AUG. 6
1932

NEW AUTO SET

Price
15¢
Per Copy

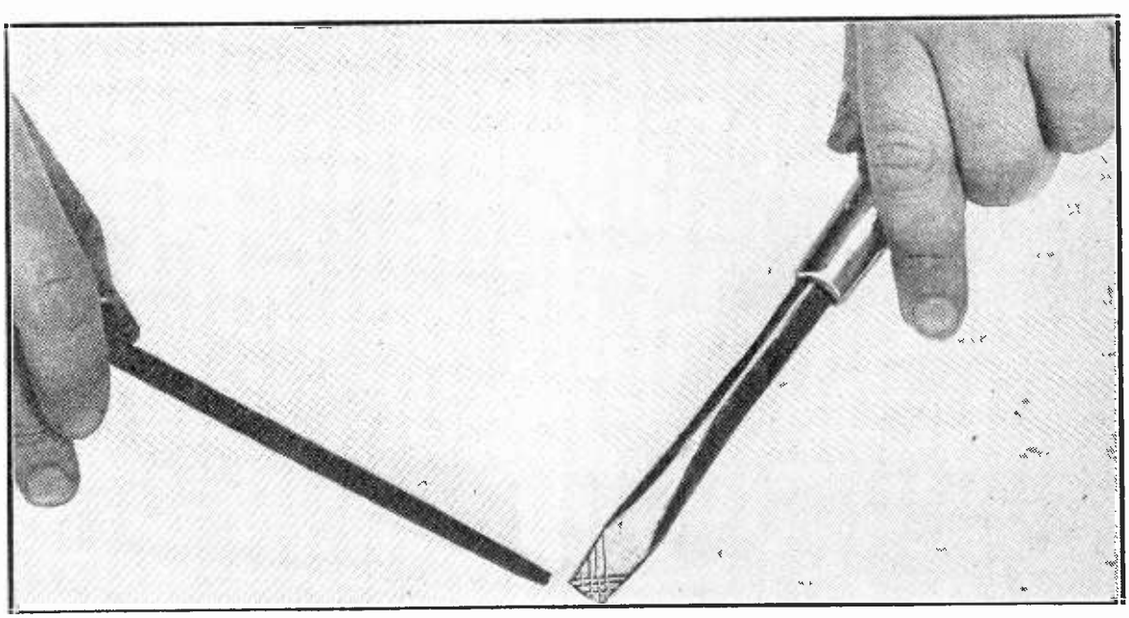
RADIO WORLD
REG. U.S. PAT. OFF.

The First and Only National Radio Weekly
Eleventh Year—541st Issue

How Television and Voice Are Sent On One Channel

Impedance Matching In Audio Circuits

SCREWS STICK TO THIS DRIVER



A screwdriver filed in diagonal directions to afford criss-cross grooves will prevent screw from slipping out, and even permit lifting.

"THE RADIO MANUAL," by G. E. Sterling. Edited by S. Kruse, E.E. Latest edition. A clear, logical presentation requiring no previous knowledge of higher mathematics or electrical engineering. An authoritative account of license requirements written by a Government Examining Officer. 805 pages. Flexible Fabroikoid, 5⅞ x 8, illustrated. $6.00. Radio World, 145 W. 45th St., New York City.

Quick-Action Classified Advertisements

7c a Word — $1.00 Minimum
Cash With Order

CODE LEARNER'S OUTFIT. Peerless Omnigraph Practice Key, Short Wave Set, $10.00. Fred Wooten, Beverly, N. J.

EBY Ant.—Ground twin binding post assemblies, 30c each. Guaranty Radio Goods Co., 143 W. 45th St., N. Y. C.

"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.

"1932 OFFICIAL RADIO SERVICE MANUAL," by Gernsback. Complete Directory of all 1931-1932 Radio Receivers. Full Radio Service Guide. Leatheroid binding, $4.00. Radio World, 145 W. 45th St., New York, N. Y.

THE FIVE NEW TUBES, 46, 56, 57, 58 and 82, characteristics, installation data, uses, fully described and illustrated in the April 30th issue (7 pages) and in the May 7th issue. Send 30c for these two copies. Radio World 145 West 45th Street, New York, N. Y.

"A B C OF TELEVISION," by Yates, $3.00. Radio World, 145 W. 45th St., N. Y. C.

BUILD A SET FOR SHORT WAVES ON EARPHONES

(Battery Operated; two 230 tubes)

COILS
One set of plug-in coils, four pairs, total eight coils.$3.00
One 300-turn honeycomb coil..... .30
CONDENSERS
Two 0.00014 mfd. junior midline tuning condensers (both) 2.40
One 0.0002 mfd. junior midline tuning condenser.... 1.35
Two 0.00035 mfd. fixed condensers (both)..... .30
One shielded block containing three 0.1 mfd. condensers (black, common, to a minus; reds interchangeable) ..... .57
RESISTORS
One 0.05 meg. pigtail resistor (50,000 ohms)..... .15
Two 4-ohm filament resistors in series, to constitute 8 ohms (both) ..... .20
OTHER REQUIREMENTS
One 9 x 7⅝ inch wooden baseboard..... .25
Four UX sockets (two for tubes, two for coil receptacles) ..... .40
One 7 x 10 inch bakelite drilled front panel..... 1.25
Two knobs, one for r-f condenser, other for feedback condenser (both) ..... .10
One vernier dial ..... .50
One push-pull A battery switch..... .20
One binding post strip with eight posts on it..... .25
One—34 tube and one—36 tube (both)..... 2.61
One pair of earphones..... 1.20

Blueprint 633-34, this circuit, 25c.

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

BLUEPRINTS OF STAR 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.

Two for the price of One

Get, EXTRA one-year subscription for any One of these magazines:

- ☐ RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW (monthly, 12 issues)
- ☐ Q.S.T. (monthly, 12 issues; official amateur organ).
- ☐ POPULAR SCIENCE MONTHLY.
- ☐ RADIO-CRAFT (monthly, 12 issues).
- ☐ RADIO INDEX (monthly, 12 issues), stations, programs, etc.
- ☐ RADIO (monthly, 12 issues; exclusively trade magazine).
- ☐ EVERYDAY SCIENCE AND MECHANICS (monthly).
- ☐ RADIO LOG AND LORE. Monthly. Full station lists, cross indexed, etc
- ☐ AMERICAN BOY—YOUTH'S COMPANION (monthly, 12 issues; popular magazine).
- ☐ BOYS' LIFE (monthly, 12 issues; popular magazine).
- ☐ OPEN ROAD FOR BOYS (monthly, 12 issues).

Select any one of these magazines and get it free for an entire year by sending in a year's subscription for RADIO WORLD at the regular price, $6.00. Cash in now on this opportunity to get RADIO WORLD WEEKLY, 52 weeks at the standard price for such subscription, plus a full year's subscription for any ONE of the other enumerated magazines FREE. Put a cross in the square next to the magazine of your choice, in the above list, fill out the coupon below, and mail $6 check, money order or stamps to RADIO WORLD, 145 West 45th Street, New York, N. Y. (Add $1.50, making $7.50 in all, for extra foreign or Canadian postage for both publications.)

Your Name.....

Your Street Address .....

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

DOUBLE VALUE!

☐ If renewing an existing or expiring subscription for RADIO WORLD, please put a cross in square at beginning of this sentence.

☐ If renewing an existing or expiring subscription for other magazine, please put a cross in square at the beginning of this sentence.

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

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.

115 DIAGRAMS FREE!

115 Circuit Diagrams of Commercial Receivers and Power Supplies supplementing the diagrams in John F. Rider's "Trouble Shooter's Manual." These schematic diagrams of factory-made receivers, giving the manufacturer's name and model number on each diagram, include the MOST IMPORTANT SCREEN GRID RECEIVERS.

The 115 diagrams, each in black and white, on sheets 8½ x 11 inches, punched with three standard holes for loose-leaf binding, constitute a supplement that must be obtained by all possessors of "Trouble Shooter's Manual," to make the manual complete. We guarantee no duplication of the diagrams that appear in the "Manual." Circuits include Bosch 54 D. C. screen grid; Balkite Model F, Crosley 30, 21, 22 screen grid; Eveready series 50 screen grid; Hrla 224 A. C. screen grid; Peerless Electrostatic series; Philco 76 screen grid.

Subscribe for Radio World for 3 months at the regular subscription rate of $1.50, and have these diagrams delivered to you FREE!

Present subscribers may take advantage of this offer. Please put a cross here ☐ to expedite extending your expiration date.

Radio World, 145 West 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, $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. 328
- ☐ 0-50 Voltmeter D.C. .....No. 327
- ☐ 6-Volt Charge Tester D.C. .....No. 23
- ☐ 0-10 Amperes D.C. .....No. 330
- ☐ 0-25 Milliamperes D.C. .....No. 325
- ☐ 0-50 Milliamperes D.C. .....No. 326
- ☐ 0-100 Milliamperes D.C. .....No. 390
- ☐ 0-300 Milliamperes D.C. .....No. 392
- ☐ 0-400 Milliamperes D.C. .....No. 394

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 | AUGUST 6th, 1932 | No. 21, Whole No. 541

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
Telephone: BR-yant 9-0558

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.

Latest Type Auto Set

New Tubes, A-V-C, Suits All Cars

By J. E. Anderson

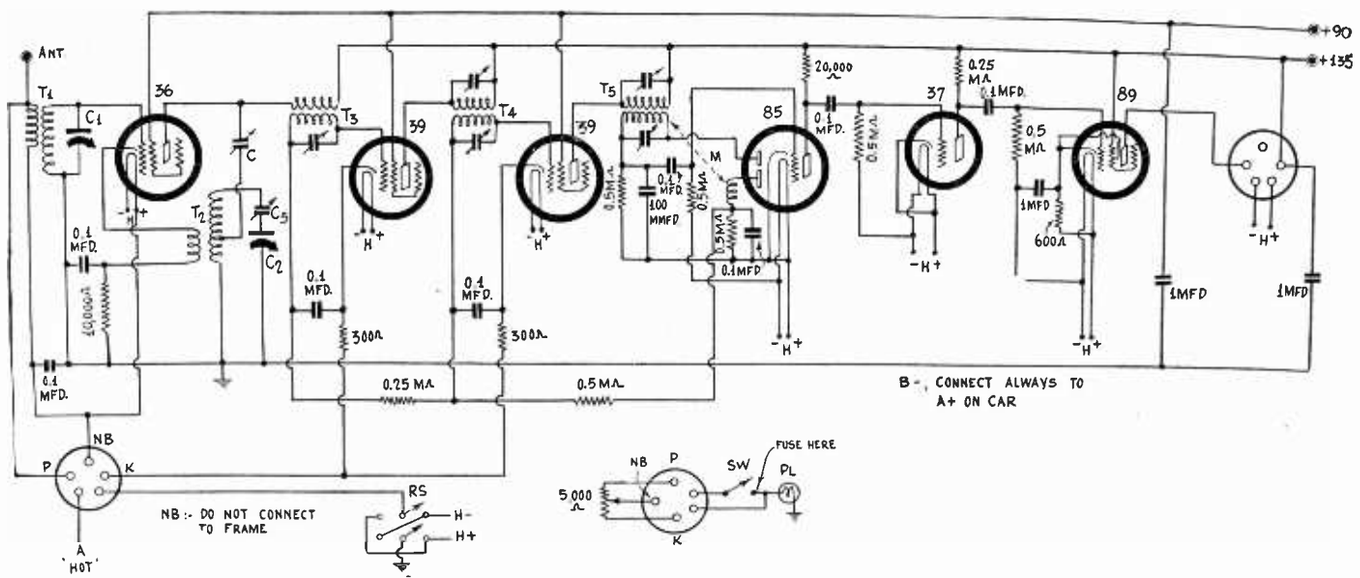


FIG. 1

The circuit of a six-tube automobile receiver incorporating automatic volume control and diode detection. Output tube is the new 89 pentode.

A SIX-TUBE automobile superheterodyne incorporating several noteworthy features is diagrammed in Fig. 1. It has a combined oscillator and first detector, two stages of intermediate frequency amplification, half-wave diode detection after the intermediate amplifier, automatic volume control, and three stages of audio frequency amplification.

Although the circuit contains only six

(*Continued on next page*)

LIST OF PARTS

Coils

T1—One r-f transformer for 350 mmfd. condenser, shielded midget type
T2, T3—One combination oscillator and i-f transformer for 175 kc intermediate and 350 mmfd. tuning condenser
T4—One 175 kc i-f transformer with two tuned windings
T5—One 175 kc i-f transformer like T4 but with an extra winding

Condensers

C1, C2—One two-gang tuning condenser of 350 mmfd.
C5—One 700-1,000 mmfd. variable condenser
Eight 0.1 mfd. condensers
One 100 mmfd. fixed condenser
Three 1 mfd. condensers

Resistors

Two 300 ohms
One 600 ohms
One 10,000 ohms
One 20,000 ohms
Two 0.25 megohms
Six 0.5 megohms
One 5,000 wirewound potentiometer (part of control unit)

Other Requirements

Six UY Sockets
Two 6-contact sockets
Five Grid clips
One three lead battery cable

(*Continued from preceding page*)
tubes it is the equivalent of an eight-tube receiver, since two of the tubes serve two purposes each. The output stage contains only one 89 tube because it was desired to limit the tubes to six and to use resistance coupling in the audio amplifier.

Let us first call attention to the method of getting grid bias, since this is always an important point of design of automobile sets. About the same scheme is used throughout the set, as far as this is possible. We note first that the cathode and suppressor grid of the 89 are connected through a 600 ohm resistor to the positive side of the filament circuit, and that the grid return is made to the negative side. These connections should be made on the socket, or as near it as practicable, in order to reduce the chance of error. The bias on the grid of this tube is therefore the sum of the storage battery voltage and the drop in the bias resistance. The total bias is approximately correct for a plate and screen voltage of 135.

First a-f Stages

The intermediate audio stage is a 37, working between resistances. Its bias is exactly equal to the voltage of the storage battery, since the cathode is connected to the positive and the grid return to the negative side. A bias of six volts is all right. The first audio amplifier is the triode part of the 85, the new duplex diode triode tube for the automobile series. Its control grid is also given 6 volts in the same manner, that is, by connecting the cathode to the positive and the grid return to the negative of the battery. This bias thus provided is not quite as high as that recommended, but there is no reason why it should be, for the signal level is low at this stage and there is no danger of drawing too much plate current from the tube through the 20,000 ohm load resistance. And the voltage gain is higher with the lower bias.

The reason the battery voltage is used for the audio tubes is that doing so avoids the use of large by-pass condensers necessary with self-bias and prevents the loss of low-note amplification by reverse feedback. The quality obtained with this kind of biasing is greatly superior to that obtained with self-bias.

Complications

The connection of the cathode of the 85 to the positive side of the filament circuit introduces a complication in the intermediate amplifier, but it is readily disposed of. The automatic bias is measured from the cathode of the 85, hence from the positive side of the filament. The fixed or manually varied bias on the intermediate tubes is measured from the cathodes of the controlled tubes to the center of the volume control potentiometer. It is desirable to have the two voltages in series, and in such a way that we can depend on them no matter whether the chassis of the set is plus or minus. The solution is to connect the slider of the potentiometer to the positive side of the filament. Thus the automatic bias begins where the fixed or manually variable leaves off.

There is one precaution that must be taken. The manual control potentiometer is connected to the antenna, which is separated from the chassis by only a radio frequency winding. This has practically no resistance to direct current. Suppose now that the chassis is negative. The primary and a portion of the potentiometer would then be connected across the storage battery. If the potentiometer were to be set at the antenna end, only the coil would be across the battery, and we would have direct short circuit. The coil would burn out, and probably a portion of the potentiometer. To avoid this possibility the antenna coil is not connected to the chassis, but to the positive side of the filament circuit. The radio frequency circuit is completed through a 0.1 mfd. condenser. The connection requires that there be no ground in the remote control unit, that is, there should be no connection between the slider and the frame. This is pointed out in a note on the diagram, both at the socket on the set and at the plug of the control unit. Some control units come with the slider lead grounded. If test shows that it is grounded, the unit should be opened up and the ground connection removed.

A Necesasry Condition

A necessary condition that a set connected like this should work in all cases, regardless of whether the positive or the negative of the car battery is grounded, is that the same filament terminals on the sockets should always have the same polarity. But the chassis may be either positive or negative. Hence we cannot connect either set of terminals to the chassis. For this reason a reversing switch, RS, has been provided, not as a part to go into the set, but rather as a guide in wiring the circuit for the particular type of grounding that is used on the car in which the set is to be installed.

Let us trace out the connections to see what happens. First let us assume that the negative of the car battery is grounded. The chassis is then negative and the negative filament terminals should be connected to the chassis. This occurs if we throw the switch to the left. When this is done the positive terminals are connected to "hot" line coming from the battery, which is positive also.

If the positive of the car battery is grounded, the positive filament terminals should be connected to the chassis. This is done by throwing the switch to the right. At the same time the negative terminals are connected to the "hot" side of the battery. No polarity need be observed in regard to the pilot light. Hence one side of it is connected to the frame of the remote control unit and the other to the "hot" lead. It lights as soon as the switch S W is closed, provided the fuse is not blown.

It is understood that the chassis of the set is connected metallically to the chassis of the car as this connection is part of the circuit. If the negative of the plate battery, or other plate voltage source, is connected to the positive of the car battery, regardless of whether the positive or negative is grounded, the storage battery voltage is added to the plate voltage. Therefore the voltage on the tubes is never less than the B supply voltage, and may be 6 volts more in some instances. If the B supply device is such that its negative is connected to the chassis of the car, which may be the case in some instances, the negative, of course, cannot always be connected to the positive of the car battery, but that does not matter as far as the circuit is concerned. It is likely that if such a device is used the voltage is of the order of 180 volts, and the extra voltage from the car battery is of little importance.

The Diode Detector

The third intermediate frequency transformer feeds into one of the diode rectifier circuits of the 85 tube. Half wave rectification is used for two reasons, first, to get a high rectified signal voltage, and second, to leave the other diode for the automatic volume control. The load resistance in the detector circuit is half megohm and this is shunted with a condenser of 100 mmfd. The signal developed across this combination is impressed on the triode part of the 85 through a 0.1 mfd. stopping condenser and across a half megohm grid leak. In view of the fact that the filter condenser across the load resistance is as low as 100 mmfd. there will be a considerable carrier component in the output of the amplifier. This may be removed by connecting a by-pass condenser of 250 mmfd. from the plate to the cathode of that tube. This condenser is not shown.

Automatic volume control is obtained from the other diode. A third winding is put on the third i-f transformer and this winding is connected in the other diode circuit. In this there is also a half megohm load resistance, but it is shunted with a condenser of 0.1 mfd. This combination provides a time constant of 0.05 second in the automatic volume control circuit, which should be ample.

The negative end of the load resistance on the a-v-c circuit is connected to the grid returns of the two intermediate frequency amplifiers through appropriate filters. These consist of one 0.5 megohm and one 0.25 megohm resistors and two 0.1 mfd. by-pass condensers.

The Detector-Oscillator

The first tube in the circuit is a detector-oscillator, utilizing a 36 type tube. A circuit of this type is very effective, but it will work satisfactorily only with a 36, 57, or a 24, the 36 being the proper tube for an automobile set.

The oscillator is of the tuned plate type, with an untuned grid coil, which is placed in the cathode lead. Coils for this type of oscillator have been worked out very carefully, and they are rather critical so it is best to get the coils already made.

The lower part of the oscillator coil is also in the i-f tuned circuit and the i-f tuning condenser C serves as by-pass for the radio frequency currents as well as for feedback.

While no trimmer condenser is shown across C2 it is understood that one is to be used. It is not necessary that one be used across C1 but most dual condensers come with trimmers attached. C5 is the series condenser necessary to adjust the circuit for padding. The oscillator coil T2 is available for an intermediate frequency of 175 kc. Hence C5 should have a range from 700 to 1,000 mmfd. About 800 mmfd. is the correct value.

