

DEC. 27

1930

MAKING A MICROPHONE

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RADIO

EG. U.S. PAT. OFF.

WORLD

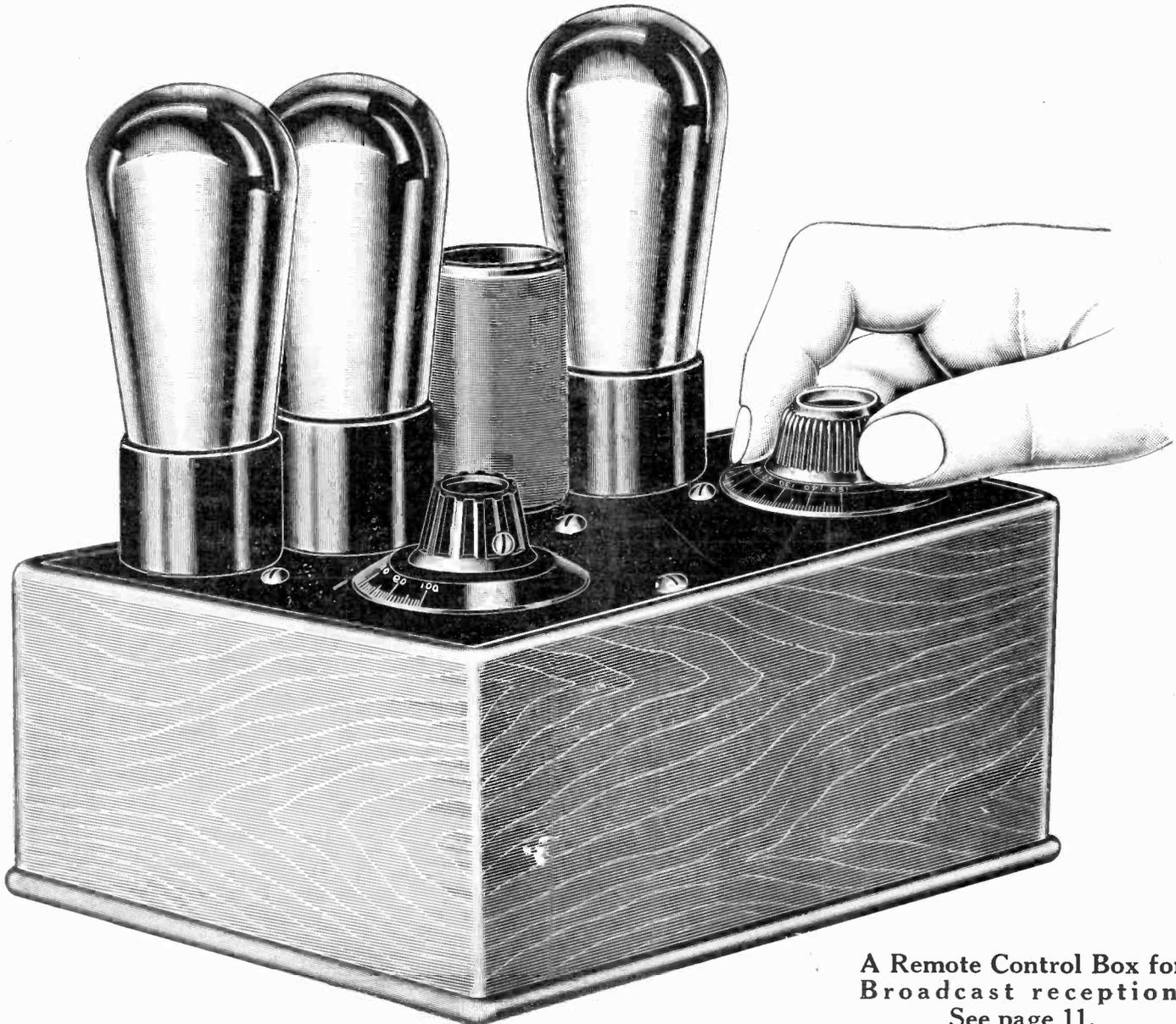
The First and Only National Radio Weekly

457th Consecutive Issue—NINTH YEAR

How to Use a Pickup

The HiQ-31 Receiver

Diagrams of New
Majestic TRF Sets



A Remote Control Box for
Broadcast reception.
See page 11.

SUPERTONE CONVERTERS

ALL-WAVE MODEL WITH REMOTE CONTROL

USING your present broadcast receiver as a basis, tune in, control volume and all switching from a distance of 24 feet or less with the new Supertone All-Wave Converter. Set your receiver dial for the highest wave (lowest frequency) and enjoy the new convenience, plus screen grid amplification and short-wave reception. Greater selectivity results on all waves, also uniform amplification.



Chassis, 10x8", including all parts, 24-ft. cable, filament transformer, less two tubes. You need obtain only a "B" voltage, 45 to 180 v., from set. Order Cat. AWRC (less two 224 tubes) @ \$19.87
Cabinet to contain above, Cat. CAB-A..... 6.32

BROADCAST MODEL WITH REMOTE CONTROL

THIS WILL BE THE 1931 SENSATION

THE standard Supertone Remote Control Box is for reception of broadcast waves only. It permits control of all three operations up to 24 feet from any radio. For AC operation. Requires only 45 to 180 B volts taken for set. No molestation of receiver. All parts, including filament transformer and 5x6 1/2" cabinet (less two 227 tubes.)

Order Cat. RCB (24-ft. cable included) @ \$12.81
The battery model, 24-ft. radius, Cat. RCB-BAT (less two 201A tubes) @ \$9.34
(Any model wired @ \$1.50 extra. Add "W" to catalogue number.)

SHORT-WAVE MODELS

EFFICIENT AC short-wave converter, 10 to 200 meters with total of only two plug-in coils. Filament transformer built in. Three 227 tubes used. Single tuning control. Hammarlund condenser. Equipped with AC switch. Works with any broadcast receiver, either TRF or Superheterodyne. No molestation of receiver. No grunting, body capacity or squeals. All parts (less tubes, but including 5 x 6 1/2" cabinet). Order Cat. SUP-3FS @ \$9.58
Cat. SUP-327-B, same appearance, uses three 227 heaters in series, across 6 v. battery. All parts, coils \$6.61



NEW SHORT-WAVE CONDENSER

Just out! A midget short-wave condenser specially made for Supertone by Hammarlund. Rotor turns in a 1-inch radius; condenser frame, 2-inch circumference, 1 1/2 inches front to back. Midline brass plates. Capacity, 4 1/2 mmfd. minimum; 212 mmfd. maximum. Order Cat. Sup-H-20 @ \$1.35

SUPERTONE PRODUCTS CORP.
218 Wallabout Street Brooklyn, N. Y.

Like Oil on Troubled Waters

ELECTRAD

Resistors and Voltage Controls overcome and pacify many acute and irritating radio difficulties. They are the choice of men who demand quality, performance, service—and correct price.

Write for Circular of Electrad Products Dept. RW-1227

175 Varick St., New York, N.Y.
ELECTRAD

RADIO MAP OF NORTH AMERICA

22 x 22 inches, printed in two colors, bound in cover.

Shows every city from Balboa to Edmonton which has a broadcasting station.

Indexed by states, provinces and cities with key for instant location on map.

Call letters, power and frequency given for each station.

Accurate; up-to-date

Scale in miles gives distances between any two cities. Time zones correctly marked.

Just what you have been wanting.

25 cents

THE RADEX PRESS

1368 E. 6th St. Cleveland, Ohio

"A" BATTERY SWITCH



A push-pull switch for battery-operated sets. Made by Benjamin Firm, sure contact, extremely long life. Special price, only \$1.35

GUARANTY RADIO GOODS CO.

143 West 45th St., New York, N. Y.

Orders-Inquiries



Can be Secured by MAIL
Send for FREE Copy

POLK'S REFERENCE BOOK and Mailing List Catalog
Gives counts and prices on over 8,000 different lines of business. No matter what your business, in this book you will find the number of your prospective customers listed.
Valuable information is also given as to how you can use the mails to secure orders and inquiries for your products or services.

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R. L. POLK & CO., Detroit, Mich.
Largest City Directory Publishers in the World
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Talking Pictures offer new opportunities. Your songs personally submitted to Picture Studios, revised for publication by Hit Writers. Words, Music, Arranging, everything pertaining to songs.

DEALERS and SERVICE MEN!
STANDARDIZE ON



For Permanent Replacement—Accurate—Guaranteed
Write for descriptive catalogue "W"
LYNCH MFG. CO., INC., 1775 Broadway, New York

Short-Wave Converter Series

In the November 8th issue of RADIO WORLD there began a remarkable series of articles dealing with the construction of short-wave converters that really do work, and that work well. Besides, the cost of parts is low. One model, 30 to 110 meters, no plug-in coils, may be built of parts costing less than \$5, for battery operation, or for AC with extra filament transformer external, while another model, 10-200 meters, two plug-in coils, using somewhat superior parts, filament transformer built-in, can be made up by you for less than \$10. Surely these are prices within the reach of all.

Low price and high achievement go hand in hand in these designs by Herman Bernard.

The series ran in the November 8th, 15th, 22nd and 29th, and December 6th, 13th, and 20th issues. Send \$1 and we will forward these seven issues and a blueprint of the AC \$5 model.

RADIO WORLD, 145 West 45th Street, New York, N. Y.

Enclosed please find \$1.00 for which send me the November 8th, 15th, 22nd and 29th, and Dec. 6th, 13th and 20th issues, containing the series of articles on short-wave converters of extremely low price, and a blueprint of the AC \$5 model.

Name

Address

City State

Save Money on Tubes!

Get a Guarantee Just the Same!

QUALITY tubes at enormously reduced prices enable you to save money and obtain full satisfaction. Any tube will be replaced on request within thirty days of its sale!

These tubes are made by a manufacturer of national reputation and are not "distress merchandise." No tube is shipped until it is carefully checked on a Readrite No. 9 Radio Test Kit.

Type	List Price	Your Cost	Type	List Price	Your Cost	Type	List Price	Your Cost
<input type="checkbox"/> 201A	\$1.25	49c	<input type="checkbox"/> WD-12	\$3.00	59c	<input type="checkbox"/> 245	\$2.00	59c
<input type="checkbox"/> 226	1.75	49c	<input type="checkbox"/> 200A	4.00	59c	<input type="checkbox"/> 280	1.90	59c
<input type="checkbox"/> 199-UX	2.50	59c	<input type="checkbox"/> 171A	2.25	59c	<input type="checkbox"/> 224	3.30	59c
<input type="checkbox"/> 199-UV	2.75	59c	<input type="checkbox"/> 171AC	2.25	59c	<input type="checkbox"/> 222	4.50	95c
<input type="checkbox"/> 120	3.00	59c	<input type="checkbox"/> 112A	2.25	59c	<input type="checkbox"/> 281	7.25	95c
<input type="checkbox"/> WD-11	3.00	59c	<input type="checkbox"/> 227	2.20	59c	<input type="checkbox"/> 210	9.00	95c

250, List \$11.00, your cost, 95c.

[Remit with order for tubes and we pay postage]

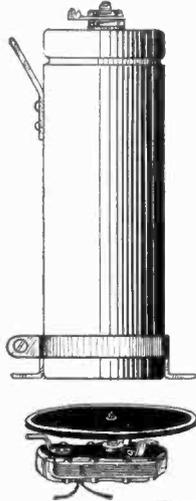
DIRECT RADIO CO.

Room 504, at 1562 Broadway, New York, N. Y.
(Between 46th and 47th Streets)

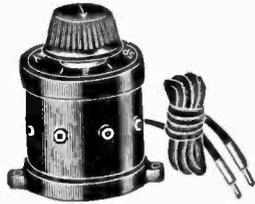
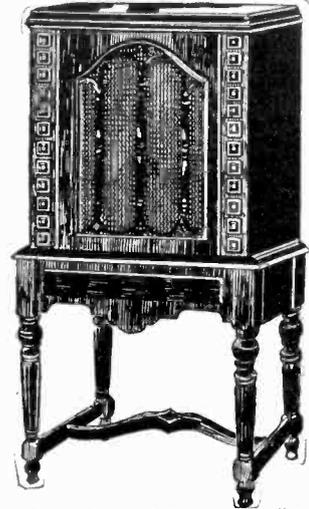
BUY NOW While Prices Are Lowest!

BIGGEST BARGAINS!

Now all the fans who build their own sets or service men who are making replacements are using the dry electrolytic condenser. It affords high, lasting capacity in compact form. The lug at top represents the anode and goes to the positive side (B+ or C+), while the aluminum case is to go to the negative side, usually ground. The capacity of the condenser is 8 mfd. The condenser, a product of Aerovox, is admirably suited for use in filter circuits for use on rectified AC or pulsating DC. The condenser must not be used on raw AC. Maximum peak voltage, 500 volts DC. Normal operating voltage, 400 volts DC. Dry, self-heating, high capacity, low leakage, unaffected by moisture. Size, 1-5/16" diam. x 4 1/4" overall. Mounts in any position. Brackets supplied. Order Cat. AV-8 @ \$1.42

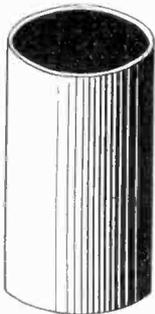


An outstanding example of the vastly popular midget receiver, not very much larger than any good speaker, yet it contains a very sensitive, efficient and powerful AC radio set, AC power pack and a speaker that would do justice reproducing the output of the most elaborate AC receiver! Startling statements, yes, but they are undeniable facts! Imagine, not even as large as most battery operated portable sets, and lighter in weight! The set will duplicate in performance (considering selectivity, sensitivity and volume) that of its much larger and more costly brothers! One dial tuning control, also switch and volume control knob (not illustrated.) Uses six tubes: three 224, one 227, one 245 and one 280. Perfect reproduction! Combined weight of entire set, speaker and tubes less than 20 lbs.! Entirely self-contained! 3 gang tuning condenser. Uses power tubes and push-pull electro-dynamic speaker! Durably built in handsome walnut case. For 110-120 volts, 50-60 cycle AC. Complete set, with the six tubes, cabinet, speaker—nothing else to buy! Order Cat. MDST @ \$39.95

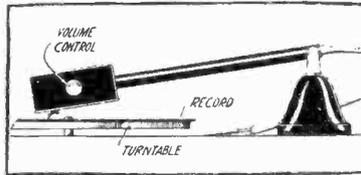


Synchronous motor for 60-cycle lines, 105 to 125 volts, with turntable, producing 80 turntable revolutions per minute. Takes up to 21-inch records. Sturdy and compact, this motor is only 1 1/2 inches thick. Not affected by line voltage fluctuations. The compactness permits installation in consoles or any other available space. Made by Allen-Hough, makers of the Phonolink pickup. Shipping weight, 7 lbs. Order Cat. SYN-M (with turntable) @ \$4.25

New Speakerrelay for connecting two speakers to it and playing either one (position No. 1, left); or the other (position No. 1, right); or both at once (position No. 2); by turning the knob. Built into an attractive black moulded bakelite case, with 18-inch connecting cords to go to the output posts of the receiver or amplifier. The speakers' cords are connected to the relay by plugging into built-in jacks. This device can be used also for switching from "phonograph pickup" to "radio." Order Cat. 121 @ \$1.10



PHONOGRAPH PICK-UP \$3.32



The famous Phonolink, made by Allen-Hough, enables playing phonograph records electrically, on your set. Volume control is built in. Adapter, free with each order, enables immediate connection to your set. Instruction sheet enclosed. Order Cat. PHL @ \$3.32.

Positively the last word in the most efficient and powerful reproducer made! As a fitting companion, it is housed in a truly exquisite deep two-tone walnut console, of rare beauty and craftsmanship! To properly baffle the ultra-powerful Peerless chassis, a chamber 15" deep, 17 1/2" wide and 18" high houses same. Front baffle of 3/4" thickness! Size of opening, 10 inches. Ideal for use with the most powerful public address amplifier. NO RATTLING, NO DISTORTION—JUST PERFECT REPRODUCTION! For that matter it is equally suited with ordinary sets, employing the average type of audio amplification systems. Order Cat. SSC @ \$24.88 [If cabinet only is desired (less speaker) order Cat. SCO @ \$13.44]



Bernard nippers. Drop-forged steel. Handiest tool for radio workers as wire-cutter, insulation stripper, and as screw-cutting. It will easily nip off protruding brass or iron screws entering up to 3/32 with easy hand pressure. A rugged, reliable and renowned instrument. Order Cat. BNP @ \$1.27



Here is the best buy of the year: A 15" diameter 110 volt D.C. dynamic chassis, with two field coil resistances, 800 ohms AND 4,000 ohms. Contains push-pull output transformer. Designed for use with any super-power amplifier—for auditorium reproduction. Shipping weight, 25 lbs. Order Cat. 1100 @ \$16.95

We also offer the following Peerless dynamic chassis: Cat. No. Size Type Price 719. 14" 110 v. D.C. \$14.95 720. 12" 110 v. A.C. 15.95 721. 12" 110 v. D.C. 9.95 1020. 12" 8 v. D.C. 9.95 1021. 10" 110 v. A.C. 11.95 1022. 9" 110 v. A.C. 9.95 1023. 9" 110 v. D.C. 7.95 1024. 9" 6 v. D.C. 7.95

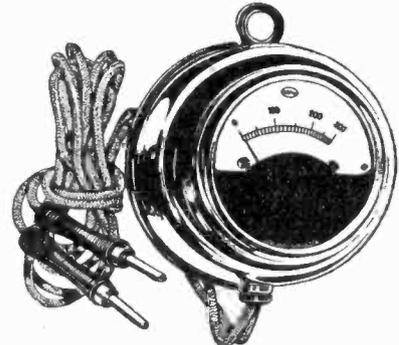
Natural bakelite tubing, made by Spaulding, in two diameters, 1 1/2 inches and 2 inches, outside diameters. One will fit inside the other even after wire is wound on the smaller diameter. Length Diam. Price 1 1/2" 1 1/2" \$0.09 2" 2" .12 3 1/2" 2" .40 The 1 1/2" length, 1 1/2" diameter, can be used for winding a primary, and be inserted.

