TENTH ANNIVERSARY NUMBER

MARCH 26
1932

Price ~~15c~~
Per Copy

RADIO WORLD

REG. U.S. PAT. OFF.

The First and Only National Radio Weekly
Eleventh Year—522nd Issue

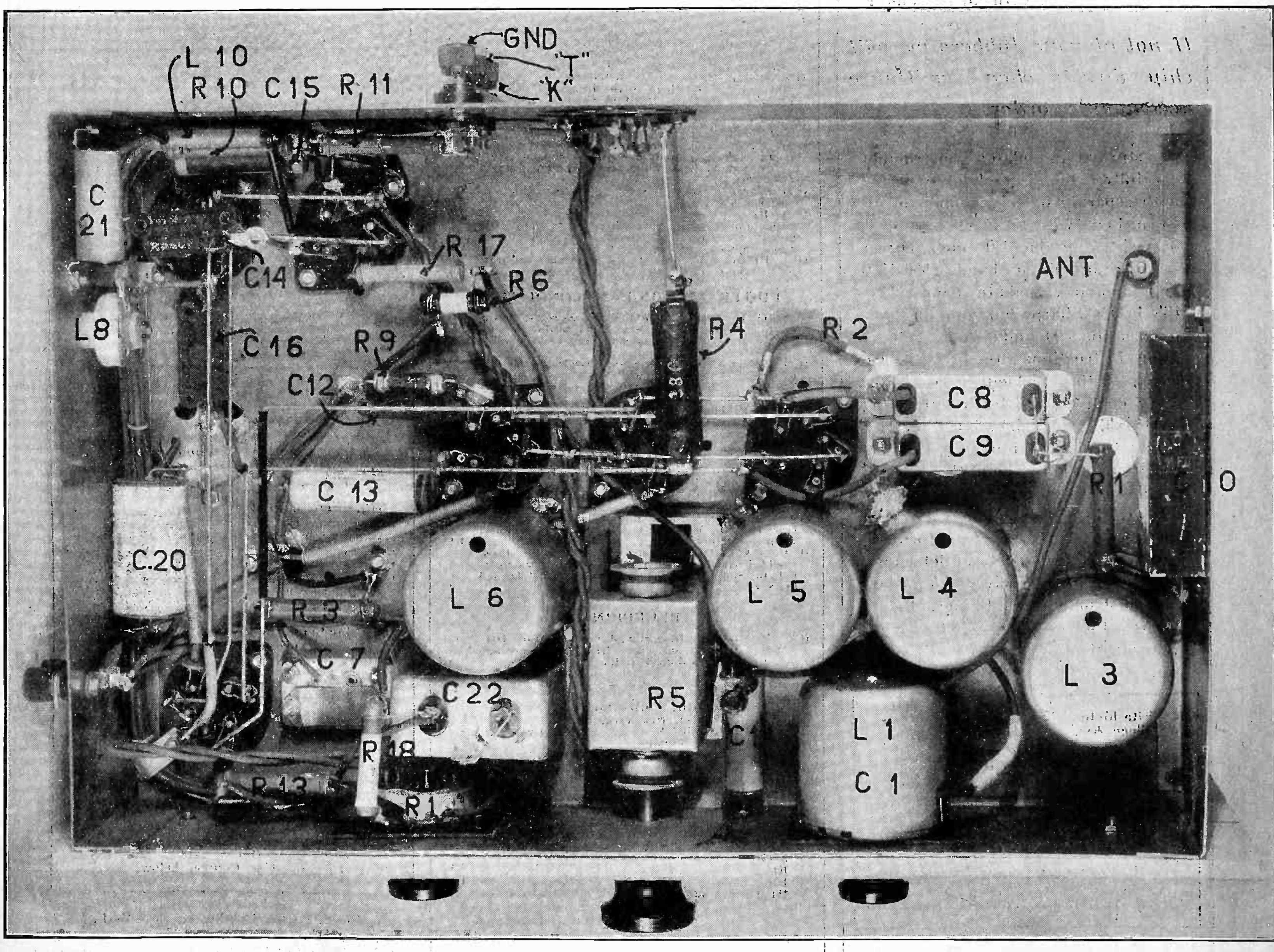
STATIONS BY FREQUENCIES

NEON OSCILLATOR,
MODULATED-UNMODULATED

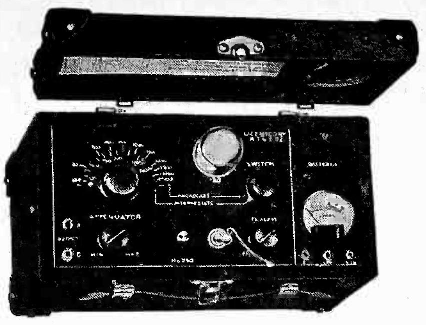
SUPERS:
4-Tube Portable
8-Tube D-C

T-R-F:
4-Tube A-C Broadcast
5-Tube A-C All-Wave
6-Circuit Tuner

90 OUT OF 96 CHANNELS—IN DAYLIGHT!



The Super-Da-Lite-R, remarkable DX-Getter, is described in an exclusive article beginning on page 4, the first publication of details of this outstanding circuit.



Readrite

OSCILLATOR

Licensed by A. T. & T. Co.

No. 551 $18 Net to dealer $30 list

No. 550 $21 Net to dealer with output meter

If not at your Jobbers we will ship direct when remittance accompanies order.

A sturdy modulated instrument carefully made. Completely shielded with separate battery compartment. Furnished with 22½-v. and 3-v. batteries and one '30 tube. Direct reading broadcast band (550-1500 kc.) and intermediate band (120-185 kc.). Sharp 2nd and 3d harmonics for 260 and 475 kc. Operating instructions attached in case cover with shielded wire leads. Very compact. In leatherette case, 6x11½x5½ in. Weighs but 8 pounds. Built to high standards. Every serviceman should have the No. 550 oscillator to align r.f. gang condensers, locate defective r.f. transformers, adjust i.f. transformers, check oscillator stage and determine sensitivity of a receiver. A necessary instrument. Get yours today. Write for catalog of servicing instruments.

Readrite Meter Works
20 College Ave.
Bluffton, Ohio

Please send all information about Readrite Oscillator and other service instruments.

Name.......................................

Address.......................................

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

Readrite Meter Works
Established 1904
12 College Ave., Bluffton, Ohio

R. C. A. VICTOR

A SINGLE BUTTON RECORDING and HIGH GAIN SPEECH "MIKE"

which can be used for phone work on all radios. Worth its value in entertainment. No Fan or Experimenter should be without one.

Your price..... **$2.95**

Try-Mo Radio, Inc.
177 Greenwich St., N. Y. City

DEALERS, WRITE FOR PROPOSITION.

SEND FOR CATALOGUE

MANY PARTS AT BARGAIN PRICES

TRANSFORMERS

(Cat. 20-V-T)—A Eliminator or dynamic speaker transformer (Jefferson), 20-volt secondary. Excellent for three 6.3 volt tubes in series. Will pass 2¼ amps. .... $ .89

UNSHIELDED BROADCAST COILS ON 3" DIAMETER BAKELITE

(Cat. SGT-5)—Three circuit tuned for .0005 mfd. condenser, for use where the untuned high impedance primary is in the plate circuit of a screen grid tube. The tuned secondary may be connected to any type tube.................. $ .90

(Cat. SGT-3)—Same as above, only for .00035 mfd. condenser .... .90

(Cat. 3-HT)—Same as Cat. 5-HT, except that it is for .00035 mfd. tuning.................. .95

(Cat. T-5)—Standard 3-circuit tuner for .0005 mfd., where primary is for any type of tube other than plate circuit of screen grid tube.................. .80

(Cat. T-3)—Same as T-5, except for .00035 mfd., condenser instead of for .0005.................. .80

(Cat. 2-R5)—Radio frequency transformer for .0005 mfd. condenser where high impedance untuned primary is in plate circuit of a screen grid tube, and secondary is tuned by .0005 mfd.................. .60

(Cat. 2-R3)—Same as 2-R5, except that it is for .00035 mfd. tuning.................. .60

(Cat. 5-TP)—Radio frequency transformer for use where primary is tuned and placed in plate circuit of screen grid tube, while secondary is not tuned. For .0005 mfd.................. .55

(Cat. 3-TP)—Same as Cat. 5-TP, except that it is for .00035 mfd. tuning.................. .55

(Cat. RF-5)—Radio frequency transformer for .0005 mfd. tuning, where untuned primary is in plate circuit of any type tube except screen grid. Useful also as antenna coupler.................. .55

(Cat. RF-3)—Same as Cat. RF-5, except that it is for .00035 mfd. tuning.................. .55

FILTER AND BY-PASS CONDENSERS

(Cat. HV-1)—Compact 1 mfd. filter condenser, for use in filter section of any B supply intended to work 245 tubes, single or push-pull, and rest of tubes in receiver $1.50

(Cat. LV-1)—1 mfd. low-voltage condenser for by-passing, 200 v. DC rating.................. .50

(Cat. LV-2)—2 mfd. low-voltage condenser for by-passing, 200 v. DC rating.................. 1.00

(Cat. SUP-31)—Three 0.1 mfd. bypass condensers in one compact case. 200 v. DC rating.................. .57

KNOBS AND DIALS

(Cat. KNB-2)—2-inch diameter moulded bakelite black knob, no pointer; ¼" shaft.................. .18

(Cat. MCD)—Marco vernier dial; moulded bakelite; black; pilot light window.................. .60

(Cat. NAT-H)—National velvet vernier drum dial, type H, with modernistic escutcheon, color wheel (rainbow feature) 3.13

(Cat. NAT-VBD)—National velvet vernier black moulded bakelite circular dial, variable ratio lever, 6-1 to 20-1; reads 0-100-0; with dial light and bracket 1.70

BLUEPRINTS

(Cat. BP-SGD-4)—Blueprint of 4-tube battery Diamond of the Air, one stage RF 222, regenerative detector, two transformer audio.................. .25

GUARANTY RADIO GOODS CO.
143 West 45th Street, New York, N. Y.
Enclosed please find $................ for which please ship at once the following:

☐	SGT-5	@	90c	☐	HV-2	@	2.50
☐	SGT-3	@	90c	☐	AVX-8	@	1.47
☐	3-HT	@	95c	☐	LV-1	@	50c
☐	T-5	@	80c	☐	LV-2	@	1.00
☐	T-3	@	60c	☐	LV-4	@	2.00
☐	2-R5	@	60c	☐	SUP-31	@	57c
☐	2-R3	@	60c	☐	KNB-2	@	18c
☐	5-TP	@	55c	☐	MCD	@	60c
☐	3-TP	@	55c	☐	NAT-H	@	3.13
☐	RF-5	@	55c	☐	NAT-VBD	@	1.70
☐	RF-3	@	55c	☐	BP-SGD-4	@	25c
☐	HV-1	@	1.50				

Name ....

Address ....

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

SERVICEMEN! Resistor Replacement Manual FREE

with purchase of 10 LYNCH Metallized Resistors, or $1 cash
More Than 200 Circuits

Metallized

LYNCH Resistors 1, 2, 3 WATTS

Write for Manual, new Reduced Price Catalog and RMA Color Code Card.
LYNCH MFG. CO., INC., 1775 WR B'WAY, New York

SERVICE

The magazine for Service Men Only.
Edited by JOHN F. RIDER

$1.00 per year in the U. S. A.

JOHN F. RIDER PUBLICATIONS
1440 Broadway New York City

Radio Noises and Their Cure

62 Articles—200 Illustrations

Every article complete, gives all types of Radio noises and tells how they may be cured. 76 full size pages. 8½ x 11. Only book of its kind ever published. Written in question and answer form so every one can understand it. Send 50c for your copy today. (75c for Canada and foreign countries.)

Newark Electric Co., 224 W. Madison St., Chicago, Ill.

ATTENTION, SERVICEMEN!

COMPLETE PUBLIC ADDRESS SYSTEMS, portable and stationary, $37.50 up, 16 types Microphones. $5.00 up. Exponential horns, trumpets and giant units. Complete line of Amplifiers, Recording Machines, Photo Tube Relays. Head Phones. Intercommunicating systems, one and two way, $7.50 up. Dearelsr and servicemen send for proposition.

MILES REPRODUCER CO.
26 E. 22nd St. New York

NATIONAL DRUM DIAL

National Velvet Vernier drum dial, type H, for ¼" shaft. An automatic spring take-up assures positive drive at all times. Numbers are projected on a ground glass. Rainbow wheel changes colors in tuning. Order Cat. ND-H @ $3.13.

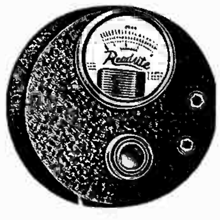
GUARANTY RADIO GOODS CO.
143 W. 45th St., New York, N. Y.

THREE-IN-ONE TESTER *FREE!*

EVERYBODY who does any radio work whatsoever, whether for fun or for pay or for both, needs a continuity tester, so he can discover opens or shorts when testing.

A mere continuity tester is all right, but—

Often it is desired to determine the resistance value of a unit, to determine if it is correct, or to measure a low voltage, and then a continuity tester that is also a direct-reading ohmmeter and a DC voltmeter comes in triply handy.



So here is the combination of all three:

A 0-4½-volt DC voltmeter, a 0-10,000-ohm ohmmeter and a continuity tester. A rheostat is built in for correct zero resistance adjustment or maximum voltage adjustment. The unit contains a three-cell flashlight battery. Supplied with two 5-foot-long wire leads with tip plugs. Case is 4-inch diameter baked enamel. Weight, 1 lb. Sent free with an order for one year's subscription for RADIO WORLD (52 weeks) at the regular rate of $6. Order Cat. PR-500. Use Coupon below.

Radio World, 145 W. 45th Street, New York, N. Y.

Enclosed please find $6 for one year's subscription for Radio World (one copy a week, 52 issues). Send Cat. PR-500 as premium.

Name ....

Address ....

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

Roland Burke Hennessy
Editor

Herman Bernard
Managing Editor

RADIO WORLD

The First and Only National Radio Weekly
ELEVENTH YEAR

J. E. Anderson
Technical Editor

J. Murray Barron
Advertising Manager

Vol. XXI MARCH 26th, 1932 No. 2. Whole No. 522

Published weekly by **Hennessy Radio Publications Corporation,** 145 West 45th Street, New York, N. Y.

Editorial and Executive Offices: 145 West 45th Street, New York
Telephones: BR-yant 9-0558, 9-0559.

OFFICERS: Roland Burke Hennessy, *President and Treasurer;* M. B. Hennessy, *Vice-President;* Herman Bernard, *Secretary.*

Entered as second-class matter March, 1922, at the Post Office at New York, N. Y., under Act of March 3, 1879. Title registered in U. S. Patent Office. Printed in the United States of America. We do not assume any responsibility for unsolicited manuscripts, photographs, drawings, etc., although we are careful with them.

Price, 15c per Copy; $6.00 per Year by mail. $1.00 extra per year in foreign countries. Subscribers' change of address becomes effective two weeks after receipt of notice.

A Cross-Continent Tuner

Pacific Coast Every Night from New York

By Anthony Swale Waring

THIS receiver is a superheterodyne, not because of any frenzied rush of public sentiment towards the superheterodyne circuit, not because of the advertising that supers have had as DX getters, not because the super presents an easy way to use lots of tubes. It is a super, but it owes its excellence by no means only to the fact that it is a super, since it is more a set of other circuits than a super. It is a super *only* because the use of the heterodyne principle makes it possible to get more efficient results out of the same number of tubes than not to use it, and *only* because such use happens to be particularly advantageous in connection with the rest of the circuit.

Now go ahead with the story.

Articles have appeared in these pages recently regarding the design problems encountered in custom built superheterodyne circuits. The advantages of the circuit have been explained and a certain amount of constructional data presented.* We are now able to give in very complete form all the constants and other information necessary to enable the reader to duplicate one of the finest custom-built tuners available.

Outgrowth of Previous Circuits

The Super-Da-Lite-R tuner, designed by E. Bunting Moore, is a direct lineal descendant (or perhaps we should say ascendant) of a successon of receivers described in these pages during the past six years. The first of these was the "Everyman 4," in which the justly famous r-f and regeneration circuit was brought to its best refinement. The Moore-Daniels and Super DX-R brought the first screen grid tubes and A-C operation in the following years, and last year, the Da-Lite-R brought tuned radio frequency to the brink of perfection, hanging up records for distance and selectivity which may possibly never be surpassed with that type of circuit.

The Super-Da-Lite-R utilizes everything of advantage found in the earlier circuit, and in addition incorporates all the advances of the last season, such as self-biasing linear detection, full automatic volume control, multiple band-pass selection, pre-attenuation, monotron self-balancing oscillator, tuning meter, antenna compensator, and everything else except floating power and free wheeling. None of these inclusions, however, has been allowed to interfere with the simplicity of the circuit—as always, dependence is placed upon thoroughly tried, standard circuits, known by experience to be thoroughly trouble-free and dependable.

Test Users Report Excellent Results

The performance of the first tuners, carefully tested by independent investigators in their own location, has thoroughly justified the designer's hopes. One after another, these users have reported perfect selectivity, and DX right down to the noise level. One user suggested that the volume control be removed from the panel. He could tune from WOR (his most powerful local) to KFI without touching the volume control, and only by watching the tuning meter was it possible to tell whether he had a local station or DX. In the laboratory in New York City, practically surrounded by skyscrapers, regular daylight demonstrations of reception from Washington, D. C., Cleveland, O., Schenectady, N. Y., and Springfield, Mass., are made when the noise permits, and by 9 p.m. E.S.T., KFI is a regular thing, as are stations just 10 kc each side of every local.

Essentially the circuit consists of a band-pass pre-selector, two stages of tuned radio frequency amplification, and a self-balancing monotron oscillating detector, one stage of high-level double band pass 175 kc amplification, and a linear self-biasing detector to feed a standard audio amplifier. The volume control tube, a vacuum-tube voltmeter in principle, with the bias of the amplifier tubes obtained from its plate drop, is energized both by a condenser coupling from the grid of the second detector and a manually operated potentiometer serving as the panel control.

Analysis of the Circuit

The signal from the antenna enters the receiver through a 25 mmfd. variable condenser mounted on the panel. An r-f choke, tuned to have a maximum reactance in the broadcast band, is connected from the antenna to ground direct. These two units are enclosed in a shield, so as to limit their input to the receiver to the current passing through the condenser.

Two tuned circuits, L2-C2 and L4-C3, are coupled by L3 to form a band pass input circuit. The attentuation of unwanted signals at this point prevents any possibility of overloading the first —51, and introducing crosstalk by premodulation of this tube. Tendency towards "images," "ghosts" and other "birdies" is also pretty well eliminated by this circuit, while the desired signal is adversely affected very little.

Two stages of tuned radio frequency follow this input system, with coupling coils arranged to further attenuate image and ghost signals because of sharp cutoff.

The input to the mixer tube is taken from the last tuned circuit of the r-f amplifier in the usual manner, as if the tube were a standard detector.

Dual Function of Condenser

The plate circuit of this tube is supplied with plate potential through the primary of the first i-f transformer, which is tuned to 175 kc by an integrally mounted adjustable condenser. This condenser also acts as a coupling condenser between the plate of the tube, and a circuit tuned by C5-C7 to frequencies always 175 kc higher than the r-f tuning circuits. The primary of the i-f transformer is of about 4 millihenry inductance and acts as an r-f choke at these frequencies.

A pickup secondary winding is tightly coupled to this circuit, and connected to energize the cathode of the tube in phase with the plate. Sufficient feedback is obtained through this coil to cause the tube to oscillate at the frequency to which it is tuned.

*"Cures for Main Troubles in Superheterodynes," pp. 8 and 9, March 5, 1932; "The Super's Superiority," pp. 3 and 4. March 12, 1932; "Automatic Volume Control," pp. 8 and 9, March 19, 1932.

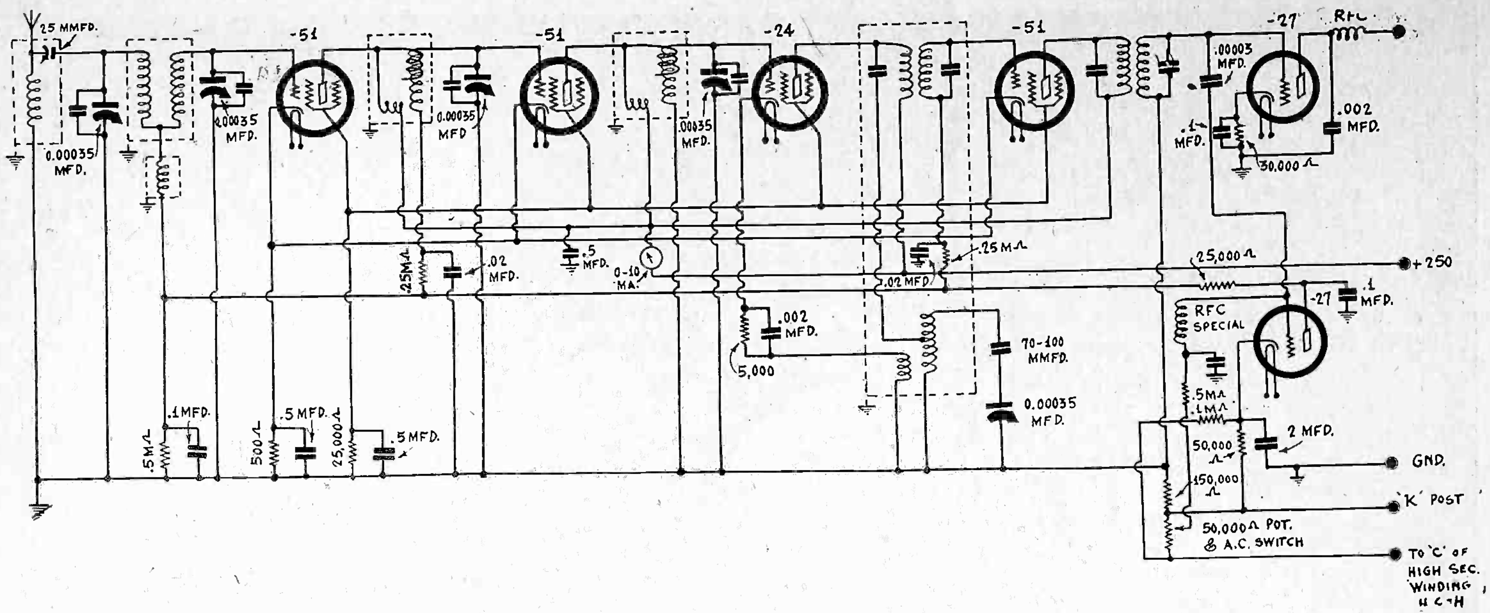


FIG. 1

The values of the constants are given in this diagram of the tuner. Six tubes are used, one of which is automatic volume control.

A negative bias of about 20 volts for the tube is obtained by the drop across R9, in series with the cathode. A 0.002 mfd. mica condenser serves to bypass this resistor at radio frequencies, but is too small to allow the intermediate frequency to pass.

Eight kc Transmission Band

A strong signal applied to the grid of the tube causes the bias to increase, as in all power detectors. This bias increase reduces the strength of the oscillations in the tube, thus automatically compensating to some extent for differences in signal strength, and serving to maintain the input to the intermediate frequency amplifier at a more uniform level than is the case when a separate oscillator tube is employed. Also since the plate current of the tube, flowing through the primary of the intermediate transformer, is governed by a combination of the oscillating current and the input signal, the modulation of one by the other is forced, and the coupling must at all time be of the correct value.

Each intermediate transformer consists of two tuned circuits, coupled to form a band-pass system, with a sharp cutoff 8 kc wide, and substantially uniform amplification over this 8 kc band. Including the linear power detector the amplification of the intermediate frequency amplifier at ordinary signal levels is about 500 times.

The second detector is of the standard plate rectification, self-biasing type, utilizing a —27 tube to obtain the maximum power output without overloading. High efficiency is obtained by the use of a high plate resistance, intended for feeding an impedance matching stage, which in turn is to supply a standard push-pull amplifier using —45 tubes, and giving altogether an audio frequency amplifier capable of the highest quality reproduction at any power likely to be required in the home.

The Automatic Volume Control

The automatic volume control tube utilizes the system described in the March 19th issue. A filter resistor to reduce possible audio frequency modulation in the control is inserted and both r-f amplifier tubes and the intermediate amplifier tube are controlled. A tuning meter may be inserted where shown, which will be of great value in insuring quality reproduction, since it enables the user to tune to the exact center of the wave and avoid distortion by sideband cutting. Such distortion is possible when tuning by ear, since the station may be tuned in while speech is being broadcast, covering a narrow band of frequencies, and music following may require a broader band for correct reproduction. The band width that the amplifier will pass (8 kc) is ample for such reproduction, provided the signal is in the center of the band, but if it is off the center sidebands on one side may not be properly reproduced. The tuning meter serves to show a direct amplification reading, too, since any change in the amplification, whether caused by the signal actuating the volume control tube or by setting of the manual control, will cause a change in the reading.

Circuits R6-C13 and R5-C11 serve as isolation filters for the grid circuits of their respective tubes, preventing coupling through the common impedance of the volume control circuits.

Hum Filters

The power supply circuits are absolutely standard. All filaments are grounded. The field of a 1,000 ohm speaker is used as the filter choke, and two 8 mfd. electrolytic condensers, C23 and C24, serve to complete the filter. The impedance of these condensers is very appreciable at radio frequencies, so they are supplemented by a non-inductive paper condenser, C20, properly to by-pass the r-f circuits.

Screen potential of 90 volts is derived from a voltage divider consisting of R3 and R4, by-passed to ground by C9. The minimum bias for the cathodes of the —51 tubes is taken across resistor R8, by-passed by C8. R1 is the plate resistor for the automatic volume control tube.

Bias for the —45 power tubes is to be obtained from a high

(*Continued on next page*)

LIST OF PARTS
For Tuner

Coils

Two shielded band pass filter coils (L2, L4)
One band pass mutual coil (L3)
Two shielded r-f coupling coils (L5, L6)
One shielded monotron oscillator coil (L7)
One shielded 175 kc. intermediate coil (L8)
One r-f choke coil (L9)
One r-f choke coil (L10)
One shielded antenna impedance coil (L1)

Condensers

One shielded antenna condenser (C1 built into L1)
One three-gang 0.00035 mfd. tuning condenser with trimmers (C2, C3, C4)
One two-gang 0.00035 mfd. tuning condenser, with trimmers (C5, C6)
One padding condenser (C7)
One 1.0 mfd. bypass condenser, 300 volts (C10)
Two 0.1 mfd. condensers (C15, C21)
Three 0.5 mfd. condensers (C8, C9, C26)
One 2 mfd. condenser (C22)
Two 0.02 mfd. condensers (C11, C13)
One 0.00003 mfd. condenser (C14)
Two 0.002 mfd. condensers (C12, C16)

Resistors

Two 0.5 meg. resistors (R1, R13)
Two 0.05 meg. resistors (R10, R11)
Four 0.25 meg. resistors (R5, 6, 15, 16)
Two 0.025 meg, resistors (R3, R17)
One 0.15 meg. resistor (R14)
One 0.1 meg. resistor (R18)
One 0.0005 meg. resistor (R2)
One 0.015 meg. resistor, 25 watts (R4)
One 0.005 meg. resistor (R9)
One 0.05 meg. potentiometer with a-c switch (R12)
One 0.5 mfd. 300 v. condenser (C20)

Other Requirements

One chassis
Six tube shields
Five grid clips
Six wafer sockets
One connector cable, plug and socket
One twin post (Ant., Gnd.)
One drum dial, escutcheon plate and pilot lamp
Three walnut knobs
One 16x8 inch front panel
One 2-piece connector for a-c line

(*Designation of constants, L1, R1, C1, etc., refer to the diagram of the complete set, Fig. 2. The tuner diagram, Fig. 1, has values imprinted instead.*)

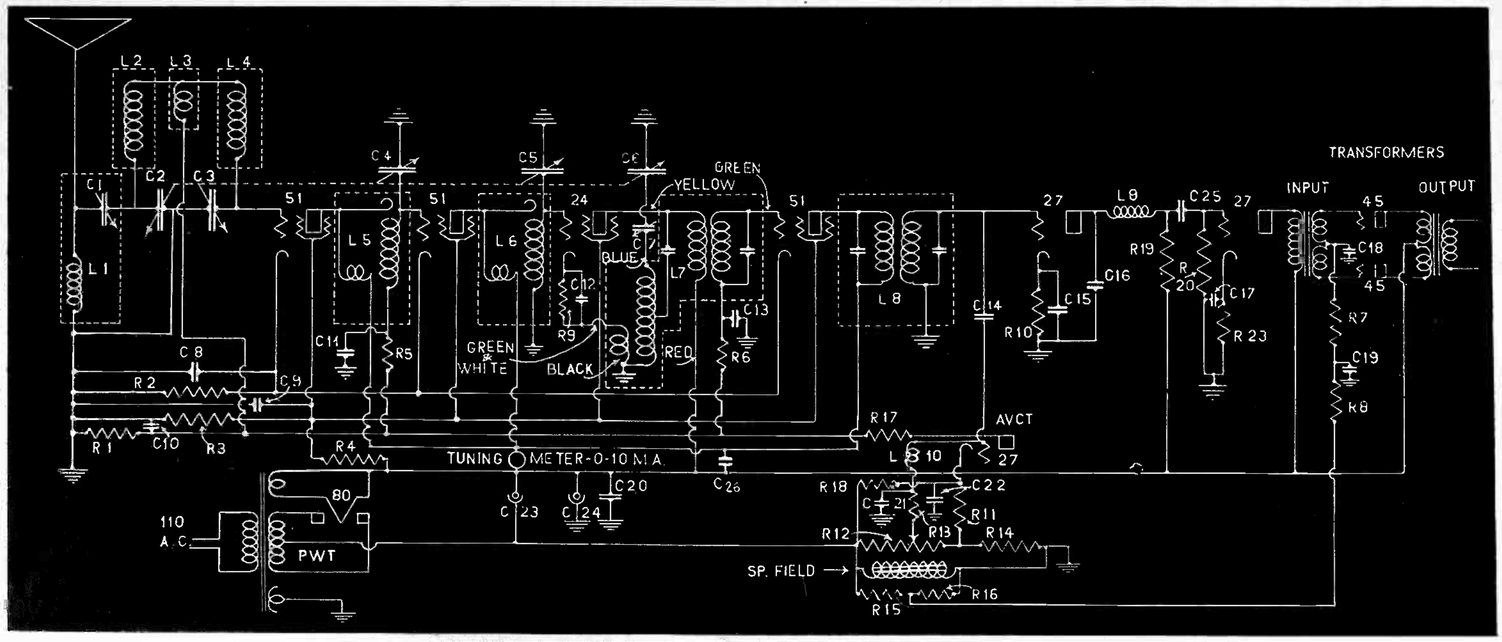


FIG. 2

The diagram for the complete receiver—tuner and power amplifier. The constants are given designations corresponding to those used in the text.

(*Continued from preceding page*)

resistance voltage divider, R15-R16, across the speaker field. The hum-balancing circuits, R8-C19, and R7-C18, serve to keep the power stage free from any appreciable hum level, and to balance out any hum introduced in the preceding impedance matching stage.

Assembly of the Tuner

In assembling the tuner, it is recommended that the parts layout shown in the blueprints be followed pretty closely. Some divergence by the more advanced experimenters will do no harm, always providing they know exactly what effects will be introduced by the change, but the plan as shown has been worked out both according to theory and actual results, and unless some rather important reason presents itself, the builder will do far better to follow the plans which have been found to be correct.

This seems a good point to present one highly important thing. It has been often stated that neat wiring results in good performance. This has never been more a fact than in this tuner. If your wiring job, when completed, looks at all sloppy, don't expect the tuner to work properly. It will probably give better results than you expect, but if you do a good job, following the wiring in the blueprint with absolute faithfulness, it will work far better.

The input coil, L2, is mounted directly over the mutual coil of the band-pass circuit, L2 atop the panel, and the mutual coil beneath. The leads from L2 pass directly through, into L3, without leaving the shielding at all.

The input control condenser, C1, and the input filter choke, L1, are enclosed in a single shield, and attached to the front panel. The shaft of C1 is of course insulated from the panel by mounting it on a thin piece of bakelite which is attached to the panel by machine screws.

Note that L6, the input coil to the monotron tube, is the only one of the tuned circuits that returns direct to ground. All the amplifier grid returns are brought to the volume control network. The tuned circuits are completed by C10 and C11, the rotors of the tuning condensers being grounded.

The bias network of the monotron tube, R9-C12, is a part of the oscillating circuit and accordingly must be mounted very solidly. The least motion on the part of these units will cause the receiver to reproduce in a wobbling, whistling manner whenever any vibration occurs.

The wires labeled A, B, C, etc., are broken on the diagram in order not to complicate the appearance. These should be formed into a neat cable and the cable laid into the corner of the chassis. In the diagram, which is of the tuner only, the connections to the negative side of the field, and to R14, are led to binding posts which should be on the back of the chassis. Again for simplicity's sake, these posts are shown on the deck of the chassis with ground wire B and wire C leading to them. It is assumed that R14 is mounted in the amplifier. If the amplifier and tuner are built as one unit, these binding posts are of course eliminated, and the connections made internally.