The Intermediate Amplifier

There is one more stage of intermediate than is customary in superheterodyne receivers. This is used to offset the lack of sensitivity in the 85 detector. For a set not to be used as an automobile receiver the extra stage would not be necessary, even if there is no r-f amplifier, but for automobile service it is highly desirable, especially when automatic volume control is used.

Since the oscillator coil is available only for 175 kc intermediate frequency, the i-f transformers must be tuned to this frequency, but they are standard and easily obtainable.

There is a high gain in the audio amplifier for it has three stages and the output tube is a pentode. A resistance coupled amplifier of this kind may motorboat when the plate battery is old. If this occurs, it is necessary to put a large by-pass condenser across the battery. This condenser is indicated as 1 mfd. in the drawing, and is connected between ground and the 135 volt lead. An electrolytic of 8 mfd. should stop the trouble if it ever appears. If it does not, break the lead between the 20,000 ohm load resistance of the 85 from the 135 volt lead and insert a resistor of 50,000 ohms. Then use a condenser of about one microfarad between ground and the junction of the two resistors. Or treat the plate circuit of the second a-f amplifier the same way, using a 0.25 megohm resistor.

Motorboating will not occur as long as the batteries are in good condition, but if a battery substitute is used, it may occur from the start. The treatment is the same as if old batteries caused the trouble. When motorboating occurs in a resistance coupled amplifier having three plate circuits, like this one, it occurs at a frequency about 100 cycles.

55 in One-Tube Reflex

Strong Locals Heard on Loudspeaker

By Caswell Henry

LAST WEEK we described a one-tube set utilizing the 55 duplex diode triode in a regenerative circuit and as diode rectifier. By adding a few more pieces of apparatus we can get still more out of that circuit, by duplexing, that is, by using the triode both as a radio and as an audio frequency amplifier. The circuit of this is shown in Fig. 1.

We first have a three-circuit tuner, as in the preceding circuit. This delivers a signal voltage to the grid of the amplifier which boosts the amplitude. Then the signal passes through the primary of the aperiodic transformer T3, which impresses a high signal voltage on the diode circuit. The two diode plates are connected together so that half-wave rectification is used. This is in order to get the greatest possible detected voltage. The load on the rectifier is the primary of an audio frequency transformer, which is on the left side in the drawing. A 0.0005 mfd. condenser shunts the primary to let the carrier frequency pass the impedance. The rectifier circuit encompasses the two diode plates, the secondary of the aperiodic transformer, the primary of the audio transformer, and the cathode.

A Signal Developed

The carrier frequency current is rectified by the tube. The ripple passes through the by-pass condenser, but the direct current component passes through the primary of the audio transformer. The intensity of this rectified current varies directly as the modulation of the carrier current and therefore there is an audio voltage impressed across the primary of the audio transformer. An audio frequency voltage is, accordingly, induced in the secondary of the audio frequency transformer, and this voltage is impressed on the control grid of the triode, in series with the signal voltage from the three circuit tuner. A second condenser of 0.0005 mfd. is connected across the secondary of the audio transformer in order to let the carrier frequency current by and to put the rotor of the tuning condenser at a low radio frequency potential. The audio voltage is also amplified by the triode and the output of the tube is delivered to a loudspeaker or headset. A condenser of 0.001 mfd. is connected from the junction of the speaker and the aperiodic coil primary to ground to let the carrier current pass the speaker.

Since the triode operates exclusively as an amplifier we must have a suitable negative bias on its grid. This is provided by connecting a resistor of 2,500 ohms between the cathode and B minus, or ground. A condenser of 4 mfd. shunts this resistance to let the radio and audio frequency currents around the bias resistor. That completes the circuit.

The Triple Function

Veterans in radio will recognize this circuit as the one-tube reflex that used to operate a loudspeaker, provided a sensitive detector was used. At the time that circuit was in vogue we had only crystal detectors which could be used, unless we were willing to use an extra tube. But, the idea was a one-tube set. Now that we have the 55 and the 85 we can do away with the crystal detector and still have a more sensitive rectifier than the crystal, as well as a very dependable one.

The single tube serves three functions:

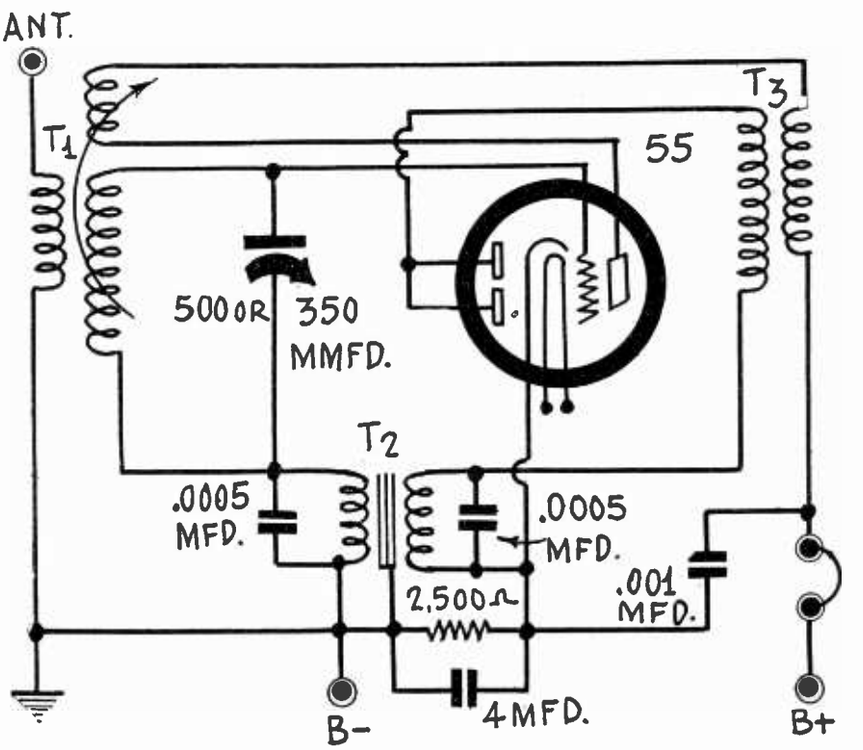


FIG. 1

first, as regenerative radio frequency amplifier, second, as half-wave diode detector, and third, as audio frequency amplifier and output tube.

Whether or not this circuit will give much depends on the antenna and ground, the three circuit tuner, and on the aperiodic transformer. The antenna should be about 75 feet long, mostly up and down, and the ground should be a cold water pipe or a metal sheet or screen buried in moist earth. The circuit tuner should be a low-loss coil. A satisfactory coil can be made by putting on 62 turns of No. 22 double cotton covered wire on a 3-inch bakelite form. The primary winding may contain from 15 to 20 turns of the same wire, wound at one end of the secondary without any separation. The tickler should contain 40 turns of No. 32 enameled wire on a form that will rotate inside the three inch form. About the largest coil that will turn inside the 3 inch form is one of 2-inch diameter, provided its length does not exceed its diameter. Mount this coil so that its shaft passes diametrically through the larger coil just above the grid end of the winding.

An Aperiodic Coil

An aperiodic coil should be wound with fine wire so that the turns can be bunched closely. No. 40 enameled wire is all right. There should be about 100 turns on each winding on a form one inch in diameter, mean value. The two windings should be as close together as possible, but the insulation should be good for 500 volts. The primary may be wound first in a narrow slot and then the secondary may be wound over it in the same slot, provided an insulator layer is put between them. Of course, it is better to get one ready made than to attempt to make one.

In case it is not desired to use an untuned transformer, a tuned one may be substituted. In this case the secondary should be tuned, that is, the winding that is connected in the rectifier circuit. The transformer T3 would then be a coil similar to T1 except that it would not have the tickler winding. It is not practical to tune the two circuits with a ganged condenser because the tuning characteristics will not be the same and also beause the rotors must not be connected.

Power Supply

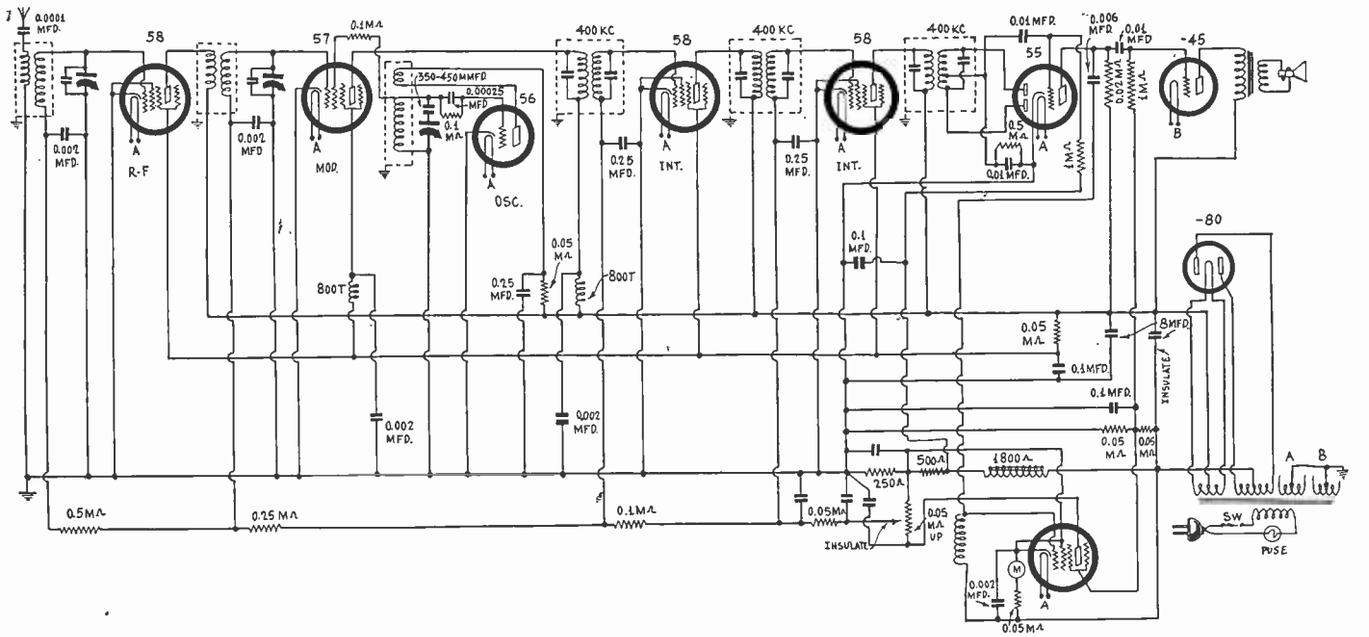
If the tube used is a 55 we need a filament source that will give one ampere without overloading the source. This current may be either d-c from a storage battery or a-c from the winding of a 2.5 volt transformer.

LIST OF PARTS

T1—One three-circuit tuner as described.
T2—One audio frequency transformer.
T3—One aperiodic r-f transformer or a transformer like T1 without the tickler.
One 350 mmfd. tuning condenser, or two of T3 is tuned.
Two 0.0005 mfd. fixed by-pass condensers.
One 0.001 mfd. fixed by-pass condenser.
One 4 mfd. by-pass condenser.
One 2,500-ohm bias resistor.
One six contact socket.
One grid clip.
Six binding posts.
One (or two) dials.
One tickler knob.

THE 57 AS AUTOMATIC D-C VOLTAGES

By Edward C.



The tube at lower right in a 57 used for automatic volume control. Its plate and screen voltages are taken from the drop is the d-c resistance (choke and resistors) between negative B at right and ground at left. Thus the positive plate voltage is grounded and a-v-c voltages are negative in respect to ground. True electron coupling is used between modulator and oscillator.

SINCE the 57 tube is such a sensitive detector, with a sharp bend, it may be used as automatic volume control tube. The main purpose of the diagram is to show such use. A complete superheterodyne is revealed, with some new features, but the automatic volume control is the chief point of interest at present, as it permits the control bias to be obtained from the drop in the plate resistor, the recommended method.

The a-v-c tube is shown at lower right. Notice that the B choke of the rectifier filter is in the negative leg. Normally there would be a drop of about 100 volts or so across this choke, something extra across the two series resistors, 250 and 500 ohms., assuming the choke is the field coil of a dynamic speaker. The resistance is marked as 1800 ohms but is not critical and may be from 1,000 to 2,000 ohms or so.

Voltaged "Backwards"

B minus, the lead from the center of the power transformer's high-voltage secondary, instead of being grounded has the choke and two extra resistors in series interrupting the route to ground. Therefore all points to the left of B minus are positive in respect to B minus.

The requirement for automatic volume control is that the tube so used be voltaged "backwards." That is, from the usual ground potential all voltages should be negative for the a-v-c tube. We have found that the voltage drops across the resistors and choke in the negative B line are in that direction. So we may take the 57, interconnect cathode and suppressor grid, and through a resistor return this particular circuit to B minus. Suppose the power tube, a '45, is biased about 50 volts negative, by returning the 1 meg. grid leak to the juncture of two approximately equal resistors (0.05 meg.) The filament of the power tube is positive, because center is grounded, and the grid is returned to a voltage about half that between ground and the B minus lead.

The cathode voltage is lifted above the grid return voltage by the amount of the voltage drop in the resistor marked 0.05 meg., while the screen voltage for the a-v-c tube is the same as the bias voltage for the power tube, and the screen voltage

What is a Satisfactory

There is no wholly satisfactory volume control. Any one is open to objections. The choice is therefore made of the least objectionable one. But that becomes much a matter of opinion, or difference of viewpoint, and so the problem is up in the air.

It is assumed that the control is so constructed that it will vary volume at a desired displacement rate. What this rate should be is not settled. Different engineers favor different attenuation factors.

The next step is to see what happens aside from mere change in volume. Likely as not there is a change of frequency. Therefore the volume control becomes a minor tuning device, which it should not be. Wherever it is placed in the radio channel it is likely to be a detuner of a sort. Yet, unless the set has automatic volume control, the manual control should be in the r-f channel, or may be combined with a-f volume control. The purpose of putting it ahead of the detector is to avoid overloading the detector. If a diode detector is used this precaution may be waived, as there is scarcely any likelihood that such a detector will be overloaded by a radio frequency amplifier or intermediate frequency amplifier.

Thus with a-v-c circuits the volume control often is found in the audio amplifier. Commonly it is a potentiometer, enabling as much as desired of the total drop across the resistor to be fed to the grid circuit of the ensuing tube. Unless the precaution is taken to have a constant impedance, possible with a specific of compound control that always permits the same amount of resistance in circuit though the voltage fed to the next grid is controlled, there will be a tuning effect again. It is not carrier frequency tuning this time but frequency distortion, arising from the damping effect on the low notes, caused by low resistance values.

On the radio side consider the simple cathode rheostat for varying the negative bias. The higher the bias the lower the amplification, the less the volume. Remote cutoff tubes are made so that this method applies. An equivalent method is changing the screen voltage. But d-c voltage changes alter the frequency. In a

VOLUME CONTROL; TAKEN FROM B CHOKE

Rainbault

for the rest of the tubes, e.g., around 50 volts. This is not as high as recommended usually, but it is high enough for a very sensitive circuit.

Truant R-F for Pickup

The other connection, as explained, is that for the plate return, to ground. It is unusual to think of ground as a positive potential for the plate, but it should be remembered that the voltages run "backward," ground being positive in respect to B minus, and a-v-c direct voltages being taken from the resistors in the minus leg between B minus and ground.

May Cut Out A-V-C

Now let us see how a-v-c results.

We have a tube properly voltaged, a grid returned to what will be about 6 volts negative, through a coil which is simply a pickup, and may consist of as many turns as may be required for the desired degree of coupling. The secondary of a broadcast t-r-f coil will suffice.

The voltage to swing the tube is the signal voltage, and this is taken off the plate circuit of the first audio tube, which is the triode part of the 55. It so happens that enough r-f escapes the detector to make this possible. However, the voltage may be taken off the plate of the final intermediate amplifier the same way, except that the coil in the a-v-c grid circuit would have to be much larger (an r-f choke coil), and the coupling condenser much smaller.

Now, as the signal amplitude rises a greater voltage is put into the a-v-c, the current increases through the plate resistor and we have a larger voltage drop. If the grid return circuits of the controlled tubes are connected to this plate resistor, for instance to the arm of a potentiometer that is in the plate circuit, the stronger the carrier amplitude, the greater the negative bias, the less the amplification from the controlled tubes, so long as any a-v-c is used. The arm may be grounded to remove all a-v-c.

Thus does the bias vary, but there should be a minimum bias so that even if there is no signal the tubes will not have high plate voltage without negative bias. The cathodes are grounded. The controlled tubes may be given a minimum bias of from 3 to 6 volts. If 250 ohms is used as shown the result will be nearer 6 volts. It is just as well to have the voltage as high as this, as the hiss is much less when no station is tuned in. However, we have the triode of the 55 to bias, the section of the tube used as audio amplifier, and if 500 ohms more are used, the return properly made, the triode of the 55 will be biased negatively around 18 volts.

Full-Wave Second Detector

The second detector here is the 55 diode, both sections used for this purpose, because it is a full-wave detector. It is of course possible to obtain a-v-c from this full-wave detector, and circuits accomplished that have been shown in these columns during the past few weeks. However, the 57 is much more sensitive, and its action is not linear, so that the control may be slightly more even, for the controlled tube's response to bias changes is not linear, either.

The resistor-capacity filters in the circuit to the a-v-c (resistors on lower line, condensers nearer the top) are to prevent feedback. Naturally there will be a long lead. It is practical to use shielded cable, not of the usual type, because there would be too much loss to ground capacity, but of the type used for auto set aerial lead-in, about ¾ inch diameter rubber, with the shield on the outside and the thick wire, around No. 14, on the inside. The shield should be grounded at half a dozen points or so, which may be done right to the chassis.

Electron-Coupled Mixer

Another novelty in the circuit is the use of true electron coupling between oscillator and modulator. It will be noticed that the oscillator has a grid leak and condenser. These serve frequency-stabilizing purposes, even though incidentally detection results in the oscillator. The suppressor grid of the modulator is connected to the control grid of the oscillator. Between them as resistor is placed, shown as 0.1 meg., but may be larger if looser coupling is desired, or smaller if tighter coupling is preferable. This resistor should not be regarded as an example of resistance coupling, for it does not serve that purpose. It is rather a de-coupler, in that it reduces the coupling that would exist were control grid of oscillator tied directly to suppressor grid of modulator.

The theory of electron coupling is that the coupling between two tubes is effectuated in the space stream of one or both of them. Thus electrons from oscillator grid are made to return through the suppressor grid of the modulator to ground. The usual practice is to tie suppressor grid to cathode, and for the modulator the suppressor then would be at ground potential. Thus the oscillator voltage would make the suppressor of the modulator positive, and this positive voltage would be limited by the resistor between the modulator suppressor grid and the oscillator control grid.

Volume Control Noise

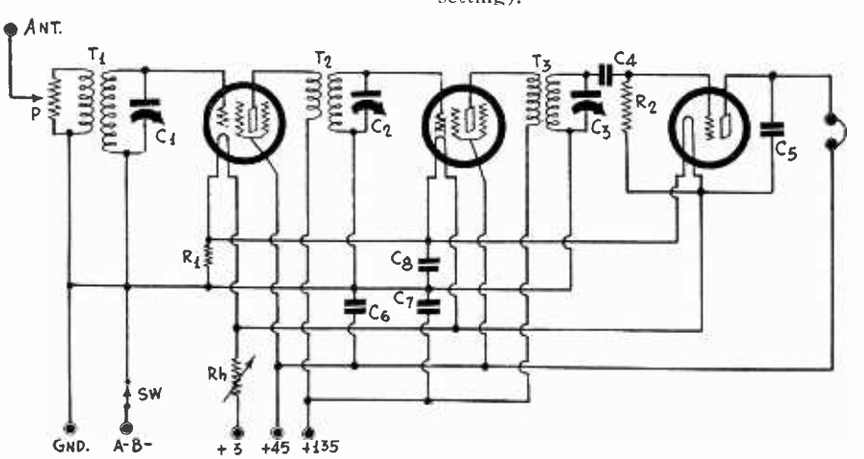
If other than a wire-wound type of resistor is used there will be noise when the control is moved, a scratching and scraping sound, and even with wire-wound units there will be noise when amplification is greatest (highest volume setting).

