 Power Supply weighs 16 pounds. The shipping weight is 17 pounds.

For 40-cycle current, 110 volts, a special supply 2" higher, is made. Cat. P245, S40 (Code Cyclone). Price \$13.50.

The 245 Power Supply, with chokes, is made also for 25 cycles, 110 volts. Only this particular combination is made for 25 cycles, although the filament-plate supply (less chokes) and the filament supply (less chokes and high-voltage winding) are made for 40 cycles.

For 25 cycles order Cat. No. P245 S 25 4 5/8" wide x 5 1/4" front to back x 9 1/8" high. Shipping weight 25 lbs. (Code Cypress) at.....\$14.50



Polo 245 Power Supply, including two chokes built in, size 4 5/8" wide x 5 1/4" front to back, 6 1/8" high. Cat. No. P245 PS 110 volts, 50-60 cycles (code Cyclops).....\$10.00
 Cat. No. P245, S40, for 40 cycles, 110 volts; size 4 5/8" wide x 5 1/4" front to back, by 8 1/8" high (code Cyclone).....\$13.50

Chief Engineer's Report on Polo 245 Power Supply

By Walter J. McCord, Chief Engineer

Every precaution has been taken to produce a 245 power supply of superb performance, and in proof thereof I take pleasure in submitting for close study by engineering minds the specifications followed, with advice to novices.

- (1)—Overall dimensions of the casing, 4 5/8" wide x 5 1/4" front to back x 6 1/8" high.
- (2)—Filament and plate secondary windings as follows: 724 volts at 100 mils, center tapped at 362; 5 volts at 2 amperes, center tapped; 2.5 volts at 3 amperes, center tapped; 2.5 volts at 12 amperes, center tapped.
- (3)—Two 50-henry chokes, DC resistance of each, 420 ohms.
- (4)—Primary draw with all secondaries worked at maximum, 88 watts.
- (5)—One transformer core with 1" x 1 3/4" cross-section; window opening 2 1/8" x 3/4". Two choke cores with 3/8" x 1 3/4" cross-section; window

opening 1/2" x 1 3/4"; .014" air gap. The laminations are stamped from high-grade Silicon sheet steel having 1.92 watts loss per pound. The joints in the transformer are all overlapping, holding the magnetic leakage to a minimum.

- (6)—Size of wire and resistance of each winding as follows: Primary—No. 24 wire, DC resistance, 5.2 ohms. Plate Sec.—No. 30 wire, DC resistance, 104.5 ohms. 5 v.—No. 18 wire, DC resistance, .102 ohms. 2 1/2 v., 3 a.—No. 18 wire, DC resistance, .051 ohm. 2 1/2 v., 12 a.—.059 x .180 rectangular wire (equals approximately No. 9 wire), DC resistance, .008 ohm.
- (7)—Total weight of block 16 lbs.

(8)—Casing is made of sheet steel and is cadmium plated. Four 3/4" mounting screws are placed in the bottom, permitting the block to be mounted to the base, in a very small space, as no space is required for mounting flanges.

(9)—Care should be taken in connecting the leads so that none of the secondaries is shorted. A shorted secondary, either a direct short or through a defective condenser, soon will burn out a transformer. Care should be taken also in connecting the primary to the proper current. The primary should be connected to 110 v. 50-60 cycles AC, never to 220 volts, neither should it be operated on a line voltage of 130 or over.

FILAMENT-PLATE SUPPLY

The Polo 245 Power Supply, less the two built-in chokes, is available to those desiring to utilize chokes they now have, and who do not find the compactness afforded by the consolidated unit absolutely necessary.

The Filament-Plate Supply has the same voltages on the secondaries, at the same ratings, as does the unit that includes the chokes.

Polo Filament-Plate Supply, consisting of five windings; primary 110 v., 50-60 cycles. Cat. No. PFPS (code Cymbal), \$7.50.

Same as above, except for 40 cycles 110 v. AC and a little greater height. Cat. P40 FPS (code Cylinder), \$10.00.

FILAMENT SUPPLY

A filament transformer only, in a smaller container than any of the others, but with the same voltage and current ratings, provides 2.5 v. at 3 amperes, 2.5 v. at 12 amperes, 5 v. at 2 amperes.