Temple Dynamic \$15.34 Beautiful Carved Wood Grille Front

This is one of the finest dynamic speakers ever made, and is highly recommended by us. AC switch is provided. A knob is built in for adjusting the speaker impedance to that of your set. An output transformer and dry rectifier are built in. Connect plugged AC cable to 110 volts AC, 50 to 60 cycles and connect tipped cords to speaker post of receiver. This remarkable speaker The Temple 10



The Temple 10 chassis in the fascinatingly decorative walnut cabinet, with carved grille ornament, as illustrated; both front and back finished. (Cabinet not sold separately.) Order Cat. TEM @ \$15.34



0-600 volts, high resistance; AC and DC (same meter reads both types). DC readings accurate to 2%, also AC readings 2% at 50-60 cycles, but accuracy is less on AC at substantially different frequencies. Order Cat. F-600 @ \$4.95 0-300 volts, high resistance. Accuracy, 2%. Case is full nickel finish. Long connecting cords have especially ornamental tip holders. Meter should be read in perpendicular position. Order Cat. F-300 @ \$2.50 0-500 volts, same as above in appearance, but the range is greater. Order Cat. F-500 @ \$3.73

EXTRA-SPECIAL SPECIALS!

- (Cat. SPEC-1)—Eria DC dynamic chassis, 9-inch cone, for operation from 6-volt storage battery. Connect speaker-tipped cords to output of set, and connect twisted pair to 6-volt storage battery. Draws 1/2 amp. from battery. Price \$9.00
(Cat. SPEC-2)—Wave trap, for cutting out interference. Connect aerial to one side of the trap, other side to antenna post of receiver from which aerial was removed, and tune out interfering stations. A great selectivity booster. Price .67
(Cat. SPEC-3)—Rider's Supplement No. 1, containing diagrams supplemental to those in Rider's "Trouble Shooting Manual," and an invaluable addition, for completeness, to any who possess Rider's manual. Price 1.22
(Cat. SPEC-4)—AC blueprint library, consisting of a book containing AC circuits for home construction, with actual blueprints therein, list of parts, coil-winding data, etc. Also encyclopedic information on radio. Price .25
(Cat. SPEC-5)—Dubilier .01 mfd. fixed mica condenser. Price .16
(Cat. SPEC-6)—Dubilier .00025 mfd. mica fixed condenser, with clips for grid leak mounting. Price .11
(Cat. SPEC-7)—0001 mfd. Dubilier fixed condenser, for connection in series with aerial to improve selectivity. Price .11
(Cat. SPEC-8)—Power transformer, with two chokes built in for B filtration. Primary, 105-125 volts, 50-60 cycles; secondaries, all center-tapped with red leads, are for high voltage for 280 to work 245 tubes, single or push-pull, and rest of tubes in set up to 100 mbs; 300 volts DC output; 2 1/2 volts 2 amps. for 245s, single or push-pull; 2 1/2 volts 14 amperes, for 227s and 224s, up to 8 of these; 5 volts for filament of 280. All, including chokes, in one cadmium plated steel case. Leads identified. Chokes are 30 henries each. Price 7.50

Special "Buy-Now" Bargain Coupon!

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

- Please ship at once the following:
Cat. AV-8 @ \$1.42
Cat. MDST @ 39.95
Cat. 121 @ 1.10
Cat. SYN-M @ 4.25
Cat. PHL @ 3.32
Cat. SSC @ 24.88
Cat. SCO @ \$13.44
Cat. 1100 @ 16.95
Cat. 719 @ 14.95
Cat. 720 @ 15.95
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Cat. 1020 @ 9.95
Cat. 1021 @ 11.95
Cat. 1022 @ 9.95
Cat. 1023 @ 7.95
Cat. 1024 @ 7.95
Cat. BNP @ 1.27
Cat. TEM @ 15.34

METERS

- Cat. F-600 @ 4.95
Cat. F-300 @ 2.95
Cat. F-500 @ 3.73
EXTRA-SPECIAL SPECIALS!
Cat. SPEC-1 @ \$9.00
Cat. SPEC-2 @ .87
Cat. SPEC-3 @ 1.22
Cat. SPEC-4 @ \$0.25
Cat. SPEC-5 @ .16
Cat. SPEC-6 @ .11
Cat. SPEC-7 @ \$0.11
Cat. SPEC-8 @ 7.50

Name Address City State (Above prices are on basis of remittance with order, but if C. O. D. is desired, if you enclose 1/4 of total amount, shipment will be made C.O.D. for balance.)

"They Say That--" New POLO Precision Power Transformers and Chokes

In Shielded Polished Aluminum Cases
ARE THE BEST

POWER TRANSFORMER
50-60 cycle 105-120 v. primary; secondaries, 2½ v. 16 amps.; 2½ v. 3 amps.; 5 v. 2 amps.; high voltage to afford 300 v. DC @ 100 ma.; all secondaries center-tapped. Cat. 245-PT @ \$9.50

B SUPPLY CHOKE
100 rca. rating; 30 henrys; DC resistance 200 ohms; tabbed at 40 and 100 ohms; suitable for "choke input" filter system; black to rectifier filament; red, not used; green, first filter condenser; yellow, final filter condenser. Suitable as center-tapped impedance, using black and yellow for extremes, green as center. Cat. 245-CH @ \$4.25

FILAMENT TRANSFORMER
For short-wave converters; 2½ v. 8 amps. (thick leads). Cat. SW-FLT @ \$2.50

For complete sets; 2½ v. 12 amps.; 2½ v. 3 amps.; both secondaries center-tapped. Cat. SP-FLT @ 4.25

SHORT WAVES FOR \$4.87—Lowest price ever for parts for a short-wave converter, Supertone Cat. SUP-3A, exactly as specified by Herman Bernard. (less tubes.) Single control, no squealing. It does work fine. Instruction sheet and pictorial diagram. External filament transformer \$2.50 extra.

Model with filament transformer built in; all parts (less tubes); Cat. SUP-3FS @ \$9.58

NEW POLO HOME RECORDER

Make your own records of radio broadcasts or family, friends or self-talking, singing or playing. The Polo pickup is both the recording head and the play-back device. Control box supplied, has volume control in it and switches from input to output. Broadcasts are directly recorded, but personal renditions require a microphone (extra) Order Cat. PHR @ \$15.00

Microphone, necessary for recording personal renditions; 500 ohms impedance; single button transverse type faithful transmission, 24 to 7,000 cycles. Cat. PM @ \$15.00

Get the home-recorder combination, pickup, control box and microphone, and enjoy a real, lasting treat. Cat. HR-COMB @ \$30.00

POLO ENGINEERING LABORATORIES

125 WEST 45TH STREET

NEW YORK, N. Y.

Fixed Condensers

Dublier Micon fixed condensers, type 642, are available at following capacities and prices:

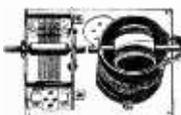
.0001 mfd. 10e	.006	20e
.00025 mfd. 10e	.00025 with clips. 20e	
.0003 mfd. 10e	All are guaranteed	
.00035 mfd. 12e	electrically perfect and	
.001	money back if not	
.0015	satisfied within five	
.002	days.	

Order Cat. MICON .0001 etc. at prices stated.

GUARANTY RADIO GOODS CO.

143 West 45th St., New York, N. Y.

TUNER ASSEMBLIES



A tuning condenser with coil to match, mounted on an aluminum base that has socket built in. The condenser shaft goes in a dial (not furnished). The tuned circuit includes a fixed and a movable winding (rotor coil) in series. The moving coil is used as a trimmer, set

once and left thus, so two separate dials are made to read alike, or gang tuning is made practical. No equalizing condensers needed. Do not couple the adjoining shafts.

For antenna circuit, input to 226, 201A, UX199, 240, 230, 232 and 222, or any other tube fitting four-prong UX socket, or for interstage coupling for 226, 201A, 199, 240 or 230, but NOT interstage for 232 or 222, order cat. BT-L-DC @ \$1.25

For interstage coupling for 232 and 222, order cat. BT-R-DC @ \$1.25

For antenna circuit as RF input to 22c or 227, or for 227 interstage coupling, (five-prong UY socket furnished) order cat. BT-L-AC @ \$1.25

For interstage coupling for 224 (5-prong UY socket furnished, order cat. BT-R-AC @ \$1.25

SCREEN GRID COIL CO.

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

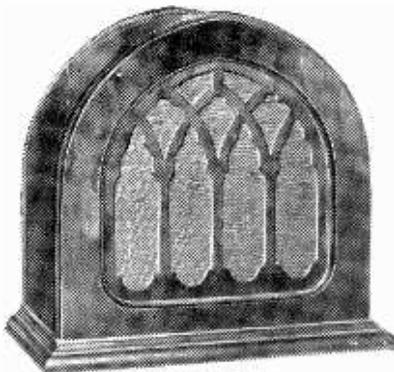
The inductor dynamic offers high sensitivity and true tonal response. It requires no exciting field current, unlike other dynamics. Order model R for 112 or 112A, and Model G for all other output tubes.

Cat. 9-G (9" extreme outside diameter) \$8.49
Cat. 9-R\$8.49
Cat. 12-G (12" extreme outside diameter)\$10.03
Cat. 12-R\$10.03



GUARANTY RADIO GOODS CO.
143 W. 45th St., New York, N. Y.

Ansonia Gothic Speaker - - \$3.95



Magnetic speaker in genuine, beautiful walnut cabinet. Order Cat. AN-G at \$3.95.

Square Model (same unit and cone) Cat. AN-S at \$3.67

Guaranty Radio Goods Co.
143 West 45th St., New York, N. Y.

Horn Unit \$1.95



Fidelity Unit, Cat. FDU.

The Fidelity unit is pre-eminent for horn type speakers such as exponential horns. The faintest word from a "whispering tenor" or the tumultuous shout of the crowd or highest crescendo of the band is brought out clearly, distinctly. Stands up to 450 volts without filtering.

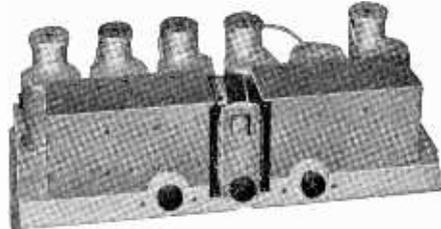
Works right out of your set's power tube, or tubes requiring no extra voltage source. Standard size nozzle and thread. Works great from AC set, battery set or any other set, push-pull

or otherwise. The casing is full nickel finish, highest polish.

This unit can be used in a portable without any horn attached and will give loud reproduction.
Order Cat. FDU, with 50-inch tipped cord; weight, 2½ lbs.; size, 2½-inch diameter, 2½-inch height. (This is the large size). Price..... \$1.95

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

Parts for the Best Circuits



NEW NATIONAL DE LUXE MB-30 SCREEN GRID TUNER—This is one of the most sensitive tuners ever developed, averaging 1 microvolt per meter, and at some frequencies attaining ¼ microvolt per meter. Its selectivity is most remarkable, and without material sideband cutting, due to use of Vreeland band pass filter and pre-selector circuits. Six tuned circuits, perfectly aligned and tested with laboratory equipment that cost more than \$1,000. The circuit, which is for AC only, uses four 224 and one 227 tubes and requires a power amplifier that will power the heaters as well. All parts mounted on chassis, ready for wiring. Steel chassis, 21% x 10% x 1¼". Order Cat. MB-30-P, list price \$85 less tubes; net price.....\$46.87

WIRED MODEL, Cat. MB-30-W, list price \$85 less tubes; net price.....\$46.87

MB-29-A TUNER, a smaller version of the MB-30, using four instead of six tuned circuits, but including also the pre-selector and band pass filter circuits. Uses three 224 and one 227. Aluminum chassis 15% x 10% x 1¼". Order Cat. MB-29-AP, list price \$69.50 less tubes; net price.....\$40.88

WIRED MODEL, Cat. MB-29-AW, list price \$79.50, less tubes; net price.....\$46.74

NATIONAL VELVETONE Push-Pull Power Amplifier, using one 227, two 245's and one 280; two stages of transformer coupling, with output transformer; heater voltage for five extra tubes; plate voltage for tuner. A matched unit for the MB-30 or MB-29-A. Phonograph jack built in. Velvetone comes completely wired. Licensed by RCA. Order Cat. FPPA, list price \$97.50, less tubes; net price.....\$57.53

HI-Q 31

HAMMARLUND HI-Q-31—The latest development in custom-set building, a 9-tube circuit, using a 8-stage band-pass filter pre-selector, three stages of 224 RF, 224 power detector, 227 first audio, two 245's for push-pull output, and a voltage regulator tube. Chassis is 23% x 12%". Order Cat. AC-31-R, list price of complete parts, \$159.80, less tubes; net price.....\$91.00

WIRED MODEL HI-Q-31—Order Cat. AC-31-RW, list price, \$184.80, less tubes; net price.....\$111.05

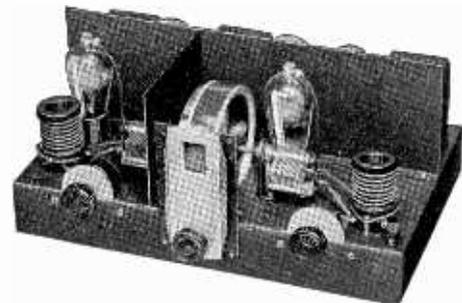
HI-Q AC TUNER WITH POWER SUPPLY (less audio)—Order Cat. AC-31-TPS, list price \$148.55, less tubes; net price.....\$82.79

HI-Q-AC TUNER ONLY (for use with external power supply)—Order Cat. AC-31-T, list price, \$107.20, less tubes; net price.....\$61.09

HI-Q-31 FOR BATTERY OPERATION—Order Cat. BAT-31-R, list price, \$119.55, less tubes; net price.....\$68.14

HI-Q-31 TUNER FOR BATTERY OPERATION (less audio)—Order Cat. BAT-31-T, list price \$102.95, less tubes; net price.....\$58.89

Short Waves



NATIONAL 5-TUBE THRILL BOX—A remarkably sensitive short-wave outfit, noted for reception of foreign stations. Uses 224 RF, 224 detector, 227 first audio, 227 push-pull second audio. A separate A and B supply is required. See below. Standard set of four pairs of coils included (21.2 to 2.61 megacycles). Humsless operation, even on earphones. Single tuning control. No grunting, no backlash, no hand capacity. Order Cat. AC-SW-5, list price, less tubes, less B supply, \$79.50; net price.....\$46.74

NATIONAL SW POWER UNIT—Furnishes heater voltage and B voltage for the AC Thrill Box. Uses 250 rectifier. Comes in wired form only. Licensed under RCA patents. Order Cat. 5880, list price, less tube, \$34.50; net price.....\$20.28

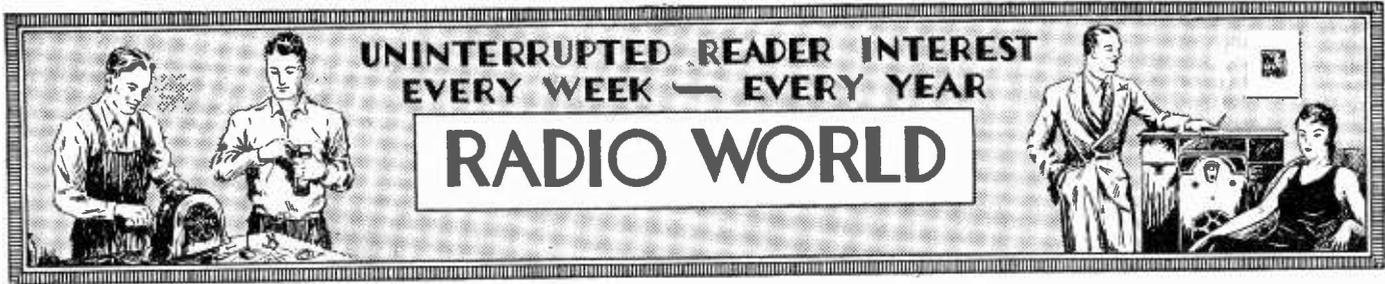
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143 West 45th Street,
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An All-Wave Mixer for Converter or Set

By Herman Bernard

[In previous articles in this series on the attainment of all-wave reception various methods were outlined. The first concerned a tuned radio frequency receiver, with a short-wave mixer or Superheterodyne adjunct, whereby the aerial was switched from mixer to the input of the tuned radio frequency set, and the three tubes used additionally for short waves cut out of circuit when the broadcast waves were to be received. Another method, presented later, dealt with the use of the short-wave radio frequency tube and the associated modulator as low-gain amplifiers even when broadcasts were to be tuned in, the oscillator being rendered ineffective then. Also, the same dial was used for both, in another circuit, due to use of an ever-changing intermediate frequency. Another idea had to do with a Superheterodyne receiver throughout with a switching arrangement to accommodate short waves. The idea developed was to use a single pole single throw switch for simplicity, and fixed condensers were introduced to afford this convenience. The present article deals with the same general Superheterodyne principle and retains the shorting condensers and single simple switching operation.—EDITOR.]

BY using a Superheterodyne circuit with a high intermediate frequency it is possible to cover a large band with a small tuning condenser, because the oscillator frequency, if chosen as the higher of two optional frequencies, will be higher than the station's carrier frequency by the amount of the intermediate frequency. Therefore if an intermediate frequency of 1,700 kc is selected, this being one that is assigned by the Federal Radio Commission only to mobile services and therefore not productive of interference, the oscillator should tune 1,700 kc higher than the broadcast band of 1,500 to 550 kc, or 3,200 kc to 2,250 kc. This range, and more, the oscillator can cover quite easily with a suitable inductance, when only .0001 mfd. is used for tuning.

Assuming, therefore, that a high intermediate frequency is used, one specially chosen may be 1,700 kc, or if obtained from a broadcast receiver, the highest frequency to which the set can be tuned satisfactorily, then the mixer as shown in Fig. 1 affords both short-wave and broadcast-wave reception. For broadcasts the entire winding is used in the oscillator grid circuit, and for short waves only half the winding, the other half being shorted out by means of a fixed condenser cut into ground.

A fixed condenser of relatively large capacity is used, rather than a switch direct to ground, as only in that way can a single pole single throw switch be used, an ordinary on-and-off switch of any type.