Volume Control?

short-wave set this is very noticeable. In a broadcast set it is not noticeable. At the intermediate level of the usual superheterodyne for broadcast signals it is not noticeable at all to the ear

Cross-modulation is a nuisance. If cathode voltage control is used on the first tube the amount of signal put into that tube is not changed much, only a little by detuning. But a way to prevent cross-modulation, or assist other methods in preventing it, is by reducing the signal input. The potentiometer across the primary of the antenna coil will reduce the signal only. But tube noises are amplified just as much all the time, whether the control is set for minimum or maximum value. At minimum value of volume due to signal the tube noises become a large percentage of the total volume of sound, or at least may become so.

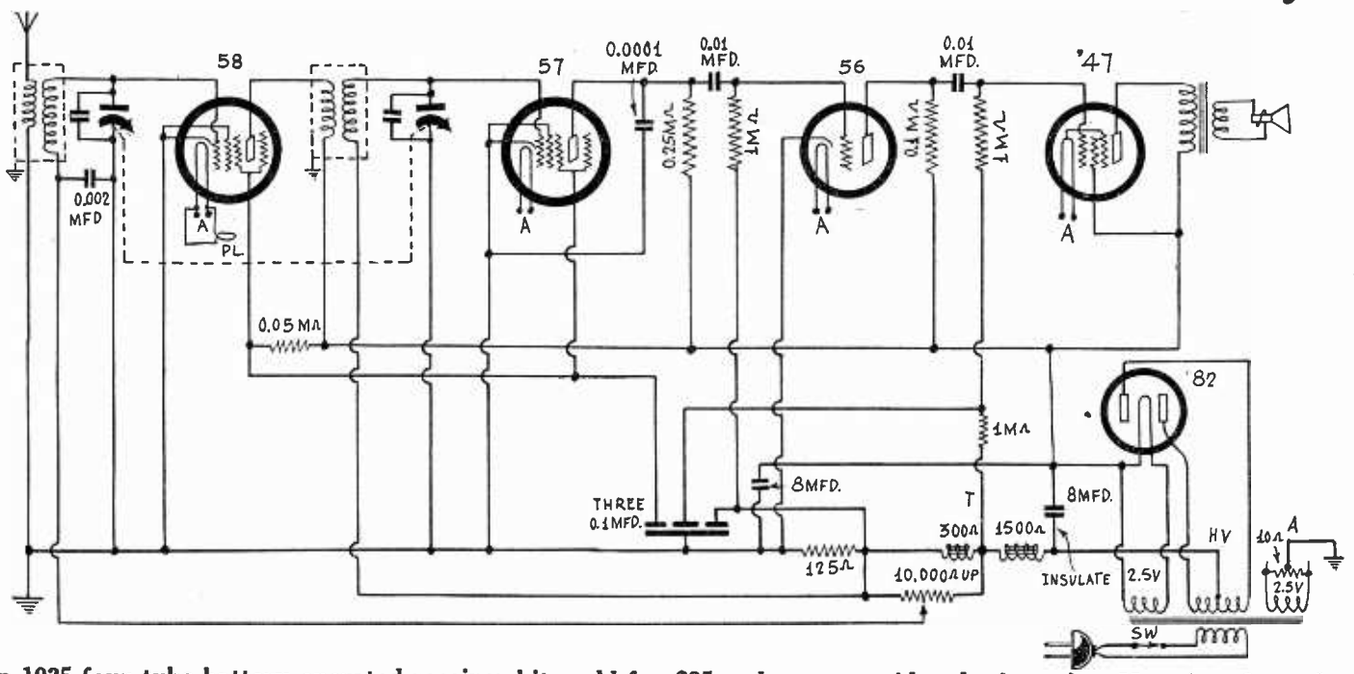
Therefore combination methods are used. One is to connect a potentiometer from one side of a cathode limiting resistor to aerial, bypass condenser from cathode to ground, arm of potentiometer to ground.



A potentiometer across the antenna primary controls only the input voltage, does some detuning, but leaves tube noises high at low volume levels of signal.

A 5-TUBE A-C RECEIVER CAN

By Jack



In 1925 four-tube battery-operated receiver kits sold for $35 and were considered a bargain. Here is a five-tube a-c receiver kit that sells to-day for around $12. The few parts that are used are put to excellent purpose and the performance is good.

SMALL set manufacturers report that when they solicit dealer business they find that the dealer asks about the price of the receiver first, and if it is low enough he gives an order. If the price isn't low enough he doesn't want to know what kind of a set it is, or anything else about it. So we are told also by an experienced salesman who works for one of the small set manufacturers.

The most popular set, he says, is one having five tubes, and here is the diagram. Parts for this set cost only $12, tubes extra, if you want to build it yourself, and included among the parts also are speaker and small cabinet. So all else you need is some wire, solder and an iron, buying the tubes extra, as you know. This is probably the first time in history that a kit for so good a little receiver is obtainable for so little as $12. It is possible probably because the whole kit has to be bought and the cost of handling and administration is reduced.

Fullest Utility

Because the 58 is a better amplifier than its predecessor, the '35, and the 57 is a far more sensitive detector than the '24, the net gain from the two circuits is about equal to that from two stages of t-r-f and detector using the older model tubes. Then, too, instead of a single stage of audio there are two a-f stages.

The selectivity is a little less, but then the price is 50 per cent. less than that for the five-tube model so popular last season.

The circuit is simple, consists of few parts, but derives the fullest utility from those parts used. A shielded two-gang condenser is used with shielded coils wound on 1 inch diameter, secondaries 127 turns of No. 32 enamel wire, primary 30 turns, wound over secondary, near the bottom, insulating fabric in between. This information is given for the benefit of those who desire to duplicate the circuit with coils of their own construction, but kit coils are of course a commercial product, enclosed in shields about 2 inches in diameter.

The cathodes of all four receiver tubes are grounded. Take the r-f, detector and first audio tubes. These are of the heater type and the cathode is brought out to a separate base pin. The suppressor grid is tied to cathode in the instances of the 58 and 57 in this circuit, and cathode goes direct to ground. This has several effects. Among them are the reduction of tendency to r-f squealing at the high frequancies, reduction of hum and, because of the choice of tubes, use of a single resistor to supply the steady bias to the r-f, detector and first audio tubes.

This resistor is marked 125 ohms on the diagram, and the 6 volts required for the recommended negative bias on the detector thus remain virtually unchanged, except that particularly strong stations will cause the bias to increase, for the bias is derived from the voltage drop across this resistor with all the B current flowing through the resistor. Strong signals increase this current, but the change is in the right direction—greater bias when greater bias is needed to prevent overloading. But the unsteadiness is not nearly so great as if a cathode resistor alone biased the detector tube, for the signal would change the bias violently.

In one measured instance of this condition, 5.5 volts negative bias applied, the strongest local station, in New York City, caused the bias to read 21 volts negative. Of course this showed overloading, as the signal voltage for 5.5 volts negative bias should not exceed 4 volts, giving a reading of around 10 volts, whereas the reading was about double that. So it is preferable to have amplifier tube currents cause the change in bias, and such is the case in the present receiver. Amplifier tube currents, and resultant biases, do not change very much with signal, except in Class B audio.

The choice of 6 volts is due to the detector requirement or recommendation. However, it is not an imperative voltage at that. Excellent detection obtains at

LIST OF PARTS

Coils

Two shielded r-f transformers, as described
One dynamic speaker with 1,800-ohm field coil, tapped at 300 ohms and containing pentode output transformer
One power transformer

Condensers

Two 8 mfd. electrolytic condensers (one must be insulated from a metal chassis, as indicated on diagram)
One 0.25 mfd. fixed condenser
One block of three shielded 0.1 mfd. condensers
Two 0.01 mfd. condensers (preferably mica dielectric)
One two-gang 0.00035 mfd. tuning condenser, with trimmers and shield
One 0.0001 mfd. fixed condenser

Resistors

One 10-ohm center-tapped resistor
Seven 1-watt pigtail resistor as follows: 125 ohms, 0.05 meg., two 0.25 meg., three 1.0 meg.
One potentiometer (0.01 meg. up), with knob

Other Requirements

One chassis
Two six-spring, two UY and one UX sockets
One a-c shaft type switch with knob
One vernier dial, travelling light type, with pilot lamp and escutcheon
One small cabinet to fit chassis
One a-c cable with plug
Two grid clips

THAT BE BUILT FOR ONLY $12

Goldstein

3.5 volts, yet we desire the bias to be higher, so that the detector, the most sensitive non-gaseous detector tube so far, will not overload readily. It will not in this circuit.

One Bias for Three Tubes

The 58 is a variable mu tube of the really remote cutoff type, so that there is some amplification left even if the negative bias is increased to 30 volts. However, with a simple circuit like this we will not get the sensitivity that would ever call for 30 volts negative bias obtained through adjustment of the volume control unit, and so we may put a potentiometer of 10,000 ohms or more across the 300-ohm section of the field coil that biases the output tube, and by moving the slider may change the bias for the r-f tube from minus 6 to about minus 23 volts, which is abundant variation.

In this way, of course, 6 volts negative bias is the minmum for the r-f tube. The recommendation, for 250 plate volts, is 3 volts minimum, but that does not mean it can not be more, and indeed the selectvity is better if the minimum is raised to 6 volts. The danger of cross-modulation is virtually eliminated.

Now, the first audio tube is biased by the same resistor, hence takes the same bias, 6 volts. The usual recommendation is a bias of 13.5 volts, for 250 plate volts, but some manufacturers point out that a different bias (9 volts) is more suitable for resistance-coupling, and indeed it does give more volume of sound. So, too, does 6 volts, compared to 9 volts, and really there is nothing against using only 6 volts, provided that the tube is not overloaded by signal, which it is not likely to be, in the light of the tuner ahead.

After the first audio tube comes the output tube, a '47 pentode, selected because of the desire for high sensitivity. This tube was built for the express purpose of serving well in small receivers, by permitting a large volume of sound output for a small amplitude of input. In other words it is a tube with a very high mu (around 90), and for that reason it is almost imperative to use an output pentode where sensitivity has to be fully capitalized. There is no wide excess amplification that may be devoted to other purposes, as in large and much more expensive receivers, and therefore the selection of the pentode is well within the bounds of good judgment.

Speaker Plug and Socket

The rectifier is shown as an 82, and this requires a 2.5-volt winding for the filament. But if a 5-volt winding is available, then an '80 rectifier may be used. There is no difference in the performance of this set whichever rectifier is selected. Only don't put the wrong tube in the rectifier socket. If the 82 is put in a socket fed with 5 volts the tube filament will burn out, whereas if the 5-volt filament of the '80 gets only half the required voltage there will be sure trouble, too, due to insufficient emission. The tube may "pop" into innocuous desuetude or even cause a short in the B feed.

In studying the circuit it should be noted that ground is negative in respect to B minus. More often B minus is grounded, but not here. Therefore if cathodes are connected to ground, the bias is negative if grid return is made to the right of the ground side of the field coil.

It is customary to use a speaker plug and cable. A UY plug fits into a chassis socket and is wired as follows: plate spring of socket to grounded chassis; grid spring of socket to grid return of the pentode circuit; cathode spring to B minus (center of high-voltage secondary of power transformer), heaters respectively to power tube plate B and B plus. This system applies to most of the popular speakers, and includes the Rola and Magnavox.

The filtration is supplied largely by the dynamic field coil, the two 8 mfd. condensers and the resistor-capacity filter, consisting of 0.1 mfd. and 1 meg., in the lower part of the pentode grid circuit.

Tight Coupling Needed for Diodes

Tight coupling is usually necessary between the 55 or the 85 and the tube ahead of it, and in tuned radio frequency sets is absolutely necessary, otherwise the sensitivity will be far too low. As a rule, in t-r-f sets, to attain the usual sensitivity obtained with a 5-tube a-c model, using earlier detector tubes, it is necessary to use two stages of audio. One of the tubes for this purpose is the triode part of the 55 or 85, hence you would have what may be rated as a six-tube set whereas formerly you had a five-tube set.

This tight coupling can be attained, without resort to any special coils, by connecting the tuned secondary as usual, putting a large condenser from the high potentional side of the coil to one anode of the 55 or 85, or to the two anodes interconnected, and running an anode leak to the high side of the cathode resistor. Each resistor may be 0.5 meg. The one from cathode to joint would be by-passed by 0.00015 mfd. for t-r-f, or if the system is used for superheterodynes having the usual intermediate frequencies, the bypass condenser may be from 0.006 mfd. to 0.01 mfd.

Tight Coupling

The stopping condenser previously referred to should be large, which means that for t-r-f sets it may be 0.001 mfd. more or less, preferably more, and that for superheterodynes it may be 0.01 mfd. These capacities are so large that the condenser impedance is low and the coupling between the two circuits is tight.

Instead of a resistor as the input load to the diode an r-f choke coil may be used, but its inductance should be very large compared to that of the tuned circuit, for again a large stopping condenser is required, and since the two inductances are substantially in parallel the extra one must be large so the net effective inductance is reduced only a little. It has been found that commercial 800-turn honeycomb choke coils are very satisfactory for this purpose for t-r-f sets, (inductance about 10 millihenries) whereas for superheterodynes two such chokes may be used in series. The condenser between high side of the tuned winding and anode should be about 0.001 mfd. for t-r-f and 0.01 mfd. for superheterodynes.

These methods relate to half-wave detection. Then one diode is used, or, if both are used, the diodes are in parallel.

Diode for A-V-C

If one diode is used then the other is free for use as automatic volume control, and the coupling may be effectuated by a condenser of 0.01 mfd. from one diode anode to the anode of the other diode, or a separate winding on the tuned coil's form may serve as pickup, or, where the choke load is used, two equal chokes may be coupled magnetically, without effective conductive coupling between them. The connections would be, load choke from anode to one side of the cathode resistor the other side of which resistors goes to cathode, other choke from other anode to the one side of a separate resistor, of 0.1 meg., that also returns to cathode. Across this second resistor, the bypass condenser should be 1 mfd.

For push-pull a center-tapped tuned secondary will not do, except for superheterodynes, as in t-r-f sets this secondary is grounded, and the cathode of the 55 and or 85 is not likely to be grounded in any circuit used, particularly as to bias the triode section a resistor is used, and the return of this resistor is nearly always to ground. Hence the cathode would be above ground potential.

In a super the center-tapped secondary is easily used, one extreme of coil to one anode, other extreme of coil to other anode, center to one side of the resistor the other side of which resistor goes to cathode.

For direct coupling, where no center-tapped tuned secondary is at hand, the method previously explained for single-sided circuits may be adopted as follows: connect a suitable r-f choke coil, as previously specified, to one anode and to one side of the stopping condenser, other end of the choke to the high side of the cathode resistor.

Excellent Quality

Put another similar choke in close inductive relationship to the first choke, and connect one side of the cathode resistor connection of the first coil, other side to the other anode. Then automatic volume control may be used by running a resistor of 0.1 meg., bypassed by 1 mfd., to the controlled tubes.

The 55 and 85 are well worth putting into a set, as the tone quality is greatly improved, and makes it possible to enjoy the very best that exists today, provided of course that distortion is not caused in the radio frequency or audio frequency amplifiers or speaker. The radio frequency distortion would consist of over-selectivity, or sideband cutting, and audio frequency distortion of wave form or frequency distortion. By using resistance-coupled audio with proper constants, and a good speaker necessary under all systems, tone will be excellent. The output tube may be one of the low mu type, as for tonal considerations the pentode output tubes do not come up to the high mark of the others.

A SEVEN-TUBE TELEVISION R
DIRECT CO

By Louis
Try-Mo

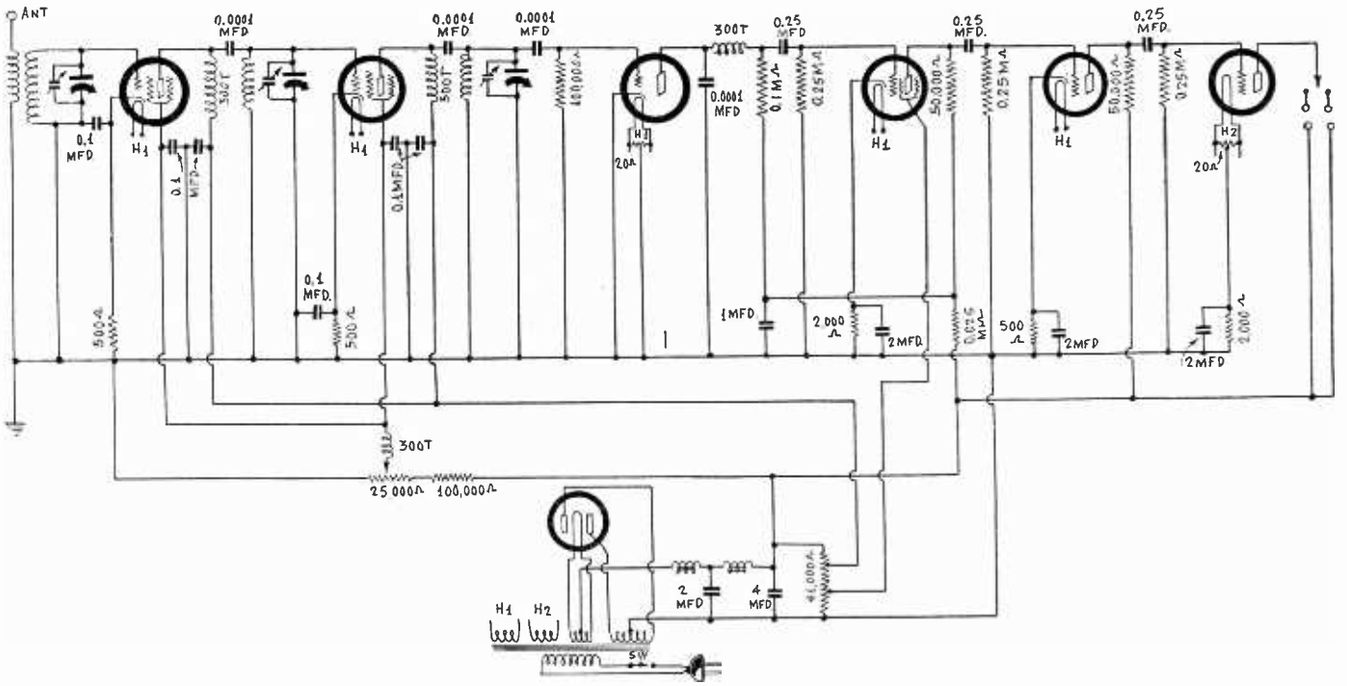


FIG. 1

THE Diagram in Fig. 1 is the circuit of a receiver especially designed for television reception. Because of this fact the radio and audio amplifiers differ considerably from circuits intended for broadcast, or sound reception. The radio frequency tuner is not so selective as it would be for sound reception, because in television it is essential to transmit and to reproduce frequencies as high as 100,000 cycles, whereas in sound transmission it is not necessary to go higher than 10,000 cycles per second. The audio amplifier is designed to amplify both high and low audio frequencies, for in a television receiver it is essential to have good gain as low as 20 cycles per second and as high as 100,000 cycles.

