DEC. 10
1932

DIODE DIAMOND

15c
Per Copy

RADIO WORLD

REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

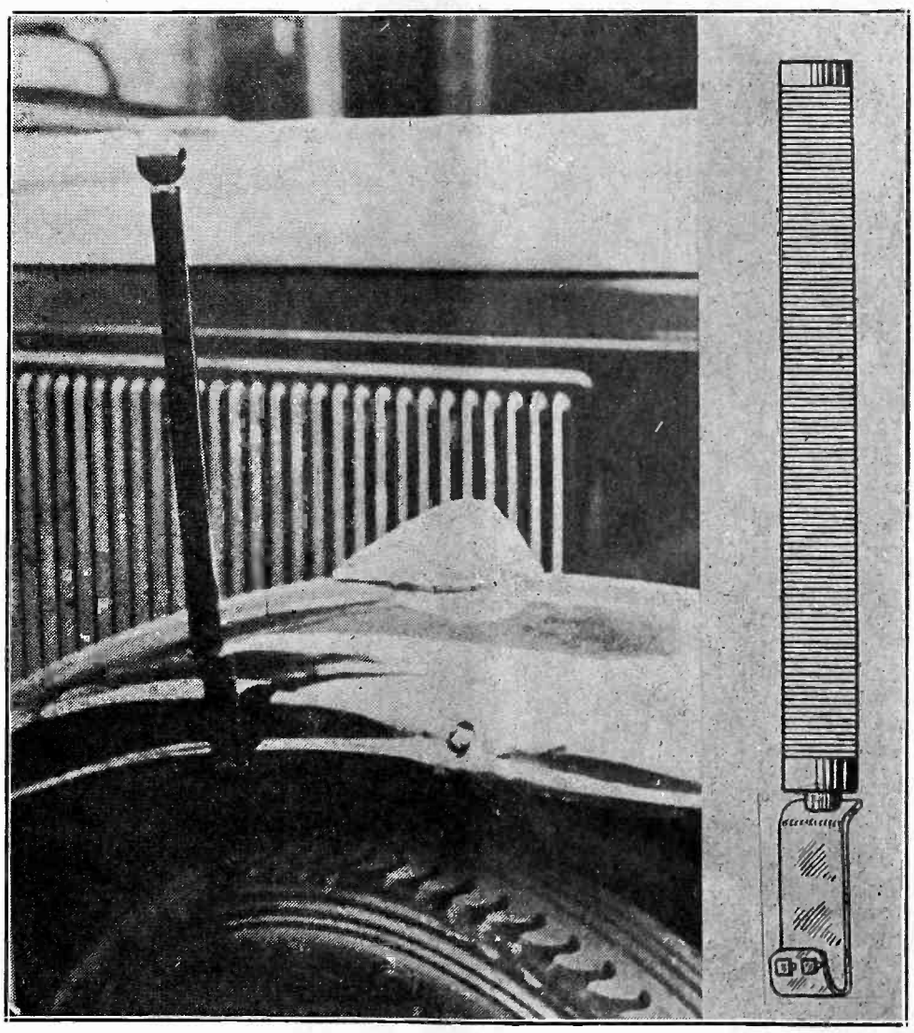
Eleventh Year *559th Consecutive Issue*

Boy's Model Ship Controlled by Short Waves

Uncanny Sensitivity in an Auto Set

Pathfinder "Super"

EASILY-MADE AUTO AERIAL



An auto aerial may be built in the form of a curb guide post and affixed to a front fender. The co[illegible] is 3/8 diameter dowel and on it are closely wound 150 turns of No. 30 s[illegible]gle silk covered wire. Over the form a non-insulating tubing is put with decorative ball at top. Connect bottom of coil to clamp and top to car set's antenna post.

CHRISTMAS GIFTS NUMBER

D. X. SPECIAL

Just Fix a Pix in the aerial terminal and increase the range and selectivity—permits knife-edge tuning—two million European users. Once "Pixed" you're fixed to bring in Distant concerts.

Test a Pix now. Money refunded if not satisfied. A technical achievement. Over THREE MILLION satisfied European users. $1.00 Postpaid. Send cash or Money Order. Send for FREE bargain bulletin.

POSTAL RADIO
135-137 Liberty St., New York, N. Y.

THE ELECTION IS OVER:

Are you ready for PROSPERITY? Have you made use of your spare time? Do you know the basic PRINCIPLES of Radio?