RF Choke in New Position

The particular mixer shown in Fig. 1A is revealed now for the first time. Its principal difference from mixers previously shown for attaining the same general result is the introduction of a new idea, that of a small radio frequency choke placed next to the grid of the modulator, and between the aerial condenser E and the tuning system.

By using a triple fixed condenser block, three 0.1 mfd. condensers in one case, the black lead, which is common to all three capacitances, is conveniently switched to ground. One of the

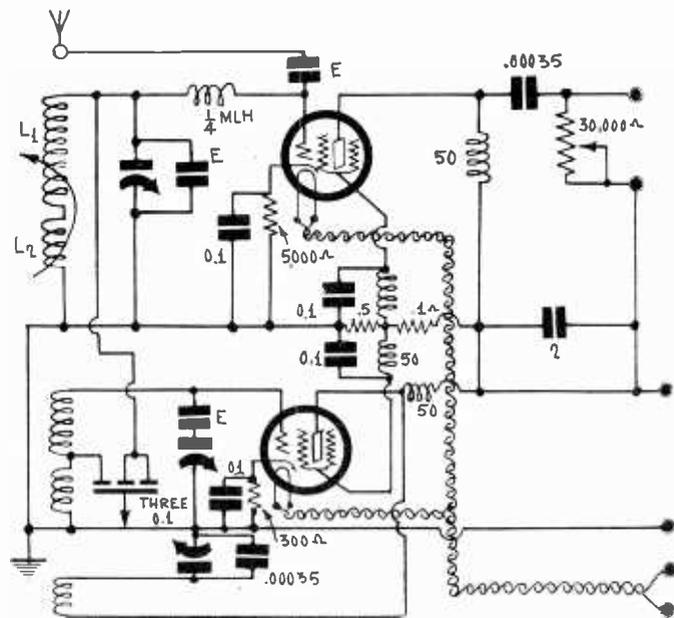


FIG. 1A

sections, 0.1 mfd., represented by a single red lead, is connected to the midtap of the oscillator's grid winding, while the two remaining red leads are joined together and connected to the little choke coil, on the tuned-circuit side.

The effect is as follows:

When the switch is "off" the fixed condensers are out of circuit and broadcast waves are tuned in, both modulator and oscillator being tuned with single control. When the switch is "on," the modulator's tuned circuit is shorted out, due to the large capacity, 0.2 mfd., acting much like a short-circuiting strap, and offering extremely low impedance, and the modulator input is untuned. The oscillator remains the only circuit for actually tuning in the short waves.

Resultant Capacity

All tuning condensers are on one shaft, that is, a three-gang condenser is used, and each section may have any capacity normally used in radio work, say, .0005 mfd. or .00035 mfd. While it is true that the oscillator's grid circuit is to be tuned with a smaller capacity, say about .0001 mfd., this objective is readily attained by including a series condenser from stator of one

(Continued on next page)

Select Right Power Tube

It Is the Heart of the Audio Amplifier System

IF your speaker is to reproduce radio programs with faithfulness, the speaker must not only be a good one but must receive electrical impulses from your set that make possible such accurate radio reproduction. These electrical impulses must follow exactly, in a wide variation of volume and pitch, the audible impulses which strike the broadcast station's microphone.

A pure output from your set can only be obtained when the power stage or section of the set is correct in all respects. In fact, most poor or outworn radio sets can be much improved by the mere modernization of the power stage and loudspeaker. This fact proves the importance of this portion of your radio set.

Power Tube Heart of Amplifier

At the heart of the power amplifier is the power tube. It must be of sufficient size to handle the demands to be made upon it, and it must be supplied with the right voltages for the B and C circuits. Also, it must have the proper accessory units to work with it. All of these essential points differ according to the type of set, the kind of power supply available, the type of speaker used and the maximum volume to be handled.

For radio sets operated by dry batteries, several types of power tubes are available. The 120 is the standard type, and when operated on 120 volts B and 22½ volts C, with dry cells for lighting the filament, good quality at moderate volume is obtained. This will run a magnetic type loudspeaker at sufficient volume and good quality, for a small or moderate sized room.

Where a storage battery is employed, and with B batteries, or a B eliminator, the 112A tube may be used with a magnetic speaker, offering fair quality and volume for a small room. A somewhat better arrangement is to have two 112A tubes connected as a push-pull amplifier and still better for the storage battery set, is the 171A tube. This is used with 135 to 180 volts B and up to 40 volts C voltage, as explained in the instruction sheet furnished with the tube.

The 171A and 245 Tubes

Where the set is all electrically operated from the house socket, a larger selection of good power tubes is to be had. The 171A is the minimum size, and a larger size is advised. The 245 is a good choice for a fair-sized room, and it is used with a dynamic type loudspeaker. For still greater volume, the 210 tube may be selected, and for very high volume ability, together with good tone qualities, the 250 superpower tube is available.

Transformers are devices which transfer the electrical energy from the preceding portion of the radio set to the grid of the power tube, and also transfer the greatly amplified electrical energy from the plate of the power tube to the loud speaker

itself. There is a special art in transformer construction, and a few manufacturers have achieved national distinction in this field.

The transformers determine the range of tone, the uniformity of amplification at the different tones and the general effectiveness of the power tube and speaker. Accordingly, good transformers, though comparatively expensive, are worth while investments. Consider the transformers when you improve your radio set's power stage. In general, good transformers are large and heavy, but your best assurance is the reputation of their makers.

Suitable Output Transformer

The output transformer must be of the correct kind to couple your particular power tube with your particular loudspeaker. This is an important point, and on this account, many manufacturers of the higher grade dynamic speakers have their own output transformers included in the base of the speaker. So select this unit after consulting with your radio adviser or dealer.

Once you have a harmoniously functioning power amplifier and speaker, keep things going smoothly by frequent check-ups on working conditions. A high-resistance voltmeter may be used to test the B and C voltages, and a filament voltmeter to note the filament voltage used. When the C battery drops off 25% in voltage, better put in a new one, for the C battery exercises a key function in controlling the grid operation of the power tube and in keeping the amount of current drawn from B batteries or power pack at a minimum, economical value. Too low grid voltage actually causes several bad effects, notably rundown B batteries or overstrained power supply pack, distortion and excess tax on the power tube.

Get Voltages Right

When you install a power tube of a different style, you must be sure that the B and C voltages are changed to compensate, or that a new system of voltage supply is installed. Not only must you take pains to have a sufficient voltage supply from batteries, eliminator or filter system, but the voltage must be steady. This assurance is gained by using heavy-duty B batteries, by installing a voltage regulator tube in the power pack of the set, or by providing an over-sized rectifier and filter system so that there is ample reserve to handle extra bursts of volume without serious fluctuation of voltage.

When a new power stage is installed, some trouble with alternating current hum may be encountered. This may usually be eliminated by connecting a special A condenser to the field coil of the dynamic speaker, or by using additional by-pass condensers in the power pack.

The Part That Sound Plays in Radio Reproduction

YOUR ears recognize as sound those vibrations of the air which have a rate of vibration known as audio frequency. The more rapid the rate of vibration, the higher is the pitch of the resulting sound, and the slower the rate, the lower is the tone you hear. This has nothing to do with the speed of travel, which is 1,084 feet per second.

Air vibrations causing sounds, even for very loud sounds, are relatively small in actual power. For sounds so strong as to be very painful to your ear, the energy in the air pressure wave may amount to only about one one-hundredth of a pound.

The number of vibrations per second is called the frequency. This determines the pitch of the tone you hear. High frequencies are represented by the flute and piccolo; low frequencies, the bass viol and organ. On the piano keyboard, middle C is about midway among the audible tones your ear can hear. That is a vibration of 256 per second, known as 256 cycles. The highest note you can hear is around 16,000 cycles, which is above the top note of the piccolo. The lowest tone ordinarily used is about 20 to 30 cycles, the deepest notes of the organ. A bass viol reaches down to about 40 cycles.

In your radio set, it is naturally desirable to have a wide range of reproduction, so that all the musical frequencies will be amplified as uniformly as possible.

Harmonics

When middle C vibrates, you do not only hear a tone of purely 256 cycles. A really pure note has no musical qualities and sounds flat. The whistles you sometimes hear in a radio set are pure tones. With the middle C piano string vibrating, the string vibrates as a whole, producing the 256 cycle tone, but in addition the string vibrates in parts of segments. The two halves of the string vibrate, thereby producing a harmonic tone which is a multiple of the 256 cycle or fundamental note.

The string also divides in thirds and fourths, thus producing harmonic vibrations which are called first, second, third and fourth harmonics. The manner in which these numerous fre-

quencies blend and combine with one another is responsible for the final tone your ear receives. This combination is what enables you to tell the difference between a piano and a mandolin, for instance, or a violin and a singing voice.

So here again we are up against a prime requisite of your ideal radio set—to handle all frequencies uniformly, so that not only the main pitch of a musical or voice tone will be reproduced, but all the harmonics as well!

Apparent Volume

Sounds which have the same amount of physical power or energy (that is, the same amplitude) do not sound equally loud when they are of different frequencies. A far greater amount of power is required to cause the same apparent effect on your ear where you have a low note than on a high note. You can prove this to your own satisfaction by watching a high-toned piano string vibrate. You can hardly notice that it moves at all. Yet, just watch a low note string, which sounds about as loud. See how far it sways from side to side! Mathematically, the energy is proportionate to the square of the frequency. A low tone of 30 cycles may be compared with a high tone of 500 cycles. These are related to each other as 90 to 250,000. Thus, to make them sound as loud, the low tone must be 250,000/90 or about 2,780 times as strong!

Need of Power Tube

This point illustrates forcibly how important it is that your set have a good power tube, operated at a comparatively high voltage, if you expect your set to reproduce music and voice truthfully.

Furthermore, both set and speaker must be capable of handling a full range of musical tones. It is useless to have a loudspeaker capable of reproducing 30 cycle tones if the set fails to amplify them. And conversely, a good set cannot operate a poor speaker satisfactorily.

How to Use a Pick-up

Connections Outlined for Realistic Reproduction

A PHONOGRAPH pickup, in principle, is a permanent horse-shoe type magnet. Between the poles of the magnet there is a small iron armature mounted in sponge rubber fastenings, and a coil of a large number of turns of very fine wire also between the pole pieces, surrounding the armature. The phonograph needle is attached to the end of the armature by a thumbscrew.

The bumps in the grooves of the record cause the needle to vibrate from side to side (up and down on the Edison record).

The movements of the needle also move the armature to which it is fastened, and the armature's movements vary the strength of the magnetic effects upon the coil of wire. In this way, weak alternating currents are generated in the coil, and thence fed to the audio amplifier of the radio set to be sufficiently amplified to operate the loudspeaker.

Connection to Transformer Primary

If your set is a powerful one, with a large power tube, and if the speaker handles strong volume, satisfactorily, the best place to connect the pick-up is to the primary coil of the first audio transformer. The cord leading from the pick-up has two wires in it, one of which goes to the P terminal of the transformer, and the other to the B terminal. These connections are commonly taken care of by an adapter, which is substituted for the detector tube.

In some instances the detector tube fits into the adapter, and then a separate switch is used on the pick-up cord to make contact when records are to be played. Neither of these plans is especially good, although either may answer temporarily or for one who does not wish to go to the trouble of getting something better.

A much better way to handle this interchanging is to have a special jack mounted on the panel of the set, or in the back. The cord from the pick-up is attached to a 'phone plug, and this is inserted in the jack whenever the phonograph is used. Here are the connections:

The type of jack required is known as a "double-circuit" jack. It has four prongs, the outer two longer so as to connect with the plug when it is inserted. When the plug is withdrawn the outer prongs bend toward each other and each connects with a shorter contact prong.

The two wires originally connected to the primary or P and B terminals of the first audio transformer are disconnected from the transformer, and connected, instead, to the inner contact prongs of the jack. Then two short wires are attached between the outer prongs and the terminals of the transformer.

Other Connection Methods

Be sure that the P terminal is connected to the prong which connects with the longer prong that is now connected to the tube socket (the plate).

When you insert the plug the transformer is disconnected from the detector tube plate and also from the B battery, and connected to the phonograph.

Where the set is somewhat less powerful, it is possible to take advantage of the amplifying power of the detector tube in addition to the amplifier tubes mentioned above. This does not give quite as good tonal quality as the first plan, but may be necessary in order to obtain sufficient volume. The simplest method of doing this is to use a jack as suggested above, but in this

case a "single open-circuit" jack will be needed. This has only two contact prongs, and it is important to select the type jack where the prongs do not make contact with each other when the plug is withdrawn.

One of the prongs is connected by a wire to the ground point of the set, which may be obtained by a contact to the metal framework, or chassis, or to the A minus in a battery set, or to the ground terminal itself. The other prong of the jack is connected to the grid contact of the detector socket. If you can't get at this, connect it to the grid condenser or grid leak mounting, on the side that leads toward the socket. Then, when you insert the plug, the pick-up will be connected between the grid and the filament of the detector tube.

It is very important to locate the jack as close to the detector socket as possible, because it is essential that the wire leading from the grid of the detector socket to the jack be only a few inches in length.

Action of Volume Control

The volume control is commonly made as a part of the cord leading from the pick-up. It consists of a smoothly variable resistor, with about 50,000 ohms maximum resistance. This is merely connected across the pick-up wires, that is, one end of the resistor to each of the two wires.

As the resistance is decreased by turning the knob so as to include less of it in circuit, more and more of the current generated in the pick-up flows through the resistor, thus decreasing the amount received by the set. The volume control may be mounted on the set, if desired, or in the phonograph, so long as the connections are made as indicated.

The mechanical noise of the needle rubbing in the grooves of the record may be amplified to an annoying extent, especially in a set which gives prominence to the high tones. A scratch filter will eliminate this, and it is made up of an iron core inductance coil of about 200 millihenries value, connected in series with a fixed condenser of .004 to .006 mfd. The remaining lead to the condenser goes to one of the wires from the pick-up, and the remaining lead to the inductance goes to the other wire from the pick-up. Scratch filters, already assembled, also may be purchased.

Counterbalanced Armature

Some of the better type pick-ups are so designed as to eliminate most of the scratching noise, by being counterbalanced so as to relieve the pressure on the needle, or in other ways. Much of the scratching noise will be found to come direct from the phonograph cabinet, and can be stopped by closing the cover each time the phonograph is played. Old-style records will not reproduce well, since the recording systems used failed to respond to the lower tones. The new electrically made selections, however, are so well recorded that all the audible frequencies, from about 30 cycles to 7,000 cycles, are reproduced successfully.

So fine are the results from electrically reproduced records, that radio owners who have a set equipped with a high-grade audio amplifier and power tubes like the 245 or larger, should not fail to get acquainted with the possibilities of this system. Any phonograph, whether a portable, or antique model, will prove entirely satisfactory, just so long as it has a motor that will turn the record around.—B. F.

Horns Retain Importance, Despite Dynamics

In some radio installations the dynamic speaker does not prove to be the best type, despite its unquestioned superiority over the most other forms for home use. The dynamic speaker is non-directional to a considerable degree. Much of the sound comes from the back, and the volume sounds about the same from different parts of the room. The horn speaker, however, projects the sound in a definite direction, and is therefore much more economical, giving a far greater apparent volume, especially to an audience.

Many different shapes of horn may be made, but the one which gives the best results is the exponential type. In this, the cross-sectional area doubles at equal distances along the length of the horn.

In the horn, the air is vibrating back and forth over a considerable distance at the small end, or neck. As the horn increases in size, the vibrations spread to a larger amount of air, and thus naturally decrease in the amount of vibration.

At the mouth of the horn, a wide area of air has been set into vibration, and it is the horn which enables the speaker unit to get a grip on the air. The longer the horn and the larger

its opening, the better will low tones be reproduced. In order to get an exponential horn into a reasonable space, it is common practice to coil them up in various shapes.

The orthophonic type phonograph owes its good reproduction, obtained without electrical amplification, to the use of a horn of this kind rather than the old small tone chambers that were used. The horn must not be made of any material that will vibrate of itself. Accordingly, plaster of paris and other compounds are used, such as sawdust moulded with a filler.

Of late, dynamic speakers have been combined with exponential horns in various ways. One of the finest loudspeakers ever built used a baffle made in an exponential horn shape, of plaster of paris about 6 inches thick. It also had a reflector in the rear, made in such a way as to reflect the sound from the rear surface of the cone around the edges and into the horn also. The heavy mass of the plaster of paris avoided all vibration. The old horns which used to be a feature of phonographs and radio sets some years ago have not gone out of style. They are just being remodeled for 1931 uses.

Transmitting Tubes

By J. E. Anderson

WHILE most tubes used in transmitting sets are of the three-element type, there are also several four-element, or screen grid tubes used as oscillators and amplifiers in such circuits. They are especially useful in transmitting circuits operating at high frequencies, from 3,000 kc and higher. There are three in particular, exemplified by the DeForest 565, a 7.5-watt tube, the DeForest 560, a 75-watt tube, and the DeForest 561, a 500-watt tube.

The 565 is a screen grid tube primarily designed as a power amplifier at radio frequencies from 3,000 kilocycles and higher, or as a crystal-controlled oscillator in constant-frequency transmitters. The internal shielding of the elements eliminates the necessity for neutralizing against feedback and self-oscillation.

CHARACTERISTICS OF AUDION 565

Normal rating, watts.....	7.5
Filament voltage	7.5
Filament amperage	2.0
Voltage amplification factor.....	150
Max. DC plate voltage, modulated.....	500
Max. DC plate voltage, unmodulated.....	500
Max. AC RMS voltage.....	500
Normal screen grid voltage.....	125
Max. plate dissipation, watts	15
Max. screen grid dissipation, watts.....	3
Max. RF grid amperes.....	5
Average plate resistance, megohms	0.2
Mutual conductance, micromhos.....	750
Plate to control-grid capacity, mmfd.....	.05
Base, UX and plate cap.	
Type filament, oscillator.	
Use, oscillator or RF amplifier.	

The Audion 560

The Audion 560 is a medium power screen grid tube designed primarily for use as a radio-frequency power amplifier, and particularly at frequencies in excess of 3,000 kc. The capacity between the plate and the control grid is extremely low and therefore there is no necessity for neutralizing as this is taken care of by the internal shielding. The capacity between the electrodes is kept low by the special method of bringing out the leads.