These are very stringent conditions. Especially is it difficult to get the high frequencies because if there is to be sufficient selectivity to separate adjacent television channels, and other channels from television, there will be sideband cutting and the higher signal frequency components will suffer reduction. Likewise is it difficult to make an audio amplifier that will amplify efficiently above 10,000 cycles because of the effect of shunt capacities, both those that must be put in to make the circuit function and those which cannot be avoided, such as grid to filament and plate to filament capacities.

Tuned Impedance Coupling

Between the antenna and the first tube is a radio frequency transformer, one with rather large primary so as to get a high gain and at the same time not excessive selectivity. Between the first and the second tube we have what amounts to tuned impedance coupling. A 300 turn radio frequency choke is connected between the plate and the B supply and the plate is coupled to a tuned circuit, and to the grid of the succeeding tube, by means of a 0.0001 mfd. condenser. Since a television receiver is designed for comparatively short waves, the coupling between the tubes is rather close, and both gain and sideband transmission are assured. The coupling between the second tube and the detector is exactly the same as that between the first and the second.

There are three tuned circuits the condensers of which are ganged. Each condenser has a trimmer across it to bring about close resonance. The close direct coupling and the two screen grid amplifiers insure a high gain, and a high gain is needed in a television amplifier if good signals are to be received from other than local stations.

The detector works on the grid leak and condenser principle. This type of detector is quite suitable because of its high detecting efficiency and because there is so much audio amplification that there is no danger of overloading the detector without first overloading the output tube.

LIST OF PARTS

Coils

One r-f antenna coil, with shield
Two r-f coupling coils, with shields
Four 300-turn r-f chokes

Condensers

One 4 mfd. by-pass condenser
One 1 mfd. by-pass condenser
Three 0.25 mfd. by-pass condensers
Four 0.0001 mfd. condensers
Two 2 mfd. by-pass condensers
Two 0.1 mfd. blocks of three condensers each
One gang of three 350 mmfd. variable condensers

Resistors

One voltage divider resistance of 41,000 ohms, with taps
Two 20-ohm centertapped hum balancing resistors
Three 0.25 megohm resistors
Three 0.1 megohm resistors
One fixed 25,000 ohm resistor
One 25,000 ohm potentiometer with line switch attached
Two 50,000 ohm resistors
Two 2,000 ohm bias resistors
Three 500 ohm bias resistors

Other Requirements

One base board, metal
One front panel
Five 5-prong sockets
Two 4-prong sockets
Three grid lead shields
Three grid clips
One tuning dial
Four binding posts
Various small hardware, washers, hookup wire, plug and cord
One power transformer and two chokes

Control of Gain

The amplification is controlled by means of a 25,000 potentiometer by means of which the voltage on the screens of the first two tubes can be controlled. The resistor in series with this potentiometer is 100,000 ohms, so the range of screen voltage is from zero to about one-fifth of the total voltage. This does not mean one-fifth of the voltage applied to the plates of the tubes, for the plate returns are made to a lower point on the voltage divider than the return of the screens. The range of the control is approximately from zero to the amplification that results when the screens have the recommended maximum bias. This is ample to control the volume.

ECEIVER; UPLING USED THROUGHOUT

Moses

Radio Co.

The audio amplifier contains four stages, considering that the grid type detector acts as amplifier as well as detector, but the tubes used are of the three element type so that the gain will not be so high as to render the set uncontrollable. An amplifier of this type ordinarily becomes unstable at the very low frequencies, usually below audibility, and this is particularly the case when it has been designed to amplify efficiently at the very low notes. To prevent motorboating in this circuit a resistance capacity filter has been inserted in the first two plate circuits. A common resistor of 25,000 ohms is used in these plate circuits, below the coupling resistors, and a by-pass condenser of 1 mfd. connects the junction to ground. This filter prevents regenerative feedback from backing up from the plate supply.

Self Bias Used

Self bias is used on all the tubes and there is a by-pass condenser for each resistor. The condensers in the radio frequency amplifier are 0.1 mfd. each and those in the audio amplifier are 2 mfd. each. The bias resistance for each of the r-f tubes is 500 ohms. The bias resistance for the second audio amplifier is also 500 ohms. The other two bias resistances are 2,000 ohms each, one for the 245 output tube and one for the 24 type audio amplifier.

Attention is called to the fact that the screen voltage on the 24 type audio amplifier is very low. Under the condition of the circuit a voltage of about 15 volts will give good amplification. Hence the screen return of this tube should be connected to a tap on the voltage divider where the voltage has this value, measured from B minus or ground. If the voltage divider has many taps near the ground end the screen should be connected to various taps to find just where the performance is the best. If the screen voltage is made as high on the audio tube as on the r-f tubes, distortion will result if any results at all will be obtained.

Hum Elimination

There are two hum balancing resistors in the circuit, each of 20 ohms, and one connected across each of the two 2.5 volt windings. These resistors are accurately centertapped. The filter in the B supply is also arranged for good filtration. Choke input to the filter is used because this smooths out the voltage better and is less severe on the rectifier tube. One of the filter condensers is 4 mfd. and the other is 2 mfd. The smaller of these condensers should be placed first, that is, after the choke next to the rectifier and the larger across the voltage divider, for in that position the condenser will not only act as a means of reducing the hum but also as a means of by-passing audio frequency currents in the amplifier.

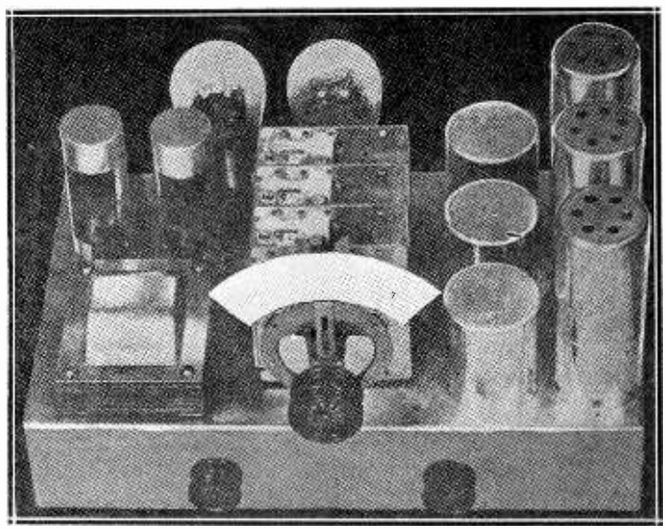


FIG. 2

Front view of chassis of 80-200-meter receiver, particularly suitable for television, though bringing in police calls, amateurs, etc., also.

The output of the amplifier is supposed to be delivered to a neon glow tube, and this tube may be connected directly in the plate circuit. But it is also desirable to have a means of connecting a loudspeaker to the output, for a television signal is best tuned in by listening just as an ordinary broadcast signal is tuned in. A switch may be provided whereby either the loudspeaker or the neon tube can be connected in the plate circuit of the output tube.

Use Dynamic Speaker

In the figure are four binding posts. The neon tube is supposed to be connected to two of them and the loudspeaker to the other two. The change-over switch is connected to the plate of the power tube and by throwing it one way or the other, either the speaker or the neon tube can be picked up.

It is best to use a dynamic speaker since a magnetic will not satisfactorily handle the output of the 45 tube. This dynamic speaker should be provided with a matching transformer, which is usually built into the speaker. The primary of this transformer should be connected to the two output posts reserved for the speaker. An inductor dynamic may be used.

Provision should also be made for the field current if the speaker does not contain its own field current supply. Just how the field current should be obtained depends on the design of the field winding. If it is designed for high voltage and low current it can be connected across the output of the rectifier, from the center of the filament winding to the ground. But to make this safe it should have been designed for the voltage existing across those points. It could also be connected in series, just like one of the chokes, provided the current required does not exceed the current required by the receiver.

2,100-2,200 KC
142.8 to 135.1 meters

W3XAK	5,000	National Broadcasting Co.	Bound Brook, N. J.			
W2XBS	5,000	National Broadcasting Co.	Bourd Brook, N. J.	60	20	2:00 to 5:00 p. m., 7:00 to 10:00 p. m., EDST, daily except Sundays and holidays.
W3XAD	500	RCA Victor Co.	Camden, N. J.	..	..	Irregular.
W2XVW (WGY)	20,000	General Electric Co.	Schenectady, N. Y.	60	20	4:30 to 5:30 p.m., EDST Friday.
W8XAV (KDKA)	20,000	Westinghouse E. & M. Co.	Pittsburgh, Pa.	60	20	3:30 to 4:30 p.m., EDST, Friday only. Sound track temporarily discontinued.
W6XS (KHJ, Los Angeles)	1,000	Don Lee Broadcasting System	Gardena. Cal	80	15	6:00 to 7:00 p.m., PST.
W9XAP (WMAQ)	2,500	National Broadcasting Co.	Chicago	45	15	12:30 to 1:30, 3:00 to 4:30, 5:45 to 6:45, 7:30 to 8 p.m.. CDST. Uses 2150 kc.

2,750-2,850 KC
109.0 to 105.2 meters

W9XAA (WCFL, Chicago)	500	Chicago Federation of Labor	Chicago			Starts June 24th.
W9XG, Lafayette, Ind.	1,500	Purdue University	W. Lafayette, Ind.	60	20	Tues. and Thurs., 2:00 to 2:45; 7:00 to 7:45, 9:00 to 9:45 p.m., CST.
W2XAB (WABC, New York City; sound over W2XE)	500	Columbia Broadcasting System	New York City	60	20	8 to 10 EDST, daily. Sound and vision on same channel. Vision on mid-channel, sound at extreme.

HOW VISION AND SOUNI ARE SENT (

By Neal

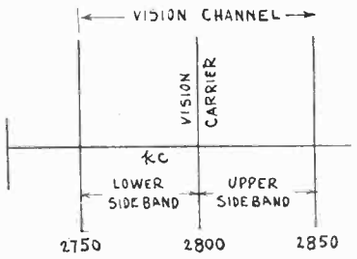


FIG. 1
This illustrates a vision channel with carrier at 2,800 kc and the side bands occupying the entire band allotted.

SIMULTANEOUS sound and vision broadcasting has come on the air, using the same vision channel for both as well as the same receiver for reproducing both. How can this be done?

When vision alone is sent on the wave the carrier is modulated with the television signals in the usual way, and the frequency in the middle is used as the carrier. This is illustrated in Fig. 1. The vision channel is 100 kc wide, the one illustrated going from 2,750 to 2,850 kc. If both sidebands are transmitted, as is usually the case, only 50 kc is allowed for each sideband, and the highest modulation frequency that can be sent is 50 kc. But at present even this band is strictly not required because of the rate of scanning. It is considered sufficient if each sideband be allowed 43 kc when the rate of scanning is 60 lines per frame and 20 frames per second.

The fact that the allowed channel width is greater than the required width, at present, has been taken advantage of by sending the sound accompaniment on the same channel, not necessarily on the same carrier.

Using Separate Carriers

If only channel width of 86 kc is required to send a satisfactory television signal and the allowed channel width is 100 kc, we have 14 kc for the sound accompaniment, or 7 kc for each sideband of the sound signal. The simplest way to utilize the spare channel space is to use two carriers within the allowed band, and displacing one with respect to the other so that there is no overlapping. How this may be done is illustrated in Fig. 2. The television carrier is selected at 2,807 kc and the sound carrier at 2,757 kc. The sound channel extends from 2,750 kc to 2,764 kc and the vision channel from 2,764 up to 2,850 kc.

In utilizing this scheme it is obviously essential to limit the sidebands of the two signals so that they do not overlap. Thus it is necessary to limit the sound to a channel 14 kc wide, for otherwise it would encroach on the territory reserved for some other service on one side and the sound would interfere with the vision signal on the other side. Likewise it is necessary to limit the vision signal to a band 86 kc wide for otherwise it would encroach on the region reserved for some other service on the upper side and it would interfere with the sound on the lower side. Both signals can be limited by means of filters, not completely, but well enough for practical purposes. While there are two independent channels and carriers, both are within the vision channel allotted for the service.

Reception of Double Wave

The reception of such a wave may offer some difficulties, but none that could not be solved without a great deal of trouble. A television tuned radio frequency receiver would pick-up both with about equal intensity, because a television receiver must be broad in order to pick-up the wide sidebands. It requires only a little less selectivity to bring in the sound channel on the same receiver with sensibly the same intensity. But that would undoubtedly cause interference in the sound channel since the visual part would be heard in the loudspeaker. And it may be that the sound would interfere with the visual signal, causing streaks and splotches.

However, we could easily select the sound portion with the superheterodyne scheme. We would first tune in the entire signal with the t-r-f tuner and then provide an oscillator for the sound to convert its frequency to one much lower. For example, if the sound carrier is 2,757 kc we could set up an oscillator operating at 2,582 kc to produce a beat frequency of 175 kc. The amplifier operating at 175 kc could be made very sharp so that the vision interference would be eliminated. The oscillator frequency is made lower than the sound carrier by 175 kc in order to keep it out of the television band. This scheme would eliminate the television signal from the sound but may not eliminate the sound from the television. But it could be removed with a sharply resonant trap somewhere in the television selector, tuning this trap to the sound carrier. For the purpose of receiving the sound we would not need all the tuned circuits since we would depend mainly on the superheterodyne intermed ate for sound selection. Hence we could put the tuned trap immediately after the point where the sound signal is diverted to the oscillator and the intermediate. Thus we would have both signals clear of interference from the other.

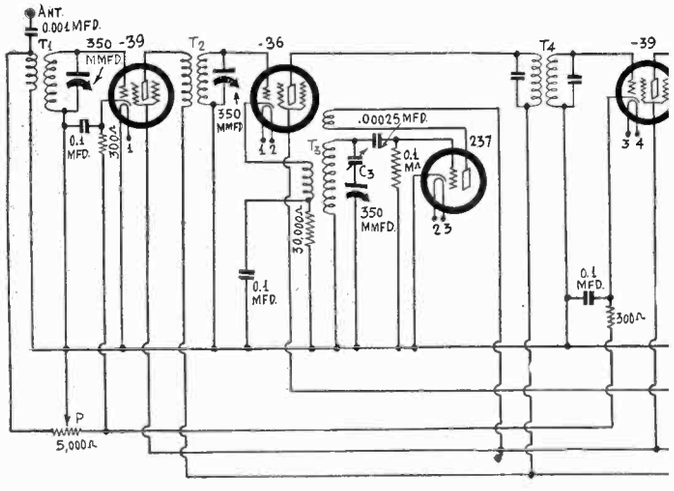
This arrangement amounts to, practically, having two independent receivers, for we would have to have separate audio stages, one continually to operate the speaker and the other the neon tube.

Using Same Carrier

There is also a possibility of using the same carrier for both sight and sound. If this is done the common carrier would be selected in the middle of the sight-sound channel, at 2,800 kc in the 2,750-2,850 channel. The vision signal would occupy the band between the carrier and 43 kc each side. This would leave 7 kc at each side of the band which could be used for the sound transmission. But

D-C Superheterodyne

The automobile series of tubes are the most suitable for d-c receivers where the filaments are connected in series, because, due to the fact that they are heaters there need be no loss of voltage, the full 115 being available for the plates, and they require only a small filament current. Many successful d-c superheterodynes have been built with these tubes. At right is one of these circuits. Note that across the push-pull input transformer secondary are two 0.5 megohm resistors, one across each half. They are for the purpose of removing line noise.



TRACK
N THE SAME CHANNEL

Fitzalan

how? If we put both sight and sound on the same carrier in the usual way the signals will be thoroughly mixed and no tuning or filtering would separate them. Moreover, the sound would be centered around the common carrier, whereas we want the sound to cover the fringes only.

Suppose we first convert the sound frequency so that the sidebands begin where the visual signal ends. Can it be done? Again we call on the superheterodyne principle. If we add 43 kc to every audio frequency the audio signal will be represented by a range of frequencies from 43 kc to 50 kc. This band of frequencies can be impressed on the common carrier exactly as the visual signal. The entire signal range will now be from zero to 50 kc and the sound will start where the vision signal leaves off.

How to Add 43 KC

Now we must find a way of adding 43 kc to every audio frequency. If we set up an oscillator having a frequency of exactly 43 kc and then modulate it with the sound signal, we shall have two side bands, one ranging from 43 kc less 7 kc to 43 kc plus 7 kc, the lower and upper sidebands, respectively. The upper sideband meets our condition for every sound frequency in it is represented by a frequency 43 kc greater than the sound frequency. Hence, by means of a suitable filter, we suppress the lower sideband and select the upper, and then impress it on the common carrier wave.

The television receiver would reproduce the entire signal from zero to 50 kc and hence would include the audio component. But it would not cause much trouble, if any, in the television receiver, for it would not be strong. Neither would it be audible in the sound receiver. It would be necessary to provide a 43 kc oscillator at the receiver and convert the frequency to the range of zero and 7 kc. This is exactly what is done in single sideband transmission and reception and this is a case of it in so far as the sound portion of the signal is concerned. Incidentally, it would be necessary to make the local oscillator frequency exactly 43 kc, or exactly equal to the frequency of the original oscillator, for otherwise there would be distortion, and it would not be of either the wave form or the frequency type, but more serious. If the receiver oscillator frequency were different from the transmitter oscillator, a given number of cycles would be added to or subtracted from the tones. For example, a tone of 256 cycles might be 270 cycles. The harmonic frequency of 256 would be 526 cycles instead of 512. Hence the two would not be harmonic, which is characteristic of discord.

Putting Sound on Higher Side

In the arrangement illustrated in Fig. 2 it would work just as well if the sound track were placed on the upper side of the television track. In that case the sound carrier would be 2,843 kc and the vision carrier would be 2,793 kc. The sight track would extend from 2,750 to 2,836 kc and the sound track from 2,836 to 2,850 kc.

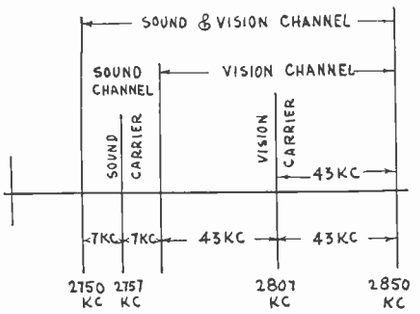
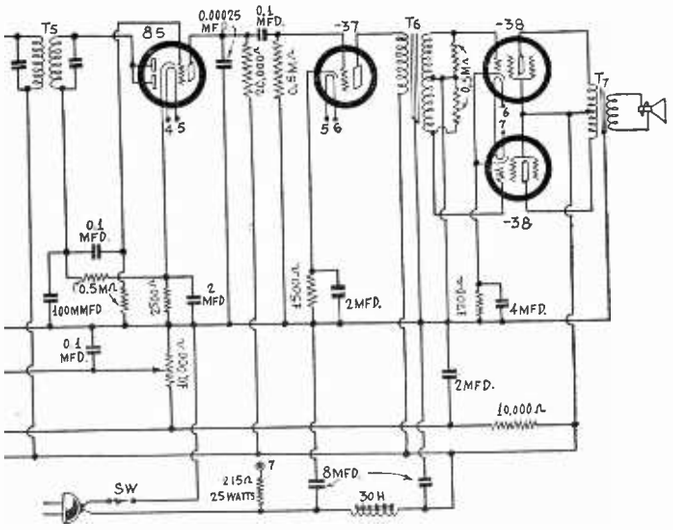


FIG. 2

This illustrates a sight-sound channel with vision carrier at 2,807 kc and the sound carrier at 2,757 kc.

with New 85 Tube



In the circuit at the left the automobile tubes have been incorporated, eight of them being used. This includes the latest addition to this series of tubes, the 85 duplex diode triode. This is used as second detector and as first audio frequency amplifier. All the values of the various parts are given, except the coils, which should be consistent with the tuning condensers. A set of three superheterodyne coils should be obtained, one an oscillator and two r-f. The i-f transformers may be of any desired frequency but they must match the oscillator coil.