The Polo Filament Transformer, consisting of four windings as described; primary, 110 v. 50-60 cycles. Cat. No. PFT (code Cyclist) \$4.25.

Same as above, except for 40 cycle, 110 v. AC. Cat. P40 FT (code Cyanide), \$6.25.



Polo 245 Filament Plate Supply (less chokes) is 4 1/2" wide, 5" high, 4" front to back. Weight 9 lbs.

NO C. O. D. ORDERS.

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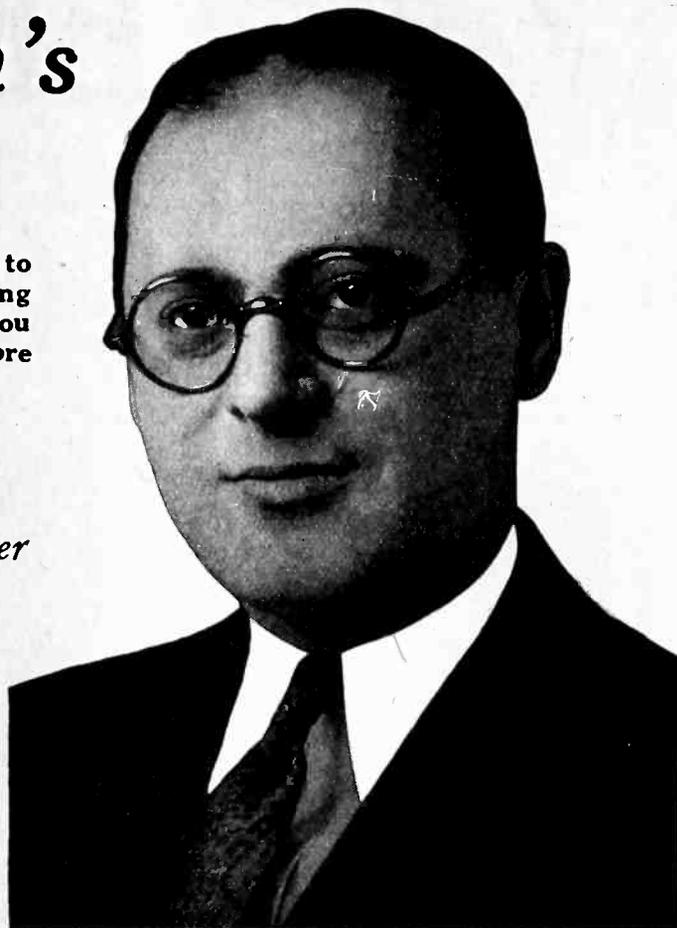
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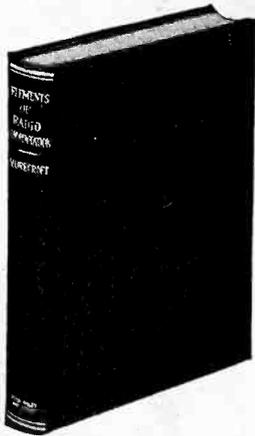
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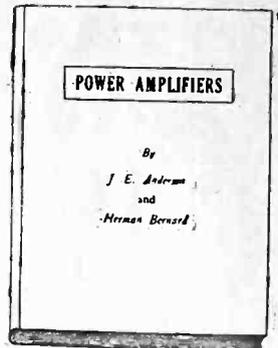
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Two switches and nine tip jacks are on the panel. The jacks are marked to receive the four-tipped leads which emerge from the plugged cable connector. These leads are colored red, blue, brown and white, and so are little rings around the tip jacks that the leads connect to. All nine jacks are marked besides.