C7 is the padding condenser. This, too, is part of the oscillating circuit, and the wires leading to it should be short and solidly mounted so that they will not be subject to vibration.

It is suggested that the plate lead from the i-f amplifier tube to L8, and the grid lead from L8 to the detector, be shielded with copper braid. C14, from the detector grid to volume control tube grid, is at very high r-f potential, and should be placed directly from the socket prong of one tube to the other. L10 should be mounted directly adjacent to the grid prong of the a-v-c tube, so that the lead from the grid prong of the socket will not be more than an inch in length.

R20 is the maximum volume level control. This should be mounted somewhere on the amplifier so that it is accessible occasionally. The setting of this resistor determines the maximum volume the set will reproduce. When the receiver is completely aligned and adjusted otherwise, a local station should be tuned in, and with the volume control on the panel set at maximum, the setting of R20 should be adjusted to the normal maximum volume which will be desired from the set. This will allow the volume control on the panel to remain at maximum most of the time, and since in this position the greatest automatic action is obtained, it will rarely be necessary to touch the panel control, except when the set is to play very softly.

Optional Tone Control

No tone control is shown in the diagram. If one is desired, it can readily be inserted by connecting a 100,000 ohm variable resistor in series with a 0.01 mfd. condenser, from the grid of one of the push-pull amplifier tubes to the grid of the other. A 10,000 ohm resistor in series with a 0.1 mfd. across the primary of the input transformer will also give satisfactory results.

This receiver has a very high overall amplification and every precaution must be taken against feedback due to improperly placed parts and wiring. So follow the directions explicitly.

In wiring the tuner recheck every single connection. If possible, get someone else to check the connections with you. Yes, we know, you did it right the first time, and you've already checked them once, but do it again. We sometimes get one wrong ourselves, and don't find it on the first check.

Now plug it in and measure voltages. The plates of the —51's to the ground, should be between 225 and 275 volts, as should also be the plate of the first detector, —24. The plate of the second detector should be between 100 and 150. All screens should be between 75 and 100. The plate of the a-v-c —27 should be 100 volts negative from ground. The cathode of that tube should be about 75 negative from ground. The arm of the

LIST OF PARTS
For Power Amplifier

Coils

One Amertran push-pull input transformer (field coil and output transformer are in speaker)

Condensers

One 0.02 mfd. mica condenser (C25)
One 10 mfd. condenser (C17)
Two 8 mfd. condensers (C23, C24)

Resistors

One 0.5 meg. resistor (R20)
One 0.05 meg. resistor (R19)
Two 0.25 meg. resistors (R7, R8)
One 2,000 ohm resistor (R23)

Other Requirements

One set of insulating washers
One dynamic speaker with 1,000 ohm or 1,500 ohm field, push-pull, 45 output transformer built in
Three wafer sockets

(*See Fig. 2 for identification of constants*)

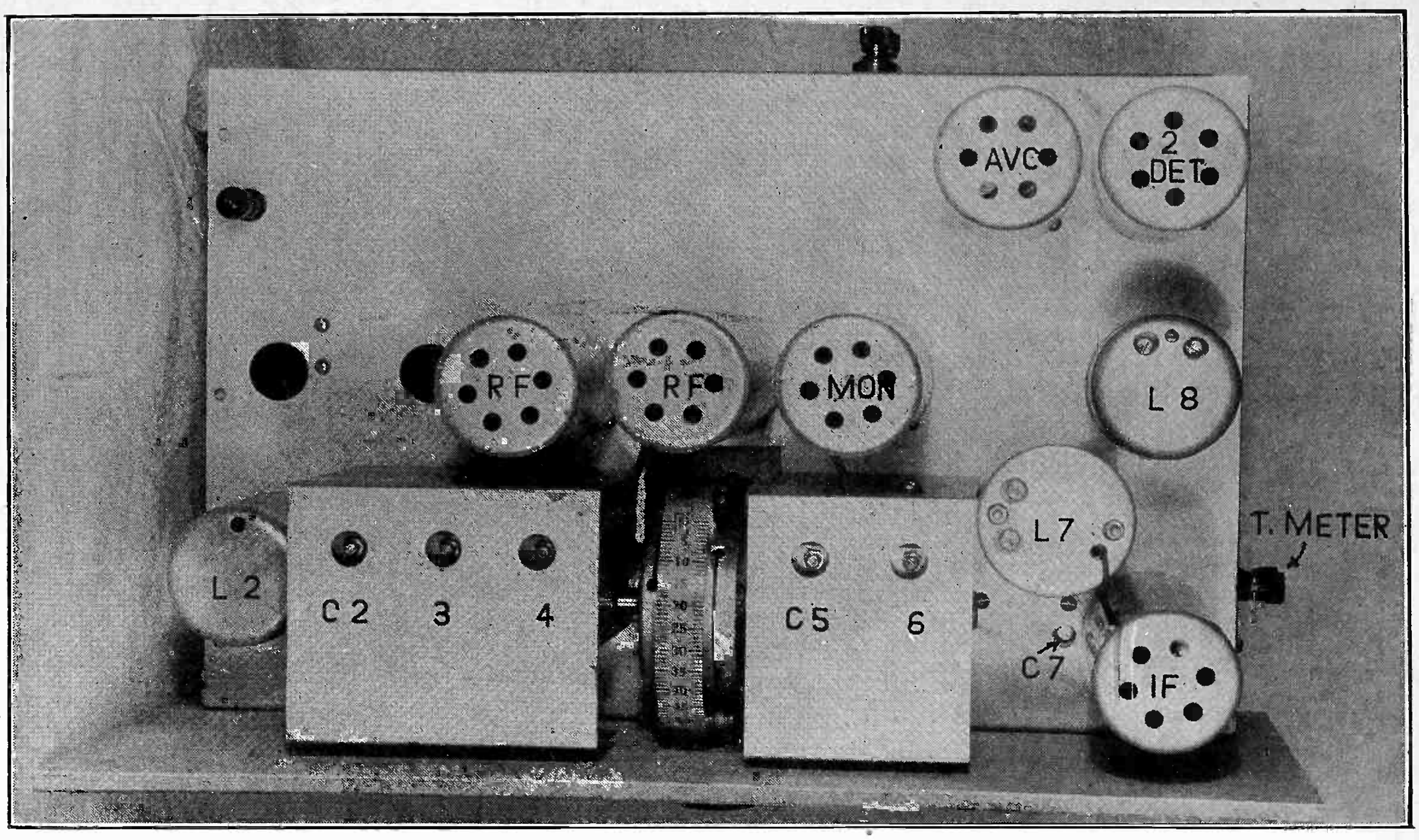


FIG. 3
The location of parts as seen from top is identified. "Mon" refers to monodyneoscillator-modulator.

volume control should vary between the last two settings. The cathodes of the —51's should read about 3 to 5 volts plus, the cathode of the monotron 10 to 15, and the cathode of the second detector about the same (though the last is actually higher than the reading unless a 5,000-ohm per volt meter is used). The grids of all the —51's should vary in voltage, measured on a high resistance meter, from 0 to 50 volts as the volume control is varied. The cathode of the first audio should be about 15 plus and the plate the same as the plates of the —51's, or perhaps a trifle lower.

Adjustments

First, adjust the intermediate transformers to the proper 175 kc setting. The following procedure is recommended.

Place the receiver in operation with the audio tubes, the detector and the i-f amplifier tube only. Put a voltmeter from the cathode of the detector to ground. Start a 175 kc oscillator, and bring the supply lead from the oscillator to the grid of the i-f amplifier tube. Adjust the screws on the top of L8 until the voltmeter reads maximum. (The sound in the loudspeaker may not be greatest at this point, to the ear, but if the volume could be reduced the proper effect would result.) Now insert the a-v-c tube and the monotron tube. Short-circuit the oscillator tuning condenser, C7. Bring the lead from the oscillator to the grid of the monotron, and adjust the screws on top of L7 for maximum reading on the voltmeter, and readjust L8 for accuracy. Reduce the volume as necessary to keep the voltmeter on the scale.

This 175 kc adjustment of the i-f transformers is the most vital and important adjustment in the whole receiver. It is a positive necessity that this be absolutely accurate for really good results. It is impossible to take too much care in making this setting, and it is impossible to do it by means of signals from broadcasting stations. An oscillator must be used, and used very carefully. Failure to get this correct will result in squealing, birdies, broad tuning, lack of sensitivity, and generally unsatisfactory results.

What to Do If Signals Aren't Heard

Next, follow the procedure for setting the trimmers and tracking condensers outlined in the March 5th issue.

Sufficient has been published about the detection of ordinary troubles, such as poor tubes, bad connections, and so on, to make any descriptions of such difficulties needless here, and the article on trouble shooting in the March 5th issue should clear up practically all the other problems likely to occur.

If the set totally fails to function when first hooked up, and everything checks up, the a-v-c tube operation can be temporarily voided, and standard control substituted as a check.

To do this, ground the lead connecting the R1, C10 and R17, which is the control lead. Remove the a-v-c tube. This will leave the set without any way of controlling the volume, that being full "on". Then disconnect R2 from ground, and put a 10,000 ohm variable resistor in series between R2 and ground.

Voltmeter Requirements

Using this as a temporary manual volume control, check the rest of the receiver, and after everything else is corrected, if the set does not operate properly when the a-v-c tube is returned to the circuit, it is self-evident that the remaining troubles are to be found in the resistance network surrounding that tube. A full description of the a-v-c method employed will be found in the issue, and references to this will undoubtedly enable the builder to localize his difficulty and correct it.

In passing, it is well to mention that for ascertaining *correct* voltages around this receiver, it is necessary to use a 5,000 ohm per volt voltmeter. This can be easily made by the experimenter by using a 0-200 microampere meter, Weston model 301 or Jewell pattern 88, in series with resistors of *five* times the values shown in the ordinary circuits for 1,000 ohm per volt meter.

If a tuning meter is employed, this should read a full 10 milliamperes with the volume control in maximum position with the antenna disconnected and no station tuned in. Leaving the volume control at maximum, but with the antenna attached, the loudest locals should reduce the reading to about 2 milliamperes, and other stations should cause proportionate deflections. Any station which is audible should cause the needle to drop somewhat.

The Antenna Condenser

C1, the antenna series condenser, should be adjusted with a station tuned in, to maximum deflection on the tuning meter.

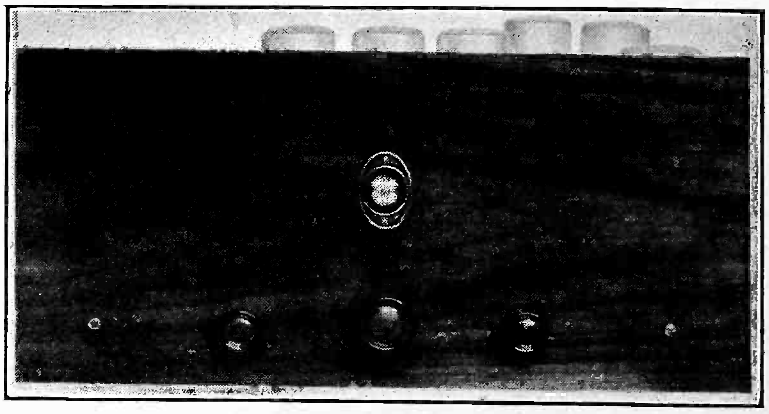


FIG. 4
Front panel view.

An Economical Eight-Tube Super Push-pull Pentode Output—400kc

By J. E.

Oscillator is Frequency-Stabilized in D-C Circuit

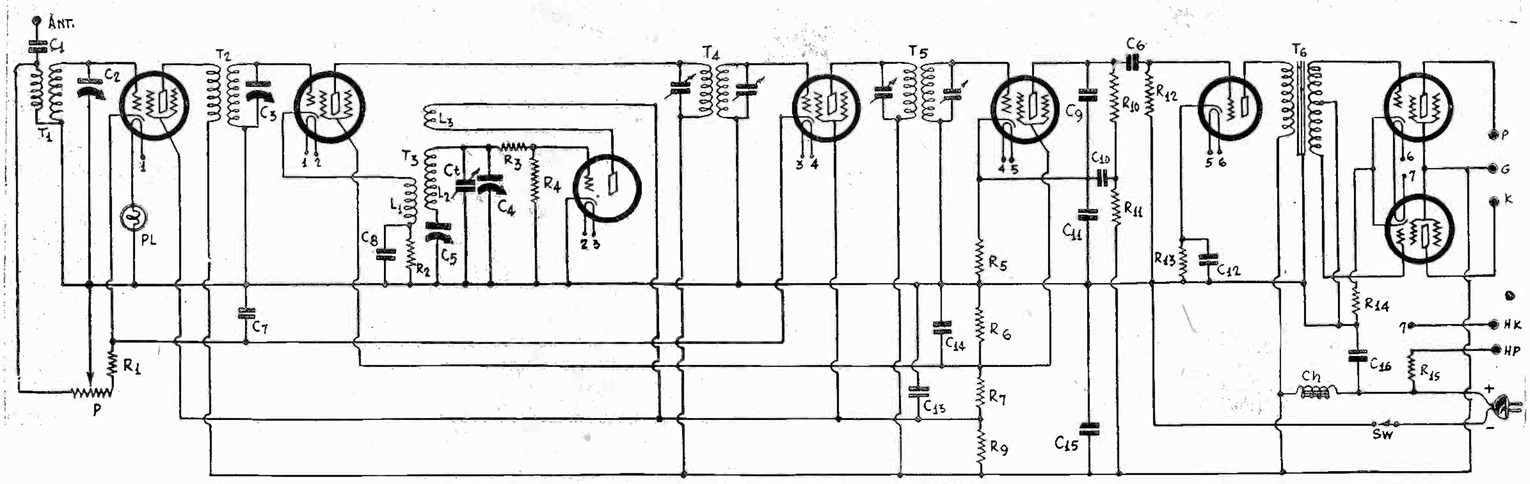


FIG. 1
The circuit of a 400 kc, eight tube superheterodyne for direct current operation.

IN RECENT issues we have published a number of superheterodynes all of which have certain features in common. Thus we published an eight-tube receiver for automobiles, in the January 16th issue, an improvement of this circuit in the January 23rd issue, an eight-tube circuit for d-c in the January 30th issue, another improvement and extension of the automobile super in the February 13th issue, the same improvement in the d-c circuit but for 175 kc intermediate in the February 20th issue, a seven-tube portable in the same issue, an eight-tube battery set in the March 5th issue, a seven-tube a-c set in the March 19th issue, and in this we shall present an eight-tube super, 400 kc, for d-c operation.

Needless Detail Omitted

It would seem that so many different variations of the same theme would be superfluous, but the fact is that no matter how many variations are given there are at least ten times as many requests on file. It is impossible to meet all the possible conditions, and we can only present those for which the greatest number makes requests. There is still room for portable superheterodynes and for circuits to be used in districts where batteries are the only source of electrical power.

In the present write-up of the d-c, eight-tube superheterodyne we shall omit those details which are common to the d-c supers we have already published, because to get them the reader has only to refer to the other descriptions.

At the outset we should say that no ground connection should be used because it is not needed and it is safer not to use it. The reason it is not needed is that the line is already grounded on one side and both sides are grounded in so far as the signal is concerned by virtue of the large by-passing condensers across the line in the set. The automatic ground, as we might call it, is better, perhaps, than any other ground that we might provide in the house.

As a safeguard against a possible ground and short circuit, we put in a small condenser C1 in the antenna lead. This need not be larger than 0.001 mfd., but how much larger it is made is immaterial. This condenser prevents a short circuit in the event that the antenna wire should touch some grounded object, an occurrence that frequently takes place. The effect of such a ground is usually to burn out the primary of the first

List of Parts

Coils

T1, T2—Two equal, midget type, shielded r-f transformers for 350 mmfd. tuning condensers.
T3—One special, shielded oscillator coil, for 350 mmfd. tuning condenser and 400 kc intermediate frequency.
T6—One push-pull audio frequency input transformer.
Ch—One low resistance 30 H. choke (about 200 ohms).

Condensers

C1—One 0.001 mfd. condenser.
C2, C3, C4—One gang of three 350 mmfd. tuning condensers with trimmers (Ct is the trimmer on C4).
C5—One 350 to 450 mmfd. trimmer condenser for series padding.
C6—One 0.1 mfd. condenser.
C7, C8, C14—Three 0.1 mfd. condensers, all in one case.
C9—One 0.00025 mfd. by-pass condenser.
C10—One 0.1 mfd. condenser.
C11—One 0.5 mfd. condenser.
C12, C13, C14—Three 0.25 mfd. by-pass condensers.
C15, C16—Two 4 mfd. paper dielectric by-pass condensers.

Resistors

P—One 10,000 ohm potentiometer.
R1—One 300 ohm bias resistor.
R2, R5—Two 30,000 ohm resistors.
R3—One 10,000 ohm resistor.
R4—One 100,000 ohm resistor.
R6—One 2,000 ohm resistor.
R7—One 2,500 ohm resistor.
R9—One 1,500 ohm resistor.
R10—One 250,000 ohm resistor.
R11—One 50,000 ohm resistor.
R12—One one megohm grid leak.
R13—One 1,250 ohm resistor (1,000 and 1,500 alternatives).
R14—One 600 ohm bias resistor.
R15—One 200 ohm, 25 watt resistor or an 82 ohm, 10 watt resistor. (The smaller resistor is used when speaker field is 125 ohms is used as part of ballast.)

Other Requirements

Sw—One line switch.
PL—One 2.5 volt pilot light, usually part of dial.
One dial.
One plug and cord.
Six grid clips.
Eight UY type sockets.
One special chassis (same size as chassis for 8-tube auto super, circuit No. 631).

heterodyne for Direct Current; Intermediate Frequency Featured

Anderson

radio frequency transformer, but more serious damage might result. Hence the little condenser C1 serves as insurance against such mishaps.

We put the pilot light PL next to the chassis in the heater circuit because if the light is connected to the circuit by flexible leads and mounted on the dial so that it moves with it, as is the case in most small sets, no serious short circuit would occur if the flexible leads should become chafed so that the wires would come in contact with the receiver chassis. In fact, no damage would occur; the lamp would simply go out and give warning that the insulation would have to be restored.

Filaments in Series

As in all sets for d-c operation the heaters, or the filaments, are connected in series. The order in which the heaters of the various tubes are connected in this series is immaterial and is determined by proximity of terminals. The numbers associated with the terminals indicate in which order the heaters might be connected, but this does not indicate at all that some other order cannot be used just as well if the wiring thereby becomes simpler. There are only two fixed connections, one at each end of the series. The pilot lamp should be connected as indicated and the ballast resistor R15 at the other end.

A word may be necessary about the connection of the ballast resistor. It will be noticed that (7) on one of the 238 tubes is connected to (7) on the speaker socket, or to Hk on this socket. Then R15, the ballast, is connected between Hp on this socket and the positive side of the line. This connection assumes that the field of the speaker is connected in series with the heaters, which in turn assumes that the speaker used requires 0.3 ampere to excite the field and that the resistance of the field winding is about 125 ohms. Such a speaker is available and made just for this use. In case this type of speaker is used the value of the ballast resistance R15 should be 82 ohms. The power dissipation in this will be about 7.5 watts, so it should be rated at a higher value than this.

It is not necessary to use this type of speaker. There is another, also designed for this purpose, which takes 110 volts. If this is used the field is connected directly across the line and not in series with the heaters and the ballast resistance. In that case the ballast resistance will have to be made 125 ohms greater than in the preceding case. That is, it should be 207 ohms. This is based on a line voltage of 115 volts rather than 110 volts, for the line voltage is usually 115 volts. It is also based on the supposition that the voltage across each heater is 6.3 volts and that the voltage across the pilot light is 2.5 volts. Of course, it is permissible to use a ballast of 200 ohms, because the tubes will stand considerably more than 6.3 volts.

Note carefully that there are two cases above, in which the ballast resistance is 82 ohms and the speaker has 125 ohms and the other in which the speaker is connected across the line, in which case the ballast resistance is 200 ohms.

Self Bias Throughout

In view of the fact that there is some hum in the heater current, it is best not to depend on the drops in the heaters for bias, and therefore to use self bias throughout. We have a limiting bias resistance R1 of 300 ohms in the cathode leads of the r-f and i-f amplifiers, both of which should be of the 234 type. In addition to this there is the volume control potentiometer P, a 10,000 ohm unit, by which the bias can be increased when amplification is desired. In the two detectors we have R2 and R5, each of 30,000 ohms. R13, which biases the first audio tube, should be 1,250 ohms although either 1,000 or 1,500 would be all right. R14 biases the two power tubes and it should have a resistance of 600 ohms.

In the plate circuit of the detector is a filter consisting of C10, a 0.1 mfd. condenser, and R11, a 50,000 ohm resistor. The object of this filter is mainly to stop intermediate frequency current from getting into the power supply, and through the back to the oscillator. A type of squealing is thereby eliminated.

Filtering Necessary

Some filtering of the B supply is necessary to eliminate hum, although not as much as is needed in a-c operated sets. One 30 henry choke Ch of fairly low resistance, say 400 ohms or less, should be used in the positive side of the line. Also two by-pass condensers C15 and C16 across the line are needed. It is not necessary to make these larger than 4 mfd. each. It is better to use paper dielectric condensers than electrolytic condensers because it is not necessary to observe polarity in the paper condensers. However, if care is taken in plugging in the line so that it is right every time, or so that it is not left on in the wrong direction, it is all right to use an electrolytic condenser of about 8 mfd. In that case it is hardly necessary to use the filter choke, at least not as large a choke as 30 henries.

Low voltage on the screens of the two detectors is assured by returning the screens to a point on the voltage divider which is only about 20 volts above ground. Since the voltage on the grid on either tube is approximately 3 volts, the net voltage on the screens is 17 volts. It is all right to make it even less than this, which is done by decreasing the value of the bleeder resistance R6.

If we make R6 1,000 ohms, we fixed the bleeder current at 20 milliamperes, which is a satisfactory value. With this selected we have to select the values of R7 and R9 consistently with the bleeder current and with the desired voltages on the other elements. If we want 70 volts on the screens of r-f and i-f amplifiers and on the plate of the oscillator, the drop in R7 should be 50 volts, and therefore the value of R7 should be 2,500 ohms, for practically the same current flows in R7 as in R6.

If the drop in Ch is not more than 5 volts and the line voltage is 115 volts, the net effective voltage on the plates of the tubes will be 110 volts, and the drop in R9 will be 40 volts. The current in R9 is 20 milliamperes plus the current to the screens of the two amplifiers and the plate of the oscillator. The total is about 26 milliamperes. Hence the value of R9 should be nearly 1,500 ohms.

The Coils

The two r-f coils T1 and T2 are regular shielded, midget type, broadcast coils wound for 350 mmfd. tuning condensers. T3 is an oscillator coil which also has been wound for a 350 mmfd. tuning condenser, and in addition for 400 kc intermediate. A matched set of coils is best because it is not easy to get the right inductance in the oscillator coil. The r-f coils and the oscillator coil should be made by the same manufacturer to fit the specifications of this circuit. Suitable coils are now available.

The trimmer condenser C5 is also a special item for this circuit. It is similar to the trimmer condensers used in many 175 kc superheterodynes but its capacity range is about 350 to 450 mmfd.

The intermediate frequency coils are similar in appearance to the r-f coils and are similarly shielded. Both windings of each transformer are tuned and the coupling between the two windings is such as to give a band pass characteristic approximately 10 kc wide.

Oscillator Stabilization

CAN SOME METHOD be introduced readily for the stabilization of the frequency of an oscillator?—K. W. U., Bangor, Me.

Yes, there are numerous methods. One of the easiest, and best, is simply to use a grid leak and condenser as would be used for ordinary detection, except that detection may not be desired, and the grid return therefore would be somewhat negative. The bias need not be altered, the leak and condenser simply connected in series fashion (as in the oscillator described this week on pages 16, 17 and 18) or with the condenser in the same position and the leak in parallel with the tuned circuit. The stabilization arises from the counteracting effect of grid current flowing in the circuit, whereby the bias voltage is maintained virtually constant. Voltage changes of this type would alter the frequency.

New Books

"Year Book of the Institute of Radio Engineers," 1932 edition ($1.50) has just been issued, and is in the hands of members, associates, etc., of the Institute. It comprises 275 pages of text, including constitution, rules, objects and history of the Institute. Besides, the usual catalogue of membership is included, listed alphabetically and also geographically. Standard vacuum tube dimensions, with diagrams of bases, are published. Also, the book contains manufacturing standards consisting of definitions applicable to broadcast receivers.

Portable Super Without Separate Performance Put First,

By Bruns

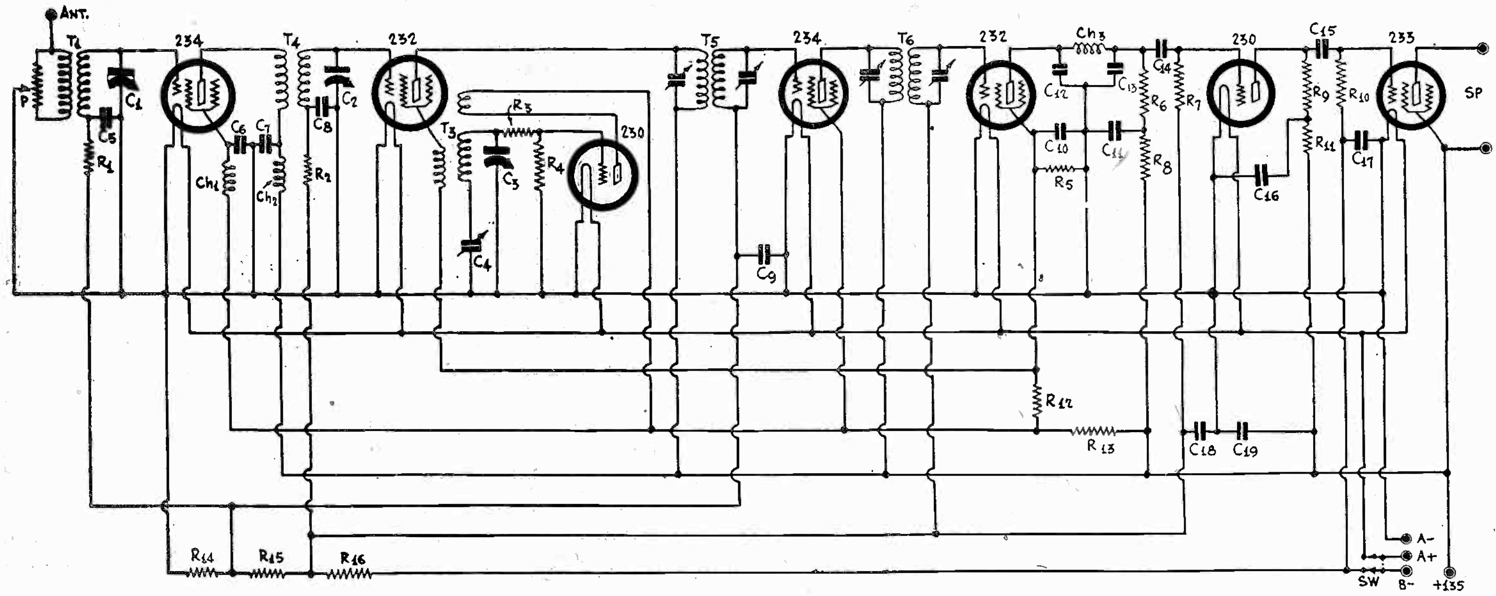


FIG. 1

This portable seven tube superheterodyne employs 400 kc for intermediate frequency and pentodes for r-f and power amplification.

THE problem of designing portable receivers is not unlike that of designing automobile sets, although the sensitivity requirements are not quite so rigid, since the portable set will not, as a rule, be used inside a car. That is, the portable set will be used in the open where the radio waves have a better opportunity of getting to the receiver. Of course, it may be that the portable set will be used in a car under the same conditions as any car set, and in that case the circuit must be just as sensitive. Since the portable may be used in a car it is just as well to design the set so that it will yield satisfactory signals even when it is used inside a shielded car with the poor pick-up that goes with that use.

Car receivers of the superheterodyne type are coming to the fore just because of their greater sensitivity, and the demand for portable superheterodynes is keeping pace. It is more important to get signals out in woods, or wherever the portable set may be taken, than it is that the receiver should be stripped of every possible pound of weight. As far as the set itself is concerned there is practically no difference in weight between a seven-tube superheterodyne and a four to six tube t-r-f receiver. The difference is largely one of power supply. We must use batteries to power any portable receiver, and the more tubes in a set the more weight must be put into the batteries, or else we must be prepared to replace the batteries at very frequent intervals. In view of the fact that if small batteries are used there must be a supply of replacements on hand on long trips. They will weigh just as much outside the set as in it. Hence it is better to put the larger batteries in the set, for they can be used more efficiently and economically.

A portable set of high sensitivity and selectivity must contain many tubes, and it cannot be made into a vest pocket edition.

Circuit for Portable Super

In Fig. 1 we have the circuit of a seven tube superheterodyne which, even with ample power supply, may be put into a portable container such as a suitcase or a specially made box. The construction of the container is a mechanical one, not electrical,

LIST OF PARTS

Coils

T1, T2—Two midget, shielded r-f transformers for 350 mmfd. condensers.
T3—One special oscillator coil for 350 mmfd. condenser and 400 kc i-f.
T4, T5—Two 400 kc intermediate frequency transformers, doubly tuned.
Ch1, Ch2, Ch3—Three 800 turns duolateral r-f chokes (about 6 millihenries).

Condensers

C1, C2, C3—One gang of three 350 mmfd. tuning condensers.
C4—One 350 to 450 mmfd. trimmer condenser.
C5, C6, C7, C8, C9—Five 0.1 mfd. condensers.
C10, C11, C18, C19—Four 0.25 mfd. by-pass condensers, or larger.
C12, C13—Two 0.00025 mfd. condensers.
C14, C15—Two 0.1 mfd. condensers.
C16, C17—Two one microfarad by-pass condensers.

Resistors

P—One 10,000 potentiometer.
R1, R2, R8—Three 50,000 ohm resistor.
R3—One 10,000 ohm resistor.
R4, R11—Two 100,000 ohm resistors.
R5—One 15,000 ohm resistor.
R6, R9—Two 250,000 ohm resistors.
R7—One two megohm grid leak.
R10—One one megohm grid leak.
R12—One 75,000 ohm resistor.
R13—One 9,000 ohm resistor.
R14—One 111 ohm resistor.
R15—One 74 ohm resistor.
R16—One 315 ohm resistor.
(R14, R15, R16 may be a 500 ohm resistor with adjustable taps).
One 1.652 ballast resistance in series with A battery.

Other Requirements

One double pole, single throw switch.
Seven binding posts.
Four grid clips.
Six UX sockets.
One UY socket.
One dial, vernier type but without pilot light.
One magnetic or inductor speaker.
Two 234 r-f pentodes, two 232 screen grid tubes, two 230, and one 233 power pentode.
Three medium size 45 volt batteries.
Six No. 6 dry cells for A supply.

C Batteries;

Weight Secondary Consideration

en Brunn

and any set builder can fit the circuit into the most suitable case. There are certain considerations, however, that must be met in designing a case for a portable set. The case must not be thick for if it is the case will interfere with the legs of the porter and even if the case and the contained circuit are light, the ensemble will not be portable. We might say that it will be luggable with difficulty. If the box is thin, there will be no trouble carrying it even if it weighs a considerable amount.

With medium small batteries for the B supply and No. 6 dry cells of adequate number for filament supply, the seven tube circuit can be assembled in a unit, including the loudspeaker, that will not tire the average man carrying it over reasonable distances. Some portable sets have been made that weighed sixty pounds. If the present set were to weigh half that amount it would be too heavy, and there is no reason why it should weigh so much.

Method of Self-Bias

Ordinarily grid batteries are used for obtaining bias for the tubes in a battery set, but this method of biasing is no longer popular. The grid batteries are a nuisance, and they are not desirable for another reason. The voltage of a grid battery does not change as the batteries become old, but the effective voltage of the plate battery does. Hence as the plate battery becomes exhausted the tubes gradually become over biased. The preferable way of biasing, and one that meets both these objections, is self-biasing just as it is done in a-c operated circuits. This is quite feasible in a battery set.

It is accomplished by inserting resistances of suitable values in the negative lead of the B battery and by returning the grid leads to suitable points along the series of resistances. The total plate current of all the tubes and the bleeder current in the voltage divider flow through these resistances, and therefore as soon as we know the total current flowing and the required bias values, we can easily compute the required resistances. The drop in R 14 biases the two screen grid amplifiers in the circuit, and the drop should be 3 volts. Therefore the drop in R14 should be 3 volts.

The drop in R14 and R15 biases the two detectors and the first audio amplifier. Good detection will be obtained at about 5 volts. Hence the drop in R15 should be 2 volts. The drop in the three resistances biases the power tube, and the required bias is 13.5 volts. Hence the drop in R16 should be 8.5 volts.

If we add up all the currents flowing we obtain about 27 milliamperes. Since the total drop in the three resistances is to be 13.5 volts, the sum of them should be 500 ohms. These should be distributed as follows: R14, 111 ohms; R15, 74 ohms; R16, 315 ohms. The best way to obtain these is to use an adjustable resistor with sliders on it, having a total resistance of 500 ohms. If a resistor of this type is used the taps may be moved until the best detecting and amplification efficiency is obtained. This is the best way, but if fixed resistors are used the nearest commercial values to those specified should be employed. They would be, without special adjustment, 100, 75, and 300 ohms.