W2XAB Sends Sight and Sound In Same Channel

W2XAB, the Columbia Broadcasting System's short-wave television station, is back on the air with simultaneous sight and sound on the same channel, the 2,750 to 2,850 kc band. The initial program included an innovation when Harold Stern's dance orchestra broadcast their music from the roof garden of the St. Moritz Hotel, New York City, while their leader talked to them and directed them from W2XAB's studio nine blocks away. Receivers set up in front of the orchestra enabled the musicians to follow Stern's baton visually and hear his instructions as he faced the flying spot.

Edwin K. Cohan, technical director of Columbia, gave an explanation of the new synchronization method and pointed out its significance.

"The frequency band, or ether channel, occupied by W2XAB," Mr. Cohan said, "extends from 2,750 kc to 2,850 kc. Thus we have a channel 100 kc or 100,000 cycles wide. We transmit a picture composed of 4,320 picture elements and we transmit twenty complete pictures per second in order to obtain a satisfactory illusion of motion. This requires approximately 86 per cent of the 100,000 cycle channel just mentioned, leaving 14 per cent, or about 14,000 cycles, unused. Since the next progressive step in picture detail and definition under present methods would require a channel wider than 100,000 cycles, 86 per cent of the band has been the highest efficiency thus far. Instead of wasting the remaining 14 per cent, as has been the practice heretofore, tonight's program inaugurates the usage of nearly all this 'waste' for the accompanying voice or music."

THE DESIGN OF MATCHING TURNS RA

By Charles

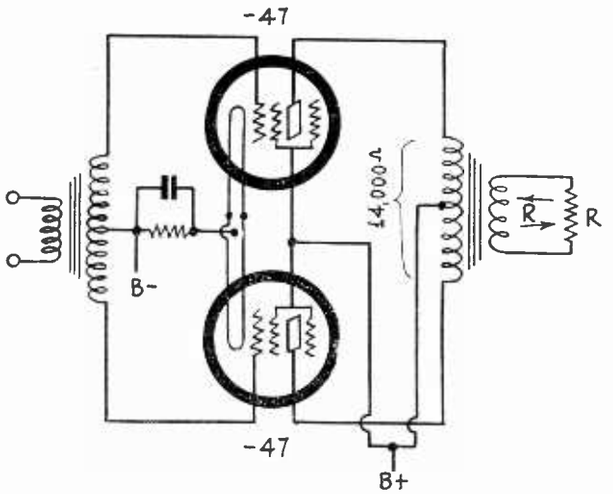


FIG. 1

The output transformer must have the proper turns ratio to provide adequate impedance match. Power loss is suffered unless matching exists. The same holds true of any audio transformer.

THERE IS often request for information on the design of output transformers which will fit a given output tube and any loudspeaker. The question usually is: How many turns should the primary of the output transformer have to give the impedance required by the particular tube in consideration? Questions of this kind come in the same class as the perennial question about Ohm's law, namely: How much resistance should be used to drop the voltage by a given amount? They are in the same class because there is no answer. Neither question proposes a problem, not even a riddle.

An output transformer serves only one purpose, namely, to match two impedances. It is a device enabling two devices of different impedances to work effectively together. It is a lever by which a low force and a large motion are transformed to a high force and a small motion, the energy remaining constant. Or, it is a device which works in the opposite direction, and that is the case of the output transformer. The voltage across the primary is the force, the current the motion. The voltage across the secondary is the force on that side of the lever, and the current in the secondary is the motion there. The ratio of turns is the leverage. The fact that we treat the transformer as a power transformer, or power lever, does not alter the situation, for power is just the rate of doing work, or of expending energy.

This Way and That

It is well known that if a power transformer is to work so as to give greatest output, (Not to give greatest efficiency), the impedance of the source should be equal to the impedance of the absorber, or of the sink, as it is often called. The loudspeaker is invariably the sink in a radio set, and the plate circuit of the output tube is the source. Now if we are to get the greatest power into the speaker, the impedance of the speaker must be equal to that of the tube. However, due to the characteristics of vacuum tubes, the greatest undistorted output is obtained when the load impedance, that is, the impedance put on the tube, is equal to twice the impedance of the tube. Hence if we want the optimum combination of power and freedom from waveform distortion we must double the load impedance. Ordinarily the impedance given with a tube is the optimum load impedance, not the impedance that gives greatest output. Incidentally, the optimum impedance makes the device more efficient, using the term in its strict sense.

It rarely happens, because it is practically impossible to make it happen, that the impedance of the speaker is equal to the optimum impedance of the tube. Hence we have to insert a lever to bring about the right ratio of forces and motions, or of voltages and currents. This lever, or output transformer, must have such a ratio of turns, or such leverage, that the tube looks into an impedance equal to the optimum load impedance and such that the speaker voice coil looks into an impedance equal to its own. This view of "looking" this way and that is derived from the method of measuring the impedances. When the impedance of the primary is measured on a bridge, with the speaker connected and functioning, the value obtained should be the optimum load impedance. Conversely, when the impedance of the secondary is measured on a bridge, with the tube connected and functioning in the primary, the impedance obtained should be equal to that of the voice coil or other armature.

Ratio Important Thing

It is clear that the important thing in an output transformer, or any other matching transformer, is the ratio of transformation, or of leverage, not the impedances of the primary and secondary when measured when the device is disconnected, or when measured with the other winding open or shorted. Entirely different results will be obtained under the two conditions.

If we have a certain heavy weight to lift, one heavier than any human being can lift unaided, we resort to some kind of mechanical transformer. It may be a simple lever, like a crow bar on a fulcrum, it may be a screw like an automobile jack, or it may be a block and tackle. In any case we select the ratio of transformation that will fit the case. For example, suppose we are to lift a large stone and we have only a crow bar with which to do it. We place the fulcrum where we think we can budge the stone. If we don't succeed the first time, we move the fulcrum nearer the stone. That is, we increase the ratio of transformation until, with the force we have available, we can succeed in our attempt, i.e., we can move the stone.

It is the ratio in this case also that determines success or failure. It may be, of course, that the lever we have is not strong enough. But that is a different problem, which must also be solved to fit the case. This problem has its counterpart in the output transformer, which we can solve after we have determined the proper ratio of transformation.

In the mechanical transformer of the lever type, the ratio of transformation is simply the ratio of distances between the fulcrum and the points of application of the forces. The primary force is applied to the lever where the hand grasps the crow bar and the secondary force is applied where the stone rests on the short end. In the electrical transformer the ratio of transformation is the ratio of turns.

Ratio of Turns and Impedances

But how is the ratio of turns related to the impedances? It can be shown by the theory of the transformer that the ratio of turns should be equal to the square root of the ratio of the impedances. We assume that the primary and secondary windings are so closely associated that there is no leakage flux—perfect coupling. That is, we assume that the fulcrum is perfectly rigid.

If a transformer is working between a tube and a loudspeaker it is working between two practically pure resistances. The tube impedance is a pure resistance at audio frequencies for capacities are negligible. The impedance of the speaker is also practically a pure resistance provided that it is properly loaded with air, that is, if it is properly baffled or if it is working into a long exponential horn. Hence we have to match two resistances, one the optimum load resistance of the tube and the other the effective resistance of the voice coil. Therefore the ratio of transformation of the output transformer should be equal to the square root of the ratio of the resistances. Suppose the voice coil has a resistance of 10 ohms and the optimum load resistance of the tube is 7,000 ohms. Then the ratio of the resistances is 700, and the proper ratio of turns is 26.5-to-1.

Suppose two of the same tubes are working in push-pull into the same speaker. Then the total optimum load resistance is 14,000 ohms, for the two are essentially in series, and the ratio of the two resistances is 1,400. Hence the proper ratio of turns is 37.4-to-1.

Ratios Only

But these are ratios only. Shall we use 37.4 turns on the primary and one turn on the secondary or shall we use 3,740 turns on the primary and 100 turns on the secondary? Clearly, the leverage condition is satisfied in both cases. It is also clear that an infinite number of combinations is possible. Which shall we use in any particular case?

Well, suppose we are to lift a ton of stone with a lever? Shall we use a strong crow bar or a straw? Or, in lifting an automobile, shall we use a screw made of hard steel or one made of soap? Obviously, we must choose the transformer to fit the case. If, in the electrical case, we are dealing with low voltage and low currents, we can use a small transformer, one which will only stand a little current and low voltage. But if we are dealing with high voltages and high currents, we must select a transformer that will stand these high voltages and currents. The answer to these questions will decide

TRANSFORMERS; TIO OF FIRST IMPORTANCE

Enris

the size of the core, the size of the wire and the actual number of turns. But size of core, material of core, and current requirements are interrelated.

The size of core and the size of the wire in both windings are determined by the permissible power losses. In commercial power transformers it is customary to proportion the transformer so that copper and core losses are approximately equal. Tables are available for the losses in both copper and transformer steel under specified conditions. But it is not necessary to design an audio output transformer on the same basis as a commercial power transformer. The same question of economy does not arise. We can make the audio transformer larger in proportion, thus reducing both copper and iron losses. But it is all right to follow commercial practice with slight modification. In an audio transformer it is essential to preserve the waveform to avoid distortion. This means we cannot operate the core at as high flux density as a commercial power transformer. Therefore a relatively larger core should be used. This will reduce iron losses, and it is just as well to proportion the copper to reduce these losses also, in the same ratio.

D-C Losses

In an audio transformer connected directly into the plate circuit of a tube we have a direct current component to take into account. This increases the losses in the primary, but this can be offset by making the primary wire a little heavier. It does not affect the secondary. This is the case both when the transformer is push-pull and when it is single sided. When the primary is single sided and connected in the plate circuit of a single tube, the direct-current component also affects the magnetization of the core. The effective permeability of the core will be less. Hence the core area should be larger than if the transformer is push-pull, for in a push-pull transformer the magnetization of the core by the direct current is balanced out by the fact that the two tubes send currents around in opposite directions. But the heating effect of the d-c remains even in the push-pull transformer.

If we know the dimensions of the core and the properties of the core, which for ordinary transformer steels can be obtained from standard tables, we can use these data for determining the required ampere-turns to produce the desired flux density in the core. Then if we make use of the current which is to flow in the primary we can obtain the number of primary turns, and from that and the required turns ratio, and finally the secondary turns.

The current to use in determining the number of turns from the ampere-turns should be the maximum current in a cycle, which is the difference between the current in each tube at zero bias and that at the operating bias. However, this differs but slightly from the current in each tube at the operating bias. The amplitude is used rather than the root mean square current in order to fix the maximum flux density. Just what the maximum density is to be is a matter of judgment, and upon this judgment will depend the total number of turns in both the primary and the secondary.

Circuit Illustrated

In Fig. 1 we have a typical circuit in which a step-down transformer is used to match the impedances of a loudspeaker and two 47 tubes in push-pull. The voice coil impedance is replaced by its equivalent resistance and is indicated by R. The resistance of the two tubes, effectively in series, is 14,000 ohms. For these particular tubes in push-pull the turns ratio of the transformer should be $(14,000/R)^{\frac{1}{2}}$. The case where R equals 10 ohms was given above and the ratio was found to be 37.4. The arrows in the secondary circuit show that the resistance should be R in both directions. That is, that the load on the secondary should be R ohms when the winding measures R ohms. In the primary there is only one arrow pointing in the direction of the transformer, which means that the resistance of the transformer should look like 14,000 ohms.

The resistance in question, of course, are only the a-c resistances. The resistance to direct current of the secondary of the transformer may be practically zero while that of the primary may be only a few hundred ohms.

Design of Interstage Transformer

The design of an interstage transformer is not based on the same theory as that of a matching transformer, because the interstage transformer works into an open circuit, practically. All that is wanted across the secondary is voltage. The primary impedance, when measured with the secondary open, should be as high as possible, because the higher it is the higher will be the voltage across the primary, and hence across the secondary for a given ratio of turns. The ratio of turns is not important here, although for a given number of primary turns the higher step-up ratio the higher the secondary voltage. But there are practical limitations on both windings, such as core saturation, distributed capacity and leakage flux.

Sometimes a very high resistance is connected across the secondary to improve the performance of the receiver. When that is done there may be some reason for fixing the ratio of turns on the basis used in the power transformer, for in this case the transformer will actually work between resistances, and there will be current as well as voltage of one megohm across the secondary of a push-pull input transformer and also suppose that it is working from a 227 tube.

The load resistance of this tube should be at least 20,000 ohms. Then the transformer will work between one megohm and 20,000 ohms. The ratio of these is 50. Hence the turns ratio would be 7.07-to-1. But the primary voltage will be higher if the load resistance is higher. Let it be 100,000 ohms. Then the ratio of the resistances is 10, and the turns ratio should be 3.16-to-1. Of course, the secondary has the larger number of turns in both cases. The ratio is that of the whole secondary to the primary.

Comparing Voltages

Which will give the greater voltage across the secondary, the one with the higher ratio and lower primary impedance or the one with the lower ratio and the higher primary impedance? Suppose the voltage in the plate circuit is one volt and that the a-c resistance of the circuit is 10,000 ohms. When the load resistance is 20,000 ohms the total is 30,000 ohms. The voltage across the primary is 2/3 volt. Since the ratio was 7.07/1, the secondary voltage will be 4.71 volts. When the load resistance is 100,000 ohms the total primary resistance is 110,000 ohms and the voltage across the primary is 10/11 volt. Since the ratio of the transformer in this case was 3.16/1 the secondary voltage will be 2.87 volts. Hence the higher impedance gives the lower voltage. This is because we changed the ratio of turns.

In the single-tube output amplifier. Fig. 2, the ratio of the matching transformer should be equal to the square root of the ratio of the optimum load impedance of the tube to the resistance of the voice coil under operating conditions. Thus if the optimum load resistance of the tube is 7,000 ohms, as is the case for the tube illustrated, and if the voice coil has a resistance of 10 ohms, the ratio of turns should be 26.5-to-1.

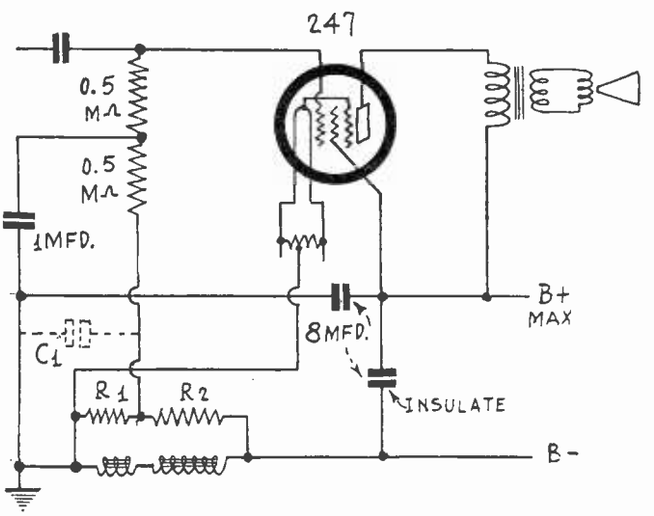


FIG. 2

In this circuit the output transformer must match the optimum load impedance of the voice coil of the speaker. The secondary winding of the transformer should have a neglible resistance, which means that large wire should be used.

Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Dial Phone Interferes

THE DIAL TELEPHONE in my home causes interference with our radio. When a number is dialed in the next room the clicking of the phone instrument is plainly heard. Can this be cured? —K. H. F., New York, N. Y.

Yes, it can. Usually all that is needed is a bypass condenser. Get in touch with the service department of your telephone company, explain the situation, and the company will send a service man who can supply the remedy at small cost. It is not permissible to tamper with the telephone, as it is the property of the telephone company. However, often a filter at the receiver input will provide the remedy, and to apply this of course it is not necessary to consult the telephone company.

* * *

Gang Condenser Accuracy

DO GANG CONDENSERS tune exactly alike? Are there not discrepancies? When each section is trimmed, is this not for parallel capacity? Suppose the condenser sections are not exactly alike? How could one trim for that defect?—K. D. L., Portland, Me.

The sections are not exactly alike, but the capacity values at any given setting are so nearly alike that for practical purposes it is not necessary to compensate for the differences. This is said in full realization of the considerable difference in frequency that small capacity difference might occasion, at high frequencies even of the broadcast band. The type of accuracy you have in mind is not necessary for broadcast receivers, and particularly not for superheterodynes, because of the high amplification following the mixer. The trimming capacities used, except in the case of the series padding condenser sometimes used in an oscillator, are for parallel corrections, to atone for differences in capacity arising from the wiring, location of parts, tubes, etc., and is the only serious discrepancy arising. If any considerable difference exists between sections of the condenser itself, apart from anything connected to them, very large series capacities would be a remedy, but condensers so poorly made would not find any commercial favor. We have had experience with many makes of condensers and our tests disclose that the accuracy is sufficient.

* * *

Meter Resistance

HOW CAN I DETERMINE the resistance of the coil in a voltmeter that I have?—B. L. F., Ann Arbor, Mich.

This is not easily done directly unless you take the meter apart sufficiently to measure or compute the resistance of the coil. However, if you know exactly the resistance of any limiting resistors used as multipliers, you can measure the total resistance and subtract from it the resistance of the known multiplier, the difference being the resistance of the meter itself. Good meters, of a popular type used as voltmeters (0-1 milliammeter with multipliers) commonly have a resistance of 27 ohms.

* * *

Dilemma

I AM GREATLY INTERESTED in the measurement of resistance. I find, however, that if I have an insensitive instrument I can not measure high resistance values very well, while if I use a sensitive instrument I can not measure low resistance values very well. So what shall I do?—F. F., Venice, Calif.

Measurement of small resistance values requires considerable current flow, and an instrument no more sensitive than a 0-100 milliammeter should be used. Measurement of high resistance requires a sensitive instrument, because small current will flow through such resistors, unless the applied voltage is made abnormally high, which also in some instances might injure the resistors subject to measurement. If you want to use a single instrument you may use a sensitive one for high resistance measurements, and put a shunt across the instrument, to make the needle indicate the equivalent of large current, and, using the same voltage source, switch from one to the other, being careful, however, not to use the shunt when high resistance is to be measured, as so much current may be passed through the meter as to injure it. You have noticed, of course, how unsuitable to wide-range resistance measurements any single meter is, because of the overcrowding of the scale at two extremes. Accuracy is not served. For real accuracy the thing to do is to measure the current through the unknown resistance and compute the value of the unknown on the basis of the voltage drop across it. This is done according to Ohm's law: resistance in ohms equals the voltage in volts divided by the current in amperes.

* * *

Short-Wave Set

MY PRESENT INTENTION is to build a short-wave receiver, battery-operated type, 2-volt tubes. Will you please show a diagram, one stage of t-r-f, regenerative detector, two stages of transformer-coupled audio? Remember, please, I have two separate 0.00014 mfd. condensers and have two sets of two-winding (UX) plug-in coils.—R. B., Philadelphia, Pa.