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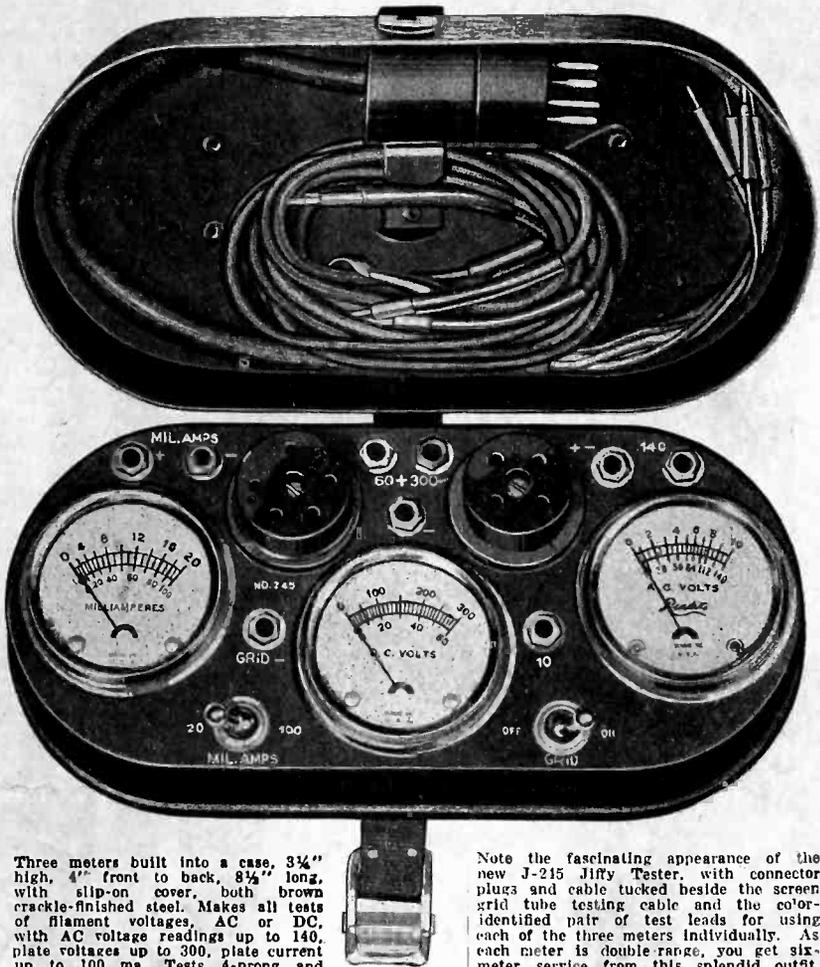
Two sockets are on the panel, one 5-prong, the other 4-prong, for holding the UX and UY tubes, including screen grid tubes, both AC and battery types. To enable full test of screen grid tubes, including AC 224 and DC 222, a screen grid cable is supplied.

The compact J-245 therefore tests all plate voltages up to 300 volts, including B eliminators; all filament voltages, DC or AC, up to 10 volts; all plate current up to 100 ma. Besides, it provides close readings for plate current of 20 ma. or less and for B voltages of 60 volts or less, and AC voltage readings up to 140, including AC live voltage. Besides, it reads screen grid voltage.

The base that contains the meters has four feet on it, is only 1 1/4" high, and snugly receives the cover. Inside the cover is a spring clip to hold the plugged cable, with a 4-prong adapter, as well as the red and black separate test leads for use of each meter independently, and the screen grid cable. You have three separate double-range meters independently accessible, in other words, six-meter service, besides the plug-in feature for joint use of all meters in testing receivers, tubes, continuity, shorts, opens, etc., as described in the instruction sheet.

This outfit has a genuine leather handle on the top for carrying, and a braided strap for keeping the cover from coming off accidentally. It is the very thing that the service man, experimenter, student and teacher have been looking for.

Order Cat. J-245 and you will be surely overjoyed at the possession of such a handy, dandy, reliable and rugged Jiffy Tester, the neatest one you ever saw, and one that abundantly answers the purposes of service work. You don't need to know in advance how to use it. The instruction sheet gives a simple but comprehensive explanation. Besides, a tube data sheet tells how to determine if tubes are O.K.



Three meters built into a case, 3 1/4" high, 4" front to back, 8 1/2" long, with slip-on cover, both brown crackle-finished steel. Makes all tests of filament voltages, AC or DC, with AC voltage readings up to 140, plate voltages up to 300, plate current up to 100 ma. Tests 4-prong and 5-prong tubes, including screen grid tubes. Test leads and instruction sheet included.

\$11.76

Note the fascinating appearance of the new J-245 Jiffy Tester, with connector plugs and cable tucked beside the screen grid tube testing cable and the color-identified pair of test leads for using each of the three meters individually. As each meter is double range, you get six-meter service from this splendid outfit. This is the most popular type of Jiffy Tester and the most desirable in the low price range.

Remit \$11.76 with order, and we pay cartage!