Filtering

In view of the fact that these resistances carry signal current as well as direct current, and that they are common to two or more circuits, rather thorough filtering is necessary to prevent oscillation. Thus in each grid lead in the radio frequency level there is a 50,000 ohm resistance, R1 and R2, and a 0.1 mfd. by-pass condenser from the low side of each coil to ground. These are C5 and C8.

In the screen circuit of the r-f amplifier is a filter consisting of an 800 turn choke Ch1 and a 0.1 mfd. condenser C6. There is a similar filter in the plate circuit. These may not be necessary in all instances and if they are not needed they should be omitted. Possibly only one of the filters is needed. The criterion is whether or not the r-f amplifier is stable. If there is no oscillation without the filters, none is needed. It may also be that only the condensers are needed. A complete filter is shown in each of the plate and screen circuit because under the worst conditions they may be needed. The circuit may first be built without them, leaving room for them in case it is found later that they must be used.

No resistance is used in the intermediate frequency amplifier grid lead but there is a condenser C9 of 0.25 mfd. capacity. C18 and C19 are also 0.25 mfd. by-pass condensers which are also used for stabilizing the set.

There is considerable filtering in the plate circuit of the detector. It is used mainly to prevent the signal frequency at the intermediate level from entering the B supply and the plate and grid voltage dividers. Prevention of heterodyne squeals due to harmonics of the intermediate frequency is the main object of this filtering.

C12 and C13 are two 0.00025 mfd. condensers and Ch3 is an 800 turn duolateral choke like the previously mentioned r-f chokes. C10 and C11 are a part of the filtering device, and each of these is a 0.25 mfd. unit while R8 is a 50,000 ohm resistance. Besides serving in this capacity R8 and C11 help to prevent oscillation at audio frequency, that is, motorboating. C16 and R11 serve this purpose also, and to do so effectively C16 should be one microfarad and R11 100,000 ohms. C17 helps it along and it should also be one microfarad.

In case motorboating should be encountered when the B battery has been used for some time, the best way of attacking the problem is to make R8, C11, and C19 larger.

Division of Plate Voltage

The two detectors will be efficient if we apply a voltage of about 15 volts on the screens, or more accurately, if we make the drop in R5 equal to 15 volts. Therefore, if we make the bleeder current one milliampere, R5 should be 15,000 ohms. Such a low bleeder current is used because it is desired to conserve the plate battery as much as practicable.

A satisfactory voltage on the screens of the amplifiers and on the plate of the oscillator is 90 volts. Hence the drop in R12 should be 75 volts. We need 75,000 ohms. For R13 we need about 9,000 ohms. This is not critical because it is not necesary to have just 90 volts on the screens.

The volume is controlled with a 10,000 ohm potentiometer P across the primary of T1, the ground being connected to the slider. The radio frequency and the oscillator coils are the same as those used in the circuits previously described and referred to in the first paragraph. That is, T1, T2, and T3 is a set of coils for 350 mmfd. tuning condensers and 400 intermediate frequency. C4 is also equal to the condenser used for trimming in those circuits. Its capacity range is 350 to 450 mmfd. T4 and T5 is a pair of 400 kc intermediate frequency transformers.

CORRECTION

In the article on "Main Troubles in Superheterodynes," March 5 issue, the paragraph headed "Use of external oscillator," stated: "If the oscillator is a screen grid tube, the short should be from grid cap to ground." In the monotron circuit, or a dynatron or pliodynatron oscillator, the grid cap doesn't affect the oscillating circuit at all. In the first and last of these, it does affect the r-f input from the antenna. It is absolutely effective in any oscillator to short the plates of the tuning condenser. If you are afraid of shorts on a dynatron plate, the shorting can be done with an 0.1 or larger condenser, but since the majority of screen grid oscillator tubes, either for home-built or commercial receivers, uses one of the above circuits, shorting the grid cap to ground is not satisfactory.

A Six-Tube T-R-F Set with New
to Simplify Con

By Jack

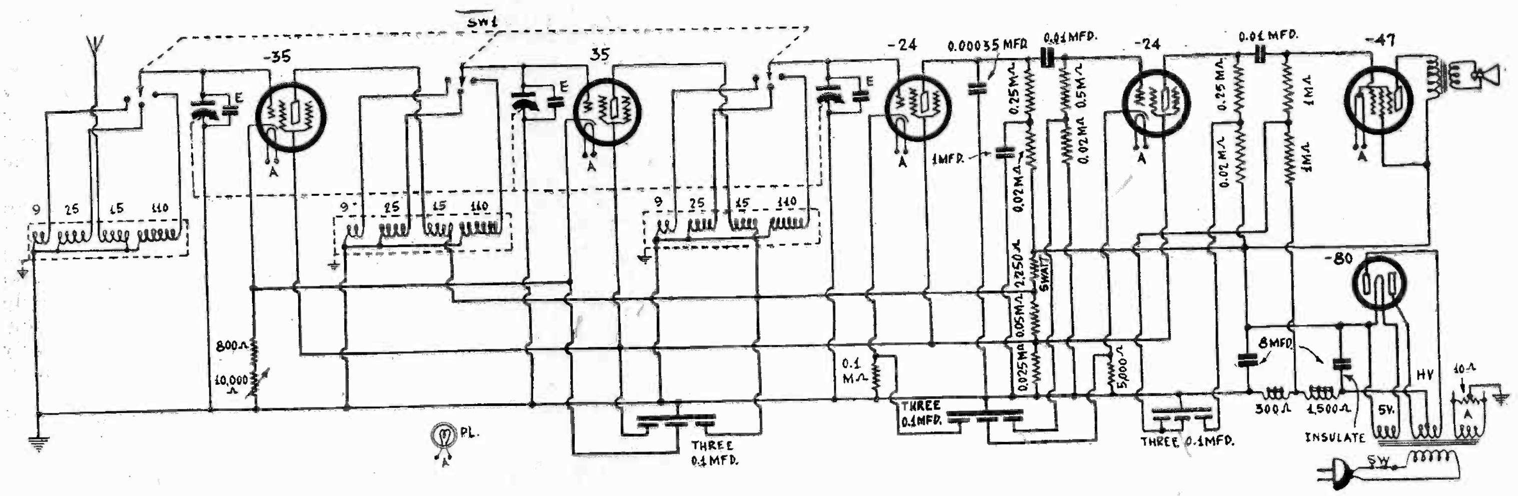


FIG. 1

By winding a single primary, and three separate secondaries, on one form, and using a long switch for moving the grid connection to pick up three companion secondaries at any one setting, wide wave band coverage may be achieved.

FEW circuits are ever shown where for wide frequency coverage there is a separate shielded transformer for each band to be covered by each stage. Separate coils are used, in unshielded fashion, particularly in short-wave converters.

However, there are many instances in which a builder desires also to cover the broadcast band. If plug-in coils are used, either shielded or unshielded, the end can be achieved readily, but most of the present-day methods embody switching. When that is true the coils are relatively close together, particularly when one considers the high frequencies. If there is no current in the adjacent coils, and no approximation of a tuned circuit, good results are obtainable.

Three Secondaries Suffice

The present method deals with the confinement of the various windings to one form. Thus, if a primary is placed in one position on the form, there may be two directly adjoining secondaries, one on one side of the primary, the other on the other side. The larger secondary—for the broadcast band—may be right close to the primary, say 1/16 inch separation, whereas the next secondary may have ⅛ inch separation. Then the third secondary would be placed beside the second one, and would be separated from the primary

If 0.00035 mfd. is used for tuning purposes, and a three-gang condenser assumed, then a tuned radio frequency set may be built on the mentioned basis, a long switch used so that the grid and the stator of the tuning condenser are moved to the respective secondaries. A total of three secondary windings would suffice, but four may be included, if desired, so that for the two small windings about the lower half of the tuning capacities will be used to increase the ratio of inductance to capacity, in the interest of improving the response on the small windings. The higher frequencies are better received by the separate-coil system than by any tapped coil system, whether the separate coils are on individual forms or, as here, on one form.

In a preliminary article last week the coil data for enamel covered wire were given for 1-inch diameter on the four-secondary basis, as follows, for 0.00035 mfd.:

Coil	*Turns*	*Size Wire*
Secondary No. 1	**127**	**32**
Primary	**15**	**28**
Secondary No. 2	**27**	**28**
Secondary No. 3	**10**	**22**
Secondary No. 4	**4**	**18**

Data for 0.0005 Mfd. Tuning

This week the diagram of the complete circuit is shown, with 0.0005 mfd. as the tuning capacity, three secondaries being used. In either case the coil forms will be longer than normally, and therefore a long shield is necessary, and in a pinch a tube shield, on a regular tube shield base, will serve the purpose. The coil data for 0.0005 mfd., 1 inch diameter, are:

Coil	*Turns*	*Size Wire*
Secondary No. 1	**110**	**32**
Primary	**15**	**28**
Secondary No. 2	**25**	**28**
Secondary No. 3	**4**	**18**

From top to bottom the windings are put on, side by side, in the order given. The separation between primary and secondary No. 1 is 1/16 inch, that between primary and secondary No. 2 is ⅛ inch, and between secondaries No. 2 and No. 3 also 1/16 inch. All windings are put on in the same direction. The grounded connections—four in the case of the antenna coil, three in the case of the two other coils—may be brought out to a single lug on the coil form. So there would be five different physical connections for the antenna coupler and six for each of the two other coils.

High Detector Bias

If a flat type dial is used—not a drum—then the tubes and coils may be at left of the dial, in this order from front to back: first r-f, second r-f, detector. Then on the other side (at right rear) would be the three remaining tubes.

Peck Gets Brighter Image, with "Reversed" Ground Glass

The screen on which the projected television image is thrown is second only in importance to the scanning system used, according to William Hoyt Peck, inventor, whose new big image television receiver was demonstrated at the St. Moritz Hotel, New York City.

Peck tested numerous types of screens during his work with color motion pictures for many years. For projecting pictures from behind the screen, he found waxed cloth superior to the various glass screens which had formerly been used. He therefore used that type of screen for his television projector during early experiments.

Later, however, he determined to try glass with a specially ground back, and found this to give about twice as brilliant an image, though it had not worked nearly as well for motion pictures. He further found that the image was much clearer when projected against the shiny surface of the glass, the ground side being toward the audience.

Also, he has shown how his apparatus can be used for transmitting permanent records of photographs and documents. To do this, the screen is replaced with a piece of photographic film, which is given the correct exposure, and is then developed and printed in the regular way.

by the sum of the axial length of the second secondary and the separation between the two windings. In this way the coupling is looser the higher the frequencies of the bands.

Coil Method

struction and Switching the Bands

Tully

The usual practice in t-r-f sets is followed up to the detector, the volume control being a 10,000-ohm rheostat or a potentiometer of that value used as a rheostat (one end open). If the direction of turning the volume control knob for volume increase does not suit you, reverse the connections to the control.

The long switch is of the insulated type, with very low capacity. The switch has to be chosen for low capacity particularly to insure full coverage of the broadcast band. The insulated type is required since the chassis most likely will be of metal, and both the pointer (pole) of the switch and the connecting points (throws) are at a high r-f potential.

The biasing resistor in the detector circuit is uncommonly high. However, the same screen voltage as is applied to the r-f tubes is fed to the detector and first audio tubes. Taking the detector alone into consideration at this moment, the effective plate voltage otherwise might be lower than the screen voltage, due to the drop in 270,000 ohms. Moreover, under this circumstance of high screen voltage on the detector, it is both correct and necessary to have a high bias. It will read of the order of 10 volts on a meter of 2,000 ohms per volt resistance.

Hum in Two-Stage Audio

It is unlikely that any meter you have will give a correct reading when put across the detector biasing resistor, unless it be an electrostatic or vacuum tube voltmeter. The 2,000-ohms-per-volt meter was used on its 30-volt scale, therefore, as 0.5 ma presented full-scale, 10 volts represents 0.166 ampere, and there was more current flowing through the meter than through the "measured" circuit. Or, to put it differently, the biasing resistor was 100,000 ohms, and the meter resistance (with multipler) was 60,000 ohms, or the actual condition, due to paralleling, was that of a biasing resistor of less than 40,000 ohms. However, the 10-volt reading, or thereabouts, may be used as guide, or preferably the current should be, measured, the resistance measured, and the voltage computed (the voltage in volts equals the resistance in ohms multiplied by the current in amperes). This will give a value around 20 volts.

The two-stage resistance coupled amplifier is stable enough, even with the high impedance choke coil in the B supply (field coil of dynamic speaker, d-c resistance a total of 1,800 ohms). However, there is always danger of much hum, and the method used to get rid of this nuisance was to include resistor-capacity filters in the detector and first audio plate circuits and first audio and power tube grid circuits. The trick that finally worked exceptionally well was to use 1 mfd. as the capacity in the detector plate circuit, from ground to the 0.02 meg. (20,000 ohm) resistor. In the pentode grid circuit the filter condenser was 0.2 mfd., comprised of two 0.1 mfd. sections of a block in parallel. The black lead of these blocks of three 0.1 mfd. goes to ground, the reds interchangeably to their destinations.

Suggested Reversal

As a test for hum reduction reverse the connections to the output transformer that is built into the speaker. This can be done at the so-called speaker plug socket. In reality this socket picks up the field coil as well as the output transformer primary. The connections commonly used are P to ground, G to tap on the field coil (grid return for pentode to afford bias), K to B minus, and heaters to B plus maximum and pentode plate. The heater reversal at the heater springs may be made on this socket.

Some idea of the voltage readings may be obtained from the following:

Common cathode connections of r-f tubes to ground: 2 to 25 volts, depending on the setting of the volume control.

Plates of r-f tubes to ground: 180 to 220 volts, depending on the setting of the volume control, as the greater the bias on these tubes the higher the plate voltage, because the drop in the 2,250-ohm series resistor is less, on account of current reduction by bias increase.

Screens of all screen-grid tubes to ground: 60 volts or 65 volts or a little more.

Cathode of detector to ground: will read around 9 or 10 volts on high resistance voltmeters, but actual voltage always will be higher than read with such meters.

Cathode of first audio tube to ground: will read around 2 volts on above meters.

Plate of detector and plate of first audio to ground: cannot be read accurately except by electrostatic means, for same reason as applies to cathode biasing voltages for these tubes, for actual voltages may be double what they seem to be.

Tap or field coil to ground: 16.5 to 20 volts. This is the pentode bias.

Pentode screen to ground, rectifier filament to ground: about 250 volts.

Voltage between shields of electrolytic condensers (8 mfd.): about 110 volts.

Voltage between pentode plate and ground: about 220 volts.

The speaker plug should be inserted, all connections as diagrammed, before the set is turned on. Failure to do so will result in an excessive strain that may break down the condensers irretrievably.

The broadcast result is excellent, so is that at the first short-wave band, while the second short-wave band is subject to vicissitudes, especially true because users try to get results thereon at night, and it is useful only during daylight. The range is from about 20 to 555 meters.

Short-Wave Receiver

A NEW short wave receiver that is arousing considerable interest in the ranks of the short wave fans and among the amateurs is the Royal Model RP. Although on the market for only a short time it is already piling up enviable reception records comparable with those of much higher priced receivers. Letters received from the owners of these sets contain glowing accounts of the reception of foreign broadcasts, code stations in all parts of the world, airplane conversations, police transmissions, etc., many of them with surprising loudspeaker volume.

One of its outstanding features is the extremely low price which places it within the reach of everyone, even those short wave enthusiasts with limited means.

The receiver is a masterpiece of advanced short wave design embodying every new worth-while development. The proper use of only two tubes, a '32 screen grid detector and a '33 power pentode output tube, gives this model the sensitivity and volume of an ordinary four tube set. This receiver is battery-operated in order to eliminate hum and other objectionable noises frequently encountered in a-c operated sets. By virtue of using the new economical, two volt tubes, one set of batteries, with ordinary use, will last approximately six months. To fully utilize the tremendous gain of the screen grid tube a special reactance, resistor, capacity coupling is used. The regeneration control is smooth acting and at the same time functions as a volume control. The same knob also operates an automatic switch.

This Royal S-W receiver is available in two types, "Regular" and "Band Spread." The amateur will be interested in the latter type as it has the 20, 40 and 80 meter bands widely spread for ease in tuning. This type is not designed to cover the rest of the short-wave spectrum and all other short-wave "bugs" are advised to purchase the "Regular," which covers from 14 to 200 meters . A special coil will extend its range to 550 meters.

The set is constructed on a heavy cadmium chassis, which effectively shields the various circuits. A full vision, micro-vernier dial with a smooth ratio of 5¼ to 1 enables the operator to tune easily for maximum results.

As seen in the illustration, the finished set is housed in an attractive crackle-finished metal cabinet, which aside from enhancing the appearance of the set, completely eliminates all hand capacity effects.

This short wave receiver fills a long-felt want and is ideal for the novice and the experienced short waver.

This set is distributed exclusively by the Harrison Radio Company of New York City, pioneer merchandisers of short wave apparatus.

Harrison Radio Co. will be in their new quarters after March 19th, at 142 Liberty St., New York. In addition to a complete line of replacement and service parts, short-wave apparatus and sets will be stocked, including transmitters. A new and enlarged television department will be included. All experimenters, hams and radio service men are invited to inspect the new quarters.

A Beginner's A-C Set

4-Tube Model Has Sensitized Detector

By Bill Malin

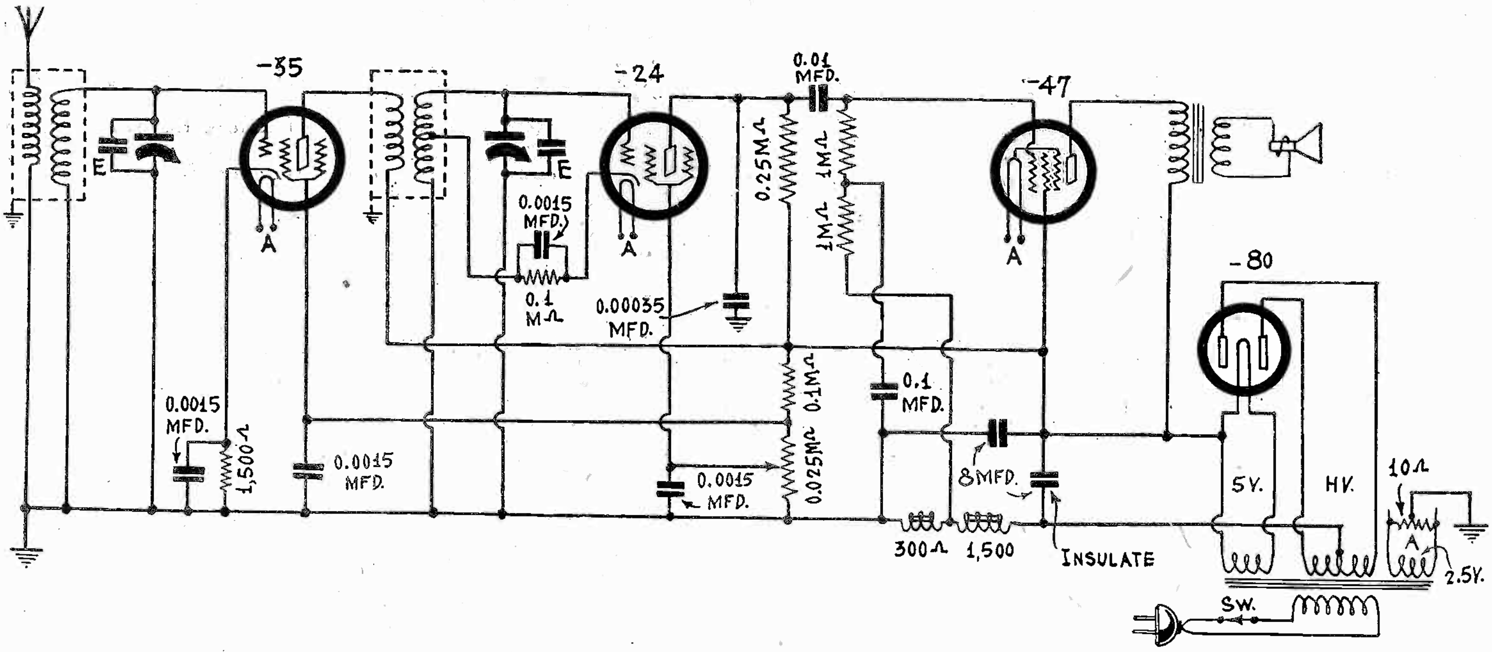


FIG. 1
A good circuit to build as your first a-c model. It has four tubes and gives good performance.

AN extremely simple four-tube a-c set that gives good performance is diagrammed in Fig. 1. The detector is specially sensitized, to make up for selectivity otherwise not high enough for the present-day use. This detector condition also improves the sensitivity.

Very few parts are needed to build this receiver. The r-f and detector tubes may be placed at left of the centrally-located tuning condenser, the detector tube at rear, while the two other tubes are at right of the tuning condenser. The power transformer may be at right front and the two 8 mfd. behind the tuning condenser. The result is a compact and efficient set.

How to Wind the Coils

The coils are wound on 1 inch form and have secondaries of 127 turns of No. 32 enamel wire, or size near that, while the primaries have 25 turns of any fine wire, wound over the secondaries, insulation fabric between. In the case of the detector coil there is a tap, which may be at about 30 turns from the ground end, or about 97 turns from the other end. Between this tap and cathode the biasing circuit is located. The tuning condensers for these coils are 0.00035 mfd. and are of the straight frequency line two-gang or double condenser type.

The maximum voltage is applied to all three tubes in the radio and audio parts of the receiver. The fourth tube is the —80 rectifier. The r-f tube is of the variable mu type, either a —35 as marked or a —51, while the detector is a —24 and the output tube a —47. Bias for the pentode is obtained through the drop in the field coil of the dynamic speaker, which field coil is used as the B supply choke.

High Detector Screen Voltage

Following most recent practice, the screen voltage for the detector is maintained high, since it is the same as the voltage on the r-f screen. Thus a high value of biasing resistor is used, 0.1 meg.

The plate load is a resistor of 0.25 meg. (250,000 ohms), and the voltage division for screen supply is obtained by tapping the juncture of two Lynch resistors of 0.05 meg. and 0.025 meg. (50,000 and 25,000 ohms, respectively). However, the 25,000-ohm unit is a potentiometer, its extremes constituting the fixed resistor, while the arm is moved along this resistor to alter the screen voltage on the detector. This screen voltage alteration applies only to the detector and enables utilization of the extra sensitivity feature purposely introduced by the fixed condenser from plate to tap on the grid winding.

Good Circuit for Beginner

The stopping condenser between detector plate and pentode grid is 0.01 mfd., while the two resistors in the pentode grid circuit are 1 meg. each. From the joint of these two resistors to ground a condenser is connected, of 0.1 mfd. capacity, and the combination of the lower 1 meg. resistor and this 0.1 mfd. condenser constitutes a hum filter. As an extra precaution against hum the leads to the primary of the output transformer (which transformer is built into the speaker) should be reversed, for there will be much less hum one way than the other. Finally there will be so little hum that you will be surprised.

So few parts are needed that a glance at the list might make one wonder if any kind of results are possible. However, if one will study the diagram he will find that every need has been fulfilled, and that therefore there is no reason to expect anything save the very best type of performance in point of tone quality, with good sensitivity and selectivity. Moreover, it is just the type of circuit for a fellow to build who has never before tackled an a-c set, for he will find no trouble getting good results.

LIST OF PARTS

Coils

Two radio frequency transformers, as described, with shields.
One midget power transformer.

Condensers

One two-gang 0.00035 mfd. straight frequency line condenser with trimmers.
Four 0.0015 mfd. fixed condensers.
One 0.00035 mfd. fixed condenser.
One 0.01 mfd. mica fixed condenser.
Two 8 mfd. electrolytic condensers, with insulating washers and connecting lug for one.
One 0.1 mfd. condenser tubular resistor.

Resistors

One 1,500 ohm biasing pigtail resistor.
One 50,000 ohm pigtail resistor.
One 0.25 meg. (250,000 ohm) pigtail resistor.
Two 1 meg. (1,000,000 ohm) pigtail resistors.
One 0.25 meg. (25,000 ohm) potentiometer with a-c switch attached.
One 10 ohm center-tapped resistor.

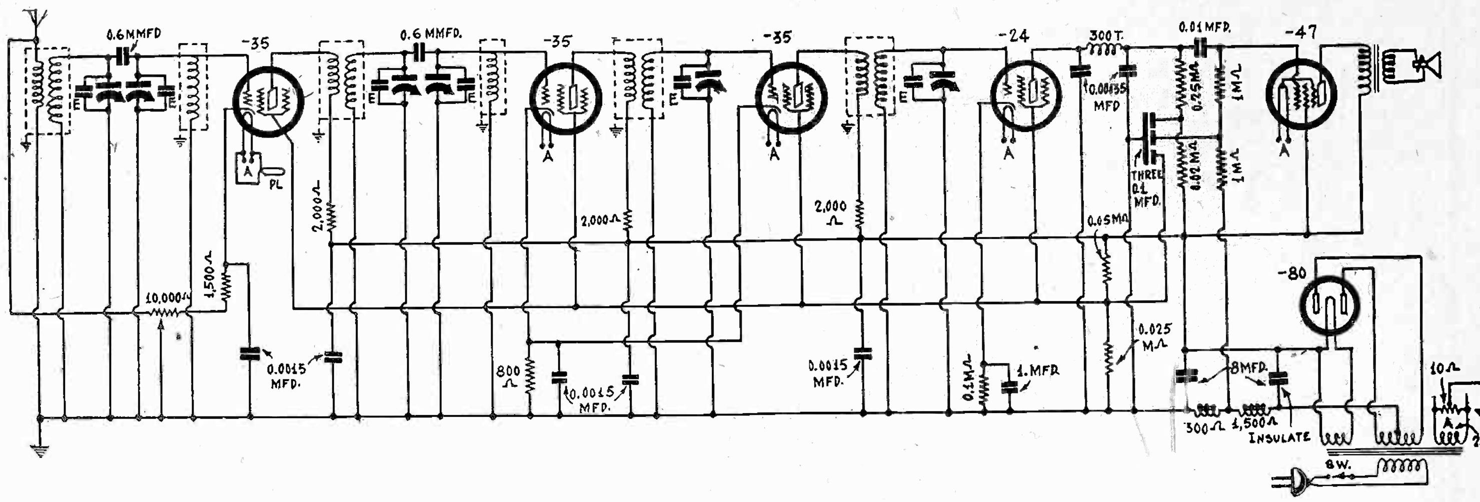
Other Requirements

One chassis.
Four UY sockets and one UX socket (one UY is for speaker plug).
One vernier dial with pilot lamp, bracket, escutcheon plate and scale.
One knob for dial and one knob for potentiometer.
One a-c cable and male plug.
One dynamic speaker, field coil resistance 1,800 ohms, tapped at 300 ohms; output transformer also built in.
One cabinet.

A Band-Pass T-R-F Set

Six Circuit Tuner with Even Sensitivity

By Thomas J. M. Clancy



A circuit for advanced radio builders, using six tuned circuits in a 6-tube radio frequency design. This type of circuit affords sensitivity of 10 microvolts per meter, or better, and also gets rid of many troubles encountered in other types of receivers.

THE standard small a-c receiver has five tubes. If another stage of t-r-f is used there will be three stages of t-r-f, which permits sensitivity of 10 microvolts per meter, or better. However, selectivity would have to be watched, lest it be too great at one end and too small at the other. More tuned circuits may be used, without adding tubes, in other words, band-pass filtration included. For the benefit of those experienced in building sets only a few suggestions will be made along the lines of a 6-tube set that is a six-circuit tuner.

Two three-gang condensers are used. The sections may be matched all right as to one three-gang, and equally well as to the other, but it is possible that one gang will not be matched to the other gang, so when the set is complete it is advisable to use a test oscillator and line up the one three-gang to the other. This can be done by shifting the position of the rotor in respect to the stator, which is practical on some makes of condensers. So for a circuit of this type see that the rotors are susceptible to this treatment. After lining up, say, at 1,000 kc, the circuit can be trimmed at 1,400 kc with equalizers.

Even Sensitivity

Now for the reasons why certain courses were adopted in the presentation of the design, Fig. 1.

The volume control is of a type frequently shown in these pages, giving r-f attenuation as well as tube characteristic alteration, for complete control of volume consistent with a sensitive receiver. The limiting resistor of 1,500 ohms, in conjunction with 10,000 ohms for control, will be found to be just right.

The plate circuits of the r-f tubes have unbypassed 2,000-ohm resistors. Can you imagine what they are for? Recall that tuned radio frequency has an amplification characteristic that is decidedly uneven, the higher frequencies being amplified a great deal more than the lower ones. So a flattening out is well in order, and the 2,000-ohm resistors afford virtually a flat response, that is, 1,500 kc amplified no more than 550 kc. Of course selectivity has to be taken into consideration—it is less with the resistors in than with them out—but the six tuned stages without some compensation like that might be too selective at the high frequencies, and the resistors prevent sideband cutting in that region. They are of small effect at the low frequency end, and regenerative effects are absent there.

Another method sometimes used, omitting the resistors, is to put a semi-peaked stage between the last tuned stage and the detector. Thus a transformer consisting of two closely coupled honeycomb coils of 300 turns or so would be used.

R-F Bypassing of High Voltage

Unfortunately, while the flattening process takes place because of the peak of the transformer, it is very difficult to avoid a band pass filter system here that overdoes the situation. That is, there will be two peaks, and their separation will depend on the degree of coupling between primary and secondary. Yet, whatever coupling is used, the selectivity is considerably lowered at the low frequencies, where it is least anyway because of absence of slightly regenerative effects, and much annoyance in tuning ensues. Therefore the resistors serve the purpose better.

The 0.0015 mfd. condensers, mica dielectric, connected from ends of the 2,000 ohm plate resistors to ground, are there to bypass the lead going to B plus and also to be cumulatively effective for r-f bypassing. Since electrolytic condensers are used in the filter of the rectifier, it is advisable to have some paper or mica dielectric capacity in parallel with the tank condenser for bypassing radio frequencies that may not well get by the electrolytic. This phenomenon has been discovered experimentally, although the full reason for its existence has not been explained.

The condenser coupling the band pass filter tuners are 0.6 mmfd. (sixth-tenths of 1 micro-microfarad), quite a small capacity. But it is a parallel capacity, and at 1,000 kc is equivalent to a series capacity of 0.05 mfd. as used in band pass filter circuits that embody a series capacity to complete the circuits of the tuned coils to ground.

Coil Information

Six coils are used. Two are impedance coils, as single windings are strangely called, and four are transformers. If the capacity used for tuning is 0.0005 mfd., then on 1⅛ inch diameter, using No. 31 wire enamel wire or thereabouts, the number of secondary turns would be 98, while if the tubing diameter is 1 inch the number of secondary turns would be 110. In either instance the primary would consist of 15 turns of any fine wire wound over the secondary and separated from the secondary by one turn of insulating fabric. For 0.00035 mfd. the secondaries would be 127 turns on 1 inch, primaries 15 turns.

The coils are enclosed in shields of aluminum or of zinc composition. The shield diameter may be as small as 1⅞ inches under these circumstances.

The detector filter choke is a 300-turn honeycomb, and the pi-filter is completed by two 0.00035 mfd. condensers to ground. That is a now standard type of detector output filter for radio frequencies, but it is well to support this filtration with a large capacity bypass condenser across the detector biasing resistor, if hum is low enough. Ordinarily a good compromise between necessary bypassing and low hum is 0.0015 mfd. or 0.002 mfd. in this position, but there is much more kick in the set with 1 mfd., and therefore this may be tried, and the hum reduced as low as possible by the usual precautions, including resistor-capacity filtration of detector plate and pentode grid circuits, raising the capacity for detector plate filtration to 1 mfd., if necessary and making a trial reversal of connections to the output transformer primary.

A Modulated-Unmodulated Swi
Neon Tube Supplies Audio Fr

By E.
E.E., Massachuse

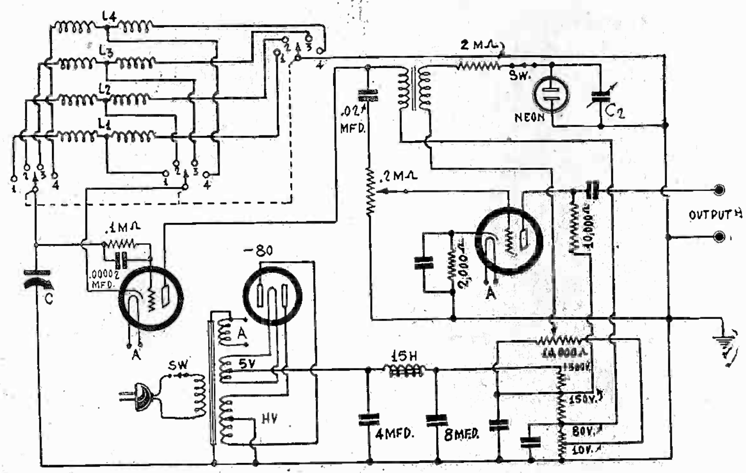


FIG. 1
The circuit of a neon tube modulated all-wave oscillator, the neon tube generating the audio frequency.

AMBITIOUS service men equip themselves with many different apparatuses with which they can do their work more expeditiously and certainly. They get meters of different kinds, circuit testers, oscillators, and various other devices.