Fig. 1023 shows the circuit. The '34 is used in the t-r-f stage, the 30 was regenerative detector and first audio, and 33 is the output pentode. Here a grid circuit and a plate circuit of the same r-f tube are tuned, and the diagram calls for use of the tuning condensers separately (not ganged), but you can meet this requirement. If regeneration fails, simply reverse the connections to the tickler winding. Bias for the first audio and output tubes is obtained through the voltage drop in resistors in series with the B minus lead. The voltages and resistors are stated on the diagram. You have the plug-in coils. You can see for yourself what extra parts you will need. We can not determine that as we do not

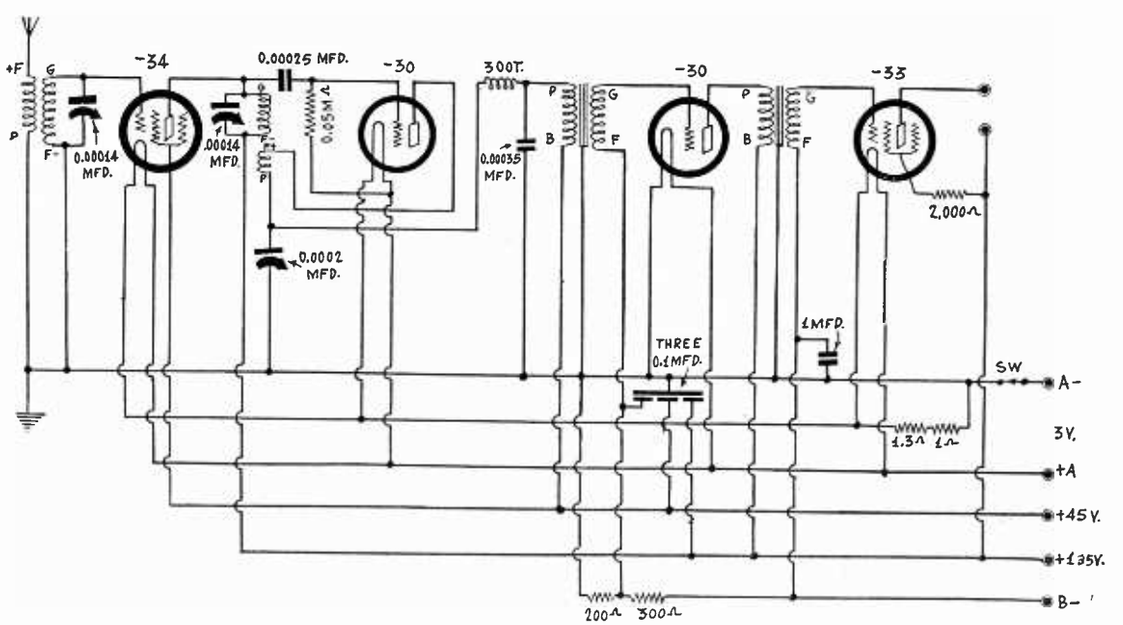


FIG. 1023

A short-wave set, using a stage of t-r-f, regenerative detector and two stages of transformer audio, with pentode output. The negative bias for the audio is obtained from the drop in resistors in the negative B lead, a better method than using C batteries, as the C battery voltage will remain practically constant while the plate voltage declines as the B batteries age or are used.

know what parts you have, other than those you've mentioned.

* * *

Setting Him Straight

PLEASE SET ME STRAIGHT on a few things in radio that I don't understand (among the many I don't.) One is, if a detector rectifies, since direct current results, how come we hear of alternating current in the audio and output transformers? Another is, why is not the vacuum tube like a perpetual motion machine, as it puts out more than is put in, that is, has an efficiency of more than unity? My third question is, when the choke is in the negative leg of the B supply, with condensers from B plus to both sides of the choke, how come there is any filtration, as the voltages are taken off the positive side, where there's no choke?—E. F. W., Shenandoah, Ia.

Let us assume that radio frequency is fed to the input of a vacuum tube that is circuited as a detector. The output will consist of truant radio frequency and also direct current, or voltage as developed across a load. Filtration removes the radio frequency from the output and we have, as you state, direct current, no a-c. Let us now assume that the carrier (radio frequency) is modulated with audio frequencies. Then the carrier amplitude is varied according to these audio frequencies. After detection and filtering we still have direct current, but not of the unidirectional type previously cited. Instead we have pulsating direct current. The pulsations are in one direction, say, positive in respect to the zero axis, hence there is truly no a-c, for a-c, graphically represented, would vary above and below the zero axis. When an audio coil is placed in the circuit alternating current is reincarnated, due to the varying pulsations of the supplied direct current setting up a varying magnetic field. Where resistance coupling is used, since no magnetic field is created, the pulsations across the resistors remain d-c, but the stopping condenser that permits the plate and grid to take different d-c voltages, will pass these pulsations, since they are of an audio frequency. The vacuum tube is not a perpetual motion machine, for one reason, because it does not give out more than is put into it. You count only the signal voltage supplied. What about the power supplied to the filament or heater, to plate, screen, etc? A higher signal voltage is taken out than is put in, but the power is much less than the total powers put into the tube. Filtration arises no matter if the choke is in the negative or positive leg, for the rectifier is one circuit.

* * *

4-Tube A-C Set

I KNOW THAT five-tube a-c sets work. But show me the diagram of a 4-tube set that works. I have the tubes—'51, '24, '47, '80. A-c operation, remember.—P. J., Raleigh, N. C.

We're remembering. See Fig. 1024. This is intended of course to be a midget receiver. It is hard to imagine a 4-tube receiver being anything else. The dynamic speaker has a field coil that's used for B supply choke. Values of constants are imprinted on the diagram.

* * *

A Correction

LAST WEEK a diagram was published as Fig. 1022, a six-tube home receiver, battery-operated, using automotive tubes. The diagram was correct, so were the values of constants given in the answer to a question, but the tube designations were misprinted in the text. These designations should have read: first and second r-f, 239 tubes, detector a 236, first audio a 237 and the output tubes two 238's.

Wants an Accessor

AS I HAVE several meters, and all testing outfits I have seen advertised include the meters built in, will you please let me know how to build a device that will enable me to connect my meters externally, and read the currents and voltages in a set? That is, I want the tester without the meters.—G. F., Macon, Ga.

Such a device was described last week (July 30th issue), using two switches for the purpose. It was called the Accessor because it renders access to the receiver currents and voltages.

* * *

Resistance of Windings

DOES the antenna coil require fewer turns and larger size wire than the primaries of subsequent coils that are in the plate circuits of tubes? Why should not the plate circuit primaries have large wire, also?—P. E., Montclair, N. J.

Practically, the size of wire, number of turns, etc., of the primary of the antenna coil depend on the circuit as a whole. For instance, if a receiver is of the t-r-f type and oscillates at the higher radio frequencies of the band there would be no particular object in using large-diameter wire for the antenna primary, as this would merely increase the trouble. Smaller diameter wire, even of the same diameter as that used on the subsequent primaries, would be all right. Plate circuit primaries may be wound of fine wire because the plate circuit resistance itself is so high that the d-c resistance of the primary is very small compared to it.

* * *

Here Are the Dates

PLEASE GIVE ME THE DATES of issues containing the official data on new tubes.—R. E. L., Walla Walla, Wash.

The 46, 56, 57, 58 and 82 were described in the April 30th issue, the 55 in the June 25th issue, the 89 in the July 23rd issue and the 85 and 83 in the July 30th issue (last week). These official data were complete and also represented the first publication of the full information as received direct from headquarters.

* * *

Auto Aerial

IN AN AUTOMOBILE SET may I use a wire under the running board as an aerial, or what would you say to wire looped around the car, concealed, of course?—H. W., Tulsa, Okla.

A single wire under the running board would not afford much pickup, nor good results unless the set was especially sensitive. However, two dowels, separated the length of the board, placed underneath, would enable putting on ten or so turns of aerial wire, which should be a few inches from the running board, particularly metal parts thereof. The loop effect is no good, as it causes a station to come in and go out as you change direction in driving, just as any loop is sensitive to direction. There are commercial running board aerials that can be bought for a couple of dollars. Other types are intended to be placed under the chassis, the roof, etc.

* * *

Parallel and Series

IF TWO RESISTORS are placed in parallel what is the result? In series? And what about condensers?—W. A., Nashville, Tenn.

Two resistors in parallel or two condensers in series afford a resistance less than the value of either component. The result is the reciprocal of the sum of the reciprocals. Thus if 6 ohms and 10 ohms are put in parallel the result is

$$\frac{1}{1/6+1/10} = \frac{1}{5/30+3/30} = \frac{1}{8/30} = 3.75 \text{ ohms.}$$

In the case of series condensers of 6 and 10 mfd., the resultant capacity would be 3.75 mfd.

Parallel condensers, and series resistors, respectively, produce a result equal to the sum. Thus 6 and 10 mfd. in parallel equal 16 mfd., and 6 and 10 ohms in series equal 16 ohms.

* * *

Connections for 46

THE DIAGRAM of a socket for the 46 shows the five connections in respect to filament, screen, grid and plate, but the text refers to inner grid and outer grid. So I don't know how to connect the tube. Please advise promptly.—G. D., Portland, Ore.

The inner grid and outer grid could be traced out by examination of the tube, but, as you say, the plainness of the explanation could be improved, as we found from examination of the same sheet. Looking at the bottom of the tube (or socket), with filament toward you, and going clockwise, the connections are: filament, filament, plate, inner grid, outer grid. The inner grid is in the same position as the control grid in the case of the '27. The outer, or grid to be connected one place or another, is in the position of the '27 cathode. For Class A connect outer grid ('27 cathode equivalent) to plate. For Class B connect both grids together ('27 cathode equivalent and '27 control grid equivalent). Inner and outer refer to the tube geometry.

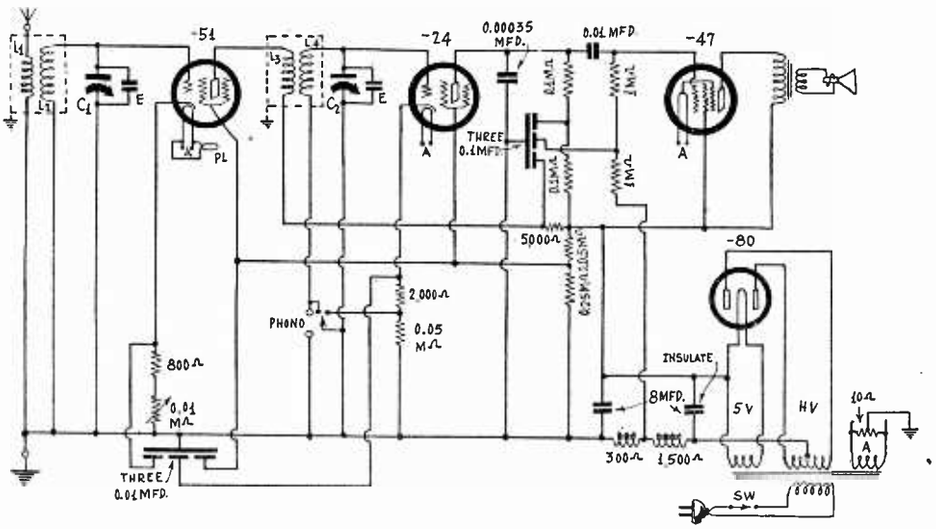


FIG. 1024

A 4-tube a-c set, using tubes prescribed by a reader. This is one of the simplest a-c sets it is possible to build, and it affords satisfactory reception of local stations.

A THOUGHT FOR THE WEEK

A CORRESPONDENT writes: "I see that WOR isn't going to let its announcers give their names any more—only initials. But why initials?"

Is that the human thing to say!

RADIO WORLD

Title Reg. U. S. Pat. Off

The First and Only National Radio Weekly

Eleventh 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 45th 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.

Onward Television!

SO far television has not meant anything at all commercially. Some persons invested in stock of television companies, and lived to regret it. Others died and were spared the regret.

From the beginning the prospect of immediate profits from investment in television enterprises seemed hopeless. The science has to be developed further, and attempting to sell television as it was then was like trying to sell a radio chassis, requiring types of tubes that don't exist. Comfortable, enjoyable service from the thing bought was out of the question. Something had to be added but just what that something should be has not even yet been determined in the laboratories.

Nevertheless television has been going forward a little. Even economic difficulties have not totally prevented its progress. Considerable amounts still are being spent on laboratory work. RCA and its subsidiaries hope that their work will enable them to give regular television program service when Radio City is inhabited, about a year hence, but it is a hope, not a promise.

So much has been accomplished in sound broadcasting, such a high degree of fidelity and enjoyment prevails, that it is felt futile to offer anything in the line of television that will fall far below that standard. Meanwhile the upward movement requires patience, skill and money. The skill the public cannot contribute. The patience it must contribute. Much of the experimental work is being done with the public's money, for the public so largely owns shares in the companies doing the work. The RCA stockholders, for instance, exceed 100,000.

Attempts are now being made to outgrow the awkward stage of television. For about five years experiments have been going on seriously. Meanwhile quite a body of lookers has been developed. It is estimated that in the metropolitan area of New York City these listeners total 9,000. Some of them started with peephole devices, no sound accompaniment. Since then sound was sent out on an entirely separate channel, and many enjoyed sound and sight in the home. The sound was good, for it represented the high development attained in this branch. But the television was only passable, even the projected vision.

The problems of refinement invest all angles of television, from the scanning device at the studio to the scanning device in the home. Optical problems abound. At first the cry was, "Let there be light." Now it is, "Let there be more and more light." How to get sufficient illumination to enable an enjoyable picture to be spread upon a screen 5 x 6 feet is still a problem. Some scanning systems that represent a real improvement in scanning do not permit sufficient illumination, and the problem would seem to be self-limiting, except that we know that in sound broadcasting and reception the gradual fading of all problems of major import finally brought about a degree of near-perfection, and we are entitled to expect television's status to become equally secure in the fullness of time.

Just now much interest focuses on the simultaneous transmission of sound and sight. The moment that ultra frequencies were suggested for television it was realized that here was the opportunity. The channel might be a 1,000 kc wide, or 100 times the width of a present sound broadcasting channel. The picture does not require the full channel width. That left room for a sound track, to be sent either on the same carrier or on a different carrier. So, one would tune in the whole channel, segregate the sound from the sight, send the sound to one audio amplifier and the sight to another, feeding them respectively to speaker and glow lamp. This does away with the nuisance of having two separate receivers to be separately tuned. Instead there is one tuner and there are two separate audio channels with their individual outputs.

W2XAB recently inaugurated combined sight-sound transmission on a single channel in the continental frequency spectrum. The first program was given on the first anniversary of the entrance of the Columbia Broadcasting System into the television transmission field. Several others hold licenses for such transmission at ultra frequencies, and no doubt will follow in due time with actual transmissions. Judging by what has resulted after the experience of CBS during one year, there will be improvements that will bring television much nearer its goal in the year to come—furnishing pictures that in detail and strength, aside from subject-matter, have some entertainment value.

There is some retardation due to the division of transmission and reception experiments. CBS is doing little, if anything, on the receiving end. RCA is doing something on both ends, for of course it hopes to have one of its subsidiaries, probably RCA-Victor, sell television sets. It is easily understood why an agency devoted to transmissions alone should have no commercial interest in receivers, but it is hoped that set manufacturers will co-operate with transmitting agencies, both knowing that no money is to be made out of the preliminary endeavors, so that receiver design in general can keep pace with advances in the transmitting end. This is true and valuable particularly because the receiver is hardly much else than the transmitter reversed.

More Enlightenment

THE growing number of talks heard on the air provides listening with an enlarged sphere of interest, for the requirement is that the speaker know his subject, and most of the microphone talkers are indeed specialists in their line. In the beginning there was a greater percentage of talk, perhaps because talk is cheap, but the trend now is toward authoritative discussions. The large chains are particularly careful about not turning over the microphone to some one who isn't well versed in his topic.

Talks on farm problems, both as to production and economies, are numerous. Various branches of learning have their representatives before the microphone. Government specialists are heard frequently, financiers disclose their viewpoints on money, credit and investments, and current news of all kinds is given over the air. Therefore listening to talks is a profitable undertaking, especially as the solution of world or national problems is sometimes very much like the solution of problems encountered in one's own personal activities.

Information acts as an alarm clock to awaken a better intelligence. Possession of the facts on the leading problems is most of the battle. Thus radio supplements the press, both newspapers and periodicals. With information raining in from all directions, greater enlightenment is bound to result. Finally response of our legislative bodies to public opinion may be quickened and we may be spared some of the solutions that are delayed so long that we forget what were the problems they were intended to solve.

Encouragement

DESPITE drop in the dollar volume of business, ascribed to tumbling prices, public interest in radio is growing, reports R. G. Dun & Co., noted mercantile and credit agency, and while bankruptcies are increasing, the amount of liabilities is less and during the past six months has shrunk considerably. The "high" was reached in the sad news column in 1930, and compared to that year the 1932 total is expected to be less, not only in dollars but as to the number of bankruptcies.

An encouraging word from the outside is most welcome, not only to manufacturers but also to wholesalers and retailers, particularly as the retailers have to extend credit to a large number of customers, and it is harder to keep a large number of small debitors up to date than a smaller number of large debtors. Collections are slow on installment accounts, and fairly good on open accounts.

Some of the large companies, although losing money, are drawing on surplus and are paying their bills more promptly now than they did in 1929. Then they took 30 days, for it was simply their business custom. Now they pay in 10 days and discount accordingly, for the 2 per cent. off for the 20 remaining days equals 37.5 per cent. a year, a little better than what any surplus draws wherever deposited or invested.

Less Policing

GOVERNMENT economies, like personal economies, do not shoot off into space but strike home. The Radio Division of the Department of Commerce is no more. Now the Division is under the Federal Radio Commission under the title, Division of Field Operations. Mere transfer of jurisdiction does not work any particular change, but the personnel is being reduced, and the vigilance of the air necessarily will be reduced also. The appropriations act passed by the Congress, approved last month, requires the transfer and invites the reduction in personnel.

Listeners no doubt will accept this condition with good grace, although knowing that the policing of the air can not be done as effectively with fewer persons at that concentrated work. Due to the work of the Radio Division the interference suffered by listeners has been reduced, until now it is at the lowest point in the history of radio, since any considerable number of stations was on the air. If listeners will make interference complaints, in justified circumstances, to the Commission this no doubt will aid in concentrating on the remaining weak spots, all of which might not be checked up regularly enough for under the limited activities.

Mackay Co. Gets Concession in China

The Chinese Government and subsidiaries of the International Telephone and Telegraph Corporation have concluded a series of agreements which will give the American corporation an important additional share of the telephone and telegraph business both within China and between China and other countries. The Mackay Co. signed the contract.

STATION SPARKS

By Alice Remsen

The Panacea

FOR VAUGHN DE LEATH

WABC, Mondays, 6:15 p.m.; Wednesdays, 6:00 p.m.; Saturdays, 8:15 p.m.

Sing me a song of the sunny south,
Under a sky of blue;
Or the romance of a lover bold,
Vowing that he'll be true.

Warble to me of a honey bee
Flying around the comb;
Sing me a song of a wayward boy,
Longing to see his home.

Maybe you know an Irish tune,
One with a rollicking swing;
Maybe you know a beautiful one,
Hymning the glories of spring.

When my heart's heavy and filled with care,
When the road seems all too long,
I ease off my burden, stop by the way,
And wait for your beautiful song.
—A. R.

* * *

AND AFTER A DAY FILLED WITH WORRY AND CARE there is nothing nicer than to tune in on Vaughn de Leath and listen to her delightful singing. She will make you forget your troubles. Her voice is a universal panacea for worry. Soothing and melodious. Listen to her; you'll like her!

* * *

News of the Studios

WABC

Cliff Edwards, known to movie and theatre audiences as "Ukulele Ike," has been signed up on an exclusive Columbia contract, and is heard over the Columbia network every Tuesday and Thursday at 7:00 p.m. EDST. He is accompanied by Nat Brusiloff's Orchestra, shorn of its brass section to blend with Edwards' style.

* * *

Another vaudeville headliner to go radio for keeps is Jay C. Flippen, the young bushy-haired comedian. Flippen also has been signed to an exclusive contract by Columbia and will serve as master of ceremonies on a new half-hour presentation entitled "Jay C. Flippencies," to be broadcast over the Columbia-WABC network every Tuesday at 9:00 p.m., EDST, beginning August 2nd. Freddie Rich's orchestra and a group of vocalists will appear on the same program.

* * *

A change in the continuity style of the Chesterfield "Music That Satisfies" program now results in three different types of presentations, each more in keeping with the styles of Ruth Etting, The Boswell Sisters, and Alex Gray. Norman Brokenshire continues as editor of all scripts and now adds to his duties by writing some of the continuity. For quite a while different writers have been used in order to evolve more informal programs and livelier continuity.