CHARACTERISTICS OF AUDION 560

Normal power rating, watts.....	75
Filament voltage	10
Filament amperage	3.25
Average voltage amplification factor.....	200
Max. DC anode voltage, modulated.....	2,000
Max. DC anode voltage, unmodulated.....	3,000
Max. DC screen grid voltage.....	500
Max plate dissipation, watts.....	100
Max. screen grid dissipation, watts.....	10
Max. grid RF amperes.....	0.15
Mutual conductance, micromhos.....	1,350
Plate to control-grid capacity, mmfd.....	0.05
Type of base, UX and flexible leads.	
Type of filament, special thoriated tungsten.	
Use, oscillator or RF amplifier.	

Audion 561

The Audion 561 is a power tube of the screen grid type that has been designed as a power radio frequency amplifier particularly at frequencies of 3,000 kc and higher. Like the Audions 565 and 560, it requires no neutralizing to prevent self-oscillation because the internal shielding prevents feed-back. It is rated at 500 watts as an oscillator.

CHARACTERISTICS OF AUDION 561

Normal power rating, watts.....	500
Filament voltage	11
Filament amperage	10
Average voltage amplification factor.....	300
Max. DC anode voltage, modulated.....	3,000
Max. DC anode voltage, unmodulated.....	4,000
Max. AC RMS anode voltage.....	4,000
Normal screen voltage.....	750
Max. plate dissipation, watts.....	400
Max. screen grid dissipation, watts.....	35
Max. grid RF amperes.....	10
Average plate resistance, megohms.....	0.133
Mutual conductance, micromhos.....	2,250
Plate to control-grid capacity, mmfd.....	0.1
Special base and flexible leads.	
Special thoriated tungsten filament.	
Use, Oscillator or RF amplifier.	

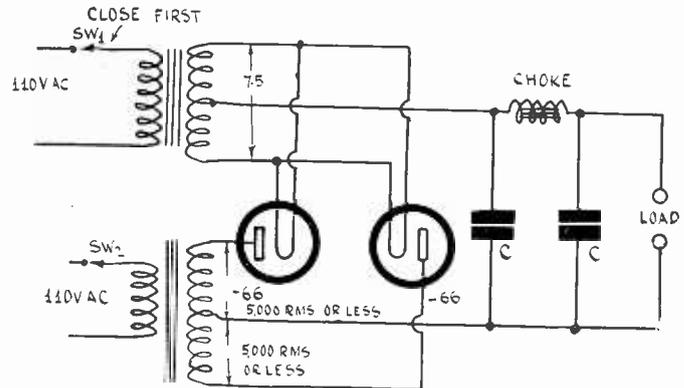


FIG. 1

THE CIRCUIT OF A FULL-WAVE RECTIFIER UTILIZING THE 566 MERCURY VAPOR RECTIFIER. THE SAME CIRCUIT MAY BE USED FOR THE LARGER SIZES OF RECTIFIERS PROVIDED THAT THE VOLTAGES ARE CHANGED APPROPRIATELY.

Rectification of alternating current to provide DC voltage and current for transmitting tubes is usually accomplished by means of mercury vapor rectifiers, which have been developed for this purpose. In general they are similar to two-element thermionic rectifiers, such as the 281, in that they have a hot cathode or filament and an anode or plate. They differ from these tubes in that they contain mercury, which, when the tube is active, is in a vaporized condition. The electrons are carried from the cathode to the plate by the ionized vapor. The DeForest Audions 566, 572 and 569 are of this type. Tubes of this type are rated in terms of inverse peak voltage and plate peak current. The inverse voltage is that when the cathode is positive with respect to the plate, or the voltage between the elements during that half cycle when no current flows. If this voltage exceeds a given value, depending on the construction of the tube, the insulation breaks down and the tube ceases to be a true rectifier. Since no inverse current is wanted, the peak, or the highest voltage during a half cycle, is given in the rating of the tube.

Current flows during the half cycle when the plate is positive with respect to the cathode and the amount of current depends on the voltage. Only a given amount of current can be drawn safely from the tube in this direction and the tube is rated at the peak value of the current. Thus the average current, which is the rectified and filtered current, is considerably less than the peak. In fact, if the input voltage is a pure sinusoidal wave and the current is directly proportional to the voltage, the mean current, in a half-wave rectifier, is only 0.318 of the peak value.

CHARACTERISTICS OF AUDION 566

Filament voltage	2.5
Filament amperage	5.0
Max. peak inverse voltage.....	7,500
Max. peak plate amperes.....	0.6
Base, UX and plate cap.	
Type filament, oxide coated.	
Use, mercury vapor, half-wave rectifier.	

CHARACTERISTICS OF AUDION 572

Filament voltage	5
Filament amperage	10
Max. peak inverse voltage.....	7,500
Max. peak plate amperes.....	2.5
Base, standard 50-watt and plate cap.	
Type filament, oxide coated.	
Use, mercury vapor, half-wave rectifier.	

CHARACTERISTICS OF AUDION 569

Filament voltage	5
Filament amperage	20
Max. peak inverse voltage.....	20,000
Max. peak plate, amperes.....	5
Base, standard 250-watt.	
Type filament, oxide coated.	
Use, mercury vapor, half-wave rectifier.	

Before applying the anode voltage on any of the mercury vapor rectifiers the filament should be lighted for 30 seconds or more.

Remote Control Tuning

By Herman Bernard

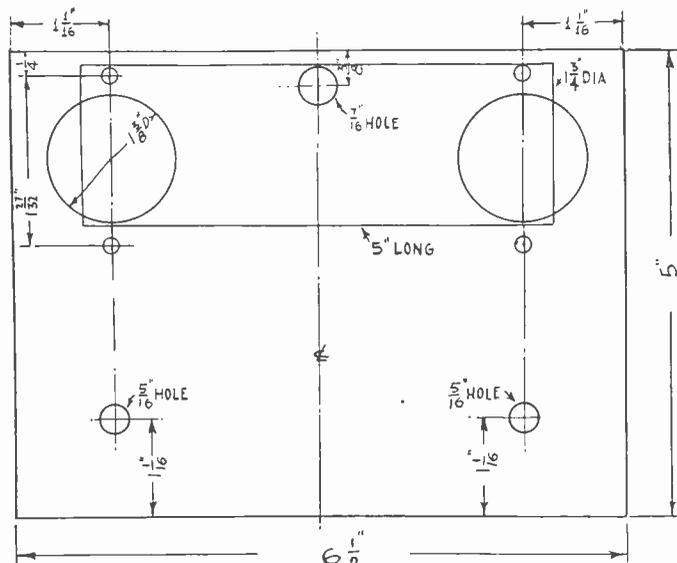


FIG. 3

A CONVERTER FOR REMOTE CONTROL OF TUNING, SWITCHING AND VOLUME OF A TUNED RADIO FREQUENCY SET, FOR BROADCAST WAVELENGTHS, MAY BE BUILT ON A 5x6½-INCH PANEL, WITH LONG COIL FORM MOUNTED TO SOCKET SCREWS BY BRACKETS.

[A converter for operating a broadcast receiver from a distance of up to 24 feet was diagrammed last week, issue of December 20th. The following discusses coil data.—EDITOR.]

THE method devised for mounting a coil system, using a single form, in constructing a remote control converter for tuning, volume adjustment and all switching from a distance of 24 feet or less is depicted in Fig. 3. The coil diameter is 1¾ inches, and the natural bakelite tubing is 5 inches long. Two holes are drilled in the tubing, and right-angle brackets with ¾-inch or ½-inch sides are used, so that the remaining hole in each bracket is fastened by a screw to a threaded bushing that is tightened down on the inside protrusion of the screw holding the socket to the panel.

By using this method the oscillator coil is wound on the left-hand side of the form, as you view Fig. 3, and the modulator at the other end. Since the bottom view is a reversal of the top panel view, the modulator coil will be at left and the oscillator coil at right during the actual use of the converter.

An Interesting Utility

The object of this device is to render remote control service for tuned radio frequency receivers. Although it also works on a Superheterodyne it does not work so well as on TRF sets. The TRF group includes the Neutrodynes, indeed, any and all non-Superheterodyne receivers.

A utility worth mentioning is that while readers are most familiar with short-wave converters that permit reception of short waves on a broadcast set, this remote control tuner also will permit reception of broadcast waves on a short-wave receiver, such as the National Thrill Box. Tune in the lowest frequency obtainable on the short-wave set, but above the broadcast upper limit (1,500 kc), and operate the remote control converter.

As for coil data, these depend on the capacity of condenser used. Since the panel is only 5x6½ inches, and the inside depth

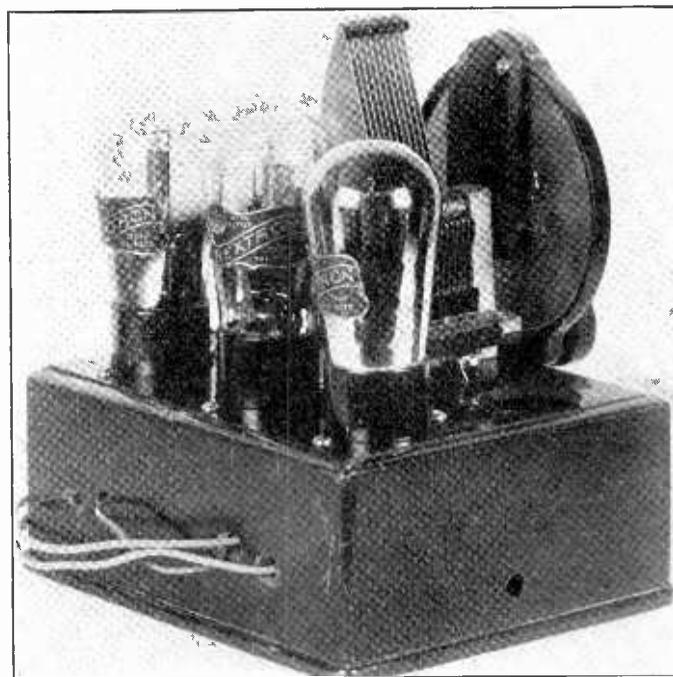


FIG. 4

TESTER SET UP TO DETERMINE PROPER NUMBER OF TURNS FOR COILS IN THE REMOTE CONTROL CONVERTER FOR BROADCAST WAVES.

of the cabinet is only 2¾ inches, it is assumed small capacity condensers will be used. For the oscillator this is favorable, because the broadcast band of wavelengths, representing a frequency difference, at extremes, of 1,050 kc, is easily covered with a small condenser, the oscillator frequency being higher than the signal carrier frequency by the amount of the intermediate frequency.

So the modulator should tune from 1,500 to 550 kc, which may be done even with a .00025 mfd. tuning condenser, as no shielding is used, and no "shrunk inductance" is suffered, with accompanying distributed capacity increase. If the intermediate frequency used is 1,500 kc the oscillator tuning should be 3,000 to 2,050 kc.

The modulator circuit is a rough tuner, and therefore may be used as a volume control. Moreover, it is not serious if the modulator does not quite cover the wave band. The oscillator will do it, and at the modulator's missing frequencies there would be only a small attenuation.

Coil Data

Coil data depend on the intermediate frequency used. In this instance the radio set is assumed to be tuned to the lowest possible frequency, say, 540 kc (just above 545 meters). Wind the modulator secondary of 85 turns of No. 28 enamel wire for .0002 mfd. or 78 turns for .00025 mfd. Leave ½-inch space. Next wind the antenna primary, consisting of 15 turns. Leave ¼-inch space and for .0002 mfd. wind 46 turns for the oscillator secondary, tabbed at the 41st turn. The tap goes to ground. For .00025 wind 40 turns tapped at the 35th turn. The oscillator plate winding may consist in all cases of 15 to 20 turns of the same size wire.

Crystal Sets Still Are of Some Use

There is still some interest shown in radio reception with the crystal detector. It has some advantage, it is true, for it permits with a set of headphones, remarkable clarity of reproduction. In addition, its cost is negligible, for there are no tubes or batteries.

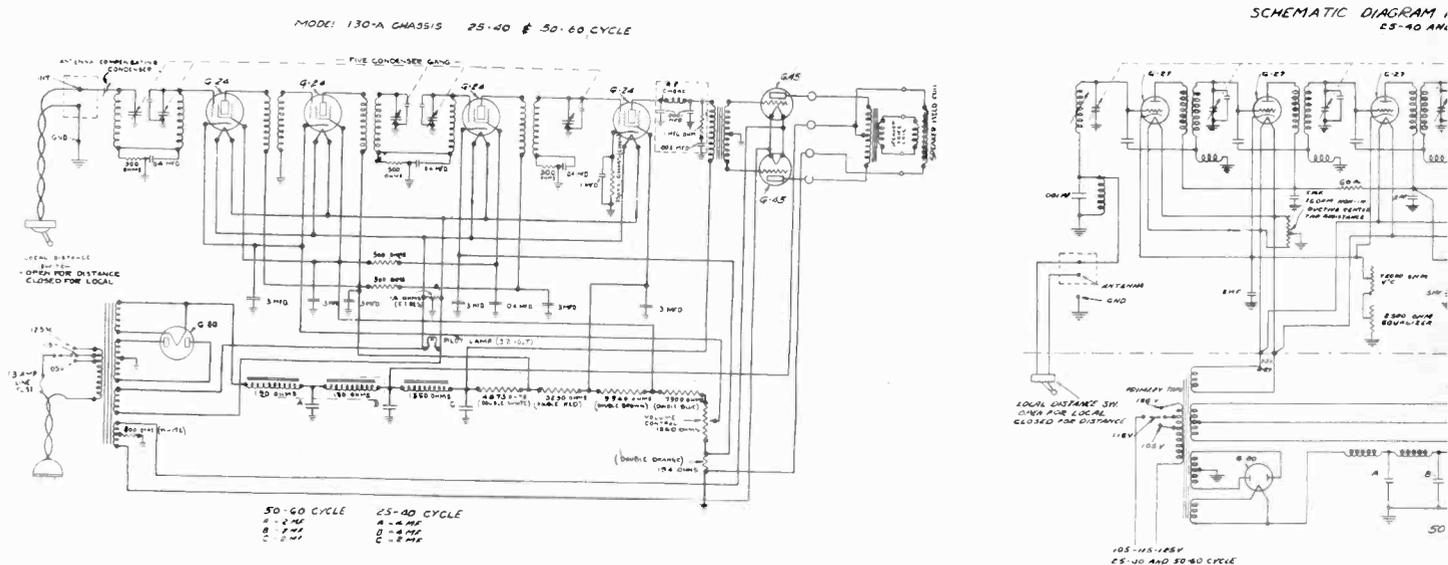
In certain locations a crystal set might be considered satisfactory. Within 15 miles of a good broadcasting station, where a fair-sized aerial can be erected, and where there are few, if any, other broadcasting stations within 25 to 50 miles, results

would be good. It is impossible to obtain sufficient sharpness of tuning, that is, selectivity, to avoid interference where there is a number of broadcasters, as near New York, Chicago and other large cities.

Of course, having to wear headphones is not liked nowadays, and the crystal is very difficult to maintain in a sensitive adjustment. A crystal set makes an ideal gift for a child, as it costs little and will provide plenty of fun and instruction. One advantage of the crystal receiver is that the audio quality is pure.

The New Majestic

Diagrams of the 90B, 10



THE Majestic Model 90B is a seven-tube receiver utilizing 227 type tubes up to and including the detector and two 245 type tubes in the push-pull output stage. The radio frequency amplifier is of the neutrodyne type, the reverse feedback being effected by connecting the grid of a tube through a small condenser to a small coil which is a part of the tuned circuit in the tuner following the tube and near the ground of that circuit. There are four of these neutralizing circuits in the receiver.

The field winding of the dynamic speaker is connected across the output of the B supply but in series with a 3,600-ohm resistance. The field winding, therefore, is wound to high resistance and high voltage so that only a low value of current is required to activate it.

A local-distance switch is provided in the antenna circuit by means of which a coil and a condenser in parallel may be cut into the antenna circuit when local stations are wanted, and shorted out when distant stations are wanted.

In addition to this volume control there is a 75,000-ohm variable resistance in series with the cathode leads of the first three tubes by which the grid bias on these tubes may be varied. In series with this 75,000-ohm resistance is a 2,500-ohm resistance called an equalizer which is also variable. Both vary the bias on the first three tubes and the 2,500-ohm resistance can be used as a fine adjustment volume control.

The Power Supply

The power transformer primary is tapped for 105, 115 and 125 volts to allow for different line voltages, the assumption being made that the average line voltage is 115 volts.

A single type —80 rectifier tube is used, and this delivers the rectified current into a filter consisting of two chokes and two by-pass condensers. No condenser is across the line next to the rectifier.

Model 90-B is made for both 50-60 cycles and for 25-40 cycles. When the line frequency is in the lower bracket the by-pass condensers in the filter are larger than when the frequency falls in the upper bracket. The difference in values is clearly indicated on the diagram, Fig. 1.

Model 100-B Majestic

The Majestic Model 100-B, Fig. 2, is essentially the same as Model 90-B, but has a provision for a phonograph pick-up unit. A transformer is connected between the pick-up unit and a 500,000-ohm potentiometer, the slider of which is connected, through a switch, to the grid of the detector tube. This potentiometer, of course, is used as volume control for the phonograph music. The switch not only throws the detector tube to either the phonograph or the radio amplifier, but it also converts the detector into an amplifier, by cutting out a 35,000-ohm grid bias resistor and substituting for it one of 1,800 ohms and also changing the plate voltage from 255 volts to 144 volts. It is not necessary to use as high plate voltage on the amplifier as on the detector to get the same output.