Oscillators are particularly popular among the service men, now that the superheterodyne is in vogue. These oscillators must cover the broadcast, intermediate, and high frequency bands, and the output should be modulated with an audio tone. However, the design should be such that the modulation can be eliminated easily when the application of the oscillator requires an unmodulated wave.

Another desirable feature in the oscillator is that the bands of frequencies generated should be changeable with a switch rather than by the plug-in method. Coils that must be plugged in get misplaced and are easily damaged, and damage to a coil may change the calibration.

Unique Oscillator

In Fig. 1 is the diagram of a unique oscillator, designed and constructed by the author. It has a tuning range from 140 kc to about 20,000 kc, this range being covered in four steps. The oscillator is of the Hartley type, which is used because it will oscillate at the very high frequencies.

The device also has a built-in power supply so that it is not necessary to make any connections for batteries or other power supply except plugging the device into the most convenient outlet.

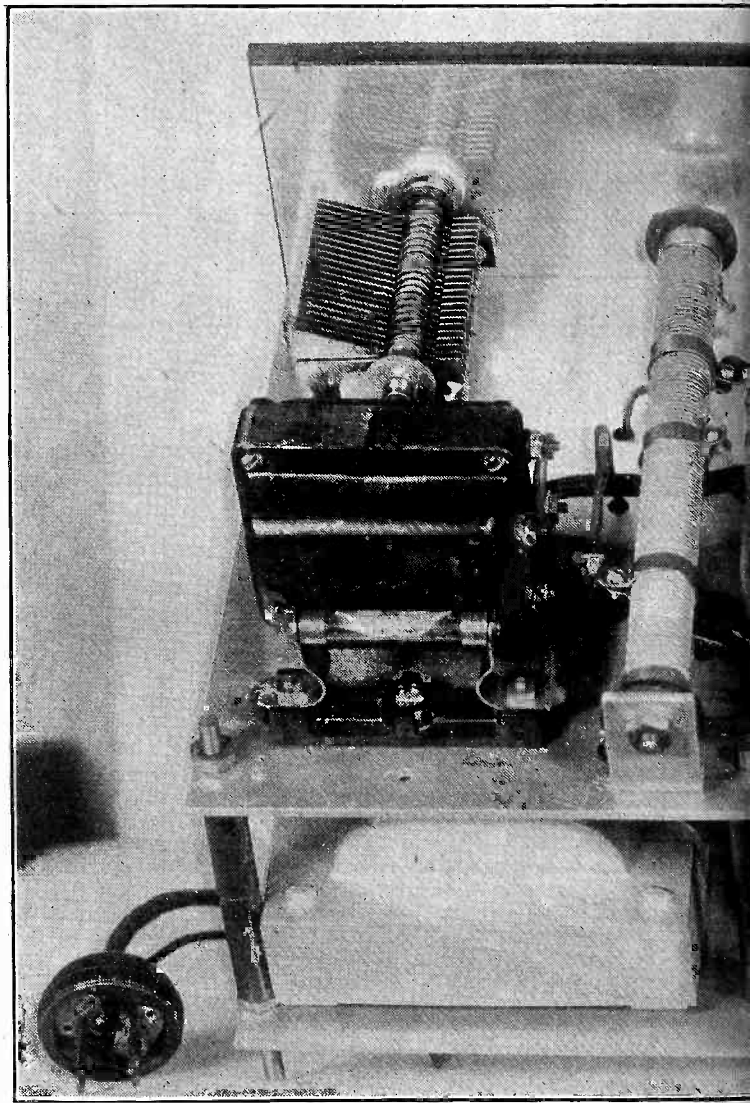
The most unusual feature of the oscillator, and in this it is truly unique, is the neon tube audio frequency oscillator, used in place of a tube of the ordinary type. The circuit of this oscillator is so arranged that it modulates the radio frequency output of the vacuum tube oscillator.

The neon tube oscillator circuit consists of the neon tube, a variable condenser C2, a 2 meg. resistor, the secondary of an audio frequency transformer, and a source of voltage, which is variable by means of a 10,000-ohm potentiometer.

The audio frequency generated by the neon tube circuit is variable over a wide range of frequencies, first, by means of the variable condenser C2 and, second, by means of the 10,000-ohm potentiometer. Frequencies as low as 60 cycles per second and as high as 10,000 cycles can be generated. For each setting of the slider on the 10,000-ohm potentiometer there is a certain frequency range that can be covered by varying the variable condenser C2.

When no modulation is desired it is only necessary to open the switch in series with the oscillator circuit. This switch is so placed that there is no change in the radio frequency circuit when the switch is opened or closed. Hence the radio frequency generated is the same whether it is modulated or not. The modulation on-off switch is mounted on the 10,000 ohm potentiometer and wired in such a manner that the switch is off whe the voltage in the neon tube circuit is minimum.

The Hartley oscillator used in the circuit is a bit unusual, to



F
Back view of the all-wave neon tube oscillator showin
ar

LIS

Coils

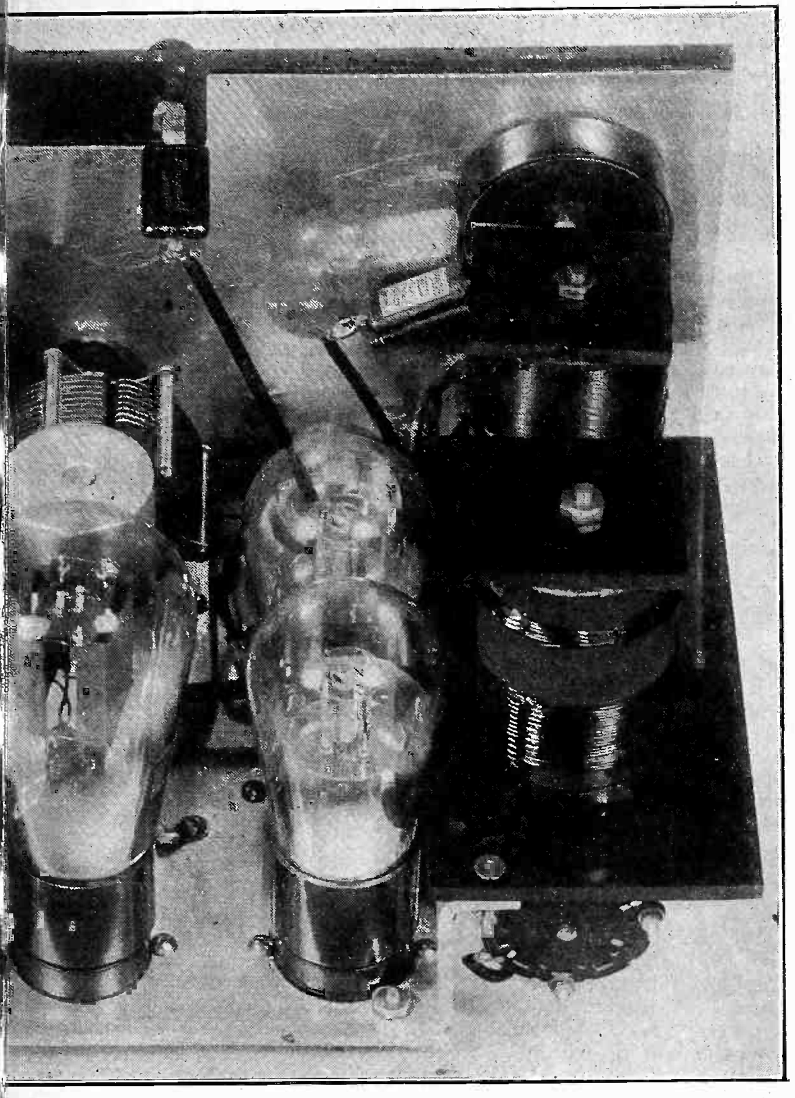
L1, L2, L3, L4—One set of oscillator coils, each coil tapped ne center (detailed data to be given in an early issue).
One power transformer contain one 5 volt, one 2.5 volt, and o 600 volt windings, the 5 and the 500 volt windings cent tapped.
One 15 henry choke coil.
One audio frequency transformer.

Condensers

One special 360 degree tuning condenser, 375 mmfd. maximu capacity (C).
One 200 mmfd. Hammarlund midget type tuning condenser (C
One 0.00002 mfd. grid condenser.
One 0.02 mfd. condenser.
One 0.0001 mfd. condenser.
One 4 mfd. condenser.

h Oscillator, 15 to 2,140 Meters; uencies from 60 to 10,000 Cycles

hiepe
itute of Technology



location of the tubes, the power supply, tuning condensers, coils.

although it cannot be called anything but a Hartley. The variable tuning condenser C is connected across the entire coil and the tap on the coil is connected to the cathode of the tube.

PARTS

One 8 mfd. electrolytic condenser.
Three 1 mfd. condensers.

Resistors

One 100,000 ohm grid leak.
One 200,000 ohm potentiometer with switch attached.
One 10,000 ohm potentiometer with switch attached.
One 2 megohm grid leak.
One 10,000 ohm fixed resistor.
One 2,000 ohm bias resistor.
One 20,000 ohm wire-wound resistor with three movable taps.

Other Requirements

One three pole, four throw switch.
One vernier dail (real vernier).
Two UY sockets.
One UX socket.

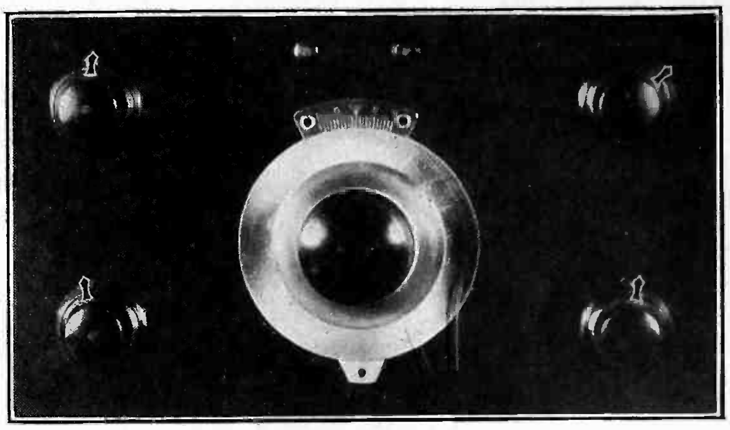


FIG 3
Front view of the neon tube oscillator, showing the arrangement of the controls. The tuning condenser control is in the middle, output binding posts above.

Still one side of the tuning condenser is grounded, the side that is connected toward the plate of the tube. The feedback is obtained through an 0.02 mfd. condenser and a 200,000-ohm potentiometer, one side of this potentiometer being grounded.

The different coils are entirely independent, not even the low sides of them being connected to a common point. This complete opening of the coils when not used is to reduce stray capacity effects. A three pole, four throw switch is used for picking up the different coils. One of the poles is connected to the variable condenser C and the grid leak and condenser, the second pole is connected to the cathode of the tube, and the third is connected to ground.

A radio frequency amplifier is interposed between the oscillator and the output, and this is done to permit variation of the output, to strengthen it when required, and also to prevent change in frequency with different loads.

The input to the amplifier is the signal voltage drop across the lower part of the 200,000-ohm potentiometer, that is, the part below the slider. Regardless of the setting of the potentiometer there is practically no discrimination with respect to frequency. In the plate circuit of the amplifier there is a 10,000-ohm load, and this too is non-discriminatory. A small condenser is connected between the plate of the amplifier and the output binding post that is not grounded. It makes little difference what the value of this condenser is, but the smaller it is the less with the radiation be from any wire connected to the live post or from any coil that may be connected between that post and ground. For most applications a condenser of 0.0001 mfd. is large enough, while values less than 0.00001 mfd. have been used.

The Power Supply

The power supply is a full-wave rectifier with a 280 tube in a typical circuit. The power transformer is such that a rectified voltage of more than 300 is obtainable and it also contains a filament winding for the two 227 tubes in the circuit.

In the filter we have first a 4 mfd. by-pass condenser, then a 15 henry choke, and after that an 8 mfd. condenser. A condenser of this capacity was necessary to eliminate a ripple in the modulated output of the oscillator. The three by-pass condensers not marked are 1 mfd. units. One of these is across the 2,000-ohm bias resistance of the amplifier and two are across sections of the voltage divider.

The on-off switch in the primary of the power transformer is mounted on the 200,000-ohm potentiometer so there is no extra control for it on the panel.

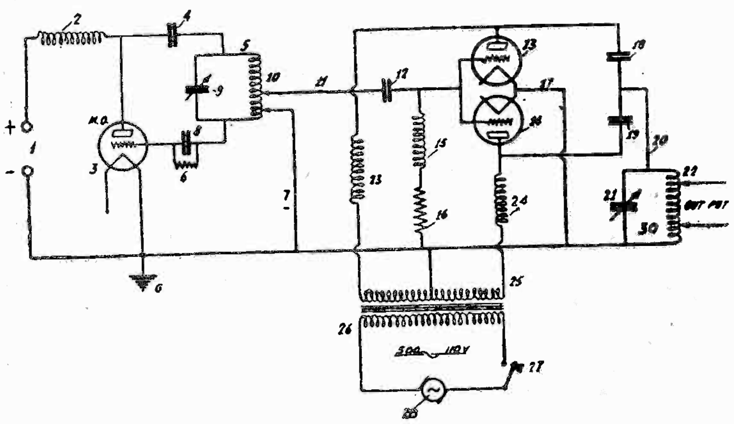
It will be observed that the 10,000-ohm potentiometer that controls the voltage on the neon tube is connected across a 150-volt section of the voltage divider. Thus the highest voltage

(*Continued on next page*)

NEW PATENTS

[Newly issued or reissued radio patents are recorded in this department. The number of the patent itself is given first. Usually only one claim is selected and the claim number also is cited. The code at the end of the title description (Cl., etc.) refers to the classification, the next number being the sub-division, which data define the nature of the patent. All inquiries regarding patents should be addressed to Ray Belmont Whitman, Patent Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.]*

1,848,133. TRANSMITTER. Fred H. Kroger, New York, N. Y., assignor to Radio Corporation of America, a Corporation of Delaware. Filed July 5, 1928. Serial No. 290,378. 3 Claims. (Cl. 250—17.)

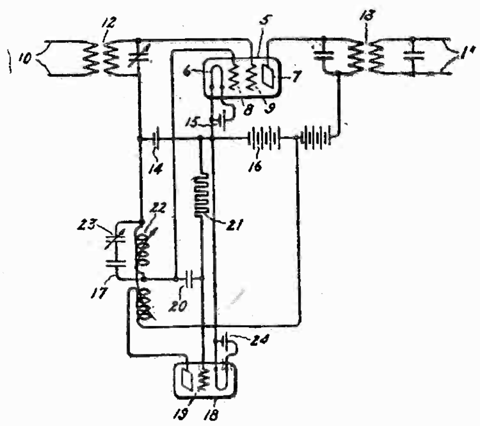


1. An apparatus for signalling at radio frequencies the combination of an amplifier system comprising a plurality of thermionic tubes having input and output elements arranged in a self-rectifying circuit including an output circuit and an input circuit, a tank circuit in said output circuit, means for oppositely supplying low frequency alternating current potentials to the anodes of said tubes including a transformer secondary winding the midpoint of which is connected to the grids of said tubes, keying means associated with said supplying means, and means for supplying high frequency oscillations to the input circuit of said amplifier.

* * *

1,848,823. OSCILLATOR COUPLING CIRCUIT FOR HETERODYNE RECEIVERS. Wendell L. Carlson, Haddonfield, N. J., assignor to General Electric Company, a Corporation of New York. Filed Oct. 7, 1930. Serial No. 487,047. 1 Claim. (Cl. 250—20.)

In a radio receiving apparatus of the heterodyne type, the combination of an oscillation generator including a tuned circuit and an electric discharge device having a grid electrode, said tuned circuit being connected with said grid electrode and ar-



ranged to have oscillations excited therein by said discharge device, and an electric discharge detector having an anode, a control grid, a space charge grid, and a cathode, said space charge grid being directly connected with said tuned oscillator circuit whereby said space charge grid provides a load for said oscillation generator, a source of unidirectional potential connected between said space charge grid and said cathode to impress a negative potential on said space charge grid with respect to said cathode thereby to prevent initial loading of said oscillation generator, a signal input circuit connected with said control grid, and a signal output circuit connected with said anode.

* * *

QUESTIONS AND ANSWERS

CAN THE PURCHASER of a patented article repair it without infringing the patent?—Leon Coply, St. Louis, Mo.

Yes. The purchased article has become the individual property of the purchaser, and is like any other piece of property which he owns. He may sell it, or he may use it so long as its usefulness lasts and then throw it away or dispose of it as junk. He may prolong its life and usefulness by repairs more or less extensive, so long as its original identity is not lost. He is prohibited only from constructing a substantially new machine. He cannot under the pretext of repairs build another machine or article.

Expert Designs 20,000 to 147 kc Oscillator

(*Continued from preceding page*)

that may be applied in the neon tube circuit is 150 volts. If the neon tube should not strike a glow at 150 volts, it is necessary to increase this voltage, for there will be no oscillation unless the tube glows. One commercial neon tube glows on 100 volts a-c but not on 135 volts d-c. This means that the glow begins the tube glows. One commercial neon tube glows on 110 volts age of a 110 volt a-c line is 156 volts. This particular glow tube was used in this circuit.

The voltage divider has a total resistance of 20,000 ohms and is of the wire-wound type with movable taps. There are three taps, one for the plate supply of the oscillator and two for the connections of the 10,000-ohm potentiometer. The taps are placed so that the voltages are 60, 80, and 150 volts. The plate return of the amplifier is made to the 150-volt point.

The output of the neon tube oscillator is impressed on the radio frequency circuit by means of an audio transformer, the primary of which is connected in the plate circuit of the r-f oscillator and the secondary in the neon tube circuit. Therefore, the transformer is reversed, or it is used as a step-down transformer. The audio transformer is in parallel with the 200,000-ohm potentiometer.

If an ordinary oscillator were used for generating the high frequency this arrangement would not work without an r-f choke in series with the audio transformer, because the feedback would be detoured from the tickler circuit through the distributed capacity of the primary of the audio transformer. In this circuit, however, the capacity aids in maintaining oscillation, because no matter which way the high frequency current goes from the plate to ground it must flow through the tickler to get to the cathode of the oscillator tube. The only effect the capacity of the transformer winding has is to lower the high frequency voltage across the 200,000-ohm resistance and hence to lower the input to the amplifier tube. This, of course, lowers the output, but the lowering is partly compensated for by the greater radiation efficiency of the higher frequencies.

The tuning condenser C used in this oscillator is of the type that turns all the way around, requiring a 360 degree dial. It contains two sections, one changing the capacity from 9 to 100 mmfd. and the other from 100 to 375 mmfd. The switching from one to the other is automatic. The dial is National Company's precision type, true vernier, 360 degree scale.

The final data on the coils L1, L2, L3, and L4 are not yet available. The first set of coils designed and calibrated had insufficient overlap. Hence a new set of coils is being developed. Those interested in the new coil data may obtain them by writing to the author care RADIO WORLD, 145 West Forty-fifth Street, New York, N. Y., although it is planned to publish them some weeks later in these columns.

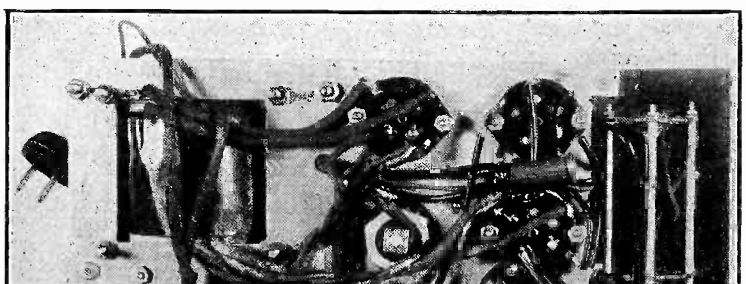


FIG. 4
The bottom view. The coil-change switch is at right.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Answers printed herewith have been mailed to University Members.

Radio University

To obtain a membership in Radio World's University Club for one year, send $6 for one year's subscription (52 issues of Radio World) and you will get a University number. Put this number at top of letter (not envelope) containing questions. Address, Radio World, 145 West 45th Street, New York, N. Y.

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.

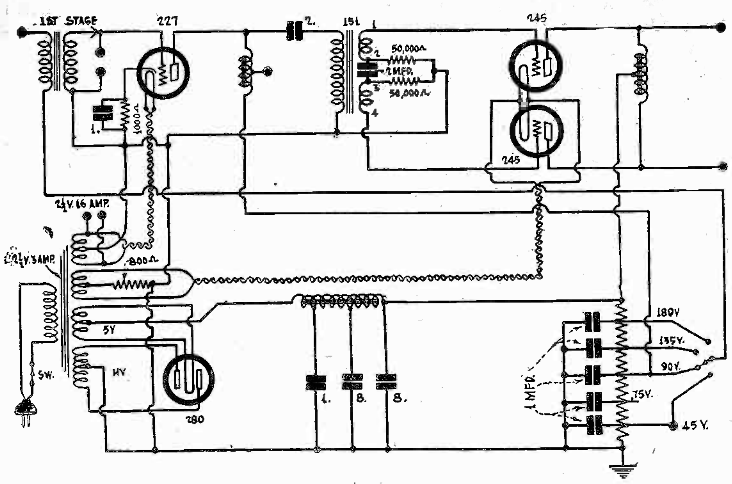


FIG. 996

Diagram of a push-pull power amplifier built by R. W., of Ames, Ia., and concerning which helpful suggestions are given for the sharp reduction of hum.

Constant D-C Voltage Drop

AS I AM confronted with an unusual problem I would appreciate your assistance. I do considerable work in districts where they have 110 volts d-c, and for operating certain devices a voltage reducer is necessary. Around 25 or 30 volts are utilized. As the load is not known in advance, and as the voltage must remain constant, I am perplexed. At first I tried high bleeder as a stabilizing agency, but that required 10 amperes to support normal fluctuations from 0 to 2 amperes useful drain, and of course that is too expensive. Have you any better solution?—S. M. E., Brooklyn, N. Y.

A far better plan would be to incorporate relays, so that the drain would determine which voltage divider taps would be effective. The d-c relays are relatively simple and quite dependable. You can get intimate information about their technical operation from relay manufacturers.

* * *

Frequency Ratio Over Wide Band

IN COVERING a wide band of frequencies, say, from 150 kc to 15,000 kc, which is a 1-to-100 frequency ratio, please let me know whether the actual ratio per band will increase or decrease with increase of frequency, and, if possible, verify with experimental data.—W. E. R., Roanoke, Va.

The frequency ratio is determined by the capacity ratio of the circuit, since the frequency ratio is the square root of the capacity ratio. In general, this ratio remains approximately constant. It is usual to treat the situation as if the ratio contracts as the frequency increases, but this is only to insure overlap, that is, no gap between bands. The ratio may change in either direction, or in one direction first, and in another direction next, although as a rule the ratio will increase with frequency. This is no doubt due to the lesser capacity contributed by the smaller coils with their better shape factor, i.e., ratio of axial length to diameter. The result of an experimental determination of ratios, using a condenser of 0.000375 mfd. maximum capacity, four different coils, is as follows, the slight missout or gaps not being material to the ratio determination: coil No. 1, 140-432 kc, ratio, 3.08; coil No. 2, 487 to 1,500 kc, ratio, 3.07; coil No. 3, 1,620 to 5,120 kc, ratio 3.16; coil No. 4, 5,400 to 17,700 kc (last-named frequency at division 12 on a 100-division dial), ratio better than 3.33.

* * *

Bias Resistors for Vari-Mu Tubes

RECENTLY I have tried different values of biasing resistors in r-f amplifier circuits using -35 and -51 tubes and I find that the biasing resistor may be much higher than usually recommended, and that results are improved. Is this consistent with your experience?—I. K., Duluth, Minn.

Yes, it is. Often the tubes do not draw as much plate current as the standard rating, and therefore the biasing resistor may be of greater than ordinarily recommended values. Receivers on which much experimenting has been done are often found to have high values of biasing resistors. For instance, a receiver in the present issue has three such tubes on a common 500 ohm biasing resistor, equivalent to 1,500 ohms for one tube, and the 627 t-r-f set has 600 ohms on two tubes, equivalent to 1,200 ohms for one tube. The gain is less but the selectivity and stability are better.

* * *

Freedom from Motor Noises

ARE SPARK SUPPRESSORS practical in the elimination of motor noises from an auto set? Please give some directions as to the location of apparatus for best results.—J. K. W., Spokane, Wash.

Spark suppressors help a little, but if the trouble is very serious the suppressors are not likely to solve it. One of the first considerations is to keep the shielded battery cable away from the motor, and therefore the battery box had better be placed somewhere near the rear of the chassis, say, half way between the instrument board and the differential. It is customary to put this box underneath, to one side of the drive shaft. Another precaution is to remove the high tension coil from behind the instrument board and mount it on the motor frame, since one side of this coil is grounded anyway, and bring a shielded wire back to the place the coil occupied on the instrument board. The auxiliary use of spark suppressors may help some. In cars that have a shield case over the spark plugs there is no especial need for the suppressors, which make the spark a little less intense. Usually the voltage is so high that the loss created by inclusion of the suppressors is not detrimental. The aerial should not be close to the motor, and naturally would not be, but if the aerial is placed under the running board it should begin a few feet behind the most forward point of the board. When these precautions are taken it is very unlikely in any car installation that you will run into motor noise trouble. Many instances of sparking noises, due to running motor, have proved troublesome to original installers and service men, and these remedies have proved effective.

* * *

Auto Circuit Recommended

WILL YOU PLEASE recommend to me an excellent design for an auto set, one that will provide reception on a par with that obtained from a high-class a-c receiver in the home?—J. S. A., Atlanta, Ga.

The eight-tube auto set designed by J. E. Anderson is highly recommended. It has pentode-vari-mu r-f push-pull pentode output. The circuit is a superheterodyne and permits reception of distant stations 10 kc removed from powerful locals. Besides, it has a sensitivity of 10 microvolts per meter, which is as good as obtained from fine broadcast superheterodynes for a-c operation in the home. This circuit is covered by Blueprint No. 631. The set may be mounted on the fireboard, which is just behind the instrument board, while the battery box and other apparatus may be placed as recommended in the reply to J. K. W., of Spokane, Wash. Provision is included for cars with either A plus or A minus grounded. Users have tuned in as many as 80 different stations in one night from all parts of the United States, Canada and Mexico, while the car was running.

* * *

Reducing Hum in Power Amplifier

HEREWITH is the diagram of a power amplifier I built. Can you suggest some means of reducing hum? It isn't so terrible but should be less.—R. E., Ames, Ia.

The choke input method is provocative of more hum than the regular method, although it extends the life of the rectifier tube. If you will rearrange the filter capacities the hum will be less. Put 8 mfd. directly next to the rectifier (center of 5-volt winding to ground), use the 1 mfd. at the central position experimentally, but remove it entirely if hum is less, as sometimes happens due to phase relationships, and leave the other 8 mfd. at the end of the filter, where you have it. Condensers of 0.1 mfd. across the 50,000 ohm resistors in the grid return of the push-pull input transformer will serve as additional hum filters. Also experimentally reverse the connections to the output transformer primary. When these methods have been tried, and the successful results retained, you will be surprised at the very great reduction in hum.

Manual and Automatic Volume Attenuation Problems

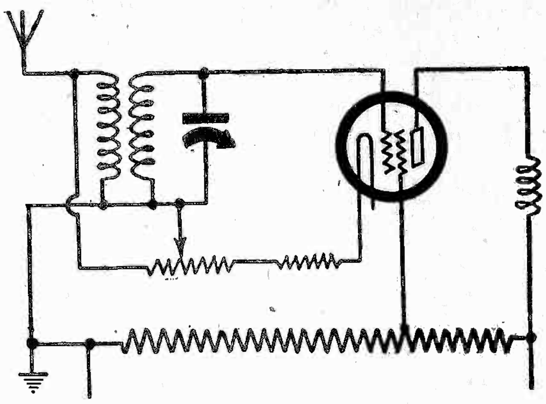


FIG. 1

Manual volume control, functioning both to alter the tube characteristics and to attenuate the r-f input. The taper of the control should be such that the characteristic is changed fast in the beginning and then r-f attenuation begins to be effective.

DORMAN H. ISREAL, formerly with the Crosley Radio Corporation, now chief engineer of the Grigsby-Grunow Company, hit it on the head when he intimated in his article, "Sensitivity Controls, Manual and Automatic," in the March issue of "Proceedings of the Institute of Radio Engineers," that there has been all too little done and said about sensitivity controls.

These are more popularly known as volume controls. It is hardly ever that a circuit designer does not ask himself the question: "Where shall I place the volume control?" Mr. Isreal, in a measure, answers this question, although the article takes the form of a discussion and contrast of various methods, with statement of the advantages and disadvantages of each, leaving the reader finally to his own choice or invention.

While the sensitivity of receivers has been increasing from year to year, he points out, the requirements for sensitivity control have grown more important as this improvement in sensitivity has taken place. He finds that at present a total attenuation of 160 decibels is necessary, and states that this gradient may be evenly divided, 80 decibels for prevention of overload of the demodulator (detector), with any degree of modulation, and the other 80, which may be accomplished in the audio system, to reduce the power output to ½ volt, an arbitrary figure, when the detector is not overloaded.

One Control for 160 db Attenuation

He points out that when a manual means is provided it is usual to accomplish the entire attenuation by one control, while if automatic volume control is used, the manual adjunct can take care of 80 db and the a-v-c the other 80. Where a local-distance switch is used, he says, this commonly has an attenuation of 40 db.

The article is divided then into two groups, the first giving attention to manual sensitivity control, which means a device for accomplishing the full 160 db attenuation, and the other automatic volume control.

He classified the two methods of manual volume control into the attenuation of r-f input, or effect directly on the carrier, and alteration of vacuum tube characteristics, and finds there is danger in both methods unless the best engineering practice is followed. Attenuation of the r-f input provides a large attenuation ratio quite readily, distortion is readily avoided, but selectivity and sensitivity may be impaired, also detuning take place unless a corrective is introduced, and the volume control, unless smoothly operative, may become "noisy," due to carrier modulation.

The leads carrying r-f potentials have to be shielded carefully, otherwise the effectiveness of the control is reduced, due to pickup subsequent to the control, and also the set may seem to be too noisy on weak signals, since the tube noises are amplified without diminuation, for the carrier input alone is cut down.

Alteration of Characteristics

As for alteration of vacuum tube characteristics, this may take place in all stages ahead of the detector, and therefore the background noise is cut down as well as the signal, also the volume control element need not have a precise gradient, because the control is not in the carrier circuit, modulation therefore does not take place, and besides the bypass condensers across biasing resistors (of which the control may be is one) introduce a time constant. Proper use avoids diminution of selectivity and absence of any serious detuning.

For alteration of characteristics he advises that the method be confined to r-f tubes of the remote cut-off type (variable mu), but cautions that a good tube must be used, one that really has a remote cutoff, otherwise cross-modulation of a weak carrier by a strong one will take place, or two moderately strong carriers will combine to generate a new frequency, equal to the sum or difference of the two, causing an interference response provided the new frequency is in the receiver range. Also, harmonic multiples of a strong fundamental will be heard. Without a good quality remote cutoff tube serious distortion will result by the use of this method, he warns, because the peak of the modulated wave will break through the r-f amplifier, at high gain, while the troughs are attenuated severely.

A diagram illustrates methods that may be used, including an adjustable resistor across the antenna primary, across the secondary of the antenna coil, and various methods applicable to these circuits and to circuits following the first tube, although he favors r-f attenuation prior to the first tube, or at its input. The effect of the permanent load introduced by some of the methods is considered. Variation of the cathode potential, screens potential and combination cathode-screen potentials is considered.

A Combination Method

A combination methods meets with his favor—that of alteration of the characteristic, by variation of the grid bias voltage, and at the same time attenuation the r-f input, the constants being chosen so that the r-f attenuation begins just before the distortion point, the characteristic alteration playing its most effective part first, and then the r-f attenuation becoming effective. This method he illustrates with a diagram (Fig. 1 herewith).

Automatic volume control tubes now operate exclusively through variation of the characteristics, but he points out that a gas-vapor type tube would make it practical to attenuate the r-f input. At present, he says, "it would be decidedly inadvisable to consider such a tube," meaning no doubt that the cost of the receiver would be increased at a time when low cost is imperative to volume sales.

The author considers various automatic sensitivity controls and shows that some of them introduce distortion due to overload. He seems to like the method of using the same tube as detector and a-v-c, as diagrammed in Fig. 2 herewith. Of this he says:

"With a signal impressed on the demodulator grid, the plate current will increase, and if this plate current passes through resistor *B*, the voltage drop across the resistor will increase. By suitable connections as indicated this voltage drop across resistor *B* is made to function as the automatic bias. This system is, of course, quite economical, and the loss in sensitivity due to the addition of the resistor *B* to the demodulator plate circuit is not serious. On the other hand, control commences for any strength of carrier and is, of course, not as complete as the previously described systems, although it may be made equal very nearly those of Figs. 7 and 8 (of this article).

Difficulty Obviated

"The difficulty of the control's taking place immediately as the carrier is impressed on the receiver can be greatly reduced by the use of the self-bias resistor *C* as indicated in the diagram. The control applied to point *A* causes the plate current to decrease and therefore the voltage across resistor *C* will decrease. The combination of these two differential effects tends to hold the net grid bias of the controlled tubes constant over an interval up to the point where the control voltage across resistor *B* becomes sufficiently large to take hold."