The present set-up provides for continuity of the "situation" type for Ruth Etting; wisecracks and frivolity for the Boswell Sisters, and a lyric atmosphere, featured by Brokenshire's poetry against a musical background, for Alex Gray.

* * *

NBC

Phillips H. Lord has done it again! Radio listeners have taken this human, kindly "Country Doctor" into their hearts, just as they took "Seth Parker," and in response to their insistent demand, the Country Doctor series, only recently inaugurated over an NBC-WJZ network, will now be broadcast five times a week instead of three. The Country Doctor, written, produced and played by Phillips H. Lord, under the sponsorship of the Lambert Pharmacal Company, may be heard each day, except Saturday and Sunday, at 10:00 p.m. EDST.

* * *

Rudy Vallee is studying law. Although he does not yet expect to abandon music for a legal career he admits he is tutoring with Dean Gleason L. Archer, of the Suffolk Law School, Boston. The Dean says that Rudy is an ardent student.

* * *

Rosario Bourdon, conductor of the Cities Service Orchestra, was honored in his native Canada recently when H. M. Canadian Grenadier Guards Band played Bourdon's composition, "Cities Service March," at a program in Montreal, Canada, devoted to the works of French-Canadian composers.

* * *

Roaming the Rialto

Mighty hot walking down Broadway. . . . Oh, boy, look at Billy Hillpot; he gets paid plenty for his radio warbling, but lookit, there he is nibbling a hot dog and drinking a nice cool orangeade at Nedick's stand, 47th and Broadway. . . Well, I never! How do you do, girls! Little Dana Suesse, composer of "Silent Love," walking along and talking very earnestly to Muriel Pollock, radio pianist and composer of note. . . As I live and breathe, if that isn't Bissell Brooke, radio editor of the Baltimore "Sunday Sun," dodging a taxi-cab; she's just back from Bermuda and is joining her mother at Atlantic City before returning to her Baltimore desk. . . Hello, Jack Foster! So you're on your way to Europe via the *Paris* on Friday for a month's vacation. Lucky devil! Don't buy out that haberdasher! . . Who's that pretty dark-haired girl, trailing the diminutive white dog? Oh, that's Maria Cardinale, prima-donna of "Footlight Echoes." . . Up and down the Rialto all day long. In and out of music publishers, talking to radio band leaders, musicians, tenors, baritones, sopranos, contraltos and crooners, looking for songs, orchestrations, new tunes, and new rhythms. What a business for a hot day!

* * *

Sidelights

JIMMY MELTON is an amateur yachtsman. . . JACK ARTHUR has bought a new speed boat. . . PAT KELLY, NBC announcer, was once a sailor. . . TED JEWETT was a silk merchant. . . HOWARD PETRIE was a bank teller. . . KELVIN KEECH was a civil engineer. . . HOWARD CLANEY was a sculptor. . . GEORGE HICKS studied for the consular service. . . NEIL ENSLEN taught piano and voice culture. . . JAMES WALLINGTON was a traveling salesman. . . Several NBC stars were born in Indiana; f'rinstance: AL CAMERON, of the AL AND PETE Duo was born in Anderson. . . PHIL DEWEY, baritone of the Revelers, first saw the light of day in Macy. . . HARVEY HAYES, NBC character actor, was born in Greencastle. EDDIE EAST AND RALPH DUMKE, the Sisters of Skillet, were both born in the Hoosier state. . . GRACIE ALLEN says that her brother swam out to a raft once but couldn't swim back—he didn't know the backstroke. . . DAVID ROSS recently celebrated his thirty-seventh birthday. . . GEORGIE PRICE, when twelve years old, tore his trousers on a nail while winning the finals of the boy's billiard championship. . . MORTON DOWNEY once sang Irish songs in a cowboy costume to a Bronx theatre audience and was promptly fired by the manager. . . NORMAN BROKENSHIRE once discussed the relative merits of blondes and brunettes with a radio engineer on a remote job, and later learned that the switch was open and the conversation broadcast. . . THE BOSWELL SISTERS were honored by a visitor from Holland the other day at one of their rehearsals; the distinguished Dutch conductor Willem von Hoogstraten, listened to the girls and pronounced himself astonished and delighted with their original harmonies. . . PHIL NAPOLEON has a very artistic rock garden on his palatial estate at Rockville Center, Long Island. CLAUDE MacARTHUR brings flowers from his Westchester garden to his fellow workers at NBC every morning. . . When a mere youth, WILLIAM DALY, NBC conductor, was congratulated by Paderewski upon his skill as a choral conductor. . . ANDY SANELLA was a gob in the U. S. Navy during the World War.

* * *

BiographicalBrevities

Some Facts About Frank Parker

Frank Parker possesses the highest male voice on the air. Was born and reared on the East Side of New York. Is of Italian parentage. Always loved music. Used to sit on church steps and listen to the organ instead of playing like other children. Was very religious as a child. Sang in the choir of the Holy Name Church for four years.

Has had wide stage experience. Started as a chorus boy, worked his way up to leads. Appeared with Hope Hampton in "No, No Nanette." Played the juvenile lead in the "Greenwich Village Follies." Sang in many operettas. Played juvenile leads in several vaudeville acts. Appeared on all the major vaudeville circuits doing his own single act. Is very fond of horses. Owns three. Is an expert polo player. Also likes to drive a car; nevertheless rides horseback each morning, or whenever possible, in Central Park. Likes aviation and can pilot a plane.

Is twenty-six years old. Is tall and slender. Dark hair and eyes. Romantically handsome. Unmarried. Very quiet and unassuming. Does not crave publicity at all. Is one of the most popular tenors on the air. Fan mail galore. There are Frank Parker fan clubs all over the hemisphere, but Frank doesn't talk about it. Too modest for his own good. Altogether a very likeable chap, without the usual inflated opinion of his own importance so common among many of the quickly made stars of radio and screen.

* * *

ANSWERS TO CORRESPONDENTS

J. F., Cedar Grove, N. J.: Write direct to sponsors of programs for request numbers. Sorry; I seldom repeat. Perhaps later in the season.

* * *

EMILY BROWN, Baldwin, L. I.: Welcome Lewis will be back on the air in the Fall, I'm sure, with a sponsored program. She does not do sustaining programs, not being signed up with a station.

* * *

(If you would like to know something of your favorite radio artist, drop a line to the conductor of this page. Address her: Miss Alice Remsen, Care Radio World, 145 W. 45th St., New York, N. Y.)

RECEPTION DEEMED IMPROVED

Washington.

Reception is better, due to the 50-cycle rule, the Federal Radio Commission reported after the rule had been in effect a month. Less interference was noted. Some stations haven't yet complied, as they haven't received monitors.

TAX IS CHARGED BY MISTAKE ON BUYER BILLING

The parts manufacturing branch of the radio industry is making quite a mess of the radio tax. It seems to be assumed that everything that has anything to do with radio is taxable. The law that the President signed is one of limited scope. Parts as such are not taxable. Indeed, radio sets as such are not taxable.

Bills that customers are receiving from many parts manufacturers carry the notation "5 per cent. tax," and the amount is added to the bill. It is hoped that the tax is actually paid by the manufacturer in every instance of the billing of the tax, even though it is his mistake that he pays the tax. Billing without paying constitutes violation of the restriction against passing on more than the legal tax paid. The penalty for violation is a fine of $1,000.

Provision of Act

Section 607 of the Revenue Act of 1932 covers the radio situation, and reads as follows:

"Sec. 607. Tax on Radio Receiving Sets, etc.

"There is hereby imposed upon the following articles, sold by the manufacturer, producer, or importer, a tax equivalent to 5 per centum of the price for which so sold: Chassis, cabinets, tubes, reproducing units, power packs, and phonograph mechanisms, suitable for use in connection with or as a part of radio receiving sets or combination radio and phonograph sets (including in each case parts or accessories therefor sold on or in connection therewith or with the sale thereof) and records for phonographs. A sale of any two or more of the above articles shall, for the purpose of this section, be considered a sale of each separately."

Exposition Necessary

Application of this provision is not such a simple matter that any business can read the section and decide whether he has to pay a tax on his product. Tax law is a science unto itself, and the interpretation of the law as applying to the multifarious detailed practices of the radio trade is settled, as to most of the important points, by the Bureau of Internal Revenue, United States Treasury Department. The local Collector of Internal Revenue will furnish printed information, or, in cases where this does not seem to give the solution, might entertain a personal visit. An attorney is best equipped to find out the answers from all sources.

But the practice of slapping the tax on a bill willy-nilly has got to stop, whether the manufacturer is paying something he needn't, or whether he is passing on to the customer something he not only needn't but didn't pay and therefore lays himself open to presecution by the relentless Federal Attorney.—*Herman Bernard.*

TYSON NAMED MANAGER

Leo B. Tyson, advertising director of KHJ in Los Angeles, has been selected to succeed Lewis Allen Weiss as manager of the Don Lee Broadcasting System.

Board Acquires Radio Division

Washington.

The appropriations bill calling for the transfer of the duties of the Radio Division of the Department of Commerce to the Federal Radio Commission was signed by President Hoover, who issued an executive order abolishing the Division and transferring the functions. Thereafter the title Division of Field Operations was selected for the branch of the Commissions work thus acquired.

Besides, the executive order called for economies, so that no employees will be retained unless indispensible to the performance of the work of the Division, and duties are to be reassigned to effectuate further economies, and unexpended balances returned to the Treasury. There were 190 employes in the Division.

W. D. Terrell, who was head of the Radio Division, is head of the Division of Field Operations.

ULTRA WAVES AID INDUSTRY

Washington

Utilization of the ultra frequencies is not confined to television and amateur use but is spreading to the building industry and elsewhere, marking the advent of ultra frequencies as commercially useful. For instance, telephonic communication between the superintendent of building construction with a section foreman on road construction, or with a steel worker aloft on the girders of a building being erected, or even between officials in a large office building, is in actual practice.

This use of the ultra frequencies is growing because of the limitation of the transmission to a range of within a few miles of the point of origin, a distance that with power limitation can be cut down considerably more. Thus many different transmitters can use the same frequencies without interference. Mobile and fixed transmitting and receiving stations are equally practical and therefore the method meets the exigencies of building construction work, as well as being suitable for fixed services. The apparatus is light and portable, offers no special difficulties and is inexpensive as to cost and upkeep.

Tube List Prices

Type	*Price List*	*Type*	*Price List*
11	$3.00	'38	2.80
12	3.00	'39	2.80
112-A	1.55	'40	3.00
'20	3.00	'45	1.15
'71-A	.95	46	1.55
UV-'99	2.75	47	1.60
UX-'99	2.55	'50	6.20
'100-A	4.00	55	1.60
'01-A	.80	56	1.30
'10	7.27	57	1.55
'22	3.15	58	1.55
'24-A	1.65	'80	1.05
'26	.85	'81	5.20
'27	1.05	82	1.30
'30	1.65	'74	4.90
'31	1.65	'76	6.70
'32	2.35	'41	10.40
'33	2.80	'68	7.50
'34	2.80	'64	2.10
'35	1.65	'52	28.00
'36	2.80	'65	15.00
'37	1.80	'66	10.50

VETERANS GET JOBS THROUGH MIKE AUCTION

Obtaining employment for war veterans by auctioning off their services over radio broadcasting stations is being urged by the United States Veterans Administration on a nationwide scale, following success of the scheme in several sections of the country.

As a result of broadcasting three such auctions in May from WRC, in Washington, 264 veterans were given employment in the District of Columbia. Veteran Administrator Frank T. Hines has addressed a communication to the managers of various veterans units throughout the country, explaining the idea and urging that it be tried locally. He credits the suggestion to Federal Radio Commissioner Harold A. Lafount.

In conducting these auctions the announcer recites the qualifications of each man seekin ga job and tells of his present circumstances. He invites listeners to telephone an offer of a job to the station while the program is in progress. The names of persons offering employment are announced. In most cases the telephones are kept busy offering the men permanent and odd jobs.

Prank Cost Four Their Audience

After 1,246 consecutive broadcasts of a series which started in 1928, the Landt Trio and White are to play the RKO Circuit for ten weeks with a vaudeville act.

Dan, Karl and Jack Landt and Howard White, heard every morning except Sunday over National Broadcasting Company networks in a program dedicated to commuters and titled "On the 8:15," have climbed out of their beds every one of those 1,246 mornings at 5:30 to rehearse their program and go on the air.

Commuters in hundreds of suburbs time their departure for the station by this broadcast. This was conclusively proven on April Fools' Day when the Landt Trio and White decided to play a little joke on their audience. The signature of their program is the sound of a train pulling out of the station. On this occasion they started the program with this sound effect at 8:00 a. m., instead of signing off with it at 8:15.

As a result hundreds of commuters were confused, scalded their throats with hot coffee, and rushed from their homes only to arrive at their offices fifteen minutes early. They protested by telephone, telegram and letter, and too late the broadcasters realized that their little prank had merely chased away their audience.

27 Oppose 1020 kc. to KYW, Philadelphia

Washington.

A furor has resulted in the squabble for the 1020 kc cleared channel given originally by the Federal Radio Commission to the Second Zone, but "loaned" to the Fourth Zone. KYW-KFKX, Chicago, owned by Westinghouse, uses it.

This station wants to move to Philadelphia and have that channel, which would then be in the Second Zone. Opposing this proposal are 27 stations, with more said to be ready to voice opposition.

CLASHES RULE FOOTBALL AND FIGHTS OFF AIR

A jam has resulted over the broadcasting of prize fights. Most of the important fights are held in New York, and the New York State Boxing Commission has ruled that it will not permit any more broadcasting of the events unless a qualified sports authority does the mike work. The stations are opposed to being told whom to assign to sports events. Moreover, fight promoters, never publicly anxious about the broadcasting, even though the right to sponsor it could be sold to an advertiser for tens of thousands of dollars, are renewing their grievance that it hurts the gate too much, particularly for the lower-priced seats.

The Sharkey-Schmeling fight held recently drew virtually a capacity arena, even though the fact it was to be broadcast was well advertised. However, some subsequent and previous fights did not do so well, particularly the Kid Chocolate-Kid Berg scrap, wherein there was much arena emptiness in Long Island City where the Madison Square Garden Bowl is located.

Close Fights

The leading Eastern colleges that have football teams constituting box office attractions have decided against broadcasting, same reason of reduced gate receipts, whereas some other colleges are in favor of it, including Notre Dame. It so happens Notre Dame is one of the best gate-drawing teams in the country.

The fight trouble is quite different from the football situation, as there is scarcely any doubt as to who wins a football game. as even a sports announcer who gets the men mixed up on the different teams can read a scoreboard. But when a fight is close there is always an argument as to which one got the better of the scrap, and the official decision might run counter to the popular verdict, as it did in the recent Sharkey-Schmeling fight, when Sharkey got the decision 2-to-1 though the sports writers for the most part thought the German had bettered his opponent, and the crowd seemed to agree.

What Listeners Felt

Listeners who heard Charles Francis Coe and Graham McNamee announce the blows thought from that description that the German was ahead.

However a view of the fight movies (eight rounds of the fifteen rounds as exhibited in local theatres) revealed a closeness that enabled one to decide either way, particularly as there is no practical science attached to deciding who wins a round on points. Estimating plays an important part, and estimates are not science.

Refund Is Declared for Show Exhibitors

A refund of 10 per cent. has been voted by Radio Manufacturers Association, Inc., to exhibitors at the sixth annual radio trade show held at Chicago last May.

This action was voluntary and unexpected. Financial results, made possible by operating economies, made the refund possible, the association stated. Credit was given to Bond Geddes, who managed the show.

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.

Wittmer's Radio Service, 196 Curlton St., Buffalo, N. Y.
Samuel Berenblum, 511 Greenwich Ave., Greenwich, Conn.
Chas. J. Oliver, 1112 N. Miami Ave., Miami, Fla.
G. Flynn, 3465 Avenue A, Council Bluffs, Iowa.
Harry Kreinest, 404 West 13th St., Covington, Ky.
Paul C. Meyer, 227 N. Center St., Grove City, Penna.
Ralph L. Evans, 512 W. Slouths St., Angola, Ind.
Jose J. Lopez, Cine Arco, Bacolod Occ. Neg., P. I.
J. L. Justice, 15 E. 10th Ave., Lexington, N. C.
Paul Sheets, 422 W. 2nd St., Xenia, Ohio.
W. H. Brown, Box 121, Durham, N. C.
F. L. Watkins, 4301 Sheriff Rd., S. E., Washington, D. C.
Henry Einkaud, 568 Jackson Ave., Bronx, New York City.
Dr. J. P. Craber, c/o Dr. Robinson, 322 West 72nd St., New York, N. Y.

GEN. SALTZMAN QUITS BOARD

Washington.

Maj.-Gen. Charles McK. Saltzman, chairman of the Federal Radio Commission, has sent in his resignation to President Hoover, stating "ill health" was the reason for quitting, and the President "regretfully" accepted the resignation. It had not been generally known here that the Chairman was in ill health.

The exact date the resignation is to take effect was not disclosed, but it was stated that no one had been selected as yet to succeed Saltzman as a Commission member. The vacancy could not be that of Chairman, as the Commission selects its own chairman from among its members.

A few months ago Ira Robinson, who had been chairman, but who was then a Commissioner, with Saltzman as chairman at the time, resigned to resume the private practice of law. Since then Robinson has appeared on behalf of several stations as their counsel before the Commission.

McNAMEE'S SLOGAN

Graham McNamee, NBC announcer, when a program has ended, calls out "Party's over."

NEW INCORPORATIONS

Fisher Industrial Co., Brooklyn, N. Y., electrical goods, radios—Attys., Attorney's Albany Service Co., 315 Broadway, New York City.
Rite-Wa Manufacturing Co., Pittsburgh, Penna., electrical devices—Attys., Capital Trust Co. of Delaware, Dover, Del.
Norge Woodside Corp., Queens, L. I., N. Y., refrigerators—Attys., Michaelson & Bernknopf, Jamaica, L. I., N. Y.
Dri Frost Equipment Corp., Middletown, Del., refrigerators—Atty., B. T. Biggs, Agent, Middletown, Del.
Wmco Hardware and Electric Co., New York City—Attys., Kossove and Leibowitz, 33 West 42nd St., New York City.

BANKRUPTCY PROCEEDINGS

Petitions Filed—Against

Charles V. and Eugene Coullard, individually and as copartners doing business as S. & S. Electric Co., selling electrical supplies, 27 Greenwich St., Hempstead, L. I., by Lightolier Co. for $100; Hirschfeld Electrical Supply Co., $500; and Metropolitan-Columbia Mfg. Co., Inc., $160.—Judge Galston has appointed George Serenbetz, Hempstead, L. I., receiver in bond of $1,000.

Schedules Filed

Austin Electric Supply Co., 103 Martine Ave., White Plains, N. Y.—Liabilities $35,253; assets $10,663, consisting of accounts.

CORPORATE CHANGES

Surrender of Authority

Alaska Refrigerator Corp., Maryland.

DISSOLUTIONS

United Electric Service Co., New York City.
Arlington Refrigerator Co., New York City.

JOBBING TRADE IN SETS LARGE; COSTS UNEVEN

Washington.

The Department of Commerce issued a report stating that it was rather surprised to find the large percentage of radio set distribution made through wholesale distributors, as the comparatively large unit cost of radio sets might be supposed to class it among those products that lend themselves better to direct selling methods.

The report stated as a fact, but without any expression of surprise, the large differences in the cost of doing business among these wholesalers. This is described as a difference in operatnig efficiency.

Nine wholesalers, average annual business $95,677, had operating expenses of 55 per cent. of the net sales.