You Will Want

RAMSEY'S RADIO BOOKS

EXPERIMENTAL RADIO
(255 pages 168 figures, 128 experiments.)
By R. R. Ramsey, Prof. of Physics, Ind. Univ. The experimenter's manual: Measurements. Tests, Calibrations, with ordinary radio and physical apparatus. "Measure and know."

FUNDAMENTALS OF RADIO
(372 pages, 402 figures.)
Modern radio explained with a minimum of mathematics. "You find it in Ramsey's." Experimental, $2.75. Fundamentals, $3.50 postpaid.

RAMSEY PUBLISHING CO.
Bloomington Indiana

RIDER'S PERPETUAL TROUBLE SHOOTER'S MANUAL

Vol. 1 and Vol. 2

Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1, but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

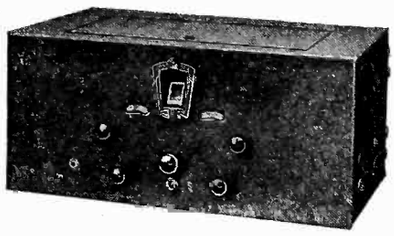
Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00

Volume No. 1 (6 lbs.). Order Cat. RM-VO @ $5.00

We pay postage in United States on receipt of purchase price with order. Canadian, Mexican and other foreign remittances must be in funds payable in New York.

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

'Round the World IN YOUR OLD ARM CHAIR



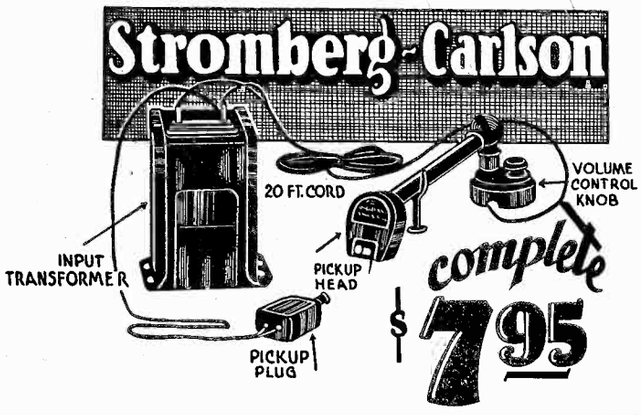
HERE'S the Christmas gift with which you and your family can tour the world of radio without leaving your fireside.

Experts say the Hammarlund Custom-Built COMET "PRO" is the most efficient Short-Wave Superheterodyne ever designed. Proof of which is found in the fact that it is used by the U. S. and Canadian Governments, leading air-transport and steamship companies, police, and key stations of broadcasting networks for their most exacting work. Amazingly sensitive, sharply selective—yet as easy to tune as an ordinary receiver. HAMMARLUND MFG. CO., 424 W. 33rd St., New York.

For Better Radio
Hammarlund
PRECISION
PRODUCTS

Write Dept. RW-12, for 16-page Folder Describing The COMET "PRO".

Magnetic Pickup Outfit



A phonograph pickup made by Stromberg-Carlson, equipped with volume control knob, with matched input transformer, a connecting cord and jack plug, for using the audio amplifier of your set, to play phonograph records. Outfit was listed @ $30.00.

OUR PRICES:

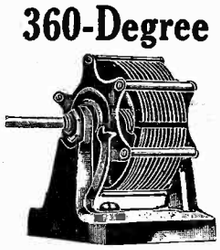
Cat. SC-3A, for grid circuit connection, **$7.95**

Cat. SC-3B, for plate circuit connection, **7.95**

Three different weights, for choice in using bead for recording, Cat. SC-W @ **1.00**

GUARANTY RADIO GOODS CO. 143 WEST 45th STREET NEW YORK, N. Y.

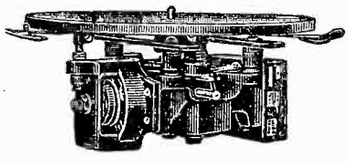
360-Degree Condenser



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, N. Y. CITY



TWO-SPEED MOTOR

33-1/3 and 78 revolutions per minute. Press a lever to change from one to the other.
Green Flyer Motor.....$10.95
Direct Radio Co., 143 W. 45th St., N. Y. City

THOR LEADS AGAIN

YOU CAN NOW HAVE THE

FAMOUS PATHFINDER

7-Tube Super-Het Kit (Complete with Dynamic Speaker) **$19.50**
Using 3-58, 1-56, 1-55, 1-280

and THE NEW 59 TUBE

SET NOW ON DEMONSTRATION

THOR'S BARGAIN BASEMENT

167 Greenwich Street, between Cortlandt and Liberty Sts., N. Y. City

MAIL ORDERS FILLED PROMPTLY DIAGRAM FREE. GET YOURS NOW

TO RADIO WORLD SUBSCRIBERS:

Congress recently enacted a law making it compulsory for postmasters to charge publishers two cents for every change of address filed with the post office.