The 500,000-ohm potentiometer is mounted so that it is con-

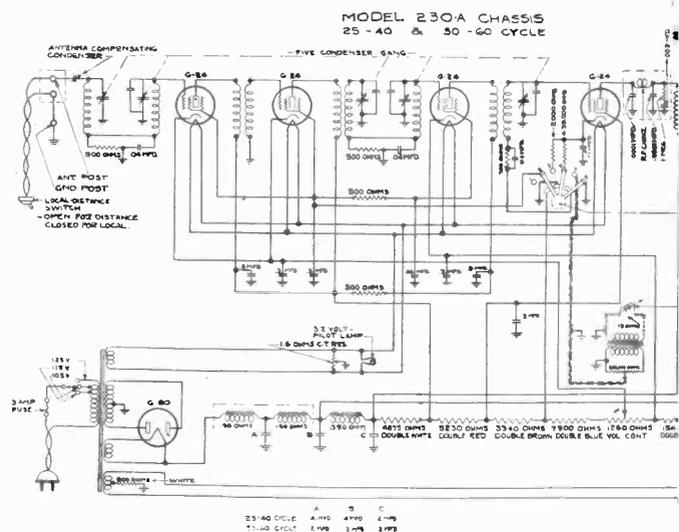
trolled by the same knob that controls the radio volume control. Thus only one knob is needed on the panel for the two controls. Of course, the radio amplifier is inactive when the switch is set for phonograph music so that there is no interference between the two.

Majestic Model 130-A

The Model 130-A Majestic, Fig. 3, is a six-tube screen grid receiver in which the first four tubes are of the 224 type and the two power tubes of the 245 type. The rectifier is of the 280 type as in the other models.

The coupler between the antenna and the first tube is a band-pass filter, that between the first and the second tubes is an untuned RF transformer, that between the second and the third tubes is another band-pass filter, and that between the third and the fourth tubes is a tuned secondary circuit. Each band-pass filter consists of two tuned circuits coupled by a .04 mfd. condenser shunted by a 500-ohm resistance. In the tuned secondary transformer there is also a .04 mfd. condenser and a 500-ohm resistor to make the tuned circuits similar.

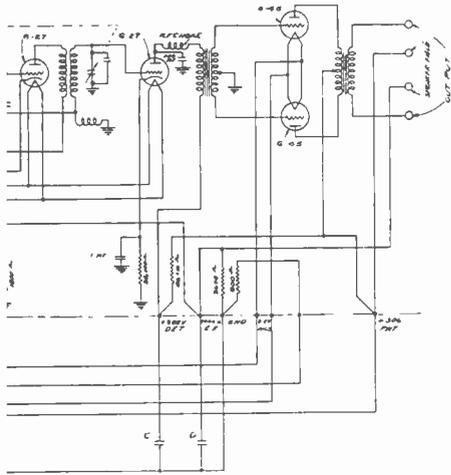
The local-distance switch is arranged so that the antenna and ground are short-circuited when the switch is set for the reception of local stations. A small compensating condenser between the high potential side of the first tuned circuit and the antenna prevents shorting the tuned circuit when the antenna and ground are joined. This small condenser is also used to equalize the tuning characteristics of the tuned circuits when the switch is open so that the gang tuning control will tune the circuit sharply.



ic TRF Receivers

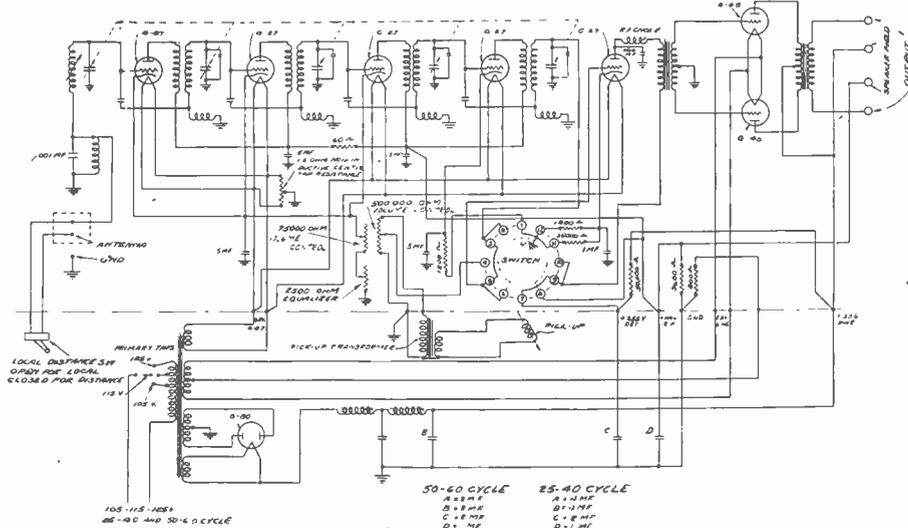
B, 130A and the 230A

MODEL 90-B MAJESTIC CHASSIS
50 CYCLE



50 CYCLE
1M F
100K
10K
1K
100
10
1
0.1
0.01

SCHEMATIC DIAGRAM FOR MODEL 100-B MAJESTIC CHASSIS
25-40 AND 50-60 CYCLE



100-115-125V
50-60 AND 50-60 CYCLE

50-60 CYCLE
A 2.5M F
B 1.5M F
C 1.0M F
D .5M F

Model 230-A Majestic

The model 230-A Majestic, Fig. 4, is essentially the same circuit as model 130-A except that it has a provision for a phonograph pick-up unit built in. In Fig. 4 we can easily trace out the change in the circuit when the phono-switch is thrown from radio to phonograph or in the opposite direction. Positions 1, 3 and 5 on the switch are for the phonograph and positions 2, 4 and 6 for radio. The bias resistors are connected to points 3 and 4. When the switch is set on the phonograph combination the 12,000-ohm bias resistor is connected to ground and the detector tube becomes an amplifier, and when the switch is set for radio the 35,000-ohm bias resistor is grounded, converting the tube to a high signal, grid bias detector.

When the switch is set off the phonograph the extreme right blade of the switch is connected to position (5), joining the slider of the 500,000-ohm potentiometer to the grid return of the detector, thus impressing the pick-up output voltage in series with the grid circuit. When the switch is set for radio, the extreme right blade of the switch is connected to point (6) and ground. Point (1) blank so that when the extreme left blade of the switch is connected to this point no screen grid voltage is applied to the radio frequency amplifier tubes. But when the blade is set on (2) the screens are connected to a point on the voltage divider giving the appropriate voltage.

Bias of Tubes

The power stage tubes are biased by means of an 800-ohm resistance connected between the center tap of the 2.5 volt winding serving the filaments of these tubes and the ground. No by-pass condenser is connected across it because the amplifier is balanced so that no appreciable signal current flows through the bias resistor. The detector tube is also biased by an individual resistor, as has been pointed out, the value being 12,000 when the tube is used as an amplifier and 35,000 ohms when it is used as a power detector.

How Bias Is Obtained

The bias for the third tube is obtained from the drop in the 154-ohm section of the voltage divider. Through this resistor the plate and screen currents of all the first three tubes flow in addition to the bleeder current. The bias on the first two tubes is obtained from the drop in the resistance to the right of the slider on the 1,260-ohm voltage divider, including the 154-ohm section. For highest sensitivity of the receiver the slider on the volume control is set near the 154-ohm resistance so that the bias on all first three tubes is the same.

Hum is minimized by grounding the center tap of a 1.6 ohm non-inductive resistance connected across the 2.5 volt heater winding serving the 224 tubes. This is rather low resistance across the winding which takes about as much current as one of the tubes, but its effect is greater that way.

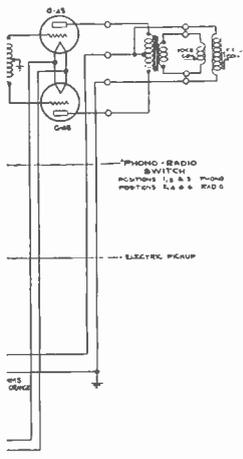
Transformer Coupling Used

The audio frequency load on the detector is a push-pull transformer having a high impedance primary.

The cathode lead from the first two screen grid leads are connected to a 1,260-ohm potentiometer which is placed near the negative side of the main voltage divider, and this potentiometer is used as a manual volume control by adjusting the bias on the first two tubes. The cathode of the third tube runs to a point on the voltage divider 154 ohms from ground, or to the junction of the 1,260-ohm volume control and the 154-ohm resistor. Thus the bias on the third tube is only the drop in the 154-ohm resistance.

The rectifier tube feeds into a 190-ohm choke, and this is followed by another choke of the same design. After this the plate current for the two power tubes is tapped off. A third choke, one of 1,500 ohms, follows, and then the plate current for the detector tube is tapped off. Thus the plate current for the detector as well as the radio frequency tubes is filtered more thoroughly than that of the push-pull tubes.

The current for the field coil of the dynamic speaker is tapped from the same tap as the current for the power tubes and is therefore filtered by the same amount before reaching the field winding. The low side of the field winding is connected to ground. Since the voltage applied to the plates and grids of the 245 tubes is about 300 volts, the voltage across the field winding is also 300 volts. This means that the winding must have a high resistance and that a strong field will be established with a comparatively small current. The resistance of the winding is 7,650 ohms.



Final Adjustments for

By John C.

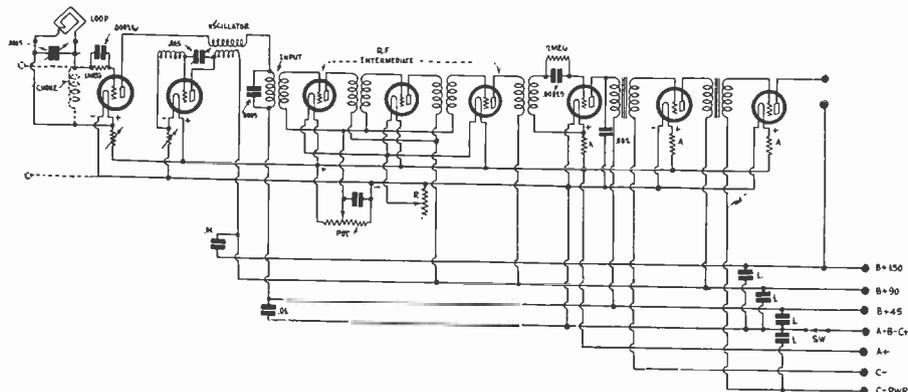


FIG. 1

[Conversion of the battery Victoreen Superheterodyne to A. C. operation was described in two preceding instalments, December 13 and 20. The third and final instalment follows.—EDITOR.]

BOTH the battery-operated set and the AC revision are provided with a dotted line circuit that is used when it is desired to use a short-wave converter. The connection is as follows:

Remove the loop leads, leaving the loop tuning condenser shunted around the grid and grid return. To these two terminals attach the output of the converter, which should have a condenser say, .00035 mfd., connected in series between the plate of the converter output tube and the grid input of the Superheterodyne. Then from the junction of these two merely attach a 1/4 mH choke as per the dotted line, whether the set is battery operated or otherwise, and set the regular tuning dials of the set to 1,500 KC or higher frequency, being sure they are in tune, and with the converter ready for operation, work the converter dials to tune in the short waves.

The sketch, Fig. 2, shows the connections to the voltage divider and includes in the total plate load the field of the dynamic speaker, which is so connected because the location of the knee of the magnetization curve for the particular pot magnet permitted ample field flux for satisfactory operation, with a drop of 55 volts, i.e., the volume of the speaker did not increase even when the applied field voltage was increased to 110 volts.

In the previous article a speaker field coil was depicted as being connected in series with the negative lead, and shunted with a bleeder resistor. This plan is all right, but if you wish to dispense with the bleeder resistor, merely substitute a dynamic field winding of 1,000 ohms resistance. The voltage drop across it will be about 70 volts and the current will be the total plate current, which will be between 75 and 80 milliamperes, the wattage being 4.5 to 5.6 watts. And if you happen to have an 8,000-ohm type field winding it may be placed around the rectifier tube output without imposing an undue additional load. The large amplification of the Superheterodyne is well brought out in the case of the author's set, which was revised as explained, its receiving range being considerably enhanced.

Tips on Adjustment

There are a few points relative to adjustment of a converted set of this type mentioned which should be reviewed. One point that should be carefully observed is that of avoiding excessive spurious frequency voltage stepup. This may be avoided if there is sufficient care taken with the distribution of the voltage divider bypass condenser capacity values.

On completion of the audio system the circuit will consist of the detector tube, a 227, in the plate lead of which is an audio transformer, the secondary of it connected across the grid of the following tube that also is a 227. The plate load of the second stage tube is push-pull.

The output transformer couples the plates to the speaker in the usual manner. If the input voltage to the grid of the detector tube is excessive the system may overload, and harmonic frequencies may appear. These may be manifested by the quality of the output at the speaker, and also they can sometimes be heard as vibrations of the transformer laminations, the sound being a kind of fizzing that is mixed in with all the other frequencies, at the ordinary volume, it being necessary to reduce the amplitude of the input voltage to the detector to stop it, with the reduced volume quality good, because the fizzing frequency is missing.

Of the list of probable causes underlying the generation of undesirable audio components in a Superheterodyne receiver, probably one of the most important is the improper or insufficient filtration of the B voltage supply. This applies to all the circuits of the set generally.

The power pack with which this set is operated has a tuned choke, the purpose of which is to help to eliminate the residual hum component from the DC plate supply. The effectiveness of this tuned hum filter or trap circuit depends in a large measure on the accuracy with which its resonant frequency is adjusted to the hum frequency in the branch of the voltage divider in which it is placed. At no load, the detectable hum (using earphones) may be reduced to the vanishing point, and

with the load on the same thing may be done also, but it is not as easy.

The no-load capacity value that tunes out the hum may not be the same as the one that is effective at full load, but on the other hand, the full load capacity will always be all right for the no load or partial load condition.

The voltage drop across the tuned choke at no load may be as low as one volt, but the "load" voltage across this choke may be twenty volts or so. Therefore it is obvious that the capacity will have to be changed, but the magnitude of the change will depend on the accuracy of no load hum elimination.

Poor filtration is most likely to be evident at the detector or first audio plate B plus supply lead, if you "earphone listen" for it between ground and this point, and the cure, of course, is to vary the tuned choke filter capacity with a view to eliminating this hum first, or at least reducing it to the lowest value possible by this means.

Because a cable is used it is always a good plan to bypass to a common ground at the binding post terminals of the B supply voltages with a 2 mfd. condenser. Then cut in on the plate lead of the detector tube with the earphones to test the audible value of the hum voltage by the same standard. When the capacity adjustment outlined is correct the hum will be very low.

There is also possibility of hum being apparent in the first audio plate output circuit, and although there is no excessive hum observed at the voltage divider contact of this circuit, with the earphones the addition of perhaps as much as 4 mfd. will be found to be effective in suppressing the major hum amplitude. All final acoustic comparisons are to be made via the speaker output. The hum frequency is 120 cycles.

Other Tuning Adjustments

As no changes are to be made to the radio frequency coils of the set it is only necessary to wire up the circuit as per the

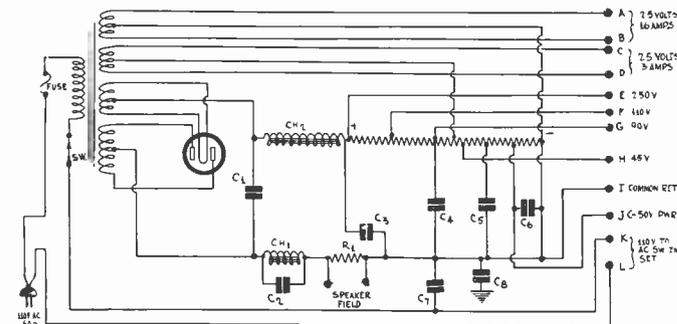


FIG. 2

A MODERN POWER PACK CIRCUIT ESPECIALLY DESIGNED FOR 8 TO 10-TUBE ELECTRIC RECEIVERS, WITH PROVISION FOR OPERATING DYNAMIC SPEAKER FIELD COILS FROM 1,000 TO 2,500 OHMS. ALSO THERE IS A TUNED HUM TRAP-OUT CIRCUIT FORMED BY CH₁ AND C₂ WHICH IS VERY EFFECTIVE. CONNECTION LEADS K AND L ARE OF SHIELDED METAL MESH COVERED WIRE, THE MESH COATING BEING GROUNDED. THE 280 TUBE IS NOT OVERLOADED, DUE TO CAREFUL DISTRIBUTION OF THE TOTAL PLATE LOAD.

Victoreen Conversion

Williams

sketch, inserting the recommended values of grid bias resistance for the 227 tubes, which for the author's set were 300 ohms, as the plate voltage was only 65 volts.

The grid bias value for the two detectors was finally decided upon as 20,000 ohms.

The intermediate frequency transformers of some kits may be tuned separately either by means of a capacity variation or an inductance change caused by a change of proximity of a brass or copper plate to the windings of the transformer. Usually these adjustments are unchanged when the circuit is revised, but if a radical change in the manner of tuning is noted, and harmonics multiply, etc., adjustment will be necessary.

Choice of Oscillator Coil Connections

The plate lead of the first detector tube is diagrammed as running from the tube socket to the plate lead terminal to the oscillator coupling coil, and from here to the plate terminal of the input transformer, and then to B plus. This circuit is excellent but its effectiveness will depend upon the relative phase relationship with the tuned windings below (Fig. 1), and as the binding posts of this coil may not be marked, it is well to try out the two connection methods, at the time tuning adjustments are made.

Volume Control and Sensitivity Control

The two potentiometers diagrammed in the circuit herewith are the means by which the volume and the sensitivity of the set are controlled.

The result of several hours of experimenting with various types of volume controls brought a number of things to light.

Chief of these was the discovery that attempts to regulate operation of the 227 grid bias merely caused the plate voltage to rise at other points in the set circuit, a condition that gave rise to much distortion at reduced volume. In fact, the distortion began to be evident with slight volume reduction. With the realization of this fact it was decided to try a different plan.

At the same time it was decided to segregate the volume controlling effect into two circuits, one for the two detectors and the other one for the three intermediate stages, this because of the different characteristics of the two circuits.

Amplify By-passed Volume Control

They were labeled Sensitivity and Volume, the first one is for varying the applied voltage to the plates of the two detectors while the second one is for similar treatment of the intermediate tube plates, though they are not connected up similarly, as you can see. The basis of the unorthodox connection of the control marked Volume is that it results in the voltage distribution along the voltage divider being virtually constant, because the load current flows either in the plate circuit or in the resistor, depending upon the position of the potentiometer slider.