Fourteen other wholesalers, in the same line, average sales $242,470, reported percentages of expenses varying from 2.5 to 4.99 per cent. Of the others—some 600—the expenses were between these extremes. About 90 per cent. had costs between 5 and 32.5 per cent.

Numerous factors are said to have been responsible for the difference, including individual peculiarities and sectional conditions and differences.

Station Changes

Changes in the "List of Broadcasting Stations by Frequencies," published in our issue of June 4th, 1932:

560 kc—WFI. Change owner to WFI Broadcasting Co.
660 kc—Delete WTIC.
680 kc—KPO—Change owner to Nat'l B'dg. Co., Inc.
760 kc—Delete WBAL.
830 kc—WHDH. Change location to Saugus, Mass.
890 kc—Delete KSEI (See 900 kc below).
900 kc—Insert KSEI, Radio Service Corp., Pocatello, Idaho—250 w.
1050 kc—KFBI. Change location to Abilene, Kans.
1120 kc—KRSC. Change power to 100 w, daytime.
1140 kc—WAPI. Change owner to WAPI Broadcasting Corp.
1200 kc—WBHS. Change power to 100 W.
1260 kc—KWWG. Change owner to Frank P. Jackson.
1260 kc—WLBW. Change owner to Broadcasters of Pennsylvania, Inc.
1270 kc—KGCA. Change power to 100 W.
1200 kc—WMBX. Change owner to WMBX B'dg. Corp.
1370 kc—WQDM. Change owner to A. J. St. Antoine and E. J. Regan.
1440 kc—WBIG. Change power to 1 KW—daytime.
1460 kc—WJSV. Change owner to Old Dominion Broadcasting Co.
1500 kc—WWSW. Increase power to 250 W (daytime).
1500 kc—KPJM. Change owner to Scott and Sturm.

Change in "Time Table of Television Transmitters," published in our issue of May 28th, 1932.
2000-2100 kc—Add W9XX, 100 W. State University of Iowa, Iowa City, Ia.

BAKELITE DECISION UPHELD

A decision excluding foreign Bakelite products has been upheld on appeal. The Circuit Court of Appeals, New York Federal District, handed down the decision. It affirmed the right of the Tariff Commission to advise the President regarding infringing products imported to this country.

ED WYNN'S JEST

The latest opera described by Ed Wynn during an NBC program was a "gangster" opera. Wynn said it was about a boy "whose parents were in the iron and steel business. His mother irons and his father steals."

RADIO INTEREST GROWING, SAYS R. G. DUN CO.

The research department of R. G. Dun & Co. has prepared a special survey of the radio industry in which there is a decidedly encouraging tone, as the report sets forth that the dollar decline in sales has not been due to diminished interest in radio but to falling prices, since the radio interest is found to be increasing.

Indeed, even those very hard pressed do not forego listening in but simply curtail the amount of time devoted to playing the set, says the report. This economy doesn't run very high in a-c operated sets (though that isn't in the report), for the cost of electricity is less than 1c per hour, and tube deterioration, at present tube prices, is less than that by about 90 per cent.

Low-Priced Sets Lead

The research department finds that lowest-priced sets sell the best, but that there is a trend toward better-grade units, and some manufacturers are giving up midget models, to concentrate on consolettes.

Collections are said to be fairly good, but retailers complain that installment accounts are "draggy." The insolvency records continued to increase numerically, but the amount of liabilities dropped sharply during the last six months, says the report.

Besides the purely trade angles there are discussions of broadcasting, advertising on the air, short-wave receiver improvements, use of radio by municipal police, with tables of number of broadcasting stations per state, wattage used compared with capital invested, retail outlets classified (types of stores selling radios), with a chart of the number of homes equipped with radio sets.

Much of the data were obtained from trade magazines, and credit is given to them, while some was obtained from broadcasting chains, the Federal Radio Commission, the Department of Commerce and Radio Manufacturers' Association, Inc.

Tumbling Prices

Virtually all of these data had been published in RADIO WORLD from time to time, but the comment of R. G. Dun on the trade situation was a new and interesting point, coming at a time when encouragement from an unbiased outside source of reliable reputation was most welcome. This comment was as follows:

"That retail sales of radio products have fallen from the record peak in the last two years is not an indication of waning popularity for the instrument, but rather a sign of intense preparation for a period of great achievement. In fact, the drop in sales in 1931 to $309,270,000, which was a 38 per cent decline from the total of $500,951,500 recorded in 1930, and a decrease of 63 per cent from the $842,548,000 in 1929, which was the record year for the industry, is regarded as the natural sequence of the tumbling prices caused by the hectic activity during 1928 and 1929, when volume and volume alone was the aim of the industry. The recession surely cannot be attributed to any abatement of interest, as the desire to enjoy the benefits of the radio takes little heed of unfavorable economic developments or of those adverse influences which congest distributive channels."

SHORT-WAVE CLUB

John Lawrence Stuot, R.F.D. No. 1, Box 51, Gotham, Wisc.
Will H. Gilette, 1110 West Bay St., Palmetto, Fla.
Robert P. De Hond, Box 180, Williamson, N. Y.
James Cunningham, Hemlock St., Arlington, Fla.

Tradiograms

By J. Murray Barron

CONFIDENCE IN RADIO

There is now in the radio trade a feeling of pick-up. Not so much that there has been any great increase in sales, but a healthy condition is prevailing. A more general air of confidence in the business for early fall is present. This does not apply to any one particular section but is taking place in numerous sections of the country.

Jobbers are seeking higher grade radio merchandise, while manufacturers are going ahead with production, and sales managers are expanding sales plans and seeking new and more aggressive distributors.

Likewise retailers are not behind in their plans for the coming season. Everywhere one sees retailers moving to larger quarters, or choicer locations, or window alterations being made and departments rearranged, all to take care of the expected increase early this fall.

During the past few weeks numerous installations of large and elaborate neon signs have take place in the radio district in New York City, and also in other large cities. There has been an increased interest in the new tubes and from general inquiries indications point to considerable construction among experimenters and much planned work for the serviceman in revamping old sets for the new tubes.

With a healthy mental condition like the above and this faith backed with concrete plans and actual preparation for the fall business, one cannot help but feel that 1932 will be a much better season than 1931.

Do not be mistaken in assuming that the organizations are simply going ahead spending money on speculations. They are familiar with conditions in their sections and know of the increased plans of other lines and of the changes taking place in manufacturing and of the increase in help in quite a few sections, also the additional productions and additional labor put to work, all very encouraging.

* * *

National Carbon Company, Inc., announces the following new jobbers to handle Everyready Raytheon 4-pillar tubes: E. A. Bowman, Inc., Detroit, Mich.; Sacks Electric Supply Co., Akron, Ohio; E. R. Poter Hardware Co., Dothan, Ala.; Falls City Auto Supply Co., Falls City, Neb.; Huey & Phil Hardware Co., Dallas, Tex.; Midwestern District, Inc., Denver, Col.; Thos. Goggan & Bros., Houston, Tex.; Burns Radio Co., Dayton, O.; Wedemeyer Radio Co., Ann Arbor, Mich.; J. H. Simon, Washington, D. C.; Langdon & Hughes, Syracuse, N. Y.; Harley D. Carpenter, Meadville, Pa., and Chas. B. Scott, Scranton, Pa.

* * *

RCA Victor Company, Inc., Camden, N. J., announces the appointment of The Radio Distributing Corporation, 588 Broad Street, Newark, N. J., as Newark jobbers for the sale of RCA Victor Centralized Radio Systems, including the new Antenaplex Systems and the Audio Distribution System. The Radio Distributing Corporation and staff will be at the service of architects, consulting engineers, contractors and builders to advise on and recommend apparatus in this line.

* * *

Many automobile owners who had parked their cars in Cortlandt Street section were surprised to find an "Important Summons" held against the windshield by the wiper. Their temperature finally became normal when they realized it was Nussbaum's "summons" to have an auto radio installed in the car as a demonstrator, without charge.

* * *

Blan The Radio Man, now of 89 Cortlandt Street, N. Y. City, is shortly to move. Large signs at 177 Greenwich Street invites the public to watch for the grand opening. This store is considerably larger than present quarters. This block between Dey and Cortlandt Streets, is conveniently situated to the Hudson Terminal, the B.-M. T. and I. R. T. subways and the Ninth Avenue Elevated.

* * *

Furst Radio Corp., opened a new store at 66 Cortlandt Street, N. Y. City. While new on "the street," Mr. Furst is well known around the Brownsville section of Brooklyn.

* * *

Greenwich Street, N. Y. City, saw the opening of a new radio store this week at number 166. The York Radio Store made its bow to the public.

WESTINGHOUSE LOSING BUT ITS CASH IS STRONG

Westinghouse Electric & Manufacturing Company reports a loss of $1,881,979 for the three months ending June 30th, an increase of $561,831 in the loss account compared to the previous quarter. Thus the total loss for the six months ending June 30th was $3,202,127. The losses are ascribed as being due largely to failure to obtain any new business of consequence, and despite strict economies in indirect expense, saving now $3,400,000 a month, and expected to increase.

The company in a statement sets forth:

"Orders received in the quarter ended June 30th were $20,343,216 compared with $20,388,658 in the quarter ended March 31st—a total of $40,731,874 in the six months ended June 30th. Sales billed in the second quarter were $21,014,770 compared with $20,377,948 in the first quarter—a total of $41,392,718 in the six months ended June 30th.

"The balance sheet at June 30th showed the company was in a strong position as to cash and other current assets. On that date current assets were $94,024,736 and current liabilities were $5,780,668, indicating a net working capital of $88,244,068. The company has outstanding no bank loans, no notes and no bonds.

"The employes retail sales campaign of May and June has an important financial bearing on Westinghouse not only at this time but also in the future. During these two months the employes sold household electrical appliances having a retail value approximating $3,000,000. Employes interested prospects. Dealers completed the sales, delivered the goods and received payment. Prices were not cut. Buyers were given no discounts. Employes received no commissions but were rewarded with prizes of merchandise based on the value of goods sold.

"Sales were made by dealers out of their stocks on hand, so that this business was not reflected, to any great extent, in the earnings of Westinghouse for the six months ended June 30th; however, the dealers to replenish stocks, which are now at the lowest point since last fall, have begun to re-order from the factory to meet current demand."

SYNCHRONIZATION RENEWED

Washington.

Although WBAL, Baltimore, and WTIC, Hartford, Conn., were refused permission to continue their synchronization experiments with WEAF and WJZ, permission has been granted by the Federal Radio Commission to WOC, Davenport, Ia., and WHO, Des Moines, Ia., to continue simultaneous operation until February 1st, 1933.

RADIO EQUIPMENT-SERVICE LEADERS

THOR'S BARGAIN BASEMENT
167 Greenwich St. New York
THE GREATEST PARTS STORE IN NEW YORK
Pathfinder Superheterodyne Kit. $16.50. with Speaker. Mail orders filled.
Thousands of sq. feet of floor space devoted exclusively to Serviceman, Amateur & Experimenter

Official National Headquarters for
Brunswick RADIO CORP.
REPLACEMENT PARTS
Complete Stock of all Brunswick and Bremer-Tully Radio Parts and Phonograph Accessories Maintained at All Times. Write for Free Manual.
BRODCO RADIO CORPORATION
142-W. Liberty St. New York, N. Y.

AUTO AERIAL
NEW and STARTLING

Improves Reception.
Ready to Install.
Sample complete.
$1.00 BILL
Dealers write for Wholesale Prices
NETSON RADIO COMPANY
78 Cortlandt Street New York

Big Bargain Basement
We carry a complete line of Public Address, Short Wave and Transmitting parts in stock. Largest assortment of Dynamic and Magnetic Speakers in the country.
Everything in Radio
TRY-MO RADIO CO. N. Y. CITY
179 GREENWICH ST.

78 AIREX 78
EXPERT REPAIRING
SPECIALISTS IN "STICKERS"
78 Cortlandt St., N. Y. City

LATHES
Used and reclaimed South Bend Lathes. One 9", $127; 13", $276; 16", $338; just a few left. Guaranteed good as new. Terms, or discount for cash. South Bend Lathe Works, 312 E. Madison, South Bend, Indiana.

POLO
PRECISION PRODUCTS
T-R-F and Superheterodynes, short-wave converters and parts.
Send for Catalogue
Polo Engineering Laboratories
125 West 45th St. New York, N. Y.

Acratest Replacement Parts
Power Transformers, Filter and By-Pass Condensers, Volume Controls, Voltage Dividers and Fixed Resistors.
SEND FOR OUR FREE 100-PAGE CATALOG
Federated Purchaser Inc.
25 Park Pl. Dept. W. N. Y. City

Public Address Systems
and sound amplification applications should be part of your radio knowledge. Modern equipment at resident schools in N. Y. and Chicago, or home study with new "no obligation" plan. Write for illustrated book.
RCA INSTITUTES, Inc.
Dept. WR-8
75 Varick Street
N. Y. C.

Experimental Radio
(255 pages, 168 figures, 128 experiments.)
By R. R. Ramsey, Prof. of Physics, Ind. Univ. The experimenters manual: Measurements, Tests, Calibrations, with ordinary radio and physical apparatus. "Measure and Know"..$2.75
RAMSEY PUBLISHING CO.
BLOOMINGTON, IND.

Short-Wave RESULTS
Play safe by using Hammarlund Isolantite-insulated Condensers, Coil Forms and Sockets. *Write Dept. RW-2 for descriptive folder.*
HAMMARLUND MFG. CO.
424 W. 33rd St., New York

SPEAKER BUILDERS SINCE 1921
Offering you direct Speaker Service on Magnetic and Dynamic Speakers.
We manufacture CONE and VOICE COIL ASSEMBLIES for any Dynamic Speaker.
Special discount to dealers.
LEOTONE RADIO CO.
63 Dey St., N. Y. City

LOOK OVER NEW RADIO HORIZONS "Below 10 Meters"
New 68-page NATIONAL Manual of Ultra Short Wave Radio contains the history of Ultra Short Wave Development, articles about Ultra SW Quasi-Optical and Infra-Red Rays, Commercial Application of Short Waves in Communications Work, 5 Meter Amateur Band, Ultra Short Waves for Television. Over 120 illustrations. Send today for your copy of this valuable book. **50c**
NATIONAL COMPANY, INC.
61 Sherman Street, Malden, Mass.

***For* Service Men**
The ELECTRAD RESISTOR HAND BOOK is a guide to resistor values in all receivers. The most useful "tool" in the service kit. $1 a year, with 4 supplements. See it at your dealer's.
175 Varick St., New York, N.Y.
ELECTRAD
Money back if not satisfied.

PARTS HEADQUARTERS
5-, 6-, 7- or 8-Tube Polymet Power Transformers. Special $1.39
16 Mfd. Electrolytic Condenser... .49
Amertran Power Block—1500 Volt C.T., Double Choke 30 H. at 150 MA. Built in; 2-2½ V., 1-5 V.C.T... 3.95
We Specialize in Auto Receivers
NUSSBAUM'S
61 Cortlandt St., N. Y. City

SERVICE
is fast becoming the leading publication for radio-service men. If you want to keep abreast of service developments, you should be a subscriber for SERVICE.
Tear out this advertisement and attach a $1.00 bill for a year's subscription, twelve issues.
JOHN F. RIDER PUBLICATIONS
1440 Broadway, New York City

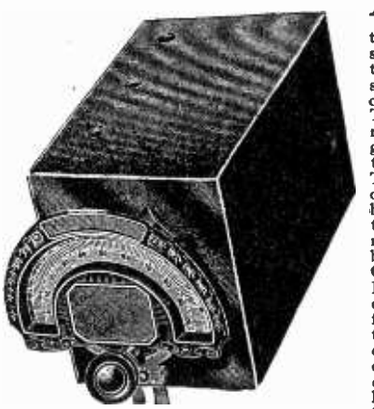
FULL LINE OF RECEIVING TUBES, INCLUDING LATEST ONES

EVEREADY-RAYTHEON 4-PILLAR TUBES
Consult the List for Tube You Want

TYPE	PRICE LIST	YOUR COST	TYPE	PRICE LIST	YOUR COST
11	$3.00	$1.95	'34	$2.80	$1.82
12	3.00	1.95	'35	1.65	1.08
112-A	1.55	1.01	'36	2.80	1.82
'20	3.00	1.95	'37	1.80	1.17
'71-A	.95	.62	'38	2.80	1.82
V—'99	2.75	1.79	'39	2.80	1.82
X—'99	2.55	1.65	'40	3.00	1.95
'100-A	4.00	2.60	'45	1.15	.75
'01-A	.80	.52	46	1.55	1.01
'10	7.27	4.73	47	1.60	1.04
'22	3.15	2.05	'50	6.20	4.03
'24-A	1.65	1.08	55	1.60	1.04
'26	.85	.56	56	1.30	.87
'27	1.05	.69	57	1.55	1.01
'30	1.65	1.08	58	1.55	1.01
'31	1.65	1.08	'80	1.05	.69
'32	2.35	1.53	'81	5.20	3.38
'33	2.80	1.82	82	1.30	.87

We will ship C.O.D. on receipt of 10%. When remitting in full enclose postage.
GUARANTY RADIO GOODS CO.
145 West 45th Street New York City

MATCHED TUNING UNITS
DIAL, SHIELDED CONDENSER, SHIELDED COILS

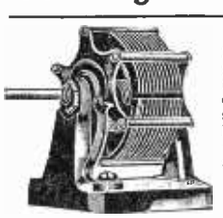


A 5-to-1 vernier dial (ghost type), with travelling light; a three-gang brass-plate shielded condenser, with trimmers built in; and a set of three shielded coils constitute the Matched Tuning Units for tuned radio frequency (two screen grid r-f and any type detector).
The coils are tapped once on each secondary, so that by switching it is possible to tune in from 80 to 200 meters, as well as the full broadcast band.
Order Cat. TU-RF @ $4.13
For double detection circuits two equal coils are furnished as above, while the third coil is for padding for broadcast band only. The padding condenser is supplied for 175 kc.
Order Cat. TU-O @..$4.83

Coils, 1" diam. tubing, 2" diam. shields. Four lugs at bottom, one at side. Code follows: P and B, primary; G and side lug, secondary. The tap for 80 meters, to which condenser stators may be switched, is the ground symbol lug at bottom. Markings stamped on shield base over which base the shield (not shown) fits tightly. For oscillation connect B to plate and P to B plus.

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

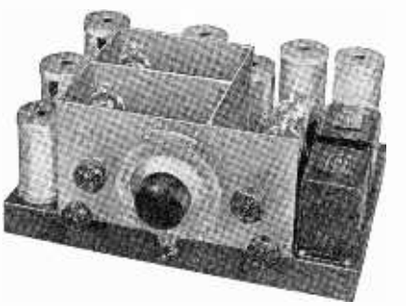
360-Degree Condenser



20 to 375 mmfd. capacity variation, effected over full 360 degrees, affords wide spreadout, better dial legibility. Great for test oscillators and all-wave tuning.
Price, $3.00 net.

DIRECT RADIO COMPANY
145 WEST 45TH STREET
NEW YORK, N. Y.

National
Ultra-Frequency Circuit



8-tube superheterodyne, 40-80 megacycles. AC-operated; total of eight plug-in coils (four pair); two-stage intermediate at 1550 kc. Tubes required, (3) 224, (2) 235, (1) 227, (2) 247. True vernier laboratory precision dial. Separate oscillator with switch enables c-w reception and aids all station-finding. Complete parts (Cat. HFR) with coils, less tubes and power supply.....$52.63
Power supply (Cat. 3258 AB, wired), less 280 tube. $23.13

Guaranty Radio Goods Co., 145 West 45th Street, New York, N. Y.

"FORD MODEL—'A' Car and 'AA' Truck," by Page. $2.50. Radio World, 145 W. 45th St., N. Y. C.

RADIO WORLD AND RADIO NEWS. Both for one year, $7.00. Radio World, 145 W. 45th St., N. Y. City.