Successful Servicing Is Impossible Without Meters

IF you are a service man you are lost without meters. You may carry individual meters around with you and still remain perplexed, for lack of any means of obtaining access to the voltages or currents you desire to test. Therefore an analyzer like the J-245 is just the thing, and it is much more neatly made than you could possibly make a tester yourself, since, besides the engineering talent required to design such a device, thousands on thousands of dollars must be invested in dies. You reap the benefit of expert engineering design, quantity production and careful instruction as to use when you buy a J-245. It is unqualifiedly recommended as superior to any tester that is anywhere near so low in price. You could pay twice as much and get half as much value!

NEVER again need you be stumped for want of the necessary measuring equipment. Suppose you want to know the AC line voltage or DC line voltage—the right hand meter gives it to you. Simply plug the red test lead into the "140" tip jack, the black test lead into the "+" tip jack. If you desire to read the plate current of one tube, insert the tube in the proper socket of the J-245, connect the plug (with the aid of the 4-prong adapter, if necessary) into the emptied socket of the receiver, switch the milliammeter to "0-20" reading, insert the four-colored cable leads into the corresponding marked and colored tip jacks and turn on the set. These are only some of the fifteen tests you can make.

Independent Access to All Three Meters Insures Versatility

BESIDES fetching appearance, sturdiness, compactness and low cost, the J-245 affords versatility by rendering individual access to each meter. Use the red and black test leads for this purpose. Suppose you want to know the total plate current drain of all tubes of a receiver. Use the milliammeter at its "0-100" setting, connect the test leads to "milliamps +,—" and the other ends of the leads in the negative B line.

This accessibility of each meter—six-meter service, remember—heightens the value of the J-245 more than 100%, and is a new feature.

YOU are all set to go when you possess the J-245. The only limitations you will possibly encounter, and these are rare instances, apply to the testing of the B voltages on 210 and 250 tubes, and to testing the Kellogg tubes, which have filament emerging from a cap at top.

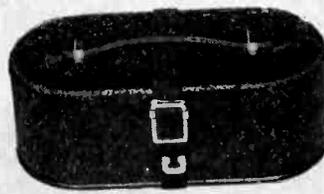
The plate voltage on a 210 is usually 350 volts while that on a 250 is usually 450 volts, and the B voltmeter reads up to 300 volts. But a series resistor will extend the range. This multiplier is an extra, and those deeming it necessary may order

Cat. No. J-10; at 88c net. to increase scale to 0-600 volts. Likewise, a Kellogg tube adapter is available. Cat. No. J-24 at 60c net. If UV199 tubes are to be tested, a pair of adapters is necessary, as these tubes have a unique base. The UX199 tubes can be tested without adapters. For UV199 tubes order Cat. No. J-19 at 60c net, which changes the UV socket of the receiver to accommodate the UX plug of the J-245, and Cat. No. J-20 at 36c net. to change the 4-prong socket of the J-245 to receive the UV199 tube.

NET PRICES AT MORE THAN 40% OFF LIST PRICE!

J-245, consisting of the complete outfit, less multiplier, UV adapters and Kellogg tube adapter. Net price.....	\$11.76
J-106, resistor to be connected in series with 0-300 voltmeter to increase reading to 600 volts. Net price.....	.88
J-19 and J-20, pair of adapters for testing UV199 tubes. Net price for both.....	.96
J-24, adapter for testing Kellogg and old Arcturus tubes. Net price.....	.60

A Neat Carrying Case



How the J-245 looks when the cover is slipped on and the strap is tightened. The handle is genuine leather.

Order a J-245 today. It is sold on a 5-day money-back guaranty, which nobody else offers. Try it out for five days after receipt. If not fully satisfied for any reason, or for no reason at all, send it back with a letter asking for refund of the money you paid. The refund will be made promptly. There are no strings to this guaranty!

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143 West 45th Street, (Just East of Broadway), New York, N. Y.

- Gentlemen: Enclosed please find \$..... Send me at once at your expense:
- One J-245 with instruction sheet, net price.....\$11.76
 - One J-106 multiplier, net price..... .88
 - Jack Terminals optional for J-106, order JT, net price..... .30
 - One pair of UV adapters, J-19 and J-20, price of both, net..... .96
 - One adapter for testing Kellogg and old type Arcturus tubes, J-24, net price..... .60

All prices are net and represent extreme professional discount already deducted.

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