This means an annual expense of a substantial sum of money to Radio World every year unless subscribers immediately notify our subscription Department of changes in address. Please let our Subscription Department hear from you just as soon as you know that there is to be a change in your address. Thank you!

Subscription Dept., RADIO WORLD, 145 W. 45th St., N. Y. C.

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. XXII | DECEMBER 10, 1932 | No. 13, Whole No. 559

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

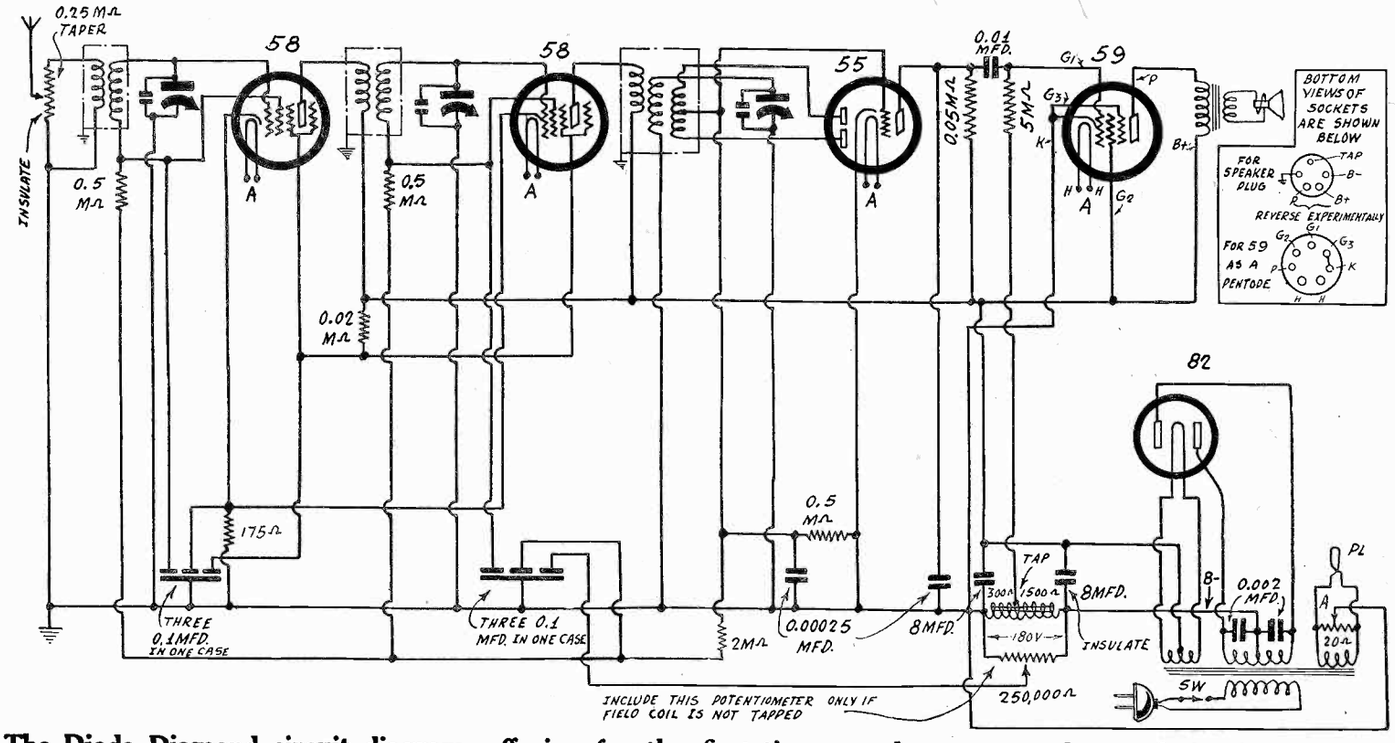
OFFICERS: Roland Burke Hennessy, *President and Treasurer;* M. B. Hennessy, *Vice-President;* Herman Bernard, *Secretary.*

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.

THE DIODE DIAMOND

By Herman Bernard



The Diode Diamond circuit diagram, offering for the first time anywhere an actual proved circuit with automatic fidelity control. Besides, there are automatic volume control, full-wave diode linear detection, direct-coupled audio in the 55, and the new 59 output pentode.