It should be noticed that there must be some B voltage to spare before this system can be introduced, due to the r-f cathode return being lifted above ground or B minus potential.

A mechanically resonant transformer for coupling tubes in an amplifier is described by Ross Gunn, Naval Research Laboratory in the March "Proceedings." The idea is to drive a vibrating reed with an electromagnet actuated by the output of one tube and then to cause the motion of the reed to induce a voltage in a second electromagnet circuit.

For driving electromagnet a headset unit from which the

Control Methods; Applied to Very Sensitive Sets

diaphragm has been removed is suggested, and in place of the diaphragm the vibrating reed is used. This, of course, must be of a magnetic material or an iron piece must be attached to the reed if it is not of a magnetic material. If this reed is placed in front of the pole pieces of a second headset unit, or any other electromagnet, its motion will change the reluctance in the circuit of the second magnet and a voltage will be induced in the winding on that magnet. It at once becomes evident that a large number of variations of this general scheme is possible.

Previous Use

A similar arrangement has been used previously in connection with tuning forks driven by a tube amplifier. One headset unit was placed near the end of one prong and the plate current of the tube was sent through the winding of this unit. A second and equal unit was placed near the end of the other prong and the winding of that unit was connected in the grid circuit of the tube. This arrangement formed an oscillator in which the two electromagnets and the fork formed a mechanically resonant transformer. The present application seems to be the first use of this scheme of coupling two tubes in an amplifier.

The main advantage of the mechanically resonant transformer is high selectivity at an audio frequency. The selectivity of the mechanically resonant transformer reported by Mr. Gunn was 115, which compares favorably with the highest selectivity in tuned electrical circuits at high frequencies. If a greater selectivity is needed the mechanical system is quite capable of giving it for we are not limited to vibrating reeds of steel or iron. We could use fused quartz reeds with small iron armatures attached or tuning forks, which would have still higher selectivities. Again, we could use highly elastic steel rods, making use of the longitudinal vibrations. The selectivity of the vibrating element used would be determined by the required selectivity, which might lie between certain fixed limits.

Not an Audio Transformer

Obviously, a mechanically resonant transformer having a natural frequency in the audio range cannot be used for coupling tubes in a receiver intended to amplify voice and music frequencies. Only one frequency would be amplified, and the frequency distortion would be practically complete. But there are many applications where such a device would be exceedingly useful. For example, in code transmission on fixed audio frequency, or in interrupted continuous wave transmission where the beat frequency could be made anything desired, the system would be valuable. It would be possible to select the tone desired and tune out all interfering noises.

The system is not suitable for high speed signalling, especially if the resonance is highly selective, because vibrating element would tend to persist in its state of rest or motion. It would take some time for the vibration to build up and it would also take some time for it to die down.

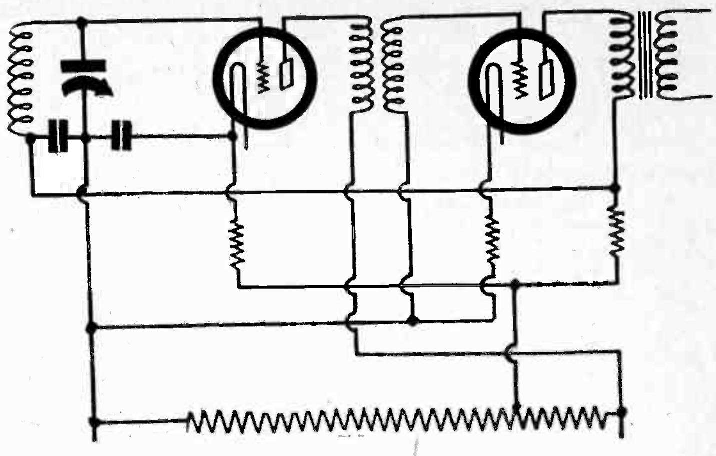


FIG. 2

An automatic volume control method, using the detector tube also for a-v-c purposes. The cathode return of the r-f tube is above ground potential. Although only one r-f tube is shown, others of course would be included, resistor-capacity filters in the grid returns of the individual controlled stages.

MAGNETOSTRICTION USE SUGGESTED

Sometime ago we heard a great deal about the Stenode method of radio reception. The advantage of this method was its extraordinarily high selectivity, and this high selectivity was due to the mechanical resonance of the quartz crystal. In effect the crystal with its associated equipment was a mechanical transformer.

However, instead of making use of the magnetic quality of iron for driving the mechanical resonator and for inducing a voltage in the secondary circuit, the piezo-electric property of the quartz crystal was used.

And here we might suggest the possibility of using the magnetostrictive properties of certain compounds of nickel for making a mechanical transformer. About the same thing can be done with the magnetostriction rod as can be done with the piezo electric crystal.

VERY LOW PRICED TELEVISOR

The Pioneer Television Co., Inc., Jersey City, N. J., announced that it will place on the market a very inexpensive and practical television receiver.

John J. Fettig, chief engineer of the Pioneer company, said:

"The layman's increasing interest in television justifies the production of an inexpensive receiver within the reach of any fan's pocketbook. It is my belief that taking a leaf from the book of automotive experience that a Ford-priced outfit will prove popular."

Tradiograms

By J. Murray Barron

Blair Radio Labs. has just put into production a new all-pentode Amplifier in modified Class B form for 110 volts direct current. This will deliver a 3-watt undistorted output and will fill a much-needed want, this type of apparatus not having been available before.

* * *

The appointment of Alfred H. Hotopp, Jr., as engineer in charge of the receiver division of the DeForest Radio Company was announced. Mr. Hotopp has been identified with the radio work of the American Telephone & Telegraph Co. He also served as assistant engineer with the Kolster Radio Corporation.

* * *

Federated Purchaser, Inc., 25 Park Place, N. Y. City, has just issued the Radio Bargain News, a 68-page tabloid catalogue showing more than 3,000 replacement parts. They specialize in replacement parts for all makes of radio receivers. There are branch offices in Jamaica, L. I., Washington St., Manhattan, Mt. Vernon, N. Y., Newark, N. J., Philadelphia, Pa., and a new office has recently been opened at Atlanta Ga. The organization is headed by Sam Roth, president. I. Weinrib is general manager and R. Joseph is advertising manager.

* * *

J. Loeb, of Specialty Service Corp., 651 Atlantic Ave., Brooklyn, N. Y., now distributors of Majestic radios, have been appointed as Brooklyn distributor for Maytag washers.

* * *

A. J. Steelman reports the forming of All-American Mohawk Distributors to handle Lyric Radio and Mohawk Refrigerators.

* * *

Blan The Radio Man Inc., 89 Cortlandt St., has just secured a large and varied stock of assorted switches. There is hardly a requirement or condition in the radio field that some one of these switches can not fill. For the Ham and DX hound he has an imported headphone of 4.000 ohms, a product of Deutche Telfon Werk, Germany.

* * *

P. R. Fredericks, 341 West 23rd St., N. Y. City, who has been identified in radio since the crystal sets days, and for the past seven years has been in the Chelsea district, has taken on the Freed-Eiseman line. He also deals in the Super-Aerial, a product of his own. This is sold complete. and there is an instruction book on how to build "King of Radio Aerials." There is also free literature.

* * *

McGraw-Hill Book Company, Inc., 330 W. 42nd St., N. Y. City, list a number of radio books in their catalogue. They also publish a great many other books on various subjects, from accounting to zoology, all of which can be examined at the New York retail store, also at 520 N. Michigan Ave., Chicago, Ill., and 883 Mission St., San Francisco, Cal.

A THOUGHT FOR THE WEEK

(10 × 1) + 1 = 10+1=XI—*which means* that RADIO WORLD starts its eleventh year *with next week's issue. Let's express the hope that ten years from now you'll be reading this page and share our happiness on our twentieth birthday.*

RADIO WORLD

The First and Only National Radio Weekly

Tenth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45tn Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor; J. Murray Barron, advertising manager.

Ultra—What?

FREQUENCY or wavelength—which shall it be? In the beginning almost everybody favored wavelength, and we heard tell of this or that station on this or that wavelength. Then a trend toward scientific endeavor struck even the set manufacturers, the dials on whose sets had been marked only in arbitrary numerical divisions, say 0-100. Frequency calibrated dials became popular on broadcast sets. Listeners were advised that it was preferable to refer to a station's frequency and forget about the wavelength equivalent. Newspapers that formerly printed wavelength only, in their program schedules, included the frequency. Everything seemed set for the final and triumphant ascendancy of frequency

Now along come the ultras, call them frequencies or wavelengths, as you prefer. The argument is put forth that wavelength designations are simpler, because the numbers are low, and the thought more readily expressed in wavelength. Five meters! How simple! Imagine trying to state the equivalent in cycles—59,960,000!

However, it appears that thousands of cycles may be expressed as kilocycles and therefore we have 59,960 kc, and indeed that millions of cycles may be expressed as megacycles, whereupon we have 59.96 megacycles. Still, 5 meters is simpler.

Who uses just 5 meters for transmission? The announcement from the station using an ultra wave nearly always comes in terms of kilocycles, as if to prove that the license owners do not agree with the statement that expression in meters is better.

Therefore we take a couple of such announcements of frequency as examples. W1XG, which will begin sight transmission from Boston, will be on 45,000 kc. This is 6.663 in meters. However, in megacycles the frequency is 45. Now which is simpler—6.663 meters or 45 megacycles?

W6XAO, Los Angeles, states it is using 44,500 kc., which is 6.738 meters. Which would you prefer for ease of statement and memory—44.5 mgc. or 6.738 meters? Just one more example. The NBC Empire State transmitter has been found on 44.74 mgc, which may be expressed also as 6.28 meters. Again, which is the choice

Suppose a station is on 43 mgc. Then the wavelength in meters is 6.973. Also contrast 60 mgc and 4.997 meters.

It seems, therefore, that not only are we confronted with as much confusion one as another, but that we must really let the more scientific method prevail, accepting with thanks the simplicity it sometimes affords, and protesting not too much about the awkwardness attaching to some of the values. And, of course, it is the frequency basis that is the more scientific, for one thing because it permits expression of absolute differences among various frequencies, whereas differences in meters have to be converted to frequencies to possess any meaning.

On the score of simplicity there is no choice between the two except on the basis of roundness of numbers, and if there seems to be more rotundity on the frequency basis we shall have to accept that.

It would be just as convenient to represent musical tones in terms of wavelength in air as to represent radio frequencies in terms of wavelengths in space. Imagine calling middle C four feet.

Three Blossoms from a Garden of Congratulations

RCA President Sends Best Wishes

I WANT to congratulate you on the Tenth Anniversary Number of RADIO WORLD. It must be gratifying to you to look back over the many years of real service to the thousands interested in the technical side of radio development. I send you best wishes for the next decade.

Very truly yours,

DAVID SARNOFF.

* * *

From a Noted Engineer

WANT to congratulate you on your printing of the Tenth Anniversary Number of RADIO WORLD. There is still a real need for the presentation of timely and helpful information on radio and television.

With best wishes for your continued success, believe me

Very truly yours,

JOHN V. L. HOGAN.

* * *

We're Willing

Walter Winchell Unburdens Himself

KEEP having good luck—it is necessary, no matter what legends you've heard. . . . And you, of all persons, ought to know how necessary it was for me to get the so-called sugary breaks. You knew me when the breaks were so sour.

Azzever,

WINCHELL

SUNDRY SUGGESTION FOR WEEK COMMENCING MARCH 27, 1932

March 27:	Footlight Echoes	WOR	10:30 p.m.
March 28:	Evening in Paris	WABC	9:30 p.m.
March 29:	Billy Jones and Ernie Hare	WJZ	7:45 p.m.
March 30:	Big Time	WEAF	8:00 p.m.
March 31:	Golden Blossoms	WJZ	8:30 p.m.
April 1:	Barbara Gould	WABC	10:45 a.m.
April 2:	Little Symphony	WOR	8:00 p.m.

(If you care to know something of your favorite radio artists, drop a card to the conductor of this page. Address: Miss Alice Remsen, and RADIO WORLD, 145 *W. 45th St., New York City.)*

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, **RADIO WORLD, 145** ***West 45th Street, New York, N. Y.***

A. L. Phillipson, 1226 River Road, Milwaukee, Oregon.
S. & H. Radio Co., Blackwell, Okla.
Edward A. Childs, 129 Ford Ave., Highland Park, Mich.
John Chapman, 2-2 So. 63rd St., Philadelphia, Pa.
Leo Feder, 1239 Sassafras St., Cincinnati, Ohio.
La Veta Light, Heat & Power Co., La Veta, Colo.
Howard F. Osterman, 201 W. Forest Ave., Olean, N. Y.
Schubert Radio Shop, 753 W. 32nd St., Chicago, Ill.
Frank Hill, Apt. 401, 6315 Harper Ave., Chicago, Ill.
Reece M. Carey, 1409 6th St., S. E., Minneapolis, Minn.
Murray A. Kahn, 8687 Bay Parkway, Brooklyn, N. Y.
Roy L. Small, 34 Lothrop, Detroit, Mich.
Theodore C. Vinther, 1612 Buena Ave., Berkeley, Calif.
Don H. Myers, 3041 Observatory Rd., Cincinnati, Ohio.
John G. de Freitas, 363 Eighth St., Troy, N. Y.
Edwin C. Nelson (automobile radios and prices, auto radio B eliminators, radio parts catalogues), 1606 D. St., N. E., Washington, D. C.
E. A. Thiele, 62 Greene Ave., Amityville, L. I.
Jas. J. Thompson, 549 Woods Ave., S. W., Roanoke, Va.
J. B. Hunt, 730 Macdonald Ave., Richmond, Calif.
Russel Strong, Box 28, Butler, Ohio.
John Kolodziej, 4201 S. Albany Ave., Chicago, Ill.
Ralph L. Cleveland, 5 St. Paul St., Montpelier, Vt.
William Bokney, No. 1 West Ave., Elyria, Ohio.

IMPORTANT NOTICE TO CANADIAN SUBSCRIBERS — RADIO WORLD will accept new subscriptions at the present rates of $6 a year (52 issues); $3 for six months; $1.50 for three months; (net, without premium). Present Canadian subscribers may renew at these rates beyond expiration dates of their current subscriptions. Orders and remittance should be mailed not later than May 15th, 1932. Subscription Dept., Radio World, 145 W. 45th St., New York, N. Y.

STATION SPARKS

By Alice Remsen

Orpheus

FOR MELODY MAGIC
(WABC, Wednesdays, 9:15 a.m.)

When Orpheus tuned his lovely lute,
And Thracian hills and valleys filled
With sound; he made the birds all mute,
So beautiful the songs he thrilled.

He charmed the furious forest beast,
And every tree bowed down its head;
He moved the rocks. From West to East,
And North to South his music spread.

Its echo wanders through the spheres,
A mighty everlasting strain;
And evermore throughout the years
His melody is heard again.

O Orpheus, sweet Orpheus!
Thy lute will never silent be.
O Orpheus, sweet Orpheus!
Thy music sounds eternally.

—A. R.

* * *

A Sweet Fifteen Minutes For Music Lovers is Melody Magic, one of the few worth-while early morning periods. Vincent Sorey conducts the orchestra and the Vocal Art Trio provides the singing. This trio of sweet-voiced young women is doing good work on WABC. Just tune in on these three contraltos—Evelyn McGregor, Helen Nugent and Charlotte Harriman—and judge for yourself. The girls may also be heard via WABC or Saturdays at 8:45 a.m.

* * *

Everyone Knows That Bing Crosby was born in Tacoma, Washington—but did you also know that he once fought Don Fraser, the Spokane junior lightweight? Well, he did—and got a draw. This is how it happened. The boys went to school together in Spokane, where Bing lived for a while. Came a quarrel; the battle was on, with bare fists—the prize was the heart of a sweet demure lassie. The draw? Well, neither won the girl.

* * *

There's A Girl, Named Nancy Turner, who broadcasts styles from WBAL, Baltimore, thrice weekly—Monday, Wednesday and Friday mornings at 9:15, E.S.T. She really knows fashions and is very popular among the women of Maryland, Pennsylvania, Virginia and West Virginia. Miss Turner makes a trip to Paris every season, visiting the exclusive salons of Jean Patou, Mme. Chanel, and Lucien Lelong. She also keeps in constant contact with leading fashion authorities, so that her talks are always up to the minute and authoritative. A very smart girl, Miss Turner. She is easy on the eyes, is always very correctly dressed, many of her clothes being specially designed. She is charming and attractive. Her special shopping service was inaugurated at WBAL early this year and is proving to be a very popular feature.

* * *

Tenor Lannie Ross, now heard in the Maxwell House series over the Columbia network, was a star track athlete during his days at Yale. At one time, having negotiated the distance in 48-2/5 seconds, he held the university's quarter-mile record. He was a member of the one-mile championship team at the Penn relays. He also was the 300-yard dash champion for two years and was on the American team that competed with Oxford and Cambridge at London. Today his singing has put him on the right track, and he's been traveling along at a rapid clip.

The Pickens Sisters of Georgia have been signed exclusively by the National Broadcasting Company and may now be heard every night except Saturday and Sunday at 10:45 p.m. E.S.T. over WJZ in a fifteen-minute program of unusual vocal harmony. The singing of the youthful Georgians so impressed N.B.C. officials at their first audition that a contract was offered immediately. The sisters have been harmonizing together since Marla was four, Helen six, and Jane eight. That was seventeen years ago. Marla's twenty-one now.

After finishing high school in Atlanta, Jane was sent by her parents to the Curtis Institute of Music in Philadelphia. There for two successive years she won the Marcella Sembrich Honorary Scholarship, and was under the direct tutelage of Mme. Sembrich. Another year found the three sisters studying together in Paris. Working together since, they have developed entirely new ideas and effects. Their musical background is distinctly of the South. They lived in a small Georgia town before moving to Atlanta, and the singing of the colored folk impressed them strongly. As little girls they sang the old songs of the South, and the intervening years have broadened their native talents, until now—well—you just listen in to them singing popular songs in their own peculiar way and you, too, will rave about them.

* * *

Sidelights

RUTH LYON, N.B.C. soprano, once taught Latin and French in Chicago . . . HOWARD LANIN was leading his own dance orchestra when he was seventeen . . . WELCOME LEWIS began as a 14-year-old "hot fiddle" player with her own orchestra in Venice, California . . . NAT BRUSILOFF came out of Russia so early that he can't remember where he was born . . . NORMAN BROKENSHIRE began life as a minister's son in the small towns of Canada and New England . . . ARTHUR ALLEN is renowned for his downeast radio accent, but he employs a Scotch chauffeur and a Chinese cook . . . ANN LEAF'S big ambition is to create something worth publishing—prose, not poetry . . . ERNIE GOLDEN has had more than a hundred of his own compositions published . . . BEN ALLEY is the latest radio artist to succumb to the lures of Lady Vaudeville . . . RALPH KIRBERY has entered the recording field. His first records are "Goodnight, My Love" and "Dream Sweetheart" . . . ALOIS HAVRILLA, N.B.C. announcer has been elected president of the Northern Valley Civic Music Association . . JUNE PURSELL is an ardent football fan . . . MAX SMOLEN, the popular Bourjois "Evening in Paris" orchestra conductor, has an ideal family—a devoted wife, a clever daughter and a bright young son. They live in Brooklyn, and think there's no one on earth like their daddy... MARIA CARDINALE, sweet-voiced prima-donna of the Golden Blossom program on WJZ and Footlight Echoes on WOR, is an ardent book collector. She owns many first editions and is an authority on bibliography.

* * *

Biographical Brevities

A FEW FACTS ABOUT BILLY JONES AND ERNIE HARE

Billy Jones and Ernie Hare met each other thirteen years ago. They were introduced by Gus Haenschen in a recording laboratory, and the team of Jones and Hare was born right there. They appeared together in vaudeville and eleven years ago made their first radio broadcast. They've been doing it ever since and are still together.

They were born on the same day of the month, and, although not related, their mothers had the same maiden name. They are the same height and the same weight and are even beginning to look alike. Both had a try at business before taking the advice of friends and going on the stage, and both were successful in their own right before they met and launched a new career in radio.

Since we must separate them, let's take Ernie Hare first. He was born in the South, in Norfolk, Va., to be exact. As a boy he sang in church choirs, but for a career he selected the baking powder business. He became a traveling salesman but failed to down the desire to sing.

In his home city of Baltimore, Md., he sang in no less than five churches, and attended the Peabody Conservatory of Music. Then he broke into the theatrical profession. He made Broadway in four years and his record includes fourteen musical shows, among them "Sinbad" in which he understudied Al Jolson. Then he met Billy Jones.

Southerner, Too

Jones will tell you he was born in the South, too; he was—on the Southern half of Manhattan Island. He also sang as a choir boy during his early school days, but abandoned the thought of a musical career and went to work in the Custom House in New York. This was abandonded in favor of a place in a bank, which in turn gave way to hard labor. He herded sheep in Wales, mined ore in upper New York State, climbed poles for the telephone company and made cable for the Western Union. All the time he continued to sing for his fellow-workers and friends. Eventually they persuaded him to give his voice a real trial and he launched out on a theatrical career. Then came several seasons in vaudeville, during which time he tried several partners, among them Bert Grant and Arty Speigel. I remember seeing him with the latter in a blackface act, written for them by Otto Johnson, in which Speigel played a Red Cross nurse and Billy played a wounded soldier. Speigel used to come on the stage pushing a wheelbarrow in which reclined Jones, with bandaged head and woe-begone expression. It was a very funny act. Billy finally reached musical shows on Broadway and scored a real success. Then he started making phonograph records and that's how he met Ernie Hare.

Face Microphone

Their career from then on was a certain success. For a while they appeared in vaudeville. Then, more for fun than anything else, they faced a microphone. One broadcast led to another, and today the boys claim the distinction of being the first entertainers ever to be paid for radio work. They are still being paid—aplenty.

By 1925, the year the National Broadcasting Company was organized, they were the sensation of the networks. One series, in which they were known as the Happiness Boys, ran for five and a half years, and another, in which they made themselves famous as the Interwoven Pair, ran for three years. Now they are launched on a third long-time contract, for three years, with Best Foods.

Those boys do nothing by halves. Three years or nothing is their motto. They are a jolly pair, each possessing a good comedy sense and a fine personality which registers great over the air. Long may they continue to entertain their millions of friends!

$768,903 NET FOR RCA IN 1931; $1.95 DIVIDEND

Gross operating income of the Radio Corporation of America for 1931, according to the annual report just placed in the hands of stockholders, was $100,124,847, or about $32,000,000 less than during the previous year, the net income was $768,903 as against $5,526,293 and the Class A preferred shares earned $1.95, as against $13.87 for 1931. No dividends have been paid or declared on common stock.

It is proposed to reduce the capital and surplus by $45,258,200, and forms to this effect are in the hands of common and Class A stockholders. Treasury stock is to be retired as follows: 36,100 of Class B preferred and 30,060 of common. The capital representation of common stock is to be reduced from $4.22 to $2.

The number of stockholders increased in 1931, so it is now over 100,000.

Feels Effect of Depression

"Radio was no less affected than older or more seasoned industries by the world-wide subnormal business conditions prevailing throughout the year, by the decline in price levels and by unemployment which curtailed the purchasing power of many families," James G. Harbord, chairman, and David Sarnoff, president, say in their report.

"Although your company entered the year with a compact and efficient organization and with production schedules balanced closely with sales response, expanded programs could be undertaken only along limited lines. In export activities the decline in foreign exchange adversely affected the earnings of your company. Intensive effort was directed toward the further improvement of manufacturing processes and in effecting economies in costs of distribution.

Consolidation Reported

"RCA Victor Company, Inc., marketed during 1931 a competitive line of radio sets and phonographs embodying many new developments of the research laboratories and offering the best values in the history of your company. The dealer organization was strengthened throughout the country, and a consolidation was accomplished on the Radiola and Victor lines of broadcast receivers."

Jenkins Taken Over By DeForest Company

At a stockholders' meeting, the DeForest Radio Company was authorized to purchase the assets of the Jenkins Television Corporation.

According to Leslie S. Gordon, president of both organizations, this move will effect marked savings in the operations under joint management, as well as facilitate the more rapid development and exploitation of the television art. The consolidation of interests completes the consolidation plans of the DeForest Company, begun with the acquiring of a controlling interest in the Jenkins Corporation through an exchange of stock two years ago, said Gordon.

An effort by a few stockholders to enjoin the sale proved futile.

Television Stations Reach Total of 27

Washington.

Two more stations have been licensed to transmit television, as follows:

W8XF, Pontiac, Mich., owned by WJR.

W8XL, Cuyahoga Heights Village, O., owned by WGAR.

The total number of licensed television stations is thus brought up to 27. The short-wave relay broadcasting stations in the United States and possessions total 28. Both groups are in the experimental class, which means their transmissions must not be commercialized, as for instance produce revenue for sponsored programs.

The ultra frequencies will be explored by the two new television transmitters, and it is expected that assignments to the continental television band also will be granted to the stations.

WHITE OBJECTS TO HIS OWN BILL

Washington.

The unusual situation of a legislator attacking a provision of a bill he himself introduced developed at a hearing before the Senate Committee on Interstate Commerce.

A bill sent from the House to the Senate provided that no license may be issued for a station if foreign interests have any control, either directly or indirectly.

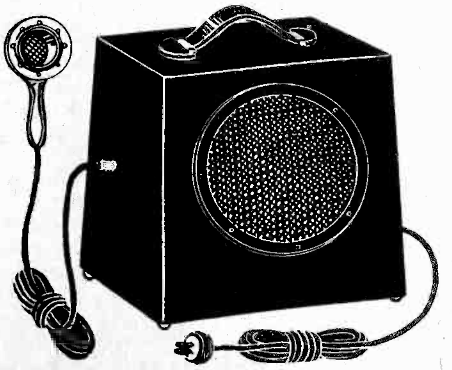
Senator White, of Maine, testified that this provision in the bill he himself introduced in the Senate would have the effect of ruling out the International Telephone and Telegraph Company from the commercial message field, the company now being the only competitor of RCA and subsidiaries. Five of the 23 or 24 directors of the I. T. & T., he said, are aliens.

"While I favor close Governmental control," he said, "I am unwilling to take a position that will work a grievous hardship on one corporation or on the system of communications."

"I confess," he added, "I did not see that provision in the bill. Now that I know it is there I shall seek to have it eliminated. The Federal Radio Commission developed the bill."

Unit for Hand Microphone

Try-Mo Radio, Inc., who are featuring RCA Victor microphone, also have a light portable amplifier as illustrated herewith.



This amplifier is made in a small carrying case, and includes input transformer, a-c amplifier, dynamic speaker and microphone, with connections for phonograph pick-up.

HAS TELEVISION SENSATION, IS JENKINS' CLAIM

C. Francis Jenkins, Washington, D. C., is well known the world over as a pioneer worker in motion picture projection and television. Hence when he reports in "The Yale Scientific Magazine" that he has developed a new system of television in which persistence of picture elements rather than persistence of vision is the basic principle communication engineers naturally become inquisitive. They want to know how it works. But they find little information in the article by Mr. Jenkins. Their inquisitiveness quickly turns into skepticism. But if they are experienced in the line they follow they will suspend judgment and await further developments, or further elucidation.

Mr. Jenkins claims that by the new system the intensity of the light available for reconstructing the television images can be multiplied thousand-fold, and that is just the thing most desired in television. Increasing the available light permits large scale projection. The system as described breaks up the image into 3,600 picture elements. That is just what is done in ordinary peep-hole television, or at least something approximating it, and the definition is such that the results can only be termed crude. Just how light of a thousand-fold intensity and projection on a large scale can alter this crudity is not apparent.

It is expected that Mr. Jenkins will further elucidate his method, particularly as he claims for it the greatest advance so far in television.

Beacons Total 100; Aid Ships in a Fog

Washington.

Two new radiobeacons to aid shipping, one at Sandusky, Ohio, on Lake Erie, and the other at West Quoddy Head, Me., have just been announced by the Lighthouse Service of the Department of Commerce. These radiobeacons, announcement of which is coincident with a conference of lighthouse superintendents now being held in Washington, will bring the total number of such navigational aids in the United States to 100.

Development of radiobeacons and their establishment adjacent to all the important ports of the country has taken place within the comparatively short period of 10 years. Radiobeacons, first conceived as a new type of fog signal, have rapidly come to be recognized by navigators as signals having a wide application in navigational problems in all kinds of weather.

New Incorporations

Birnbach Radio Co., New York City—Atty., I. M. Levy, 51 Chambers St., New York, N. Y.

Armrad Radio and Television Corp., New York N. Y.—Atty., H. Hoffert, 1450 Broadway, New York, N. Y.

Kingston Radio Co., Kingston, N. Y.—Attys., Merkle, Merkle & Luberts, 9 Park Place, New York, N. Y.

The Delaware Shop, Inc., Jersey City, N. J., radios, electric refrigerators, etc.—Atty., Victor Ruskin, Jersey City, N. J.

Kaylite, New York, N. Y., electric fixtures—Atty., S. A. Fried, 291 Broadway, New York, N. Y.

Koppel Engineering Co., Brooklyn, N. Y., electricity generators—Atty., J. P. Berg, 5 Beekman St., New York, N. Y.

Sun-Gazette Broadcasting Co., Wilmington, Del., radio broadcasting and receiving stations—Attys., Corporation Trust Co., Wilmington, Del.

STATIONS BY FREQUENCIES

United States, Canadian, Newfoundland, Cuban and Mexican Transmitters Listed

The stations listed herewith are listed in the order of frequencies, with equivalent wavelengths given. The call, location, tuner and power are stated. The location is that of the main studio, for United States stations. If the transmitter is located elsewhere it is indicated additionally, preceded by T. The power given is licensed the maximum. Some stations use maximum power in daytime only. These are identified by an asterisk after the power figure (*). Usually in such cases the night power is half the day power. CP means construction permit, license expected.

—EDITOR.

540 KILOCYCLES—555.6 METERS

CKX—Brandon, Manitoba, Can.; Manitoba Telephone System; 500 W.

550 KILOCYCLES—545.1 METERS

WGR—Buffalo, N. Y.; T—Amherst, N. Y.; Buffalo Broadcasting Corporation; 1 KW.
WKRC—Cincinnati, Ohio; WKRC (Inc.); 1 KW.
KFUO—St. Louis, Mo.; Concordia Theo.Sem.; 1 KW.
KSD—St. Louis, Mo.; Pulitzer Publishing Co.; 500 W.
KFDY, Brookings, S. Dak.; South Dakota State College, 1 KW.*
KFYR—Bismarck, N. Dak.; Meyer Broadcasting Co., 2½ KW.*
KOAC—Corvallis, Oreg.; Oregon State Agricultural College, 1 KW.

560 KILOCYCLES—535.4 METERS

WLIT—Philadelphia, Pa.; Lit Bros.; 500 W.
WFI—Philadelphia, Pa.; Strawbridge & Clothier; 500 W.
WQAM—Miami, Fla.; Miami Broadcasting Co.; 1 KW.
KFDM—Beaumont, Tex.; Magnolia Petroleum Co.; 1 KW.*
WNOX—Knoxville, Tenn.; WNOX, Inc.; 2 KW.*
WIBO—Chicago, Ill.; T—Des Plaines, Ill.; Nelson Bros. Bond & Mortgage Co.; 1½ KW.*
WPCC—Chicago, Ill.; North Shore Church; 500 W.
KLZ—Denver, Colo.; Reynolds Radio Co. (Inc.), 1 KW.
KTAB—San Francisco, Calif.; T—Oakland, Calif.; The Associated Broadcasters (Inc.), 1 KW.

570 KILOCYCLES—526.0 METERS

WNYC—New York N. Y.; City of N. Y.; 500 W.
WMCA—New York, N. Y.; T—Hoboken, N. J.; Knickerbocker Broadcasting Co. (Inc.); 500 W.
WSYR-WMAC—Syracuse N. Y.; Clive B. Meredith; 250 W.
WKBN—Youngstown, Ohio; WKBN Broadcasting Corp.; 500 W.
WEAO—Columbus, Ohio; Ohio State University; 750 W.
WWNC—Asheville, N. C.; Citizen Broadcasting Co.; 1 KW.
KGKO—Wichita Falls, Tex.; Wichita Falls Broadcasting Co., Inc.; 500 W.*
WNAX—Yankton, S. Dak.; The House of Gurney (Inc.); 1 KW.
KXA—Seattle, Wash.; American Radio Telephone Co.; 500 W.
KMTR—Los Angeles, Calif.; KMTR Radio Corporation; 500 W.

580 KILOCYCLES—516.9 METERS

WTAG—Worcester, Mass.; Worcester Telegram Publishing Co. (Inc.), 250 W.
WOBU—Charleston, W. Va.; WOBU (Inc.), 250 W.
WSAZ—Huntington, W. Va.; WSAZ (Inc.); 250 W.
WIBW—Topeka, Kans.; Topeka Broadcasting Association (Inc.), 1 KW.
KSAC—Manhattan, Kans.; Kansas State Agricultural College; 1 KW.*
KMJ—Fresno, Calif.; Jas. McClatchy Co.; 500 W.; C. P. only: see 1210 KC.
CFCY—Charlottetown, Prince Edward Island, Canada; Island Broadcasting Co., Ltd.; 500 W.
CHMA—Edmonton, Alberta, Can.; Christian & Missionary Alliance, 250 W.
CKCL—Toronto, Ontario, Can.; Dominion Battery Co., Ltd.; 500 W. (Uses call CFCL on Sundays), 500 W.
CKUA—Edmonton, Alberta, Can.; University of Alberta; 500 W.