But to prevent the complete short-circuiting of the voltage divider a stop is provided whose effect is to check the motion of the slider at a point where the applied plate voltage is insufficient to make the tubes of the intermediate stage operative. This provision results at the same time in a current flow through the potentiometer, but the magnitude of this current is insufficient to heat the potentiometer unduly, and thus the plan from this angle works out satisfactorily. There is, however, one other point, and it is that the slider must be by-passed from slider to common return, and from slider to B plus, the capacities being 1 mfd. each. This was shown necessary by experiment.

The connective wiring for this volume control system is wholly within the set assembly. No additional leads are to be run to the power pack.

The "Sensitivity" Control

The variation of the applied voltage on the plates of the two detectors is the best way to work them.

As the maximum plate voltage is not in excess of 45 volts, the current due to these two tubes is not excessive, and the usual shunt connected potentiometer is satisfactory. This has been proven in this particular case, so we pass it along to you. The mode of connection is as per the sketch herewith, with the slider by-passed as previously outlined. The use of the sensitivity control is not specially well illustrated when you attempt to tune in local stations, but with the more distant ones its value will be appreciated.

The grouping of the parts of the converted set has been found to be correct and this part of the story dealt with the adjustments to the bias voltages of the various stages, and how the necessary degree of operative sensitivity was attained to justify the conversion to AC operation.

In addition to the above methods of devising a suitable volume control, which was purposely omitted from the article of last

week, was taken up, as the fan doubtless will be more or less left up in the air on this score if something were not done about it.

An alternative method of coupling between the detector tube plate and the first audio stage is diagrammed herewith. The chokes may be the secondaries of a 1-to-3 audio transformer and the coupling condenser may be .01 mfd. This circuit is comparable to the 1-to-1 ratio audio transformer as regards the final loudspeaker results. In other words, a skimpy transformer will tend to be high pitched while a generously proportioned one is likely to have higher impedance at the lower frequencies. The set when finally completed is found to be very much improved and the conversion is well worth the cost.

Power Pack

The values of the marked constants are as follows:

- C1—4 mfd.
- C2—2 mfd. or more.
- C3—4 mfd.
- C4—4 mfd.
- C5—2 mfd.
- C6—2 mfd.
- C7—.01 mfd.
- C8—.01 mfd.
- CH1—Polo Tuned Choke.
- CH2—Polo Double 30 Henry Choke.
- R1—800 to 1,000 ohms (with 110-volt field coil provides 60 to 90 volts).
- R2—24,000 ohm voltage divider (three sections).

List of Parts

The Power Pack

One type PT 245 power transformer; secondary output, 360 volts DC; 2.5 volts, 16 amperes; 2.5 volts, 3 amperes; 5 volts, 2 amperes.

One Multitap Voltage divider, 17,000 ohms, has 20 taps.

One Guaranty Voltage divider, 7,000 ohms, has 5 taps (one section).

One Polo double choke, 30 henries per section.

One Polo tuned choke (not center tapped).

Two Bakelite binding post strips, 3/16x1 1/4x8 inches.

Four 2 mfd. hi-volt condensers.

One AC switch.

Twelve binding posts.

One 12-lead connection cable.

One roll of hookup wire.

One condenser block, 2-4 mfd., 2-2 mfd., 2-.01 mfd.

One 280 rectifier tube.

One four-prong socket.

One Steel Cabinet, 8"x11 1/4"x9 1/2" high.

The Set

One output transformer, or Polo output Choke.

Four 2 mfd. paper condensers.

Four 1 mfd. paper condensers.

Seven .01 mfd. shielded fixed condensers.

Nine resistor clip mounts.

Two 20,000-ohm fixed resistors.

Seven 300-ohm pigtail resistors.

Two 30,000-ohm volume control potentiometers.

One 50,000-ohm fixed resistor.

Seven five-prong tube sockets.

Two four-prong tube sockets.

Seven 227 tubes.

Two 245 tubes.

One roll of hook-up wire.

One bakelite strip, 3/16 x 10 x 1 inch.

Twelve binding posts.

One panel mounting switch (AC).

Hardware

Twelve 1 1/2 x 6/32 brass machine screws and nuts.

Eight flathead iron No. 6 wood screws, 3/4 inch long.

Twenty-four 1 x 6/32 inch R. H. brass machine screws and nuts.

Four 2 x 10/32 R. H. iron machine screws.

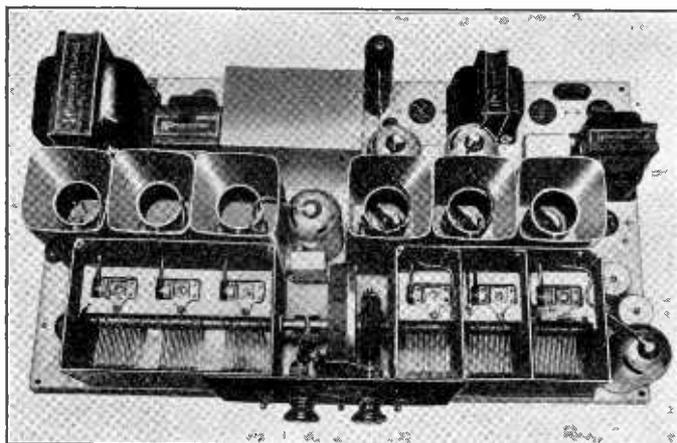
Two brass angles, 1/2 x 3/4 inch (drilled).

Cable Wire

White, blue, green, brown, red black tracer, blue yellow tracer, yellow, shielded mesh, No. 9 D.C.C., No. 16 D.C.C.

The Hammarlund HiQ-31

By Lewis W. Martin



CONNECTIONS AND TESTING OF THIS RECEIVER ARE DESCRIBED.

[Herewith is the second and final instalment of the article dealing with the Hammarlund Hi Q-31. The first instalment was published last week, issue of December 20.—EDITOR.]

ANOTHER important feature of the —31 is the volume control, which is operated by varying the voltages on the screen grids of the radio frequency tubes. With it a very close adjustment of volume can be obtained. When receiving local stations, the "Local-Distance" switch is thrown to the local position, in which position a 200 ohm resistor is placed in series with the third tuned circuit of the band pass filter. The overall selectivity is not noticeably lowered since the resistance only affects one tuned circuit out of a total of six. But the reduction in an input radio frequency voltage produced by the "Local-Distance" switch makes it unnecessary at any time to so reduce the volume with the main volume control. The radio frequency tubes accordingly are operated on the lower bend of their characteristics. The switch makes it possible, therefore, to always operate the set without critically adjusting the volume control, resulting in ease of operation under all reception conditions.

And now we come to the tone control, a refinement which will be found useful in a number of ways. First, it permits adjustment of the balance between the high and low frequencies to suit the individual tastes of the user. It also helps to cut out noises and high-pitched heterodyne whistles when tuning in distant stations. A third use of the tone control will be found during the Summer months when static is severe. Since static, as it is reproduced by the loud-speaker, predominates in high frequencies, it can be suppressed to a large degree by turning the tone control to the "B" position, resulting in a reduction in high frequency amplification. Consequently, static becomes less bothersome.

Pointers on Mechanical Features

Although the assembly and wiring of this receiver are very simple, to further facilitate matters, the following pointers are offered.

As to the installation of the band filter unit. This is mounted as shown in the various photos, the four leads passing through the chassis pre-provided. Nuts and lock washers are placed on the three mounting screws which protrude through the chassis. The mounting feet inside the condenser shield are then secured with screws and nuts. The unit is further secured by three $\frac{1}{4}$ x8/32 screws which pass up through the chassis into tapped holes in the condenser frame. These screws must not be longer than $\frac{1}{4}$ inch.

Now the dial drive mechanism should be slipped on the condenser shaft of the radio frequency amplifier unit. Now slip on the dial indicator drum and condenser shaft coupling. This radio unit can now be secured to the chassis in the same manner as the band filter.

The dial escutcheon is mounted with the ornamental screws furnished with the dial, the short screw going into the lower hole. If this screw extends beyond the nut, it should be filed off flush. The lamp bracket is then mounted in the top screw of the escutcheon to hold it in place, using the Bakelite washer to insulate it from the escutcheon.

The lug on this lamp bracket should then be bent out and a 15-inch lead soldered to it, a lead of the same length being also soldered to the lamp socket and these two wires being twisted together.

In mounting the dial drive to the panel, the screws on the panel should be loosened, so as to relieve any strain due to misalignment. The screws then can be retightened.

The voltage divider should be mounted with the label at the top, and the lugs pointing toward the panel.

After every part has been put in its place, the wiring is the next step.

Ready for the Wiring

It is suggested that a colored pencil be used to mark out each wire on the diagram as that wire is connected.

Where wires are joined together, or where other bare surfaces occur, a liberal use of insulating tape is recommended.

Special care should be taken in connecting the 12 mfd. by-pass condenser across the 2,500-ohm C biasing resistor of the first audio tube. The plus terminal of this condenser should be connected to the K terminal of the —27 socket, and the minus terminal to the chassis.

After wiring is completed, each connection should be carefully checked to assure proper operation of the receiver. Remember that a wrong connection may not only easily make the difference between perfect and poor results but may cause considerable damage to the parts.

The use of an Amperite voltage regulator tube is strongly recommended, but where the line voltage is uniform as to make its use unnecessary, the two terminals of the Amperite socket can be connected together, and the connection to the terminal marked 90 volts, must then be moved to the terminal marked 115 volts.

Now It Takes the Air

The final step in the assembly is the removing of the covers of the variable condenser shields, and turning of the rotor plates of both condensers so that they are fully meshed. Then the flexible coupling should be slid along the condenser shafts until the gap in the coupling coincides with the space between the ends of the two condenser shafts. Then the set screws should be tightened.

Now turn the dial knob to the right until the stop is reached. The set screws in the drum drive should then be tightened. If the dial light has not as yet been placed in its socket, now is the time to do so. The indicator should then be centered with the escutcheon aperture and its set screw tightened in such a position that the word "record" is even with the indicating points, when the condenser plates throw the automatic phonograph switch.

The tubes can now be placed in their respective sockets, the shields placed over the screen grid tubes, and the connectors placed over their control grid caps.

Details on Grounding

If the special Hi Q speaker is used, its four-prong plug should now be inserted in the socket marked "SPKR." Under no circumstances should an attempt be made to operate the receiver with this plug disconnected, since serious damage to the filter condenser might result. Of course, if another type of speaker is used, the method of installation is different, this being related in the latter part of this description.

After setting the "on and off" switch on the panel to the "off" position, the receiver can be connected to the 110-volt line, using the cord with its connectors. Incidentally the duplex receptacle is for the purpose of providing 110 volts for operation of an AC dynamic speaker, should the special Hi Q speaker not be used, and also for a 110-volt phonograph motor.

Now the speaker voice coil leads or input transformer leads can be plugged into the speaker jack, and the antenna and ground connected.

The ground binding post is insulated from the chassis in order that the same may be grounded independently. Although results vary under different operating conditions, best operation is generally obtained by running a separate ground wire from the chassis to the wall plate of the 110-volt outlet.

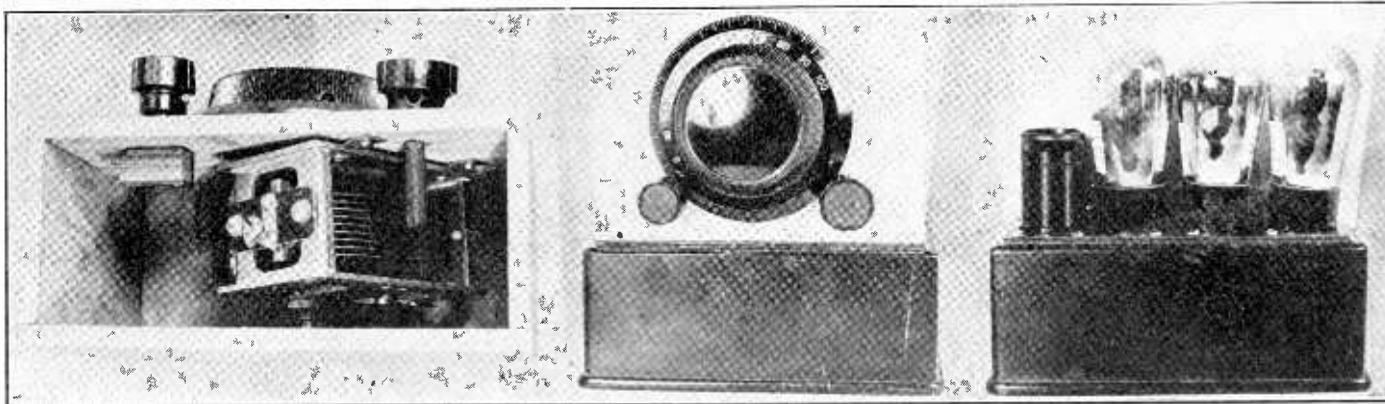
The "on and off" switch can now be turned on and if all the connections have been made correctly, the filaments of the —80 and the —45 tubes should come slowly to a red glow. The heater filaments of the —24 and —27 tubes should glow brightly. A set of tested tubes should be used for best results.

Not Critical on Aerial Length

Due to the use of the three-stage input filter, the length of the antenna does not have a very marked effect on the selectivity of the receiver. There are two antenna binding posts, one for a long antenna, that is one having an overall length, including the lead-in, of 75 feet or more, and a binding post for a short or indoor antenna.

After the best connection for the particular location has been made, and all the tubes light properly, the next step is to adjust the trimmers. A station at about 1,400 to 1,500 kilocycles should be tuned in as loudly as possible. The volume of this station should then be reduced with the volume control, until the signal

(Continued on next page)



THREE VIEWS OF A SHORT-WAVE CONVERTER LAY OUT. BERTRAM REINITZ SAYS HE BUILT A GOOD ONE AT A COST OF ONLY \$4.27.

Fistful of Distance @ \$4.27

WHEN I saw the November 8th issue, with its beginning of a series of articles on short-wave converters, which I see was ended in the December 20th issue, I got enthusiastically excited, because I am deeply thrilled over short-wave reception and believe it is the coming thing.

I built three converters, the AC model with filament transformer external, the AC model with filament transformer inside, and a battery model. All worked superbly, and I got a fistful of distance.

My own layout is somewhat different from the one shown in the full-scale picture diagram in the December 13th issue, not as good looking, yet handy. I erected a wooden plane perpendicular to the top of the box, and on this frame mounted the tuning condenser, volume control and an AC switch. The outfit cost me \$4.27 and I never got so much action for so little money.

Your series on these converters to be built at lowest prices ever, is certainly commendable, and I wish you a Happy New Year a hundred times over.

BERTRAM REINITZ,
18 East 23rd Street,
Brooklyn, N. Y.

Resistance by Chemist's Scale

IN an article in the July 5th, 1930, issue of RADIO WORLD I explained the physical law that governed the expansion and contraction of metal, etc., under influence of heat, and the distortion that might be caused through the sparking between the intervals or the collision of the atoms in a metallic body under heat pressure.

I received correspondence from other radio publications that my ideas were too technical for publication. I did not think that any radio engineers representing the query and answer oracle of any radio publication could express an opinion of this kind and still consider himself an engineer.

These liquid resistances, I explained, would diffuse the calories of heat in the

Forum

liquid contents of the tube, and the heat dissipation would be evenly distributed in the fluid, whereas the metallic or wire-wound resistance would combine the heat dissipation to the length times the cross-sectional area of the metal. I have found values in ohms that could be governed by the apothecary scale.

I have used graphites, indigos, powdered metals with acids, alkalis and oils, and disintegrated them also in distilled fluids, such as water, obtaining ohmic values that were governed by the chemist's scale.

JAMES A. MCGOVERN,
335 East 25th Street,
New York, N. Y.

Single 2½-Volt Winding Intrigues Him

THE circuit of Radiola 80 as published in RADIO WORLD December 13th is very interesting and from it we learn that some of the things we have been taught for many years by the instructors in the radio press are subject to a little questioning.

Ever since the advent of the 245 tube we have been told that on account of the high grid bias it was necessary to supply the 224 or 227 heaters from an individual power transformer secondary, yet in this most excellent receiver we find only one secondary and the statement, "To all heaters, UX245 filaments and pilot lamp."

On the sheets that are wrapped around the 227 and 224 tubes we find the instruction to the effect, "Plate voltage, maximum and recommended, 180." But in this circuit, whose engineering cannot be questioned, we find one high voltage lead running without any resistors to all the tubes except the second detector. Assuming that the customary plate voltage of 250 is supplied to the 245s, and this would seem necessary with only one stage of

audio, it would seem that perhaps the tube manufacturers don't know just how good their tubes are. Or perhaps their right hand knoweth not what their left hand doeth.

A. B. GARDNER,
Box 296, Coconut Grove, Fla.

Old Fox Sees New Light

READ in RADIO WORLD of December 13th the article entitled, "How an AC Short-Wave Set Was Designed." It is very interesting. I would like to read some more about it. I am an old fox already, but maybe I will start all over again, if what Mr. Dana Bacon, of the National Company, writes is true.

Best regards and a Happy New Year to you all.

M. J. PUSNICK,
87 Bergen Street,
Brooklyn, N. Y.

Favors Constructional Data

RECENTLY I have noticed in RADIO WORLD articles dealing with some of the older styles of radio receivers. One of these dealt with a type of Neutrodyne with which I am familiar. There are, I am sure, many readers who now, especially, are not able to afford the expense of a new receiver, but having more time than money to spare will be interested in the possibilities of revamping the set which they now have, using a few additional new parts. I have rebuilt quite a few sets, some of which I have converted from DC operation to AC operation with a self-contained power pack and I have had a good measure of success. I would like to see more constructional articles of this kind, because in my opinion they are timely. More power to your excellent magazine!

JAMES C. WILKINS,
No. 12½ Dart Avenue,
Rockaway, N. Y.

FADA DEFEATS LEKTOPHONE

Washington.

In a recent decision handed down by the United States Supreme Court it was held that the design of Fada speakers does not infringe the Lektophone patents.