590 KILOCYCLES—508.2 METERS

WEEI—Boston, Mass.; T—Weymouth, Mass.; Edison Electric Illuminating Co. of Boston; 1 KW.
WKZO—Berrien Springs, Mich.; WKZO (Inc.); 1 KW.
WCAJ—Lincoln, Nebr.; Nebraska Wesleyan University; 500 W.
WOW—Omaha, Nebr.; Woodmen of the World Life Insurance Association; 1 KW.
KHQ—Spokane, Wash.; Louis Wasmer (Inc.), 2 KW.*
CMW—Havana Cuba; Columbus Commercial & Radio Co.; 1400 W.

600 KILOCYCLES—499.7 METERS

WICC—Bridgeport, Conn.; T—Easton, Conn.; Bridgeport Broadcasting Station (Inc.); 250 W.
WCAC—Storrs, Conn.; Connecticut Agricultural College; 250 W.
WCAO—Baltimore, Md.; Monumental Radio (Inc.), 250 W.
WREC—Memphis, Tenn.; T—Whitehaven, Tenn.; WREC (Inc.), 1 KW.*
WMT—Waterloo, Iowa; Waterloo Broadcasting Co.; 500 W.
KFSD—San Diego, Calif.; Airfan Radio Corporation (Ltd.); 1 KW.*
CNRO—Ottawa, Ontario, Can.; Canadian National Railways; 500 W.

610 KILOCYCLES—491.5 METERS

WJAY—Cleveland, Ohio; Cleveland Radio Broadcasting Corporation; 500 W.
WIP—Philadelphia, Pa.; Gimbel Brothers (Inc.); 500 W.
WDAF—Kansas City, Mo.; Kansas City Star Co.; 1 KW.
KFRC—San Francisco, Calif.; Don Lee (Inc.); 1 KW.
WFAN—Philadelphia, Pa.; Keystone Broadcasting Co.; 500 W.

620 KILOCYCLES—483.6 METERS

WLBZ—Bangor, Me.; Maine Broadcasting Co. (Inc.); 500 W.
WFLA-WSUN—Clearwater, Fla.; Clearwater Chamber of Commerce and St. Petersburg Chamber of Commerce; 2½ KW.*
WTMJ—Milwaukee, Wis.; T—Brookfield, Wis.; The Journal Co. (Milwaukee Journal), 2½ KW.*
KGW—Portland, Oreg.; Oregonian Publishing Co.; 1 KW.
KTAR—Phoenix, Ariz.; KTAR Broadcasting Co.; 1 KW.*
CMCJ—Havana, Cuba; Rafael Rodriquez; 250 W.

630 KILOCYCLES—475.9 METERS

KGFX—Pierre, S. D.; Dana McNeil; 200 W.
WMAL—Washington, D. C.; M. A. Leese Radio Corp.; 500 W.*
WOS—Jefferson City, Mo.; Missouri State Marketing Bureau, 500 W.
KFRU—Columbia, Mo.; Stevens College; 500 W.
WGBF—Evansville, Ind.; Evansville on the Air (Inc.); 500 W.
CFCT—Victoria, British Columbia; Victoria Broadcasting Asso..; 50 W.
CJGX—Winnipeg, Manitoba; T—Yorkton, Saskatchewan; Winnipeg Grain Exchange; 500 W.
CNRA—Moncton, New Brunswick; Canadian National Railways; 500 W.
XETA—Veracruz, Ver., Mex.; Manuel Espinosa Tagle; 500 W.
XETF—Veracruz, Ver., Mex.; Manuel Angel Fernandez; 500 W.

640 KILOCYCLES—468.5 METERS

WAIU—Columbus, Ohio; Associated Radiocasting Corp.; 500 W.
WOI—Ames, Iowa; Iowa State College of Agriculture and Mechanic Arts; 5 KW.
KFI—Los Angeles, Calif.; Earle C. Anthony (Inc.), 50 KW.

645 KILOCYCLES—464.8 METERS

CHRC—Quebec, Quebec, Can.; CHRC, Ltd.; 100 W.
CKCI—Quebec, Quebec, Can. (Uses transmitter of CHRC); Le Soleil, Inc.; 100 W.
CKCR—Waterloo, Ontario, Can.; Wm. C. Mitchel & Gilbert Liddle, 100 W.
CHMJ—Cienfuegos, Cuba; Arturo Hernandez; 40 W.

650 KILOCYCLES—461.3 METERS

WSM—Nashville, Tenn.; National Life & Accident Insurance Co.; 5 KW.
KPCB—Seattle, Wash.; Queen City Broadcasting Co.; 100 W.

660 KILOCYCLES—454.3 METERS

WEAF—New York, N. Y.; T—Belmore, N. Y.; National Broadcasting Co. (Inc.); 50 KW.
WTIC—Hartford, Conn.; Travelers Broadcasting Service, Inc.; 5 KW.
WAAW—Omaha, Nebr.; Omaha Grain Exchange; 500 W.
CMCO—Havana, Cuba; J. L. Stowers; 250 W.
CMDC—Havana, Cuba; Juan Fernandex de Castro; 500 W.

665 KILOCYCLES—450.9 METERS

CHWK—Chilliwack, British Columbia, Can.; Chilliwack Broadcasting Co., Ltd.; 100 W.
CJRM—Moose Jaw, Saskatchewan; T—old city Moose Jaw, Can.; James Richardson & Sons, Ltd.; 500 W.
CJRW—Winnipeg, Manitoba; T—Fleming, Saskatchewan, Can.; James Richardson & Sons, Ltd.; 500 W.

670 KILOCYCLES—447.5 METERS

WMAQ—Chicago, Ill.; T—Addison, Ill.; WMAQ (Inc.); 5 KW.

675 KILOCYCLES—444.2 METERS

VOWR—St. John's, N. F.; Wesley United Church; 500 W.

680 KILOCYCLES—440.9 METERS

WPTF—Raleigh, N. C.; Durham Life Insurance Co.; 1 KW.
KFEQ—St. Joseph, Mo.; Scroggin & Co. Bank; 2½ KW.
KPO—San Francisco, Calif.; Hale Bros. Stores (Inc.), and the Chronicle Publishing Co.; 5 KW.
XFG—Mexico City, Mex.; Sria de Guerra y Marina; 350 W.

685 KILOCYCLES—437.7 METERS

VAS—Glace Bay, Nova Scotia, Can.; Canadian Marconi Co.; 2 KW.

690 KILOCYCLES—434.5 METERS

CFAC—Calgary, Alberta, Can.; The Calgary Herald; 500 W.
CFRB—Toronto, Ontario, Can.; T—King, Ontario, Can.; Rogers Majestic Corp., Ltd.; 4 KW.
CJCJ—Calgary, Alberta, Can.; Albertan Pub. Co., Ltd.; 500 W.
CNRX—Toronto, Ontario, Can.; T—King, Ontario, Can. (Uses transmitter of CFRB); Canadian National Railways; 4 KW.
XET—Monterrey, N. L., Mex.; Mexico Music Co., S. A.; 500 W.

700 KILOCYCLES—428.3 METERS

WLW—Cincinnati, O.; T—Mason, Ohio; Crosley Radio Corporation; 50 KW.

710 KILOCYCLES—422.3 METERS

WOR—Newark, N. J.; T—Kearny, N. J.; Bamberger Broadcasting Service (Inc.); 5 KW. (50 KW. C. P.)
KMPC—Los Angeles, Calif.; R. S. MacMillan; 500 W.
XEN—Mexico City, Mex. (Actual frequency 711 KC., 421.9 Meters); Cerveceria Modelo, S. A.; 1 KW.

720 KILOCYCLES—416.4 METERS

WGN-WLIB—Chicago, Ill.; T—Elgin, Ill.; WGN, Inc.; 25 KW.

730 KILOCYCLES—410.7 METERS

CHLS—Vancouver, British Columbia (Uses transmitter of CKCD); W. G. Hassell; 50 W.
CHYC—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can. (Uses transmitter of CKAC); Northern Elec. Co., Ltd.; 5 KW.
CKAC—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can.; LaPresse Pub. Co.; 5 KW.
CKCD—Vancouver, British Columbia, Can.; Vancouver Daily Province; 50 W.
CKFC—Vancouver, British Columbia, Can.; United Church of Canada; 50 W.
CKMO—Vancouver, British Columbia, Can.; Sprott-Shaw Radio Co.; 100 W.
CKWX—Vancouver, British Columbia, Can.; Western Broadcasting Co., Ltd.; 100 W.
CNRM—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can. (Uses transmitter of CKAC); Canadian National Railway; 5 KW.
XER—Villa Acuna, Coah., Mex. (Actual frequency 735 KC., 408.1 Meters); Compania Radiodifusora de Acuna, S. A.; 75 KW.
CMK—Havana, Cuba; Cuban Bdcg. Co.; 3150 W.

740 KILOCYCLES—405.2 METERS

WSB—Atlanta, Ga.; Atlanta Journal Co.; 5 KW. (50 KW.—C. P.).
KMMJ—Clay Center, Nebr.; The M. M. Johnson Co.; 1 KW.
——— —Portsmouth, N. H.; Granite State Bldg. Corp.; 250 W. C. P.

750 KILOCYCLES—399.8 METERS

WJR—Detroit, Mich.; T—Sylvan Lake Village, Mich.; WJR, The Goodwill Station (Inc.), 10 KW.
KGU—Honolulu, Hawaii; M. A. Mulroney and Advertiser Pub. Co., Ltd.; C. P. only; (see 940 KC.).
XEQ—C. Jaurez, Coah., Mex.; Feliciano Lopez Islas; 5 KW.

760 KILOCYCLES—394.5 METERS

WJZ—New York, N. Y.; T—Boundbrook, N. J.; National Broadcasting Co.; Inc.); 30 KW.

(*Continued on next page*)

(Continued from preceding page)

760 KILOCYCLES—394.5 METERS (Cont.)

WBAL—Baltimore, Md.; Consolidated Gas, Electric & Power Co.; 1 KW.
WEW—St. Louis, Mo.; St. Louis University; 1 KW.
KVI—Tacoma, Wash.; T—Des Moines, Wash.; Puget Sound Broadcasting Co. (Inc.); 1 KW.

770 KILOCYCLES—389.4 METERS

KFAB—Lincoln, Neb.; KFAB Broadcasting Co.; 5 KW. (25 KW. C. P.).
WBBM-WJBT—Chicago, Ill.; T—Glenview, Ill.; WBBM Broadcasting Corp. (Inc.); 25 KW.

780 KILOCYCLES—384.4 METERS

WEAN—Providence, R. I.; Shepard Broadcasting Service (Inc.); 500 W.*
WTAR-WPOR—Norfolk, Va.; WTAR Radio Corporation; 500 W.
WMC—Memphis, Tenn.; T—Bartlett, Tenn.; Memphis Commercial Appeal, Inc.; 1 KW.*
KELW—Burbank, Calif.; Magnolia Park, Ltd.; 500 W.
KTM—Los Angeles, Calif.; T—Santa Monica, Calif.; Pickwick Broadcasting Corporation; 1 KW.*
CKY—Winnipeg, Manitoba, Can.; Manitoba Telephone System; 5 KW.
CNRW—Winnipeg, Manitoba, Can. (Uses Transmitter of CKY); Canadian National Railways; 5 KW.
XEY—Mexico City, Mex.; Partido Socialista S. E.; 500 W.

790 KILOCYCLES—379.5 METERS

WGY—Schenectady, N. Y.; T—South Schenectady, N. Y.; General Electric Co.; 50 KW.
KGO—San Francisco, Calif.; T—Oakland, Calif.; National Broadcasting Co. (Inc.); 7½ KW.
CMBS—Havana, Cuba; Enrique Artalejo; 150 W.
CMHC—Tuinucu, Cuba; Frank H. Jones; 100 W.

800 KILOCYCLES—374.8 METERS

WBAP—Fort Worth, Tex.; Carter Publications (Inc.); 10 KW.
WFAA—Dallas, Tex.; T—Grapevine, Texas; Dallas News and Dallas Journal A. H. Belo Corporation; 50 KW.
XFC—Aguascalientes, Ags., Mex.; Gobierno Edo. Aguascalientes; 350 W.

810 KILOCYCLES—370.2 METERS

WPCH—New York, N. Y.; T—Hoboken, N. J.; Eastern Broadcasters (Inc.); 500 W.
WCCO—Minneapolis, Minn.; T—Anoka, Minn.; Northwestern Broadcasting (Inc.); 5 KW. (50 KW. C. P.)
VOAS—St. John's, N. F.; Ayre & Sons, Ltd.; 75 W.

820 KILOCYCLES—365.6 METERS

WHAS—Louisville, Ky.; T—Jeffersontown, Ky.; The Courier Journal Co. and The Louisville Times Co.; 10 KW.
XFI—Mexico City, Mex.; Sria Ind. Com. y Trabajo (Actual frequency 818.1 KC—366.7 Meters); 1 KW.

830 KILOCYCLES—361.2 METERS

WHDH—Boston, Mass.; T—Gloucester, Mass.; Matheson Radio Co. (Inc.); 1 KW.
WRUF—Gainesville, Fla.; University of Florida; 5 KW.
KOA—Denver, Colo.; National Broadcasting Co. (Inc.), 12½ KW.
WEEU—Reading, Pa.; Berks Broadcasting Co.; 1 KW.

834 KILOCYCLES—359.5 METERS

CMGA—Colon, Cuba; Leopoldo V. Figueros; 100 W.

840 KILOCYCLES—356.9 METERS

CJBC—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can. (Uses transmitter of CKGW); Jarvis St. Baptist Church; 5 KW.
CKGW—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can.; Gooderham & Worts; 5 KW.
CKLC—Calgary, Alberta, Can.; T—Red Deer, Alberta, Can.; Alberta Pacific Grain Company; 1 KW.
CNRD—Red Deer, Alberta, Can. (Uses transmitter of CKLC); Canadian National Railways; 1 KW.
CPRY—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can. (Uses transmitter of CKGW); Canadian Pacific Railway Co.; 5 KW.

842 KILOCYCLES—356.1 METERS

CMC—Havana, Cuba; Cuban Telephone Co.; 500 W.

850 KILOCYCLES—352.7 METERS

KWKH—Shreveport, La.; T—Kennonwood, La.; Hello World Broadcasting Corporation; 10 KW.
WWL—New Orleans, La.; Loyola University; 10 KW.

856 KILOCYCLES—350.3 METERS

CMJE—Camaguey, Cuba; Manuel Fernandez; 20 W.

860 KILOCYCLES—348.6 METERS

WABC-WBOQ—New York, N. Y.; T—West of Cross Bay Blvd., Queens Co., N. Y.; Atlantic Broadcasting Corporation; 5 KW.
WHB—Kansas City, Mo.; T—North Kansas City, Mo.; WHB Broadcasting Co.; 500 W.
KMO—Tacoma, Wash.; KMO (Inc.); 500 W.
XFX—Mexico City, Mex.; Sria de Educacion Publica; 500 W.

870 KILOCYCLES—344.6 METERS

WLS—Chicago, Ill.; T—Crete, Ill.; Agricultural Broadcasting Co.; 50 KW.
WENR—Chicago, Ill.; T—Downers Grove, Ill.; National Broadcasting Co., 50 KW.

880 KILOCYCLES—840.7 METERS

WGBI—Scranton, Pa.; Scranton Broadcasters (Inc.); 250 W.
WQAN—Scranton, Pa.; E. J. Lynett, prop., The Scranton Times, 250 W.
WCOC—Meridian, Miss.; Mississippi Broadcasting Co. (Inc.); 1 KW.*
WSUI—Iowa City, Iowa; State University of Iowa; 500 W.
KLX—Oakland, Calif.; The Tribune Publishing Co.; 500 W.
KPOF—Denver, Colo.; Pillar of Fire; 500 W.
KFKA—Greeley, Colo.; The Mid-Western Radio Corporation; 1 KW.*
CHML—Mount Hamilton, Ontario, Can.; Maple Leaf Radio Co., Ltd.; 50 W.
CJCB—Sydney, Nova Scotia, Can.; N. Nathanson; 50 W.
CKCV—Quebec, Quebec, Can.; Vandry, Inc.; 50 W.
CKPC—Preston, Ontario, Can., Cyrus Dolph; 100 W.
CNRQ—Quebec, Quebec, Can. (Uses transmitter of CKCV); Canadian National Railways; 50 W.

885 KILOYCLES—338.8 METERS

CMX—Havana, Cuba; Francisco Lavin; 1 KW.

890 KILOCYCLES—336.9 METERS

WJAR—Providence, R. I.; the Outlet Co.; 500 W.*
WKAQ—San Juan, P. R.; Radio Corporation of Porto Rico; 500 W.*
WMMN—Fairmount, W. Va.; Holt-Rowe Novelty Co.; 500 W.*
WGST—Atlanta, Ga.; Georgia School of Technology; 500 W.*
KGJF—Little Rock, Ark.; First Church of the Nazarene; 250 W.
WILL—Urbana, Ill.; University of Illinois; 500 W.*
KUSD—Vermillion, S. Dak.; University of South Dakota; 750 W.*
KFNF—Shenandoah, Iowa; Henry Field Co.; 1 KW.*
CFBO—St. John, New Brunswick, Can.; C. A. Munro, Ltd.; 500 W.
CKCO—Ottawa, Ontario, Can.; Dr. G. M. Geldert; 100 W.

890 KILOCYCLES—336.9 METERS (Cont.)

CKPR—Port Arthur, Ontario, Can.; Dougall Motor Car Co., Ltd.; 50 W.
XES—Tampico, Tams., Mex.; Emilio Bali; 500 W.
CMCF—Havana, Cuba; Raoul Karman; 250 W.

900 KILOCYCLES—333.1 METERS

WBEN—Buffalo, N. Y.; T—Martinsville, N. Y.; WBEN, Inc.; 1 KW.
WKY—Oklahoma City, Okla.; WKY Radiophone Co.; 1 KW.
WJAX—Jacksonville, Fla.; City of Jacksonville; 1 KW.
WLBL—Stevens Point, Wis.; State of Wisconsin, Department of Agriculture and Markets, 2 KW.
KHJ—Los Angeles, Calif.; Don Lee (Inc.); 1 KW.
KSEI—Pocatello, Idaho; Radio Service Corp.; 250 W. C. P. 500 W.
KGBU—Ketchikan, Alaska; Alaska Radio and Service Co. (Inc.), 100 W. (500 W., C. P.).

910 KILOCYCLES—329.5 METERS

CFQC—Saskatoon, Saskatchewan, Can.; The Electric Shop, Ltd.; 500 W.
CJGC—London, Ontario, Can.; T—Strathburn, Ontario, Can.; London Free Press & Ptg. Co., Ltd.; 5 KW.
CNRL—London, Ontario, Can.; T—Strathburn, Ontario, Can. (Uses Transmitter of CJGC); Canadian National Railways; 5 KW.
CNRS—Saskatoon, Saskatchewan, Can. (Uses transmitter of CFQC); Canadian National Railways; 500 W.
XEW—Mexico City, Mex.; Mexico Music Co.; S. A.; 5 KW.

915 KILOCYCLES—327.7 METERS

CFLC—Prescott, Ontario, Can.; Radio Association of Prescott; 100 W

920 KILOCYCLES—325.9 METERS

WBSO—Needham, Mass.; Babson's Statistical Organization (Inc.); 500 W.
WWJ—Detroit, Mich.; The Evening News Association (Inc.); 1 KW.
KPRC—Houston, Tex.; T—Sugarland, Texas; Houston Printing Co.; 2½ KW.
WAAF—Chicago, Ill.; Drovers Journal Publishing Co.; 500 W.
KOMO—Seattle, Wash.; Fisher's Blend Station (Inc.); 1 KW.
KFEL—Denver, Colo.; Eugene P. O'Fallon (Inc.); 500 W.
KFXF—Denver, Colo.; Colorado Radio Corporation; 500 W.

925 KILOCYCLES—324.1 METERS

CMCD—Havana, Cuba; Angel Bertematy; 250 W.
CMCN—Havana, Cuba; Antonio Ginard; 250 W.

930 KILOCYCLES—324.4 METERS

WIBG—Elkins Park, Pa.; St. Paul's P. E. Church; 25 W.
WDBJ—Roanoke, Va.; Times-Royal Corp.; 500 W.*
WBRC—Birmingham, Ala.; Birmingham Broadcasting Co. (Inc.); 1 KW.*
KGBZ—York, Nebr.; Dr. George R. Miller; 1 KW.*
KMA—Shenandoah, Iowa; May Seed & Nursery Co.; 1 KW.*
KFWI—San Francisco, Calif.; Radio Entertainments (Inc.); 500 W.
KROW—Oakland, Calif.; T—Richmond, Calif.; Educational Broadcasting Corporation; 1 KW.*
CFCH—North Bay, Ontario, Can.; Northern Supplies, Ltd.; 100 W.
CFRC—Kingston, Ontario, Can.; Queens University; 250 W.*
CHNS—Halifax, Nova Scotia, Can. (Uses 910 KC. temporarily); Maritime Broadcasting Co., Ltd.; 500 W.
CJCA—Edmonton, Alberta, Can.; T—Oliver, Alberta, Can.; The Edmonton Journal; 500 W.
CNRH—Halifax, Nova Scotia, Can. (Uses transmitter of CHNS-910 KC. temporarily); Canadian National Railways; 500 W.
XEB—Mexico City, Mex.; El Buen Tono, S.A.; 1 KW.
CMJF—Camaguey, Cuba; John L. Stowers; 50 W.

940 KILOCYCLES—319.0 METERS

WAAT—Jersey City, N. J.; Bremer Broadcasting Corporation; 300 W.
WCSH—Portland, Me.; T—Scarboro, Me.; Congress Square Hotel Co.; 1 KW.
WFIW—Hopkinsville, Ky.; WFIW (Inc.); 1 KW.
WHA—Madison, Wis.; University of Wisconsin; 750 W.
WDAY—Fargo, N. Dak.; T—West Fargo, N. Dak.; WDAY (Inc.); 1 KW.
KOIN—Portland, Oreg.; T—Sylvan, Oreg.; KOIN (Inc.); 1 KW.
KGU—Honolulu, Hawaii (C. P. for 750 KC.—2½ KW.); Marion A. Mulrony and Advertiser Publishing Co. (Ltd.); 1 KW.
XEO—Mexico City, Mex.; Partido Nacional Rev.; 5 KW.

950 KILOCYCLES—315.6 METERS

WRC—Washington, D. C.; National Broadcasting Co. (Inc.); 500 W.
KMBC—Kansas City, Mo.; T—Independence, Mo.; Midland Broadcasting Co.; 1 KW.
KFWB—Hollywood, Calif.; Warner Bros. Broadcasting Corporation; 1 KW.
KGHL—Billings, Mont.; Northwestern Auto Supply Co. (Inc.); 1 KW.
VONA—St. Johns, N. F.; Lane, Gillard & Avery; 30 W.
CMHD—Caibarien, Cuba; Manuel Alvarez; 250 W.

960 KILOCYCLES—312.3 METERS

CHCK—Charlottetown, Prince Edward Island, Can.; W. E. Burke & J. A. Gesner; 100 W.
CHWC—Regina, Saskatchewan, Can.; T—Pilot Butte, Saskatchewan, Can.; R. H. Williams & Sons, Ltd.; 500 W.
CJBR—Regina, Saskatchewan, Can. (Uses transmitter of CKCK); Saskatchewan Co-operative Wheat Producers, Ltd.; 500 W.
CKCK—Regina, Saskatchewan, Can.; Leader Publishing Co., Ltd.; 500 W.
CKNC—Toronto, Ontario, Can.; Canadian National Carbon Co.; 500 W.
CNRR—Regina, Saskatchewan, Can. (Uses transmitter of CKCK); Canadian National Railways; 500 W.
XED—Reynosa, Tams., Mex. (Actual frequency 965 KC—310.8 Meters); Cia. Int. Dif. Reynosa, S. A.; 10 KW.

965 KILOCYCLES—310.7 METERS

CMBC—Havana, Cuba; Domingo Fernandez; 150 W.
CMBD—Havana, Cuba; Luis Perez Garcia; 150 W.

970 KILOCYCLES—309.1 METERS

WCFL—Chicago, Ill.; Chicago Federation of Labor; 1½ KW.
KJR—Seattle, Wash.; Northwest Broadcasting System (Inc.); 5 KW.
CMBT—Havana, Cuba; Emilio Perera; 500 W.

977 KILOCYCLES—306.9 METERS

CMGF—Matanzas, Cuba; Bernabe R. de la Torre; 50 W.

980 KILOCYCLES—305.9 METERS

KDKA—Pittsburgh, Pa.; T—Caxonburg, Pa., Westinghouse Electric & Manufacturing Co.; 50 KW.

985 KILOCYCLES—304.4 METERS

CFCN—Calgary, Alberta, Can.; T—Strathmore, Alta., Can.; W. W. Grant & H. G. Love; 10 KW.

990 KILOCYCLES—302.8 METERS

WBZ—Springfield, Mass.; T—East Springfield, Mass.; Westinghouse Electric & Manufacturing Co.; 25 KW.
WBZA—Boston, Mass.; Westinghouse Electric & Manufacturing Co.; 1 KW.
XEK—Mexico City, Mex.; Arturo Martinez; 100 W.

1000 KILOCYCLES—299.8 METERS

WHO—Des Moines, Iowa; Central Broadcasting Co.; 5 KW. (C. P. 50 KW.)
WOC—Davenport, Iowa; Central Broadcasting Co.; 5 KW. (C. P. 50 KW.).
KFVD—Culver City, Calif.; Los Angeles Broadcasting Co.; 250 W.
XEA—Guadalajara, Jal., Mex; Alberto Palos Sauza; 100 W.
XEC—Toluca, Mex.; Jesus R. Benavides; 50 W.
XEE—Oaxaca, Oax., Mex.; Alfonso Zorrilla B.; 105 W.
XEFE—N. Laredo, Tams., Mex.; Rafael T. Carranza; 100 W.
XEFI—Chihuahua, Chih., Mex.; Feliciano Lopez Islas; 100 W.
XEFS—Queretaro, Quer., Mex., Salvador Sanchez, 40 W.
XEI—Morelia, Mich., Mex.; Carlos Gutierrez; 100 W.
XEJ—C. Juarez, Chih., Mex.; Juan G. Buttner; 100 W.
XEL—Saltillo, Coah.; Antonio Garza Castro; 10 W.
XETC—Jalapa, Ver., Mex.; Juventino Canchez; 100 W.
XETG—Torreon, Coah., Mex.; Feliciano Lopez Islas; 100 W.
XEU—Veracruz, Ver., Mexico.; Fernando Pazos; 100 W.
XEV—Puebla, Pue., Mex.; Ciro Molino; 100 W.
XEY—Merida, Yuc., Mex.; Partido Socialista S. E.; 105 W.

1010 KILOCYCLES—296.8 METERS

WQAO—New York, N. Y.; T—Cliffside, N. J.; Calvary Baptist Church; 250 W.
WLAP—Louisville, Ky.; American Broadcasting Corp. of Kentucky; 250 W.
WHN—New York, N. Y.; Marcus Loew Booking Agency; 250 W.
WPAP—New York City; Palisades Amusement Park; 250 W.
WRNY—New York, N. Y.; T—Coytesville, N. J.; Aviation Radio Station (Inc.); 250 W.
KGGF—South Coffeyville, Okla.; Hugh J. Powell and Stanley Platz, doing business as Powell & Platz; 500 W.
WNAD—Norman, Okla.; University of Oklahoma; 500 W.
WIS—Columbia, S. C.; South Carolina Broadcasting Co. (Inc.); 1 KW.*
KQW—San Jose, Calif.; Pacific Agricultural Foundation Ltd.; 500 W.
CHCS—Hamilton, Ontario; T—Fruitland, Ontario (Uses transmitter of CKOC—630 KC. temporarily); Hamilton Spectator; 1 KW.*
CKIC—Wolfville, Nova Scotia; Acadia University; 50 W.
CKOC—Hamilton, Ontario; T—Fruitland, Ontario (Uses 630 KC temporarily); Wentworth Radio Broadcasting Co., Ltd.; 1 KW.*
CKTB—St. Catharines, Ontario; T—Fruitland, Ontario. (Uses transmitter of CKOC, 630 KC., temporarily); Taylor & Bates, Ltd.; 1 KW.*
CMBW—Havana, Cuba; Modesto Alvarez; 150 W.
CMBZ—Havana, Cuba; Manuel y G. Salas; 150 W.

1017 KILOCYCLES—293.73 METERS

CMJH—Ciego de Avila, Cuba; Luis Marauri; 15 W.

1020 KILOCYCLES—293.9 METERS

WRAX—Philadelphia, Pa.; WRAX Broadcasting Co.; 250 W.
KYW-KFKX—Chicago, Ill.; T—Bloomingdale Township, Ill.; Westinghouse Electric & Manufacturing Co.; 10 KW.
XEFD—Tijuana, B. C., Mex.; Carlos de la Sierra, 300 W.

1030 KILOCYCLES—291.1 METERS

CFCF—Montreal, Quebec, Can.; Canadian Marconi Co.; 500 W.
CNRV—Vancouver, British Columbia, Can.; T—Lulu Island, British Columbia, Can.; Canadian National Railways; 500 W.

1034 KILOCYCLES—290 METERS

CMKC—Santiago de Cuba; M. P. Martinez; 150 W.

1,040 KILOCYCLES—288.3 METERS

WMAK—Buffalo, N. Y.; T—Grand Island, Buffalo, N. Y.; Buffalo Broadcasting Corporation; 1 KW.
WKAR—East Lansing, Mich.; Michigan State College; 1 KW.
KTHS—Hot Springs National Park, Ark.; Hot Springs Chamber of Commerce; 10 KW.
KRLD—Dallas, Tex.; KRLD Radio Corporation; 10 KW.

1050 KILOCYCLES—285.5 METERS

KFBI—Milford, Kans.; Farmers & Bankers Life Insurance Co.; 5 KW.
KNX—Hollywood, Calif.; T—Los Angeles, Calif.; Western Broadcast Co.; 5KW.
XEFC—Merida, Yuc., Mex.; Hugo Molina Font.; 10 W.

1060 KILOCYCLES—282.8 METERS

WBAL—Baltimore, Md.; T—Glen Morris, Md.; Consolidated Gas, Electric Light & Power Company of Baltimore; 10 KW.
WTIC—Hartford, Conn.; T—Avon, Conn.; Travelers Broadcasting Service Corporation; 50 KW.
WJAG—Norfolk, Nebr.; Norfolk Daily News; 1 KW.
KWJJ—Portland, Ore.; KWJJ Broadcast Co. (Inc.); 500 W.

1070 KILOCYCLES—280.2 METERS

WTAM—Cleveland, Ohio; T—Brecksville Village, Ohio; National Broadcasting Co. (Inc.); 50 KW.
WCAZ—Carthage, Ill.; Superior Broadcasting Service (Inc.); 50 W.
WDZ—Tuscola, Ill.; James L. Bush; 100 W.
KJBS—San Francisco, Calif.; Julius Brunton & Sons Co.; 100 W.
CMBG—Havana, Cuba; Francisco Garrigo; 150 W.
CMCB—Havana, Cuba; Antonio Capablanca; 150 W.

1080 KILOCYCLES—277.6 METERS

WBT—Charlotte, N. C.; Station WBT (Inc.); 5 KW.
WCBD—Zion, Ill.; Wilbur Glenn Voliva; 5 KW.
WMBI—Chicago, Ill.; T—Addison, Ill.; The Moody Bible Institute Radio Station; 5 KW.

1090 KILOCYCLES—275.1 METERS

KMOX—St. Louis, Mo.; Voice of St. Louis (Inc.); 50 KW.

1100 KILOCYCLES—272.6 METERS

WPG—Atlantic City, N. J.; WPG Broadcasting Corporation; 5 KW.
WLWL—New York, N. Y.; T—Kearny, N. J.; Missionary Society of St. Paul the Apostle; 5 KW.
KGDM—Stockton, Calif.; E. F. Peffer; 250 W.

1110 KILOCYCLES—270.1 METERS

WRVA—Richmond, Va.; T—Mechanicsville, Va.; Larus & Brother Co. (Inc.); 5 KW.
KSOO—Sioux Falls, S. Dak.; Sioux Falls Broadcast Association (Inc.); 2½ KW.
CMHI—Santa Clara, Cuba; Lavis y Paz; 15 W.

1120 KILOCYCLES—267.7 METERS

WDEL—Wilmington, Del.; WDEL (Inc.); 350 W.*
WDBO—Orlando, Fla.; Orlando Broadcasting Co. (Inc.); 250 W.
WTAW—College Station, Tex.; Agricultural and Mechanics College of Texas; 500 W.
KTRH—Houston, Tex.; Rice Hotel; 500 W.
WISN—Milwaukee, Wis.; Evening Wisconsin Co.; 250 W.
WHAD—Milwaukee, Wis.; Marquette University; 250 W.
KFSG—Los Angeles, Calif.; Echo Park Evangelistic Association; 500 W.
KMCS-KRKD—Inglewood, Calif.; Dalton's (Inc.); 500 W. (1 KW. C.P.).
KRSC—Seattle, Wash.; Radio Sales Corporation; 50 W.
KFIO—Spokane, Wash.; Spokane Broadcasting Corporation; 100 W.
CFCA—Toronto, Ontario, Can.; Star Publishing & Printing Co.; 500 W.
CFJC—Kamloops, British Columbia, Can.; S. D. Dalgleish & Sons, Ltd.; 100 W.
CHGS—Summerside, Prince Edward Island, Can.; R. T. Holman, Ltd.; 100 W.

1120 KILOCYCLES—267.7 METERS (Cont.)

CJOC—Lethbridge, Alberta, Can.; H. R. Carson; 100 W.
CNRT—Toronto, Ontario, Can.; (Uses transmitter of CFCA); Canadian National Railways; 500 W.

1130 KILOCYCLES—265.3 METERS

WOV—New York City; T—Secaucus, N. J.; International Broadcasting Corporation; 1 KW.
WJJD—Moosehart, Ill.; Supreme Lodge of the World, Loyal Order of Moose; 20KW.
KSL—Salt Lake City, Utah; Radio Service Corporation of Utah; 5 KW. (50 KW.—C. P.).
XEH—Monterrey, N. L., Mex.; Constantino Tarnaca; 1 KW. (Actual frequency 1,132 KC.—265 Meters).

1140 KILOCYCLES—263.0 METERS

WAPI—Birmingham, Ala.; Alabama Polytechnic Institute, University of Alabama and Alabama College; 5 KW.
KVOO—Tulsa, Okla.; Southwestern Sales Corporation; 5 KW. (25 KW.—C.P.).
XEZ—Mexico City, Mex.; Joaquin Capilla; 500 W.

1150 KILOCYCLES—260.7 METERS

WHAM—Rochester, N. Y.; T—Victor Township, N. Y.; Stromberg-Carlson Telephone Manufacturing Co.; 5 KW.
CMCQ—Havana, Cuba; Andres Martinez; 600 W.
CMQ—Havana, Cuba; Jose Fernandez; 250 W.

1160 KILOCYCLES—258.5 METERS

WWVA—Wheeling, W. Va.; West Virginia Broadcasting Corporation; 5 KW.
WOWO—Fort Wayne, Ind.; Main Auto Supply Co.; 10 KW.

1170 KILOCYCLES—256.3 METERS

WCAU—Philadelphia, Pa.; T—Byberry; Universal Broadcasting Co.; 10 KW.

1180 KILOCYCLES—254.1 METERS

WINS—New York, N. Y.; T—Astoria, L. I., N. Y.; American Radio News Corp.; 500 W.
WDGY—Minneapolis, Minn.; Dr. George W. Young; 1 KW.
KEX—Portland, Ore.; Western Broadcasting Co.; 5 KW.
KOB—State College, N. Mex.; New Mexico College of Agriculture and Mechanic Arts, 20 KW.
WMAZ—Macon, Ga.; Southern Broadcasting Co., Inc.; 500 W.

1190 KILOCYCLES—252.0 METERS

WOAI—San Antonio, Tex.; T—Selma, Tex.; Southern Equipment Co.; 50 KW.

1200 KILOCYCLES—249.9 METERS

WRBL—Columbus, Ga.; WRBL Radio Station Inc.; 50 W.
WABI—Bangor, Me.; Pine Tree Broadcasting Corporation; 100 W.
WNBX—Springfield, Vt.; First Congregational Church Corporation; 10 W.
WCAX—Burlington, Vt.; Burlington Daily News; 100 W.
WORC-WEPS—Worcester, Mass.; T—Auburn, Mass.; Albert Frank Kleindeinst; 100 W.
KERN—Bakersfield, Calif.; Bakersfield Bdcg. Co.; 100 W.
WIBX—Utica, N. Y.; WIBX (Inc.); 300 W.*
WFBE—Cincinnati, Ohio; Post Publishing Co.; 250 W.*
WHBC—Canton, Ohio; St. John's Catholic Church; 10 W.
WLBG—Petersburg, Va.; T—Ettrick, Va.; WLBG Inc.; 250W.*
WNBO—Washington, Pa.; John Brownlee Spriggs; 100 W.
WCOD—Harrisburg, Pa.; Keystone Broadcasting Corporation; 100 W.
KWJC—Lancaster, Pa.; Lancaster Broadcasting Service, Inc.; 100 W.
WNBW—Carbondale, Pa.; C. F. Schiessler and M. E. Stephens, doing business as Home Cut Glass & China Co.; 10 W.
KMLB—Monroe, La.; J. C. Liner; 100 W.
WABZ—New Orleans, La.; Samuel D. Reeks; 100 W.
WJBW—New Orleans, La.; C. Carlson; 100 W.
WBBZ—Ponca City, Okla.; C. L. Carrell; 100 W.
WFBC—Knoxville, Tenn.; Virgil V. Evans; 50 W.
KGHI—Little Rock, Ark.; O. A. Cook; 100 W.
KBTM—Paragould, Ark.; W. J. Beard, Beard's Temple of Music; 100 W.
WJBC—La Salle, Ill.; Wayne Hummer & H. J. Dee, doing business as Kaskaskia Broadcasting Co.; 100 W.
WJBL—Decatur, Ill.; Commodore Broadcasting Corporation; 100 W.
WWAE—Hammond, Ind.; Hammand-Calumet Broadcasting Corporation; 100 W.
KFJB—Marshalltown, Iowa; Marshall Electric Co. (Inc.); 250 W.*
WCAT—Rapid City, S. Dak.; South Dakota State School of Mines; 100 W.
KGDY—Huron, S. Dak.; Voice of South Dakota; 100 W.
KFWF—St. Louis, Mo.; St. Louis Truth Center (Inc.); 100 W.
KGDE—Fergus Falls, Minn.; Jaren Drug Co.; 250W.*
WCLO—Janesville, Wis.; WCLO Radio Corporation; 100 W.
WHBY—Green Bay, Wis.; T—West De Pere, Wis.; St. Norbert College; 100 W.
WIL—St. Louis, Mo.; Missouri Broadcasting Corporation; 250 W.*
KGFJ—Los Angeles, Calif.; Ben S. McGlashan; 100 W.
KSMR—Santa Maria, Calif.; Santa Maria Radio; 100 W.
KWG—Stockton, Calif.; Portable Wireless Telephone Co. (Inc.); 100 W.
KGEK—Yuma, Colo.; Elmer C. Beehler, trading as Beehler Electrical Equipment Co.; 100 W.
KGEW—Fort Morgan, Colo.; City of Fort Morgan; 100 W.
KVOS—Bellingham, Wash.; KVOS (Inc.); 100 W.
KGY—Olympia, Wash.; KGY Inc.; 100 W.
WFAM—South Bend, Ind.; South Bend Tribune; 100 W.
WBHS—Huntsville, Ala.; The Hutchens Co.; 50 W.
CKOV—Kelowna, British Columbia, Can.; J. W. B. Browne; 100 W.
10AB—Moose Jaw, Saskatchewan, Can.; Moose Jaw Radio Assn.; 25 W.
10AK—Stratford, Ontario, Can.; Classic Radio Club; 10 W.
10BJ—Prince Albert, Saskatchewan, Can.; Prince Albert Radio Club; 25 W.
10BP—Wingham, Ontario, Can.; Wingham Radio Club; 15 W.
10BQ—Brantford, Ontario, Can.; Telephone City Radio Assn.; 5 W.
10BU—Canora, Saskatchewan, Can.; Canora Radio Association; 15 W.
CMJG—Camaguey, Cuba; Pedro Nogueras; 30 W.

1205 KILOCYCLES—248.8 METERS

CMGB—Matanzas, Cuba; Jose Anorga; 7.5 W.

1210 KILOCYCLES—247.8 METERS

WMRJ—Jamaica, N. Y.; Peter J. Prinz; 100 W.
WJBI—Redbank, N. J.; Monmouth Broadcasting Co.; 100 W.
WGBB—Freeport, N. Y.; Harry H. Carman; 100 W.
WCOH—Yonkers, N. Y.; T—Greenville, N. Y.; Westchester Broadcasting Corporation, 100 W.
WOCL—Jamestown, N. Y.; A. E. Newton; 50 W.
WLCI—Ithaca, N. Y.; Lutheran Association of Ithaca, N. Y.; 50 W.
WPAW—Pawtucket, R. I.; Shartenberg & Robinson Co.; 100 W.
WSEN—Columbus, Ohio; Columbus Broadcasting Corporation; 100 W.
WJW—Mansfield, Ohio; John F. Weimer (owner Mansfield Broadcasting Association); 100 W.
WALR—Zanesville, Ohio; Roy W. Waller; 100 W.
WBAX—Wilkes-Barre, Pa.; T—Plains Township, Pa.; John H. Stenger, Jr.; 100 W.
WJBU—Lewisburg, Pa.; Bucknell University; 100 W.
WBBL—Richmond, Va.; Grace Covenant Presbyterian Church; 100 W.
WMBG—Richmond, Va.; Havens & Martin (Inc.); 100 W.

(Continued on next page)

(*Continued from preceding page*)

1210 KILOCYCLES—247.8 METERS (Cont.)

WSIX—Springfield, Tenn.; Jack M. and Louis R. Draughon, doing business as 638 Tire and Vulcanizing Co.; 100 W.
WSOC—Gastonia, N. C.; WSOC (Inc.); 100 W.
WJBY—Gadsden, Ala.; Gadsden Broadcasting Co. (Inc.); 100 W.
WQDX—Thomasville, Ga.; Stevens Luke; 50 W.
WRBQ—Greenville, Miss.; J. Pat Scully; 250 W.*
WGCM—Gulfport, Miss.; T—Mississippi City, Miss.; Great Southern Land Co.; 100 W.
KWEA—Shreveport, La.; Hello World Broadcasting Corporation; 100 W.
KDLR—Devils Lake, N. Dak.; KDLR (Inc.); 100 W.
KGCR—Watertown, S. Dak.; Greater Kampeska Radio Corp.; 100 W.
KFOR—Lincoln, Nebr.; Howard A. Shuman; 250 W.*
WHBU—Anderson, Ind.; Anderson Broadcasting Corp.; 100 W.
KFVS—Cape Girardeau, Mo.; Oscar C. Hirsch, trading as Hirsch Battery & Radio Co.; 100 W.
WEBQ—Harrisburg, Ill.; First Trust & Savings Bank of Harrisburg, Ill.; 100 W.
KGNO—Dodge City, Kans.; Dodge City Broadcasting Co. (Inc.); 100 W.
WSBC—Chicago, Ill.; World Battery Co. (Inc.); 100 W.
WCRW—Chicago, Ill.; Clinton R. White; 100 W.
WEDC—Chicago, Ill.; Emil Denemark (Inc.); 100 W.
WCBS—Springfield, Ill.; Chas. H. Messter and Harold L. Dewing; 100 W.
WTAX—Springfield, Ill.; WTAX (Inc.); 100 W.
WHBF—Rock Island, Ill.; Beardsley Specialty Co.; 100 W.
WOMT—Manitowoc, Wis.; Francis M. Kadow; 100 W.
WIBU—Poynette, Wis.; William C. Forrest; 100 W.
KMJ—Fresno, Calif.; James McClatchy Co.; 100 W. (C. P. for 580 KC.)
KFXM—San Bernardino, Calif.; J. C. & E. W. Lee (Lee Bros. Broadcasting Co.); 100 W.
KPPC—Pasadena, Calif.; Pasadena Presbyterian Church; 50 W.
KDFN—Casper, Wyo.; Donald Lewis Hathaway; 100 W. (C. P. for 1,440 KC.—500 W.)
KFJI—Klamath Falls, Ore.; KFJI Broadcasters, Inc.; 100 W.
WPRO—Providence, R. I.; Cherry & Webb Broadcasting Co.; 100 W.
CFCO—Chatham, Ontario, Can.; John Beardall; 100 W.
CFNB—Fredericton, New Brunswick, Can.; Jas. S. Neill & Sons, Ltd.; 50 W.
CJOR—Vancouver, British Columbia, Can.; T—Sea Island, British Columbia, Can.; G. C. Chandler; 500 W.
CKMC—Cobalt, Ontario, Can.; R. L. MacAdam; 100 W.
XEX—Mexico City, Mex.; Excelsior; 500 W.

1220 KILOCYCLES—245.8 METERS

KGMP—Elk City, Okla.; Bryant Radio & Electric Co.; 100 W.
WCAD—Canton, N. Y.; St. Lawrence University; 500 W.
WCAE—Pittsburgh, Pa.; WCAE, Inc.; 1 KW.
WDAE—Tampa, Fla.; Tampa Publishing Co.; 1 KW.
WREN—Tanganoxie, Kans.; Jenny Wren Co.; 1 KW.
KFKU—Lawrence, Kans.; University of Kansas; 500 W.
KWSC—Pullman, Wash.; State College of Washington; 2 KW.*
KTW—Seattle, Wash.; First Presbyterian Church; 1 KW.

1225 KILOCYCLES—244.8 METERS

CMBY—Havana, Cuba; Callejas-Cosculluela; 350 W.
CMCA—Havana, Cuba; Manuel Cruz; 150 W.

1230 KILOCYCLES—243.8 METERS

WNAC-WBIS—Boston, Mass.; T—Quincy, Mass.; Shepard Broadcasting Service (Inc.); 1 KW.
WPSC—State College, Pa.; The Pennsylvania State College; 500 W.
WSBT—South Bend, Ind.; South Bend Tribune; 500 W.
WFBM—Indianapolis, Ind.; Indianapolis Power & Light Co.; 1 KW.
KGGM—Albuquerque, N. Mex.; New Mexico Broadcasting Co.; 500 W.*
KYA—San Francisco, Calif.; Pacific Broadcasting Corporation; 1 KW.
KFQD—Anchorage, Alaska; Anchorage Radio Club; 100 W.
XETQ—Mexico City, Mex.; Carlos G. Caballero; 100 W.

1240 KILOCYCLES—241-8 METERS

WXYZ—Detroit, Mich.; Kunsky-Trendle Broadcasting Corporation; 1 KW.
KTAT—Fort Worth, Tex.; T—Birdville, Tex.; S. A. T. Broadcast Co.; 1 KW.
WACO—Waco, Tex.; Central Texas Broadcasting Co. (Inc.); 1 KW.
KGCU—Mandan, N. Dak.; Mandan Radio Assn.; 250 W.
KLPM—Minot, N. Dak.; John B. Cooley; 250 W.
KTFI—Twin Falls, Idaho; Radio Bdcg. Corp.; 500 W.*

1249 KILOCYCLES—240 METERS

CMAB—Pinar del Rio, Cuba; Francisco Martinez; 20 W.

1250 KILOCYCLES—239.9 METERS

WGCP—Newark, N. J.; May Radio Broadcast Corporation; 250 W.
WODA—Paterson, N. J.; Richard E. O'Dea; 1 KW.
WAAM—Newark, N. J.; WAAM (Inc.); 2 KW.*
WDSU—New Orleans, La.; T—Gretna, La.; Joseph H. Uhalt; 1 KW.
WLB—Minneapolis, Minn.; T—St. Paul, Minn.; University of Minnesota; 1 KW.
WRHM—Minneapolis, Minn.; T—Fridley, Minn.; Minnesota Broadcasting Corporation; 1 KW.
KFMX—Northfield, Minn.; Carlton College; 1 KW.
WCAL—Northfield, Minn.; St. Olaf College; 1 KW.
KFOX—Long Beach, Calif.; Nichols and Warriner (Inc.); 1 KW.
XEFA—Mexico City, Mex.; Manuel F. Murguia; 250 W.

1260 KILOCYCLES—238.0 METERS

WLBW—Oil City, Pa.; Radio-Wire Program Corporation of America; 1 K.*
KWWG—Brownsville, Tex.; The Brownsville Herald Publishing Co.; 500 W.
WTOC—Savannah, Ga.; Savannah Broadcasting Co., (Inc.); 500 W.
KRGV—Harlingen, Tex.; KRGV (Inc.); 500 W.
KOIL—Council Bluffs, Iowa; Mona Motor Oil Co.; 1 KW.
KVOA—Tuscon, Ariz.; Robert M. Riculfi; 500 W.

1270 KILOCYCLES—236.1 METERS

WEAI—Ithaca, N. Y.; Cornell University; 1 KW.
WFBR—Baltimore, Md.; Baltimore Radio Show (Inc.); 500 W.
WASH—Grand Rapids, Mich. (Uses transmitter of WOOD); WASH Broadcasting Corporation; 500 W. (1 KW.—C.P.).
WOOD—Grand Rapids, Mich.; T—Furn-Kunsky-Trendle Broadcasting Corp.; 500 W.
WJDX—Jackson, Miss.; Lamar Life Insurance Co.; 1 KW.
KWLC—Decorah, Iowa; Luther College; 100 W.
KGCA—Decorah, Iowa; Charles W. Greenley; 50 W.
KOL—Seattle, Wash.; Seattle Broadcasting Co. (Inc.); 1 KW.
KVOR—Colorado Springs, Colo.; Reynolds Radio Co., Inc.; 1 KW.
XEFB—Monterrey, N. L., Mex.; Quintanilla & Stevenson; 50 W.

1280 KILOCYCLES—234.2 METERS

WCAM—Camden, N. J.; City of Camden; 500 W.
WCAP—Asbury Park, N. J.; Radio Industries Broadcast Co.; 500 W.
WOAX—Trenton, N. J.; WOAX (Inc.); 500 W.
WDOD—Chattanooga, Tenn.; T—Brainerd, Tenn.; WDOD Broadcasting Corporation; 1 KW. (5 KW.—C.P.).
WRR—Dallas, Tex.; City of Dallas, Tex.; 500 W.
WIBA—Madison, Wis.; Badger Broadcasting Co.; 500 W.
KFBB—Great Falls, Mont.; Buttrey Broadcast (Inc.); 2½ KW.*

1285 KILOCYCLES—233.4 METERS

CMCU—Havana, Cuba; Jorge Garcia Serra; 150 W.
CMCW—Havana, Cuba; Jose Lorenzo; 150 W.

1290 KILOCYCLES—232.4 METERS

WNBZ—Saranac Lake, N. Y.; Earl J. Smith and William Mace, doing business as Smith & Mace; 50 W.
WJAS—Pittsburgh, Pa.; T—North Fayette Township, Pa.; Pittsburgh Radio Supply House; 2½ KW.*
KTSA—San Antonio, Tex.; Lone Star Broadcasting Co. (Inc.); 2 KW.*
KFUL—Galveston, Tex.; News Publishing Co.; 500 W.
KLCN—Blytheville, Ark.; Charles Leo Lintzenich; 50 W.
WEBC—Superior, Wisc.; Head of the Lakes Broadcasting Co.; 2½ KC.*
KDYL—Salt Lake City, Utah; Intermountain Broadcasting Corporation; 1 KW.

1300 KILOCYCLES—230.6 METERS

WBBR—Brooklyn, N. Y.; T—Rossville, N. Y. (Staten Island); Peoples Pulpit Association; 1 KW.
WHAP—New York, N. Y.; T—Carlstadt, N. J.; Defenders of Truth Society (Inc.); 1 KW.
WEVD—New York, N. Y.; T—Forest Hills, N. Y.; Debs Memorial Radio Fund (Inc.); 500 W.
WHAZ—Troy, N. Y.; Rensselaer Polytechnic Institute; 500 W.
WIOD—Miami, Fla.; T—Miami Beach, Fla.; Isle of Dreams Broadcasting Corporation; 1KW.
KFH—Wichita, Kans.; Radio Station KFH Co.; 1 KW.
WOQ—Kansas City, Mo.; Unity School of Christianity; 1 KW.
KGEF—Los Angeles, Calif.; Trinity Methodist Church, South; 1 KW.
KFJR—Portland, Ore.; Ashley C. Dixon, trading as Ashley C. Dixon & Son; 500 W.
KTBR—Portland, Ore.; M. E. Brown; 500 W.
KFAC—Los Angeles, Calif.; Los Angeles Broadcasting Co.; 1 KW.
XEM—Mexico City, Mex.; Maria T. de Gutierez; 250 W.

1310 KILOCYCLES—228.9 METERS

WKAV—Laconia, N. H.; Laconia Radio Club; 100 W.
WEBR—Buffalo, N. Y.; Howell Broadcasting Co. (Inc.); 200 W.*
WMBO—Auburn, N. Y.; WMBO, Inc.; 100 W.
WNBH—New Bedford, Mass.; T—Fairhaven, Mass.; Irving Vermilya, trading as New Bedford Broadcasting Co.; 100 W.
WOL—Washington, D. C.; American Broadcasting Co.; 100 W.
WGH—Newport News, Va.; Hampton Roads Broadcasting Corporation; 100 W.
WEXL—Royal Oak, Mich.; Royal Oak Broadcasting Co.; 50 W.
WFDF—Flint, Mich.; Frank D. Fallain; 100 W.
WBEO—Marquette, Mich.; Lake Superior Broadcasting Co.; 100 W.
WHAT—Philadelphia, Pa.; Independence Broadcasting Co.; 100 W.
WTEL—Philadelphia, Pa.; Foulkrod Radio Engineering Co.; 100 W.
WJAC—Johnstown, Pa.; Johnstown Automobile Co.; 100 W.
WFBG—Altoona, Pa.; William F. Gable Co.; 100 W.
WRAW—Reading, Pa.; Reading Broadcasting Co.; 100 W.
WGAL—Lancaster, Pa.; WGAL, Incorporated; 100 W.
WSAJ—Grove City, Pa.; Grove City College; 100 W.
WBRE—Wilkes-Barre, Pa.; Louis G. Baltimore; 100 W.
WKBC—Birmingham, Ala.; R. B. Broyles, trading as R. B. Broyles Furniture Co.; 100 W.
WTJS—Jackson, Tenn.; Sun Pub. Co.; 100 W.
WTSL—Laurel, Miss.; G. H. Houseman; 100 W.
WROL—Knoxville, Tenn.; Stuart Broadcasting Corporation; 100 W.
KRMD—Shreveport, La.; Robert M. Dean; 50 W.
WSJS—Winston-Salem, N. C.; Winston-Salem Journal Co.; 100 W.
KTLC—Houston, Tex.; Houston Broadcasting Co.; 100 W.
KFPM—Greenville, Tex.; Dave Ablowich, trading as The New Furniture Co.; 15 W.
KTSM—El Paso, Tex.; W. S. Bledsoe and W. T. Blackwell; 100 W.
WDAH—El Paso, Tex.; W. S. Bledsoe and W. T. Blackwell; 100 W.
KFPL—Dublin, Tex.; C. C. Baxter; 100 W.
KFXR—Oklahoma City, Okla.; Exchange Avenue Baptist Church; 250 W.*
WKBS—Galesburg, Ill.; Permil N. Nelson; 100 W.
WCLS—Joliet, Ill.; WCLS (Inc.); 100 W.
WKBB—Joliet, Ill.; Sanders Brothers Radio Station; 100 W.
KWCR—Cedar Rapids, Iowa; Cedar Rapids Broadcast Co.; 100 W.
KFJY—Fort Dodge, Iowa; Cedar Rapids Broadcast Co.; 100 W.
KFGQ—Boone, Iowa; Boone Biblical College; 100 W.
KGFW—Ravenna, Nebr.; Central Nebraska Broadcasting Corporation; 100 W.
WBOW—Terre Haute, Ind.; Banks of Wabash (Inc.); 100 W.
WJAK—Marion, Ind.; Marion Broadcast Co.; 50 W.
WLBC—Muncie, Ind.; Donald H. Burton; 50 W.
KGBX—St. Joseph, Mo.; KGBX (Inc.); 100 W.
KFBK—Sacramento, Calif.; James McClatchy Co.; 100 W.
KCRJ—Jerome, Ariz.; Charles C. Robinson; 100 W.
KGCX—Wolf Point, Mont.; First State Bank of Vida; 250 W.*
KGEZ—Kalispell, Mont.; Donald C. Treloar; 100 W.
KFUP—Denver, Colo.; Fitzsimmons General Hospital, U. S. Army; 100 W.
KFXJ—Grand Junction, Colo.; R. G. Howell and Charles Howell, doing business as Western Slope Broadcasting Co.; 100 W.
KMED—Medford, Ore.; Mrs. W. J. Virgin; 100 W.
KXRO—Aberdeen, Wash.; KXRO (Inc.); 100 W.
KIT—Yakima, Wash.; Carl E. Haymond; 100 W.
WFDV—Rome, Ga.; Rome Broadcasting Corp.; 100 W.
KFYO—Tubbock, Tex.; Kirksey Bros.; 250 W. (C.P. only; see 1420 KC.).

1320 KILOCYCLES—227.1 METERS

WADC—Akron, Ga.; Allen T. Simmons; 1 KW.
WSMB—New Orleans, La.; Saenger Theatres (Inc.) and Maison Blanche Co.; 500 W.
KTFI—Twin Falls, Idaho; Radio Broadcasting Corporation; 250 W.
KID—Idaho Falls, Idaho; KID Broadcasting Co.; 500 W.*
KGHF—Pueblo, Colo.; Curtis P. Ritchie and Joe E. Finch; 500 W.*
KGMB—Honolulu, Hawaii; Honolulu Broadcasting Co. (Ltd.); 250 W.

1330 KILOCYCLES—225.4 METERS

WDRC—Hartford, Conn.; T—Bloomfield, Conn.; WDRC (Inc.); 500 W.
WSAI—Cincinnati, O.; T—Mason, Ohio; Crosley Radio Corporation (lessee); 1 KW.
WTAQ—Eau Claire, Wis.; T—Township of Washington, Wis.; Gillette Rubber Co.; 1 KW.
KSCJ—Sioux City, Iowa; Perkins Brothers Co.; 2½ KW.*
KGB—San Diego, Calif.; Don Lee, Inc.; 500 W.

1340 KILOCYCLES—223.7 METERS

WSPD—Toledo, Ohio; Toledo Broadcasting Co.; 1 KW.
KFPW—Fort Smith, Ark.; Southwestern Hotel Co.; 50 W.
WCOA—Pensacola, Fla.; Pensacola Bdcg. Co.; 500 W.
KFPY—Spokane, Wash.; Symons Broadcasting Co.; 1 KW.

1345 KILOCYCLES—223 METERS

CMCG—Havana, Cuba; Jose Justo Moran; 30 W.
CMCR—Havana, Cuba; Aurelio Hernandez; 150 W.
CMCY—Havana, Cuba; M. D. Autran; 50 W.

1350 KILOCYCLES—222.1 METERS

WAWZ—Zarephath, N. J.; Pillar of Fire; 250 W.
WMSG—New York, N. Y.; Madison Square Garden Broadcast Corporation; 250 W.
WCDA—New York, N. Y.; T—Cliffside Park, N. J.; Italian Educational Broadcasting Co. (Inc.); 250 W.
WBNX—New York, N. Y.; Standard Cahill Co. (Inc.); 250 W.
KWKK—St. Louis, Mo.; T—Kirkwood, Mo.; Greater St. Louis Broadcasting Corporation; 1 KW.

1350 KILOCYCLES—222.1 METERS (Cont.)

WEHC—Emory, Va.; Emory & Henry College; 500 W.
KIDO—Boise, Idaho; Boise Broadcasting Station; 1 KW.

1360 KILOCYCLES—220.4 METERS

WFBL—Syracuse, N. Y.; Onondaga Radio Broadcasting Corporation; 1 KW.
WQBC—Vicksburg, Miss.; Delta Broadcasting Co. (Inc.); 500 W.
WCSC—Charleston, S. C.; Lewis Burk; 500 W.
WJKS—Gary, Ill.; Johnson-Kennedy Radio Corporation; 1¼ KW.*
WGES—Chicago, Ill.; Oak Leaves Broadcasting Station (Inc.); 1 KW.*
KGIR—Butte, Mont.; KGIR (Inc.); 500 W.
KGER—Long Beach, Calif.; Consolidated Broadcasting Corp.; 1 KW.
XEG—Mexico City, Mex.; Miguel Zarza; 100 W.

1370 KILOCYCLES—218.7 METERS

WRDO—Augusta, Me.; WRDO, Inc.; 100 W.
WQDM—St. Albans, Vt.; A. J. St. Antoine; 100 W.
WLEY—Lexington, Mass.; Carl S. Wheeler, trading as Lexington Air Stations; 250 W.*
WSVS—Buffalo, N. Y.; Elmer S. Pierce, principal, Seneca Vocational High School; 50 W.
WBGF—Glens Falls, N. Y.; W. Neal Parker and Herbert H. Metcalfe; 50W.
WCBM—Baltimore, Md.; Baltimore Broadcasting Corporation; 250 W.*
WBTM—Danville, Va.; L. H., R. G. and A. S. Clarke, doing business as Clarke Electric Co.; 100 W.
WLVA—Lynchburg, Va.; Lynchburg Broadcasting Corporation; 100 W.
WHBD—Mount Orab, Ohio; F. P. Moler; 100 W.
WHDF—Calumet, Mich.; Upper Michigan Broadcasting Co.; 250 W.*
WJBK—Highland Park, Mich.; James F. Hopkins (Inc.); 50 W.
WIBM—Jackson, Mich.; WIBM (Inc.); 100 W.
WRAK—Williamsport, Pa.; Clarence R. Cummins; 100 W.
WHBQ—Memphis, Tenn.; Broadcasting Station WHBQ (Inc.); 100 W.
KGFG—Oklahoma City, Okla.; Oklahoma Broadcasting Co. (Inc.); 100 W.
KCRC—Enid, Okla.; Enid Radiphone Co.; 250 W.*
WMBR—Tampa, Fla.; F. J. Reynolds; 100 W.
KMAC—San Antonio, Tex.; W. W. McAllister; 100 W.
KFJZ—Fort Worth, Tex.; Ralph S. Bishop; 100 W.
KONO—San Antonio, Tex.; Mission Broadcasting Co.; 100 W.
KGKL—San Angelo, Tex.; KGKL (Inc.), 100 W.
KFLX—Galveston, Tex.; George Roy Clough; 100 W.
WGL—Fort Wayne, Ind.; Fred C. Zeig (Allen-Wayne Co.); 100 W.
KGDA—Mitchell, S. Dak.; Mitchell Broadcasting Corporation; 100 W.
KFJM—Great Forks, N. Dak.; University of North Dakota; 100 W.
KWKC—Kansas City, Mo.; Wilson Duncan, trading as Wilson Duncan Broadcasting Co.; 100 W.
WRJN—Racine, Wis.; Racine Broadcasting Corporation; 100 W.
KGAR—Tucson, Ariz.; Tucson Motor Service; 250 W.*
KRE—Berkeley, Calif.; First Congregational Church of Berkeley; 100 W.
KOOS—Marshfield, Ore.; H. H. Hansetly (Inc.); 100 W.
KFBL—Everett, Wash.; Otto Leese and Robert Leese, doing business as Leese Bros.; 50 W.
KVL—Seattle, Wash.; KVL, Incorporated; 100 W.
KFJI—Klamath Falls, Ore.; KFJI Broadcasters, Inc.; 100 W.
KGFL—Raton, N. Mex.; KGFL, Inc.; 50 W.
KUJ—Walla Walla, Wash.; KUJ, Inc.; 100 W.
WRAM—Wilmington, N. C.; Wilmington Radio Asso.; 100 W.
WJTL—Tifton, Ga.: Oglethorpe University; 100 W.
WPFB—Hattiesburg, Miss.; Hattiesburg Bdcg. Corp.; 100 W.
CMGH—Matanzas, Cuba; Alberto Alvarez; 150 W.

1375 KILOYCLES—218 METERS

CMAC—Pinar del Rio, Cuba; Oscar S. Mechoso; 30 W.
CMGE—Cardenas, Cuba; Genaro Sebater; 30 W.

1380 KILOCYCLES—217.3 METERS

WSMK—Dayton, Ohio; Stanley M. Krohn, Jr.; 200 W.
KQV—Pittsburgh, Pa.; KQV, Inc.; 500 W.
KSO—Clarinda, Iowa; Iowa Broadcasting Co.; 500 W.
WKBH—LaCrosse, Wis.; WKBH (Inc.); 1 KW.
KOH—Reno, Nev.; The Bee, Inc.; 500 W.
KQV—Pittsburgh, Pa.; KQV Broadcasting Co.; 500 W.
XETB—Torreon Coah., Mex.; Jose A. Berumen; 125 W.

1382 KILOCYCLES—217.25 METERS

CMJC—Camaguey, Cuba; Feliciano Isaac; 150 W.

1390 KILOCYCLES—215.7 METERS

WHK—Cleveland, Ohio; T—Seven Hills, Ohio; Radio Air Service Corporation; 1 KW.
KLRA—Little Rock, Ark.; Arkansas Broadcasting Co.; 1 KW.
KUOA—Fayetteville, Ark.; University of Arkansas; 1 KW.
KOY—Phoenix, Ariz.; Nielsen Radio & Sporting Goods Co.; 500 W.