Meter Readings on the Hi Q-31 Receiver

(Continued from preceding page)

is barely audible. Under no conditions should the set be retuned to arrive at this low volume setting, since a false setting will result. All but the antenna equalizer should then be adjusted with an insulated adjusting stick or bakelite rod, filed down, until the signal is brought up to maximum strength. The dial should then be turned up to 600 kilocycles and the first equalizer, or the one in the antenna circuit, should then be adjusted. In making these adjustments, the "Local-Distance" switch should be kept toward the "D" side.

As an aid to checking the accuracy of wiring and making sure that the voltages at various points in the circuit are correct, the following table of voltages is given. A high resistance DC voltmeter, one having a resistance of 1,000 ohms per volt, should be used. In using, connect the negative terminal of this meter to the chassis, turn on the set and adjust the volume control to about half on. Attach a piece of wire to the positive terminal of the voltmeter. When the free end of this wire is touched to

the following points, the meter should read as follows:

Terminal No. 5 of voltage divider.....	180 volts
Terminal No. 4 of voltage divider.....	90 volts
Terminal No. 3 of voltage divider.....	45 volts
Terminal No. 2 of voltage divider.....	0 volts
P terminal of socket Nos. 1, 2, 3 and 5.....	180 volts
P terminal of socket No. 4.....	70-80 volts
P terminal of socket Nos. 5 and 7.....	280-300 volts
G terminal of socket Nos. 1, 2 and 3.....	20-30 volts
K terminal of socket Nos. 1, 2 and 3.....	1-2 volts
G terminal of socket No. 4.....	45 volts
K terminal of socket No. 5.....	10-12 volts
K terminal of socket No. 4.....	4 volts
P terminal of socket No. 10.....	280-300 volts
F terminal of socket No. 10.....	180 volts
G terminal of socket No. 10.....	50 volts
F terminal of socket No. 10.....	0 volts

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Those not answered in these columns are answered by mail.

RADIO UNIVERSITY

Annual subscriptions are accepted at \$6 for 52 numbers, with the privilege of obtaining answers to radio questions for the period of the subscription, but not if any other premium is obtained with the subscription.

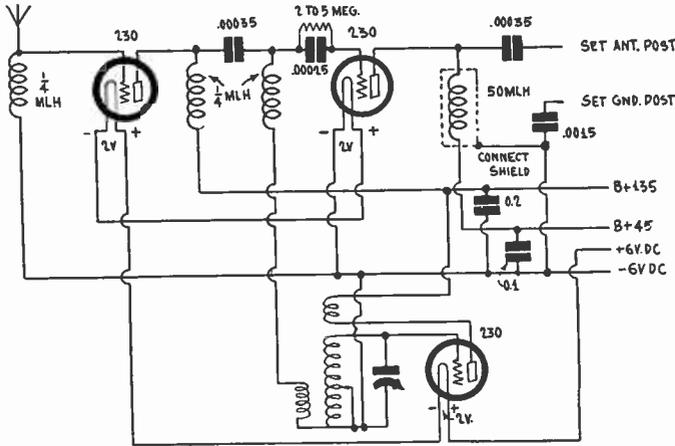


FIG. 872

IN THIS SHORT-WAVE CONVERTER THE PICK-UP COIL IS PUT IN THE GRID RETURN CIRCUIT IN SERIES WITH THE GRID IMPEDANCE, WHICH IS A 1/4 MILLI-HENRY CHOKE COIL. THERE IS ONLY ONE TUNING CONTROL, MAKING THE CONVERTER EASY TO TUNE.

Grid Modulation Converter

WILL you kindly publish a circuit of a short-wave converter in which the pick-up coil is connected in series with the grid return lead. You have shown many circuits in which the pick-up coil has been connected in the cathode lead, the screen lead, and the plate lead, but I cannot recall having seen one in which it was in the grid lead. I know it is practical because most superheterodynes are designed that way.—B.L.C.

In Fig. 872 you will find such a converter. It is for battery tubes and grid condenser, grid leak detection. It will work just about as well if no grid leak and condenser are used, especially if the stopping condenser is made small. Now it is marked at .00035 mfd. but it could well be as small as .0001 mfd.

Burn-out of Fuses

MY receiver is equipped with fuses in the primary of the line. The other day these fuses blew out and now as soon as I put in new ones they, too, go. Is this an indication that the primary is short-circuited or could some other trouble account for the blow-out?—L.B.

The short which causes the blow-out may be either in the primary or in one of the secondary windings. If you have an ohm meter measure the resistance of the primary. It should indicate something like 5 ohms. If it is nothing, of course, the primary is short-circuited. Tests should also be made on the secondary windings, both the high voltage and the low voltage. The high voltage winding should have resistance of the order of 500 ohms while the low voltage one has a very low resistance. It is possible that if one of the secondary windings is shorted, the short will be outside the transformer so that the point may be located by inspection or by removing the tubes.

Why Lossers Are Used

WHY are some intermediate transformers built with a copper disc between the two windings, or a copper ring around the coil? It seems to me that this causes a great loss in efficiency.—J. C.

If the copper ring or disc is between the two windings it serves two purposes, first, as a capacity shield to prevent transfer of energy through the distributed capacity, and second, as a lossler to keep the selectivity of the circuit down to a desired level. If the copper ring or disc is inside, outside or at the ends it serves only as a lossler. A shield between the windings may be slotted so that it will act as a capacity shield without acting as a lossler.

Behavior of Short-Wave Converter

I HAVE a short-wave converter with a set of plug-in coils. I have noticed that I can tune in certain stations with both the oscillator and the modulator when the two coils are supposed to cover different ranges, that is, I have a small coil in the oscillator and a larger one in the modulator and the signals can be tuned in on both. How do you explain this phenomenon?—T. C. R.

As you know, the converter is a superheterodyne and all superheterodynes bring in every signal in at least two places on the

oscillator dial, provided that the dial covers the necessary range. Now when you tune in a station with a large coil in the modulator and a small one in the oscillator, the oscillator is evidently set on the higher of the two settings. Of course it is also possible that the coils overlap. In this case the oscillator should be set at a high value of capacity and the other at a small when the station is tuned in with both. Again, it is possible that the oscillator beats with a harmonic of the signal frequency.

Field Winding for Bias Resistor

WOULD it be practical to connect the field winding of a loudspeaker in place of the grid bias resistor for the 245 power tubes? If it is practical would it be necessary to by-pass the winding?—L.D.F.

It would be practical to connect the field winding in that position provided it were wound to operate on 50 volts and 64 milliampères, that is, if the resistance of the field winding were 780 ohms. If the resistance were higher the bias would be too high and if it were lower the bias would be too low. It would be desirable to connect a large condenser across the field winding.

Pure Note Oscillator

I AM looking for an oscillator circuit which will give a radio frequency oscillation that is practically pure or free from harmonics. What circuit do you recommend?—B. F. L.

One method of getting a pure oscillation is to tune the plate circuit instead of the grid circuit and feed the plate through a choke coil. A condenser of large value is connected to the plate and in series with this is a variable resistance of rather high value, which is connected to the top of the tuned circuit. If the variable resistance, which controls the feed-back, be adjusted until the circuit oscillates very feebly, the waveform is pure. Another way of doing it is to fig up a push-pull oscillator using two equal tubes and balancing the circuit very carefully. The type of feed-back in this circuit may be the same as in the circuit just described.

Potentiometer Volume Control

I BUILT a short-wave converter and attempted to control the volume by means of a high resistance potentiometer in the grid circuit of the first tube. It does not work out as it should. When the slider is set at one end the volume is terrific but as soon as I move it a little bit it practically goes out. What is the reason?—W.H.F.

One trouble may be that the resistance of the potentiometer is not high enough or it may be that the instrument is defective. Try one having a total resistance of at least 500,000 ohms, and make sure that there is a continuous resistance from the antenna to ground.

Short-Wave Stations Weak

I HAVE built one of your de luxe short-wave converters and I cannot get many stations unless I turn up the amplification of the broadcast receiver to maximum. Then I get plenty of short-wave stations but there is a lot of noise on all of them. Why do I have to turn up the amplification so high and why is there so much noise?—F.W.C.

You have to turn up the amplification because the short-wave stations are weak, not because the receiver is insensitive. One evidence for this fact is that the signals are noisy when they do come in. Another is the fact that when the plug-in coils are made large enough to bring broadcast stations, the signals come in so strong that the amplification in the broadcast receiver must be turned down so that the stations cannot be heard without the aid of the converter. And the noise disappears at the same time.

Noise Filter

WILL a noise filter placed in the AC feed line take out enough hum to make it worth while? I have reference to a filter consisting of chokes in series with the line and condensers across it.—B.D.

Most of the noise that is heard in the set enters it by way of the antenna circuit and any filter put in the power supply line will cut out no part of this noise. It will cut out some of the noise that enters the set by way of the power line. Whether this is enough to warrant the use of the filter depends on the set and it would have to be tried to make a determination. Sometimes a great deal of noise and hum is eliminated by putting a 25-watt lamp from one side of the power line to ground, connecting it so that it does not light up. That is easily tried at no great expense. It does not have to be a 25-watt lamp. Any lamp that is available in the house will do.

Right or Wrong?

QUESTIONS

(1)—It is not possible to couple a screen grid tube detector to an amplifier effectively without the use of resistance coupling.

(2)—By means of a center-tapped choke coil of very high impedance it is possible to couple a single-sided detector to a push-pull amplifier.

(3)—A good band pass filter can be constructed by tuning both the primary and the secondary of a radio frequency transformer.

(4)—A band pass filter of this type has a pass-band characteristic which widens the closer the coupling between the two tuned circuits.

(5)—A band pass filter of the tuned primary, tuned secondary type, has one peak which is determined by the capacity and the inductance of the coil in the circuit and another peak determined by the capacity and the inductance of the coil augmented by twice the mutual inductance of the two coils.

(6)—Heater type tubes like the 227 and the 224 cannot be mounted safely in a horizontal position because the heater element would sag and come in contact with the cathode.

(7)—Hum can be reduced in a B supply by connecting a series tuned circuit consisting of a small choke coil and a large condenser across the line or in shunt with the voltage divider. It will practically eliminate the hum frequency if the resistance of the coil is low and if the circuit is tuned to the hum frequency.

(8)—Hum can also be eliminated effectively by putting a parallel tuned circuit of similar design in series with the line.

(9)—An oscillator covering the range between 275 to 750 kc can be calibrated against broadcast stations just as easily as an oscillator covering the broadcast range.

(10)—Double resonance characteristics sometimes appear when a receiver is overloaded. That is, a given station comes in loudest at two points on either side of the point where it should come in.

(7)—The hum in a radio receiver can be balanced out by feeding back energy into the amplifier in reverse phase provided that the frequency feed-back is equal to that of the hum.

(8)—Quartz is the only crystal that is piezo-active and it is for this reason alone that quartz crystals are used for frequency stabilizers.

(9)—In receivers in which the volume is automatically controlled by controlling the grid bias on the radio frequency tubes cross talk between stations results due to modulation.

ANSWERS

(1)—Wrong. It is possible to couple a screen grid tube by means of a high impedance coil, such as the secondary of a good audio frequency transformer. Such a coil sometimes has an inductance as high as 1,000 henries and the impedance at 400 cycles would be of the order of 250,000 ohms, which is as high as the plate coupling resistors ordinarily used.

(2)—Right. This is done in one of the best known radio receivers. The detector is a 224 screen grid tube and the coupling device is center-tapped choke such as the secondary of a high grade audio frequency transformer. It acts as an auto-transformer and impresses the voltage on one tube by direct coupling and on the other by mutual inductance.

(3)—Right. A circuit of this type is equivalent to a circuit in

which there are two equal coils in series and a small coil in shunt serving as a coupling impedance.

(4)—Right. Roughly, the width of the band is directly proportional to the mutual inductance and the mutual inductance decreases as the distance between the coils is increased. Hence the farther away the coils are the narrower is the band passed. When the distance is above a certain value there is only one peak and the single-hump characteristic is sharper the greater the distance beyond that point.

(5)—Right. One of the peaks is located on the assumption that the inductance in the winding alone is in the circuit and the other peak on the assumption that the inductance is equal to the inductance of the winding plus twice the inductance common to the two circuits.

(6)—Wrong. The heater type tubes are so rugged and the heater filament so well protected against sagging that the tubes may be mounted horizontally just as well as vertically. Indeed, they are so mounted in one well designed receiver. The directly heated tube, however, must be mounted vertically.

(7)—Right. This is one way of minimizing hum. If the circuit is tuned to the hum frequency the only impedance will be the resistance of the coil and the condenser, and this is comparatively small so that as far as the hum frequency is concerned the circuit is practically short-circuited. This method is also employed to eliminate response peaks due to resonance, but when it is so used a resistance is connected in series to prevent a complete short circuit at the resonance frequency. The resistance is adjusted until the peak is just brought down to the level of the amplification at other frequencies.

(8)—Right. This method is now used in most commercial receivers because it is the most effective way of eliminating the hum for a given cost of the equipment.

(9)—Right. The 275 to 750 kc band is just one octave lower than the broadcast band so that by comparing the second harmonics of the lower frequency oscillator with the frequencies from broadcast stations it is possible to establish many points on the lower frequency oscillator. Of course, there is overlapping so that some of the frequency may be compared directly.

(10)—Right. The peaks arising from this phenomenon are not true resonance characteristics but they appear to be on the tuner. The effect does not appear in all circuits because the overloading takes the form of blocking rather than a drop in the output. In one instance where the phenomenon appears is that of the power detector. Overloading in this takes the form of a decrease in the output, the decrease beginning when the grid becomes considerably positive.

(7)—Right. This is often done, not only to balance out the 60 cycle hum due directly to the alternating current but also the hum due to the 120 cycle component.

(8)—Wrong. There are many crystals which exhibit piezo-electric properties and the reason quartz is used is that it is more constant and has a greater selectivity than other piezo-active crystals.

(9)—Right. When the signal voltage is high the bias must be made so high that the operating point is on the curved portion of the grid voltage, plate current characteristic and there is much modulation or detection.

FREE AID TO A NEW JOB!

SITUATIONS WANTED AND HELP WANTED ADVERTISEMENTS WITHOUT COST!

RADIO WORLD will publish, FREE, under the heading of Radio Situations Wanted or Help Wanted, advertisements for those who are seeking radio situations or for employers who are adding to their working forces.

Address: Industrial Dept., RADIO WORLD, 145 W. 45th St., N. Y. C.

SITUATIONS WANTED

RADIO SERVICE MAN, 35 years old, desires position in southwest. Been actively engaged in radio in all forms since its beginning. Just recently disposed of own shop. Would like to get in the sound engineering game. Address, D. W. Pickett, 917 No. Washington St., Kokomo, Indiana.

NATIONAL RADIO INSTITUTE STUDENT wishes position with store or factory. M. J. Palmer, 10733 Lafayette Ave., Chicago, Ill.

YOUNG ELECTRICAL ENGINEER wishes job in a radio laboratory or engineering department. Will work for small starting salary. Location preferably in the middle west. D. Zimmerman, 1720 W. Harrison St., Chicago, Ill.

YOUNG MAN, 25 YEARS OF AGE, with 7 months' training in short-wave at the McKim Radio and Electric School, Akron, Ohio. Would like work in laboratory of a radio manufacturing company. Very much interested in shortwave work. Willing to start at the very bottom and work up. Good character. John A. Williams, Box 13, Star City, W. Va.

YOUNG MAN WISHES CONNECTION with a Radio Research Laboratory which is interested in the reduction of received static only. Write S. Stella, 958 How Ave., Bronx, New York City.

WILL GIVE SERVICES, 7 to 8 hours daily, for opportunity to learn radio service work. Have chauffeur's license. Prefer 42nd Street, New York City, district. Box 156, Radio World.

RADIO SALESMAN AND SERVICEMAN, one who can meet the public. Fifteen years of practical experience and theory on receiving sets and installations. I am no wizard but can get results and make satisfied customers. Would consider any location. Robert J. Fogg, Reading, Mich.

EXPERIENCED. Good general knowledge of technical radio work, construction and repairing. Am 36 years of age and married. Reference: Radio and Television Institute, Chicago, Ill. Steve Marko, 139 Brighton Drive, Akron, Ohio.

YOUNG MAN WANTS WORK IN RADIO LABORATORY or radio repairing. Have had Technical School Training, and experience. Also have an Amateur Ticket. Matthew Ajeman, 75 Park Street, Rockland, Mass.

ALL 40 CLEARED CHANNELS NOW TO GET 50 KW

Washington.

The Federal Radio Commission has just announced that it is in favor of granting all forty cleared channel stations the right to use the maximum output power of 50,000 watts.

The Commission's Chief Examiner, Ellis A. Yost, submitted a favorable report to the Commission, the outcome of nearly a month and a half of daily hearings.

During the hearings the mass of technical detail that was reviewed revealed that the confining of cleared channel stations to moderate output powers was considered a waste of their potential usefulness. In an opinion rendered by the Commission late last Spring the authority to use 50,000 watts was restricted to twenty of the forty cleared channels, and this decision meant that only four of the eight cleared channels in each zone were assigned to such zone. More than a score of stations applied for the right to the remaining high-power assignments.

Licenses Recommended

First Zone: WHAM, Rochester, 5,000 watts; WBZ, Springfield, Mass., 15,000 watts; WOR, Newark, 5,000 watts, and WJZ, New York, 30,000 watts.

Second Zone: WHAS, Louisville, 10,000 watts, and WCAU, Philadelphia, 10,000 watts.

Third Zone: WAPI, Birmingham, WSM, Nashville, WBT, Charlotte, and KVOC, Tulsa, all 5,000 watts.

Fourth Zone: WHO-WOC, Des Moines, 5,000 watts; WCCO, Minneapolis, 7,500 watts; WMAQ, Chicago, 5,000 watts; WBBM, Chicago, 25,000 watts, and WGN, Chicago, 25,000 watts.

Fifth Zone: KGO, San Francisco, 7,500 watts; KGA, Denver, 12,500 watts; KPC, San Francisco, 5,000 watts and KSL, Salt Lake City, 5,000 watts.

Denials Recommended

The stations which the Federal Radio Commission recommends be denied, because they are regionals, or operate on limited time, and therefore not eligible for this class of power, are WWJ, Detroit, now using 1,000 watts; WREC, Memphis, using 500 watts at night; WCFL, Chicago, using 1,000 watts during daylight only, and Station WTMJ, Milwaukee, using 1,000 watts at night. In addition it is recommended that the application of WBBM, of Chicago, be denied in so far as it requests full-time operation, but recommends the granting of the requested increase in power from 25,000 to 50,000 watts of this station.