1400 KILOCYCLES—214.2 METERS

WCGU—Brooklyn, N. Y.; United States Broadcasting Corporation; 500 W.
WFOX—Brooklyn, N. Y.; Paramount Broadcasting Corporation; 500 W.
WLTH—Brooklyn, N. Y.; Voice of Brooklyn (Inc.); 500 W.
WBBC—Brooklyn, N. Y.; Brooklyn Broadcasting Corporation; 500 W.
KOCW—Chickasha, Okla.; Oklahoma College for Women; 500 W.*
WCMA—Culver, Ind.; General Broadcasting Corporation; 500 W.
WKBF—Indianapolis, Ind.; T—Clermont, Ind.; Indianapolis Broadcasting (Inc.); 500 W.
WBAA—West Lafayette, Ind.; Purdue University; 1 KW.*
KLO—Ogden, Utah; Peery Building Co.; 500 W.
XEP—N. Laredo, Tams., Mex.; Asociacion Radiodifusora Latino-Americana, S. A.; 200 W.

1405 KILOCYCLES—213.4 METERS

CMBI—Havana, Cuba; Francisco Mayorquim; 30 W.
CMBN—Havana, Cuba; Armado Romeu; 30 W.
CMCH—Havana, Cuba; Hernani Torralbas; 15 W.
CMCM—Havana, Cuba; Martinez-Madicu; 15 W.

1410 KILOCYCLES—212.6 METERS

WRBX—Roanoke, Va.; Richmond Development Corporation; 250 W.
WBCM—Bay City, Mich.; T—Hampton Township, Mich.; James E. Davidson; 500 W.
KGRS—Amarillo, Tex.; E. B. Gish (Gish Radio Service); 1 KW.
WDAG—Amarillo, Tex.; National Radio and Broadcasting Corporation; 1 KW.
WODX—Mobile, Ala.; T—Springhill, Ala.; Mobile Broadcasting Corporation; 500 W.
WSFA—Montgomery, Ala.; Montgomery Broadcasting Co. (Inc.); 500 W.
KFLV—Rockford, Ill.; Rockford Broadcasters (Inc.); 500 W.
WHBL—Sheboygan, Wis.; Press Publishing Co.; 500 W.
WAAB—Boston, Mass.; Bay State Broadcasting Corp.; 500 W.
WHIS—Bluefield, W. Va.; Daily Telegraph; 250 W.

1420 KILOCYCLES—211.1 METERS

KGVO—Missoula, Mich.; Mosby's (Inc.); 100 W.
WTBO—Cumberland, Md.; Associated Broadcasting Corporation; 210 W.*
WILM—Wilmington, Del.; T—Edge Moor, Del.; Delaware Broadcasting Co. (Inc.); 100 W.
WPAD—Paducah, Ky.; Pierce E. Lackey and S. Houston McNutt, doing business as Paducah Broadcasting Co.; 100 W.

1420 KILOCYCLES—211.1 METERS (Cont.)

WEDH—Erie, Pa.; Erie Dispatch-Herald Broadcasting Corporation; 100 W.
WMBC—Detroit, Mich.; Michigan Broadcasting Co.; 210 W.*
WELL—Battle Creek, Mich.; Enquirer-News Co.; 50 W.
WFDW—Anniston, Ala. T—Talladega, Ala.; Raymond C. Hammett; 100 W.
WJBO—New Orleans, La.; Valdemar Jensen; 100 W.
KGFF—Shawnee, Okla.; D. R. Wallace (owner KGFF Broadcasting Co.); 100 W.
KABC—San Antonio, Tex.; Alamo Broadcasting Co. (Inc.); 100 W.
KXYZ—Houston, Tex.; Harris County Broadcast Co.; 100 W.
KFYO—Abilene, Tex.; T. E. Kirksey, trading as Kirksey Brothers; 250 W.* (C.P. for 1310 KC. move to Lubbock, Tex.)
WSPA—Spartanburg, S. C.; Virgil V. Evans, trading as The Voice of South Carolina; 250 W.*
KICK—Red Oak, Iowa; Red Oak Radio Corporation; 100 W.
WIAS—Ottumwa, Iowa; Iowa Broadcasting Co.; 100 W.
WLBF—Kansas City, Kans.; The WLBF Broadcasting Co.; 100 W.
WMBH—Joplin, Mo.; Edwin Dudley Aber; 250 W.*
WEHS—Evanston, Ill.; WEHS (Inc.); 100 W.
WHFC—Cicero, Ill.; WHFC, Inc.; 100 W.
WKBI—Chicago, Ill.; WKBI, Inc.; 100 W.
KFIZ—Fond du Lac, Wis.; The Reporter Printing Co.; 100 W.
KFXY—Flagstaff, Ariz.; Albert H. Scherman; 100 W.
KGIX—Los Vegas, Nev.; Los Vegas Radio Corp.; 100 W.
KFXD—Nampa, Idaho; Frank E. Hurt, trading as Service Radio Co.; 500 W.
KGIW—Trinidad, Colo.; Leonard E. Wilson; 100 W.
KGKX—Sandpoint, Idaho; W. W. Von Cannon, trustee; 100 W.
KGGC—San Francisco, Calif.; The Golden Gate Broadcasting Co.; 100 W.
KXL—Portland, Ore.; KXL Broadcasters, Inc.; 100 W.
KBPS—Portland, Ore.; Benson Polytechnic School; 100 W.
KORE—Eugene, Ore.; Frank L. Hill and C. G. Phillips, doing business as Eugene Broadcast Station; 100 W.
WJMS—Ironwood, Mich.; Morris Johnson; 100 W.
WDEV—Waterbury, Vermont; Harry C. Whitehall; 50 W.
WAGM—Presque Isle, Me.; Aroostock Broadcasting Corp.; 100 W.
WADL—Tupper Lake, N. Y., Tupper Lake Bdcg. Co., Inc.; 100 W.

1430 KILOCYCLES—209.7 METERS

WHP—Harrisburg, Pa.; T—Lemoyne, Pa.; WHP (Inc.); 1 KW.*
WBAK—Harrisburg, Pa.; Pennsylvania State Police, Commonwealth of Pennsylvania; 1 KW.*
WCAH—Columbus, Ohio; Commercial Radio Service Co.; 500 W.
WNBR—Memphis, Tenn.; Memphis Broadcasting Co.; 500 W.
KGNF—North Platte, Nebr.; Great Plains Broadcasting Co.; 500 W.
KECA—Los Angeles, Calif.; Earle C. Anthony, Inc.; 1 KW.
WFEA—Manchester, N. H.; New Hampshire Broadcasting Co.; 500 W.
WHEC—Rochester, N. Y.; WHEC, Inc.; 500 W.
WOKO-WABO—Albany, N. Y.; T—Mount Beacon, N. Y.; WOKO (Inc.); 500 W.

1440 KILOCYCLES—208.2 METERS

WCBA—Allentown, Pa.; B. Bryan Musselman; 250 W.
WSAN—Allentown, Pa.; Allentown Call Publishing Co. (Inc.); 250 W.
WBIG—Greensboro, N. C.; North Carolina Broadcasting Co. (Inc.); 500 W.
WTAD—Quincy, Ill.; Illinois Broadcasting Corporation; 500 W.
WMBD—Peoria Heights, Ill.; E. M. Kahler (owner Peoria Heights Radio Laboratory); 1 KW.*
KLS—Oakland, Calif.; E. N. and S. W. Warner, doing business as Warner Bros.; 250 W.
WMBD—Peoria Heights, Ill.; Peoria Bdcg. Co.; 500 W.
WTAD—Quincy, Ill.; Ill. Bdcg. Corp.; 500 W.
KDFN—Casper, Wyo.; Donald L. Hathaway; 500 W. (C.P. only; see 1210 KC.)

1450 KILOCYCLES—206.8 METERS

WSAR—Fall River, Mass.; Doughty & Welch Elec. Co., Inc.; 250 W.
WBMS—Hackensack, N. J.; WBMS Broadcasting Corporation; 250 W.
WNJ—Newark, N. J.; Radio Investment Co. (Inc.); 250 W.
WHOM—Jersey City, N. J.; New Jersey Broadcasting Corporation; 250 W.
WSAR—Fall River, Mass.; Doughty & Welch Electric Co. (Inc.); 250 W.
WGAR—Cleveland, Ohio; WGAR Broadcasting Co.; 500 W.
WTFI—Athens, Ga.; Toccoa Falls Institute; 500 W.
KTBS—Shreveport, La.; Tri State Broadcasting System (Inc.); 1 KW.

1460 KILOCYCLES—205.4 METERS

WJSV—Alexandria, Va.; T—Mt. Vernon Hills, Va.; WJSV, Inc.; 10 KW.
KSTP—St. Paul, Minn.; T—Westcott, Minn.; National Battery Broadcasting Co.; 10 KW.

1470 KILOCYCLES—204.0 METERS

WLAC—Nashville, Tenn.; Life and Casualty Insurance Co.; 5 KW.
KGA—Spokane, Wash.; Northwest Broadcasting System (Inc.); 5 KW.

1480 KILOCYCLES—202.6 METERS

WKBW—Buffalo, N. Y.; T—Amherst, N. Y.; WKBW (Inc.); 5 KW.
KFJF—Oklahoma City, Okla.; National Radio Manufacturing Co.; 5 KW.

1490 KILOCYCLES—201.2 METERS

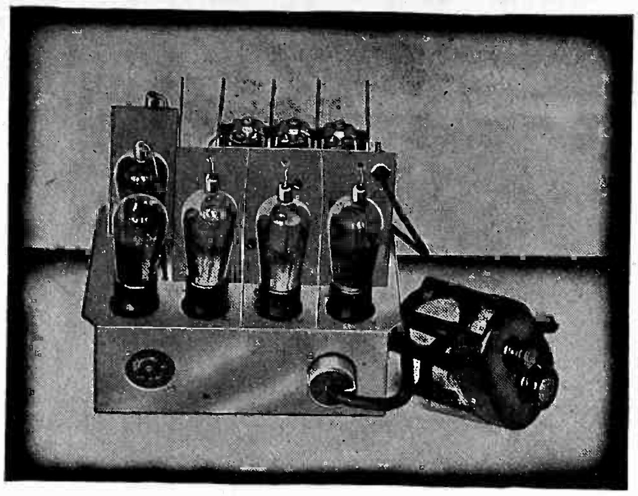
WCKY—Covington, Ky.; T—Crescent Springs, Ky.; L. B. Wilson (Inc.); 5 KW.
WCHI—Chicago, Ill.; T—Batavia, Ill.; Midland Broadcasting Co.; 5 KW.

1500 KILOCYCLES—199.9 METERS

WMBA—Newport, R. I.; LeRoy Joseph Beebe; 100 W.
WLOE—Boston, Mass. T—Chelsea, Mass.; Boston Broadcasting Co. 250 W.
WNBF—Binghamton, N. Y.; Howitt-Wood Radio Co. (Inc.); 100 W.
WMBQ—Brooklyn, N. Y.; Paul J. Gollhofer; 100 W.
WLBX—Long Island City, N. Y.; John N. Brahy; 100 W.
WWRL—Woodside, N. Y.; Long Island Broadcasting Corporation; 100 W.
WSYB—Rutland, Vt.; H. E. Seward, Jr., and Philip Weiss, doing business as Seward & Weiss Music Co.; 100 W.
WKBZ—Ludington, Mich.; Karl L. Ashbacker; 50 W.
WMPC—Lapeer, Mich.; First Methodist Protestant Church of Lapeer; 100 W.
WPEN—Philadelphia, Pa.; Wm. Penn Broadcasting Co.; 250 W*.
WWSW—Pittsburgh, Pa.; Walker & Downing Radio Corp.; 100 W.
WOPI—Bristol, Tenn.; Radiophone Broadcasting Station WOPI (Inc.) 100 W.
WRDW—Augusta, Ga.; Musicove (Inc.); 100 W.
KGFI—Corpus Christi, Tex.; Eagle Broadcasting Co. (Inc.); 250 W*.
KUT—Austin, Tex.; KUT Broadcasting Co.; 100 W.
KGKB—Tyler, Tex.; East Texas Bldg. Co.; 100 W.
KGIZ—Grant City, Mo.; Grant City Park Corporation; 100 W.
KGKY—Scottsbluff, Nebr.; Hillard Co. (Inc.); 100 W.
WKBV—Connersville, Ind.; William O. Knox, trading as Knox Battery & Electric Co.; 150 W*.
KGFK—Moorehead, Minn.; Red River Broadcasting Co. (Inc.); 50 W.
KPJM—Prescott, Ariz.; A. P. Miller; 100 W.
KXO—El Centro, Calif.; E. R. Irey and F. M. Bowles; 100 W.
KDB—Santa Barbara, Calif.; Santa Barbara Broadcasters, Ltd.; 100 W.
KREG—Santa Ana, Calif.; J. S. Edwards; 100 W.
KPQ—Wenatchee, Wash.; Wescoast Broadcasting Co.; 50 W.
KCMC—Texarkana, Ark.; No Miss. Bdcg. Corp.; 100 W.
WMIL—Brooklyn, N. Y.; Arthur Faske; 100 W.
XETZ—Coyoacan, D. F., Mex.; Manuel Zetina; 100 W.
CMBL—Havana, Cuba; Julio C. Hidalgo; 20 W.
CMBQ—Havana, Cuba; Gali-Sardinas; 50 W.
CMBR—Havana, Cuba; Tomas Basail; 15 W.

Anderson's Auto Set, No. 631

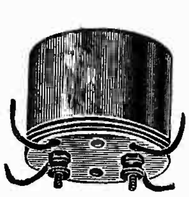
In an automobile set what you need and must have is SENSITIVITY. You read about high-powered home receivers having a sensitivity of 10 microvolts per meter. Here is an 8-tube auto set, chassis 7 x 11½ x 2¾ inches, that has just such sensitivity. It brings in DX through 50,000 watt locals 10 kc. removed. Did you ever hear of that before in an auto set? Volume is high, without distortion. Push-pull pentode output. This circuit was designed and engineered by J. E. Anderson and is by far the best auto set we've ever heard. Variable mu, pentode r-f tubes.



Complete kit of **parts**, **including** remote tuning control, running board aerial, speaker, battery box, everything but tubes which are: two 236, two 237, two 238 and two 239 (automotive 6-volt series). Order Cat. JE-631 @............**$50.00**

Set of tubes for car receiver (Cat. 630-TUK), @.......**$11.80**

INTERMEDIATE FREQUENCY TRANSFORMERS



FOR short wave superheterodyne work 1,600 kc. is the popular intermediate frequency, because you can tune to below 9 meters without interlocking of modulator and oscillator circuits, due to the high intermediate frequency. Our 1,600 kc. shielded transformers have large diameter wire, loose coupling for selectivity and stability, and Hammarlund's new superheterodyne condensers built in, accessible to a screwdriver. Both plate and grid circuits are tuned. Shield is 2⅛ inch diameter, 2⅞ inches high. For variable mu tubes. Order Cat. FF-1600 @..............................$1.65

Doubly tuned fixed-frequency transformer, 1 to 1 ratio, 175 kilocycles. Band pass filter characteristic. Hammarlund 20-100 mfd. equalizers across primary and secondary accessible. Aluminum shield (must be grounded) 2¼ inches diameter, 2½ inches high, removable bottom. For variable mu tubes. Order Cat. FF-175 @..............................$1.50

Same as directly above, for 400 kc. Order Cat. FF-400 @..............$1.50

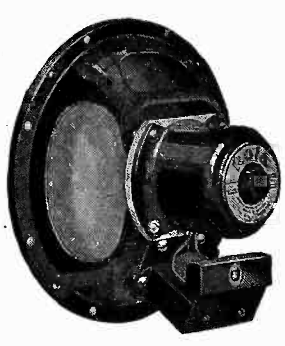
ROLA DYNAMIC SPEAKERS

Series F, Rola dynamic speakers for single pentode output, with 1,800 ohm field coil tapped at 300 ohms. Field coil may be used as B supply choke, with 300 ohm section for 247 bias, if field is put in negative rectifier leg. Output transformer built in, 7" cone. Cat. RO-18 @ $4.50

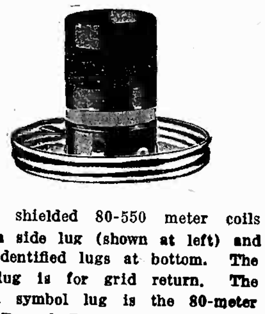
Same as above, except that cone diameter is 10.5 inches. Cat. RO-18-10 @ $5.85

Same as above, except that cone diameter is 12 inches. Cat. RO-18-12 @ $6.95

Rola dynamic 6-inch cone for automobile sets, 6 volt field to be connected to car's storage battery. Speaker fits on fireboard under the instrument board. Shielded cable is supplied with each speaker. Cat. RO-AU @ $4.95



BROADCAST COILS WITH 80-METER TAP



The shielded 80-550 meter coils have a side lug (shown at left) and four identified lugs at bottom. The side lug is for grid return. The ground symbol lug is the 80-meter tap. P and B go to antenna and ground or plate and B plus. For oscillation B goes to plate and P to B plus.

TAPPED coils are proving very popular, as they make for economy of room and also afford good results. The Roland coils are obtainable for broadcast coverage, 200 to 550 meters, with tap for going down to 80 meters, so television, airplane talks, amateur and other interesting transmission may be heard. An insulated three-deck two-tap long switch is needed for front panel band shifting. See illustration at right. These coils are wound on 1⅛ inch diameter and are attached at the factory to aluminum screw bases, with four identified lugs protruding at bottom and a fifth lug at side. An aluminum cover (not illustrated) screws over the base.

The primary is wound over the secondary, with insulating fabric between, and the inductance is kept exactly equal for all coils by keeping the axial length of the winding identical, as well as the number of turns. Therefore at top (what looks like a separate winding), a space is "spun," as well as at bottom, to insure such identical inductance.

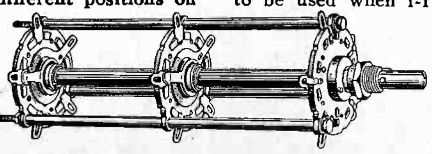
For 80-550 meters, for use with 0.00035 mfd. three gang, order Cat. M-35-C (three coils, three shields at this price) @ $2.45

For 0.0005 mfd. order Cat. M-05-C @..................$2.45

175 kc tuning unit: 3-gang condenser, trimmers, r-f and modulator coil, and special oscillator coil with 700-1000 mmfd. padding condenser and 0.6 mmfd. grid-to-grid coupling condenser. Padding directions supplied, (Cat. 175-TU) @ **$6.03**

LONG SWITCHES

Three decks, four different positions on each deck. Cat. LSW-4-3 @ **$2.95**



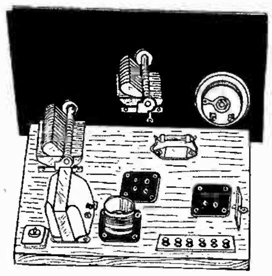
Three decks, two different positions on each deck (used in 627 circuit). Cat. LSW-2-3 @ **$2.65**

SUPER CONDENSERS

Fine padding condenser, 700-1,000 mmfd. to be used when i-f is 175 kc. Cat. PC-710 @..**$ .50**

Coupling condenser, oscillator grid to modulator grid, 0.6 mmfd., no pickup winding needed. Cat. C-6T @ ....**$ .18**

Battery Set 15 to 200 Meters



A SHORT-WAVE receiver, using two 230 (2-volt) tubes, requiring 3 volts filament battery source and 90 volts of B battery. The circuit is detector and one transformer coupled audio stage. This "detector and one step" has been standard for ten years. With this circuit reception the world over has been enjoyed and the elated users number into the teeming thousands. Ranges 15 to 200 meters, using five plug-in coils. Old-timers know this circuit well. Persons who have had no experience with short-waves will find this a most appropriate circuit for a thrilling beginning. The circuit can be wired in 1½ hours.

PARTS REQUIRED: 5 plug-in coils, **$1.50**; Hammarlund 0.00014 mfd. tuning cond., **$1.20**; Hammarlund 0.0002 tuning cond., **$1.35**; **three UX sockets, 30c; audio** trans., **70c**; 50,000 ohm leak, **10c**; 300 turn honeycomb, **30c**; 0.00025 mfd., clips, **15c**; 6.5 ohm limiting resistor for filament circuit, **15c**; 20-ohm rheostat, **40c**; 20-100 mmfd. equalizer, **20c**; battery switch, **20c**; 6 bind. posts, **30c**; bind. post strip, **10c**; vernier dial, **50c**; two knobs, **10c**; 7 x 10 bakelite panel, **$1.25**; 7 x 10 baseboard, **25c**.

Complete parts, with blueprint, less tubes, (Cat. SW-DAF), @ **$9.10**

Two 230 tubes @ total of..............................**$1.92**

Precision Parts

600 TURN HONEYCOMB coil, total diameter 1¼ inches; will tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd equalizer). Cat. HC-800 @..............................$ .50

300 TURN HONEYCOMB coil, same style, tunes to 400 kc. with 0.0001 mfd. Also may be used without condenser as antenna input coil, screen and plate choking, or two used inductively coupled for evening the amplification of t-r-f sets, in untuned stage feeding detector Cat. HC-300 (each) @..............................$ .30

50 TURN HONEYCOMB coil, ¼ millihenry, for all short wave purposes. Cat. HC-50 @..................$ .25

1 WATT PIGTAIL RESISTORS, all resistance values. Mention Cat. PGTR and state resistance in ohms thereafter. Price ....$ .15

5 WATT 2,250 OHM resistor to drop maximum B to B plus 180 volts for plates of r-f tubes in any t-r-f set. Cat. 5-W-2 @..............................$ .45

POTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ 95c; 25,000 ohms @ $1.25; 50,000 ohms @ $1.25; 100,000 ohms @ $1.25; 500,000 ohms @ $1.25.

POTENTIOMETER with a-c switch attached, 10,000 ohms, for variable mu grid bias as volume control. Cat. POT-5-SW @ $1.55

WALNUT FINISH, EITHER DORSET OR STANTON CABINET for midget sets, cut for 7-inch cone. Cat. MDCB @ $4.90

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Shielded. Cat. DJA-35 @..............................$1.95

KELFORD 30 henry choke; stands up to 100 ma; in black shield case. Cat. KEL-30 @..............$1.75

KELFORD 15 henry B supply choke; 60 ma; unshielded. Cat. KEL-15 @..............................$ .95

2.5 VOLT center tapped fil. trans., 8 amperes (will stand up to five heater tubes, when voltage is 2.25 v). Cat. FLT @ $1.62

HAMMARLUND 0.0002 mfd. variable condenser, junior midline; rotation is within 2-inch diameter; for short waves. Cat. H-20 @..............................$1.35

HAMMARLUND 60 mmfd. manual trimming condenser. Cat. H-60 @..............................$ .79

HAMMARLUND 20-100 MMFD. EQUALIZERS: adjusting screw works in a threaded brass stud, so excess force cannot damage the unit. Cat. 3-EQ-100 (price is for three) ....$ .60

CHASSIS for midget, fits in Roland cabinet; chassis is 13½ inches wide, 7½ inches front to back; flaps front and back 3 inches high; drilled for sockets and speaker plug and for volume control and switch at front. Cat. 5-TCH @ $1.75

CHASSIS for 6 tube midget. Cat. 6-TCH @.....$1.75

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Cat. DJA-35 @..............................$1.95

THREE 0.1 MFD. condensers in one shield case; black lead is common; three red leads go interchangeably to destination; mounting screw built in. Cat. 31 @...$ .57

MIDGET POWER TRANSFORMER, for five-tube set, to handle three heater tubes, one 247 and one 280. Cat. MPT-5 @ $3.15

MIDGET POWER TRANSFORMER for six-tube set, to handle four heater tubes, one 247 and one 280. Cat. MPT-6 @ $3.55

8 MFD. WET ELECTROLYTIC condenser, for inverted mounting; washer and extra lug provides insulation from chassis for circuits with B choke in negative leg. Cat. LCT-8 @ ....$ .62

TELEVISION KIT, 80-100 meters, using two stages 235-r-f, 224 power detector, 224 first a-f, 247 output, 280 rectifier. R-f coils have right-angle honeycomb chokes with 4-turn pickup windings. Designed by Edwin Stannard. Dorset cabinet and Rola speaker included. 110 v., 50-60 c. Order Cat. TK @ $18.95

GUARANTY RADIO GOODS CO., 145 West 45th St., NEW YORK, N. Y.

Quick-Action Classified Advertisements

7c a Word — $1.00 Minimum
Cash With Order

RADIO-MEN! ATTENTION! Increase your business 100%. Send $1.00 for complete working plan. Nothing else to buy. A. D'Antoni, 2260 Washington Ave., Bronx, N. Y. City.

TRANSFORMERS, (Radio Power) rewound; specials made. Supreme Radio Laboratory, Dept. W, 16 Fulton Ave., Rochester, N. Y.

R.C.A. VICTOR SHORT-WAVE CONVERTERS, brand new, complete with eight coils and three tubes, $14.95. 3000-ohm Frost wire wound potentiometer, manufacturer's type, 30c. Four for $1.00. Baldwin double magnetic cone speaker chassis, new, $1.35. We pay the postage. Radio Exchange, 164 East Broadway, Salt Lake City, Utah.

"THE MODERN GASOLINE AUTOMOBILE," by Victor W. Page, M.S.A.E. New Revised and Up-to-date Edition. A whole library of information now complete in one large octavo volume of 1,146 (6 x 9) pages—1,000 engravings. Bound in flexible scarlet fabrikoid. Price $5.00. Radio World, 145 W. 45th St., New York, N. Y.

THE FORD MODEL—"A" Car and Model "AA" Truck — Construction, Operation and Repair — Revised New Edition. Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

EBY antenna-ground binding post assembly for all circuits. Ground post automatically grounded on sets using metal chasses. Assemblies, 30c. each. Guaranty Radio Goods Co., 143 West 45th St., New York, N. Y.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

BARGAINS in first-class, highest grade merchandise. Phono-link pick-up with vol. control and adapter, $3.32; .00025 mfd. Dubilier grid condenser with clips, 18¢. P. Cohen, Room 1214, at 143 West 45th Street, New York City.

"AMATEUR MOVIE CRAFT," by James R. Cameron. A book dealing with the making and showing of 16 m/m pictures and the equipment necessary for same. Paper cover, $1.00; Cloth, $1.50. Radio World, 145 W. 45th St., New York, N. Y.

Your Choice of NINE Meters!

To do your radio work properly you need meters. Here is your opportunity to get them at no extra cost. See the list of nine meters below. Heretofore we have offered the choice of any one of these meters free with an 8-weeks' subscription for RADIO WORLD, at $1, the regular price for such subscription. Now we extend this offer. For the first time you are permitted to obtain any one or more or all of these meters free, by sending in $1 for 8-weeks' subscription, entitling you to one meter; $2 for 16 weeks, entitling you to two meters; $3 for 26 weeks, entitling you to 3 meters; $6 for 52 weeks, entitling you to six meters. Return coupon with remittance, and check off desired meters in squares below.

RADIO WORLD, 145 West 45th Street, New York, N. Y. (Just East of Broadway)

Enclosed please find $............for ....weeks subscription for RADIO WORLD and please send as free premium the meters checked off below.

☐ I am a subscriber. Extend my subscription. (Check off if true.)

☐ **0-6 Voltmeter D.C.** ....No. 326
☐ **0-50 Voltmeter D.C.** ....No. 337
☐ **6-Volt Charge Tester D.C.** ....No. 23
☐ **0-10 Amperes D.C.** ....No. 338
☐ **0-25 Milliamperes D.C.** ....No. 325
☐ **0-50 Milliamperes D.C.** ....No. 350
☐ **0-100 Milliamperes D.C.** ....No. 390
☐ **0-300 Milliamperes D.C.** ....No. 399
☐ **0-400 Milliamperes D.C.** ....No. 394

NAME ....

ADDRESS ....

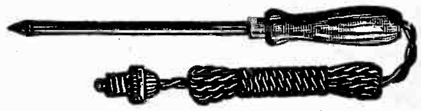
CITY............................ STATE............

1,000 PAGES! 2,000 DIAGRAMS! IN RIDER'S NEW 7-POUND MANUAL

JOHN F. RIDER'S PERPETUAL TROUBLE SHOOTER'S MANUAL is the book you need if you want to do profitable servicing. This loose leaf volume contains every bit of radio service information of all popular commercial broadcast receivers manufactured since 1920 and includes the latest diagrams. In addition to the wiring diagrams of the receivers the Manual contains chassis layouts, color coding, electrical values, chassis wiring diagrams, and the wiring of units sealed in cans. It also contains a course in Trouble Shooting, the use of set analyzers, data upon Superheterodynes, automatic volume control, etc. Page size is 8½x11, bound, 1,000 pages, index and advertisements on additional pages. Order CAT. RM-31 and remit $4.50. We will then pay postage. Shipping weight 8 pounds. Ten day money back guarantee.

RADIO WORLD
145 WEST 45th ST NEW YORK CITY

SOLDERING IRON FREE!



Works on 110-120 volts, AC or DC; power, 50 watts. A serviceable iron, with copper tip, 5 ft. cable and male plug. Send $1.50 for 13 weeks' subscription for Radio World and get these free! Please state if you are renewing existing subscription.

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

RADIO WORLD and "RADIO NEWS"

BOTH FOR ONE YEAR $7.00 Canadian and Foreign $8.50

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only national radio weekly and the leading monthly for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months. Total, 64 issues for $7.00.
RADIO WORLD, 145 West 45th Street, New York, N. Y.

SHORT WAVES AND TELEVISION

If you did not see our comprehensive Short-Wave and Television number, send 15c for a copy. It gives the latest and most interesting information on these allied topics. Some of the features:

Short-Wave Time Table. What's on the air on high frequencies during the 24 hours, arranged on an hourly basis, in the four United States time zones and Greenwich mean time.

Time Table of Television Transmitters. Call, watts, owner, location, frequency, lines, frames and schedule of all regularly operating television transmitters in the United States.

A Television Projector, by Ivan Bloch, E.E. How to make a lens disc for 10x12 inch screen picture and assemble related apparatus.

A T-R-F Television Receiver, by Edwin Stannard. Two-35, two-24, one-47, one-80. Cost of parts less than $19.

The Super-Regenerator for Ultra Frequencies, by Joseph D. R. Freed.

Stroboscopic Synchronization, by H. Marshall Scolnick.

Scanning, by J. E. Anderson.

Single Sideband for Vision, by R. D. Le Mert.

Columbia Broadcasting System's Television Experiences, by William A. Schudt, Jr., director.

The Hammarlund Comet, 15-550 Meter All-Wave Super, by Lewis W. Martin (Part I).

Powering a Short-Wave Converter from a Pentode Tube, by Herman Bernard.

15-200 Meter 2-Tube Battery Set, by Jack Tully. Cost of parts under $9.

Expert Short-Wave Tuning Advice, by James Millen, general manager, National Company. When to listen in for particular waves for best results.

Television Instruction. Schools and courses listed.

R-F Pentodes in a Broadcast Portable, by Charles J. Endicott.

Send 15c for a copy of the February 27th issue (Short-Wave and Television Number) or subscribe and start with this issue. Radio World, 145 W. 45th St., New York, N. Y.

245 Tubes at 30¢ Each

Four for $1.00
Sold on basis of remittance with order. We will pay the postage.

RELIABLE RADIO CO.
143 West 45th Street New York, N. Y.

BINDER FREE For New Yearly Subscribers

This binder is made of fine brown Spanish fabricoid and will hold 52 issues of Radio World. Year 1931-32 stamped in gold on front cover. A very limited supply on hand. Sent free to new yearly subscribers who send $6 direct to publication office before March 25, 1932. If already a subscriber, send $6 and 52 issues will be added to present subscription. No other premium with this offer.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK CITY

BLUEPRINTS OF PRIZED CIRCUITS

8-TUBE AUTO SET

Sensitivity of 10 microvolts per meter characterizes the 8-tube auto receiver designed by J. E. Anderson, technical editor of Radio World, and therefore stations come in with only six feet of wire for aerial, and without ground. Most cars will afford greater aerial pickup, and besides the car chassis will be used as ground, so with this receiver you will get *results*. The blueprint for construction of this set covers all details, including directions for cars with negative A or positive A grounded. The circuit features are: (1) high sensitivity; (2), tunes through powerful locals and gets DX stations, 10 kc either side; (3), latest tubes, two 239 pentode r-f, two 236 screen grid, two 237 and two 238; push-pull pentodes, all of 6-volt automotive series; (4), remote tuning and volume control on steering post, plus automatic volume control due to low screen voltage on first detector; (5), running board aerial. The best car set we've published. This circuit was selected as the most highly prized after tests made on several and is an outstanding design by a recognized authority. Send for Blueprint 631, @ 50c

SHORT-WAVE CONVERTER

If you want to build a short-wave converter that costs only a very few dollars, yet gives good results, furnishing all its own power from 110 volts a-c, and uses no plug-in coils, you can do so from Blueprint 630. Price.........25c

5-TUBE AC, T-R-F

Five-tube a-c receivers, using variable mu r-f, power detector, pentode output and 280 rectifier, are not all alike by any means. Forty circuits were carefully tested and one selected as far superior to the others. This prized circuit was the 627, and if you built it, you will always be glad you followed our authentic Blueprint, No. 627. This is the best 5-tube a-c t-r-f broadcast circuit we have ever published. Price 25c

A-C ALL-WAVE SET

An all-wave set is admittedly what many persons want, and we have a circuit that gives excellent broadcast results, and is pretty good (not great) on short waves. No plug-in coils used. Cost of parts is low. Send for Blueprint, No. 628-B, @..........25c.

In preparation, an 8-tube broadcast superheterodyne for 110v d-c. Write for particulars.

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