In a statistical summary, appended to his report, Chief Examiner Yost has shown the total number of kilowatts now in use by all cleared channel station applicants is 197½ (197,500 watts). The total number of kilowatts radiated if all cleared channel applications are granted will be 1,000 (1,000,000 watts).

CHINA'S TRANSMITTER READY

Shanghai.

The Nationalist Government Ministry of Communications of China states that its transpacific radio transmitter at Shanghai is now ready for operation. It will afford direct communication between California and China, the service is expected to be inaugurated on December 1st, 1930.

Word-Mint Adds Three Expressions

Ray Perkins, National Broadcasting System comedian, is continuing the compilation of a dictionary of radio words, started several years ago.

His latest additions to the proposed volume are:

"Schmoozic": Sweet, soft clingy music.

"Ethritis": Hardening of the eardrums due to too much listening to the ether waves.

"Announcerebral obesity": Fatheadedness as applied to announcers.

SINGERS GIVEN \$25,000 PRIZES

The Atwater Kent Foundation has announced the winners in the final of the Fourth National Radio Audition, recently given at the studios of the National Broadcasting Company, at 711 Fifth Avenue, New York City. The first prize for men was won by Raoul E. Nadeau, of New York. Carol Deis, of Dayton, O., won the first prize for women. Miss Deis, a typist, is a soprano and aspires to be a concert singer. There were ten contestants in the finals chosen from the long list of those heard, and there was one boy and one girl for each of the five geographical districts. The other winners in the finals are as below:

Miss Mary G. Cortner of New Orleans, a soprano, and Stephen F. Merrill of Campbell, Cal., a tenor, each of whom got a second prize of \$3,000 in cash and the privilege of one year's free tuition in vocal culture.

Miss Joyce Allman of Dallas, Texas, a contralto, and Richards W. Dennis of Sioux Falls, S. D., a tenor, each got a third prize of \$2,000 in cash and one year's tuition.

Mrs. Paula J. Phoenix of Oakhurst, N. J., a soprano, and W. Eugene Loper of Jackson, Miss., a baritone, each got a fourth prize of \$1,500 in cash and are entitled to one year's tuition.

Miss Esther B. Combs of Long Beach, Cal., a soprano, and Ross Graham, of Hot Springs, Ark., a bass-baritone won the fifth prizes of \$1,000 each in cash with the privilege of a year's free tuition.

Mr. Nadeau and Miss Deis each got \$5,000 in cash, the privilege of two years musical tuition at an American Conservatory, and a gold medal. They both said they expected to continue their music study.

Ask 15% of Air Time for Education Alone

At a recent conference on radio education, held at the Board of Education Hall, Chicago, under the chairmanship of the United States Commissioner of Education, William John Cooper, a resolution was drawn up for presentation to the Federal Radio Commission.

The resolution calls for the permanent and exclusive assignment of a minimum of 15% of all the broadcasting channels to educational institutions, both private and Government controlled. Federal Radio Commissioner Lafount attended the conference. Armstrong Perry, a specialist in radio education, said that steps were being taken to apprise Congress to the trend of the discussions of the country's leading educational minds, and that formal aid would soon be sought at Washington. studies.

TRADIOGRAMS

The Grigsby-Grunow Company, sponsors of Majestic's Old Curiosity Shop dramas, Majestic Home Hour and co-sponsors of the American School of the Air, all of which are heard over the Columbia Broadcasting System, set a new mark in radio history for a record number of hours broadcast under one banner. For the year 10,616 stations unit programs were presented. Between 10,000 and 25,000 fan letters are received weekly by Majestic in response to its various radio broadcasts.

* * *

A condenser to meet the capacity requirements of the modern Superheterodyne circuit, is being manufactured by the Dubilier Condenser Corporation, of New York City, and made available to RCA Superheterodyne licensees. The new all metal and mica condenser, named the toothpick condenser because of its elongated proportions, can be made to capacities of from one micro-microfarad (.000001 mfd.) to 2,500 micro-microfarad (.0025 mfd.).

* * *

The 1931 radio trade show will be held in Chicago, June 8th to 12th, inclusive. The show will be held under one roof, giving opportunities for displays in an exhibition hall and private hotel demonstration rooms. The selection of the hotel will be made at an early date. The Institute of Radio Engineers will hold its convention June 4th to 6th, immediately preceding the trade show, and the Music Industries Chamber of Commerce and the National Association of Music Merchants will hold their convention, June 15th to 18th, immediately following the trade show, in the same locality. Exhibitors are required to show current merchandise or be denied the privilege of having either a booth in the exhibition hall or the use of hotel demonstration rooms. Radio products only may be displayed in the exhibition hall. Exhibiting members are permitted to exhibit radio products and products of their own manufacture other than radio products in demonstration rooms, provided such products are offered for distribution through the jobber and dealer channels represented by the trade show attendance.

* * *

Polymet Products has entered the sound equipment field. Plants of the company fabricate all the elements entering into the construction of these items. The Polymet plant at Winsted, Conn., makes the copper, enameled and insulated wire. The Easton, Pa., plant fabricates the coils, solenoids, chokes and transformers. The main plant, in New York, is entirely devoted to the manufacture of condensers and resistors. Besides parts manufacture, Polymet also assembles complete amplifiers suitable for sound work.

RADIO ALARM TRAPS BURGLAR

The effectiveness of a newly installed form of radio alarm of the Buffalo Police Department proved its worth recently. The device detected a burglar in the act of entering a store. The news was relayed to headquarters and the burglar was arrested within ten minutes of the time of the arrival of the warning signal.

A THOUGHT FOR THE WEEK

LET'S kiss 1930 goodbye and forget about the old man. He wasn't such a bad old scout; he was just a bit querulous and touchy and was sworn at so often that he wasn't able to show the best that was in him. But here we are, safe and sound, and ready to greet that youngster, 1931, whose smiling face looms on the horizon; that is, the smile is there for us to see if we don't put on blinders. We threw ours away long ago.

Here comes 1931! Let's go to meet the boy! He'll treat us the way we treat him! Smile, you rascals. smile!

BOARD COUNSEL SAYS STATIONS CAN END SLUMP

It is the opinion of Col. Thaddeus H. Brown, general counsel of the Federal Radio Commission, that a National Radio Campaign whose purpose is to contribute morally and otherwise to the restoration of public confidence in business, is what is needed right now. Col. Brown points out that the revival of business would be sensibly aided by the broadcasting of information that would remove the present cloud of uncertainty that hampers many business.

Asserting that in fundamentals America is sound and that its financial structure basically is strong, Col. Brown said that the great mass of American people apparently are not convinced of these facts. Conditions are not good, he added, "but fundamentally America's business structure is safe."

Wants 600 to Co-operate

Much care must be exercised in the type of messages and the selection of speakers for a radio campaign.

"If tomorrow the 600 radio stations could inaugurate a series of brief addresses by outstanding men and women, I am sure a change for the better would be seen.

"Not a select and chosen few, but millions of people must cooperate if we are to expect early improvement in the business situation," he asserted. "In any campaign to gain public confidence, radio potentialities must not be overlooked. This fastest means of communication, can do much to aid. Radio reaches the family circle every day and every night; an invited, a welcome visitor.

Must Spread Optimism

"In addition, its effect is instantaneous. A message can be transmitted to millions of people in seconds, if necessary, and thus bring about coordinated and united action which is most essential."

The people must be reached with messages of optimism, presenting the simple truth. "They must be told about business conditions, told about them in an honest and straightforward manner," he added. "There must be no clouding of the facts, no dodging of the truth."

Television On Air From Morning to Night

Two 5-kv. radiovision transmitters, W2XCD at Passaic, N. J., and W2XCR at Jersey City, N. J., are on the air from morning till night.

The following schedule is in effect every day except Sunday, according to the engineering staff of the DeForest Radio Company:

10:00-12:00 a.m.—W2XCD. Film Features.
2:00- 3:30 p.m.—W2XCR. Direct Pickup Features.
3:30- 5:00 p.m.—W2XCD. Film Features.
7:00- 9:00 p.m.—W2XCR. Direct Pickup Features.
9:00-11:00 p.m.—W2XCD. Film Features.

Both transmitters operate on 2050 kc. The 48-line, 15-pictures-per-second system is used.

Knife Imparts Sight to Pianist

Lansing, Mich.

At the Lawrence Hospital here recently the sight of a 25-year-old radio pianist was restored. The artist, Merwin Jenkins, born blind, was operated on by Dr. John O. Wetzel, of Lansing. Mr. Jenkins is a graduate of the Michigan School for the Blind, and is known as the Sunshine Entertainer. He formerly broadcast over WREO.

The novel operation consisted in the removal of an intra-capsula cataract from the right eye, which, after anesthetization, was slit nearly in two parallel to the plane of the lens, which was removed. In place of the lens a specially ground glass lens is to be substituted. This lens will have to be removed every day for some time for irrigation, but in the meantime normal visual perspective will be assured.

TRANSCRIPTION MUSIC OPPOSED

Chicago.

Merlin H. Aylesworth, president of the National Broadcasting Company, opposed transcribed radio programs in addressing a joint meeting of the Chicago Advertising Council and the ways and means committee of the Chicago Association of Commerce at the La Salle Hotel.

"What are these mysterious programs referred to as 'electrical transcriptions'?" Mr. Aylesworth asked. "They are phonograph records prepared for use in radio broadcasts.

"We sympathize with the station which is too small to be able to afford original talent, or the station which needs revenue with which to continue to operate, but we believe that the phonograph record has no place on the air. If we are to have broadcasts of that kind, we had better go back to the records which we can buy and play on our own phonographs.

"It is a waste of the valuable wave rights assigned to radio stations to use them in broadcasting phonograph records. The living voice, original music and news events put on the air at the time they happen are the justification for radio."

Automatic SOS Put On Lifeboats

Washington.

Lifeboats of the new Dollar liner President Hoover, are equipped with automatic radio transmitting equipment that sends out the international distress signal on 500 meters. The operator of this new device need not be conversant with the code at all, it being only necessary for one to operate a hand driven generator that will furnish the necessary operative current to work the transmitter. In addition to the foregoing, the transmission will furnish the necessary information to those at the direction finder, who will be able to determine the location of the lifeboat as well as its drift. The device was briefly outlined by Commissioner Harold A. Lafount, who stated in addition to the above that the small generator furnishes sufficient power to operate a lamp. The service range of the set under normal conditions is said to be 1,000 miles.

NEW MIKE LETS ARTISTS WORK AT A DISTANCE

Engineers of the National Broadcasting Company have been experimenting with a new type of microphone called the parabolic reflector type. This instrument is the outcome of the application of the laws of sound reflection, and by means of it decidedly improved quality of orchestral reproduction will be afforded when large orchestral performances are broadcast from either indoor or outdoor auditoriums.

One of the novelties is that no longer is it necessary for the pickup to be close to the artists, thus resulting in the better mixing of the musical frequencies.

The microphone is provided with a large reflector to focus on the microphone diaphragm the sound frequencies that originate within the focal area of the reflector. This scheme tends to discriminate between the desired sounds and those outside the range of the reflector, and is said to suppress extraneous noises effectively.

The new microphone's position corresponds roughly to that of the average distance of the ordinary listener from the place where the orchestra is assembled. This instrument has been adopted for regular use.

Tone Control Sold As An Accessory

The radio buying public is offered a large variety of accessories for attachment to the broadcast. Some of them are meritorious and some of them are not, nevertheless a lot of them are sold. The latest helpful device of this class is a type of attachable tone control which may be operated on a long cable.

The attachment to the set consists of a small box with a knob on the front. The box can be placed inside the set or on top of the cabinet. Two wires lead from the back of it. Two wafer-like adapters at the ends of the wires fit under the output tube prongs.

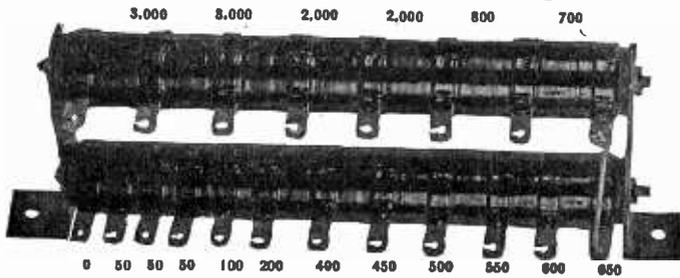
Blaricom with Electrad

The progress of Electrad, Inc., in developing its amplifier business has resulted in an enlargement of its technical staff, said Arthur Moss, president of the company. Millard Van Blaricom, expert in amplifying systems, is now on the technical staff of Electrad, Inc. Mr. Van Blaricom will assist customers in their problems with amplifiers and their application, assuring a close co-operation between our company and its customers.

PERMIT FOR PRINTER SYSTEM

The Federal Radio Commission has granted a permit to the American Radio News Corporation, a subsidiary of the Hearst interests, to erect a long wave station for use with a multidirectional radio printer system. The permit is for the use of 750 watts on 95 and 99 kilocycles. Stations WAI, Atlanta, Ga., and KIP, San Francisco, operated by the same company, will change their equipment to conform.

Multi-Tap Voltage Divider



The resistance values between the twenty taps of the new Multi-Tap Voltage Divider are given above. The total is 17,100 ohms and affords nineteen different voltages.

The Multi-Tap Voltage Divider is useful in all circuits, including push-pull and single-sided ones, in which the current rating of 100 milliamperes is not seriously exceeded and the maximum voltage is not more than 400 volts. Higher voltages may be used at lesser drain. Conservative rating, 40 watts.

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The expertness of design and construction will be appreciated by those whose knowledge teaches them to appreciate parts finely made. When the Multi-Tap Voltage Divider is placed across the filtered output of a B supply which serves a receiver, the voltages are in proportion to the current flowing through the various resistances. By making connection of grid returns to ground, the lower voltages may be used for negative bias by connecting filament center, or, in 27 and 224 tubes, cathode to a higher voltage.

If push-pull is used, the current in the biasing section is almost doubled, so the midtan of the power tubes' filament winding would go to a lug about half way down on the lower bank. Order Cat. MTVD. List price \$3.25, net price \$2.50.

Trouble-Finding Dial FREE!

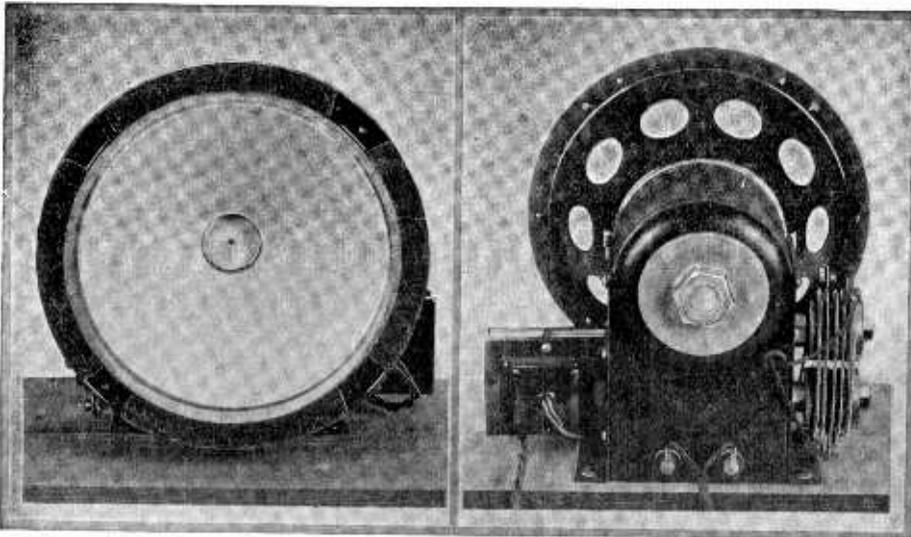


Here is an 8" diameter dial that you slide around to shoot trouble in an audio circuit or B supply or power amplifier. Trouble is divided into five groups: distortion, howl, dead amplifier, weak signals and bum. By sliding the dial to one of fifty different positions the cause of the trouble is read in the slotted opening. Invented by John F. Rider. Send \$1.00 for eight weeks subscription for Radio World and get a Trouble-Finding Dial free with instructions on back. If extending an existing subscription please so state.

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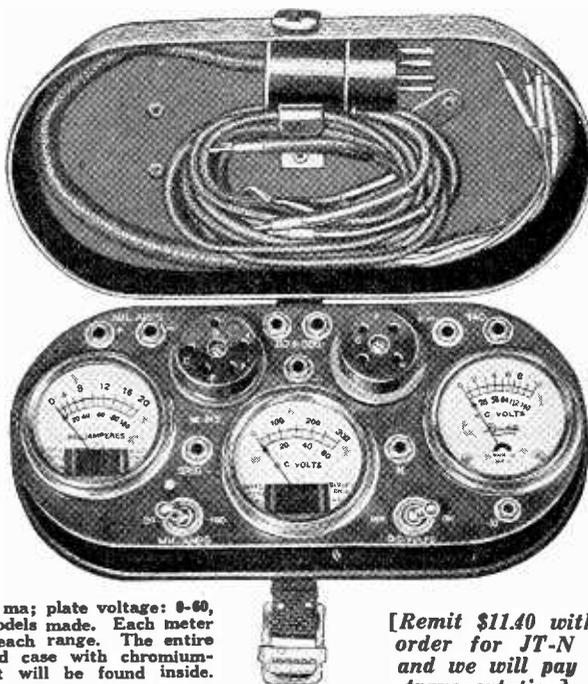
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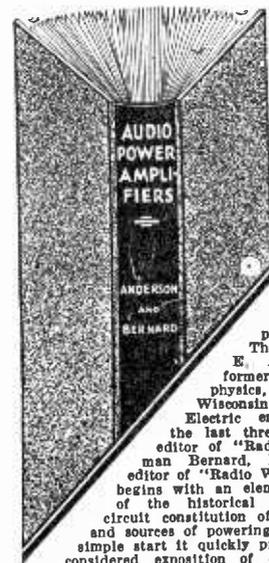
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