SO far as we know, only in these columns have tuned radio frequency circuits been shown with automatic volume control, and yet the system works out satisfactorily. However, for a. v. c. to be effective there must be quite a few stations that deliver large quantities of voltage to the detector, hence even a t-r-f set has to be built on lines of high sensitivity. The reason is that a. v. c. tends to level the volume to a predetermined value in respect to stations that otherwise would produce greater volume, whereas on stations that come in with less than this predetermined volume there is virtually no effect. Strong signals are reduced but weak ones are not, hence at low input voltages there is no control.

There has never been any trouble in making t-r-f sets sensitive enough. The trouble, if any, has been to make them selective enough. The present receiver therefore develops the amount of selectivity which may be expected to a t-r-f set of this type—assuming a. v. c. absent—and relies on the tubes, loads and voltages to produce the sensitivity. This they do in all-sufficient fashion.

Automatic Selectivity Control

With a. v. c. introduced it is practical, with the 58 r-f tubes, to add automatic selectivity control as well, by returning the suppressors to a negative voltage, varied by the signal. It can be seen, therefore that variable bias, as in a. v. c., affecting the control grid need only be made to affect the suppressor as well, which is accomplished by tying the suppressor to the end of the tuned secondary windings in two instances.

The r-f end, with a. v. c., is along standard lines, the return end of the secondary, however, not going directly to ground but the d-c return being through a resistor which is tied to the load resistor of the 55 detector. Both these resistors are bypassed. Two r-f stages are controlled, a separate filter (resistor and bypass condenser) for each.

But first we have to consider the detector input. We have a three-gang condenser. That means the rotor of the detector tuning section, since it is common with the rotors of the two other sections, is grounded. We find that the coupling transformer between second r-f and detector has to have a load resistor connected between its return and the cathode. That goes for the full-wave type of detection here used and for the single-sided diode detector. The cathode of the 55 is common to the diode and to the triode unit, for there are two tubes in the one envelope, or, three tubes, from another viewpoint, when two diode units would be used separately. Thus we have two limiting factors even in the present full-wave

LIST OF PARTS

Coils

Two r-f transformers for interstage coupler, for 0.00042 mfd.
One three-winding transformer; secondary for 0.00042 mfd., tertiary a 100-turn center-tapped choke.
One 60 ma. power transformer.

Condensers

One three-gang shielded 0.00042 mfd. in shield.
Two shielded blocks, three 0.1 mfd. in each block (black leads are common, go to ground).
Two 0.00025 mfd. fixed condensers.
One 0.01 mfd. mica fixed condenser.
Two 8 mfd. electrolytic condensers, one with two insulating washers and a special connecting lug.

Resistors

One 20-ohm center-tapped potentiometer.
One 175-ohm pigtail resistor.
One 0.05 meg. pigtail resistor.
Three 0.5 meg. pigtail resistors.
Two 0.25 meg. potentiometers (250,000 ohms); insulated type.
One 2-meg. pigtail resistor.
One 5-meg. pigtail resistor.

Other Requirements

One chassis, 13¾ inches wide x 2½ inches high x 7¾ inches front to back.
One vernier dial, traveling light type, with bracket and pilot lamp; dial reads, left to right, 0 to 100.
Three knobs (one for dial, one for volume control, one for a-c shaft switch).
One dynamic speaker, 1,800-ohm field coil, tapped at 300 ohms; output transformer built in, has matched impedance for 59 tube used as pentode X.
One shelf 7¼ x 2½ inches, with two brackets.
Three six-spring, one five-spring (UY), one 7-spring and one four-spring (UX) sockets. The UY is for speaker plug.
One a-c shaft type switch.
Two threaded bushings ⅝ inches long.
One a-c cable and plug.
Three special aluminum shields for the 58 and 55 tubes.
One rubber grommet for a-c cable exit.
Tubes required: two 58, one 55, one 59 and one 82.

detector. One is the commonness of the cathode and the other is the grounded rotor.

Usual Transformer Won't Do

Therefore we can not use the ordinary transformer, because the tuned circuit would have to be interrupted by a resistor, the load on the tube, hence we can't ground the secondary winding. We need a condenser across the load resistor, but this must not be so high as to cause serious attenuation of the higher audio frequencies. Therefore it must be relatively small, say, 0.00025 mfd. Hence if we tried to use an ordinary coil we would have the bypass condenser of 0.00025 mfd. in series with the tuning condenser, and completely upset the third tuned circuit. Results would be next to nil.

This fact alone has been the cause of much trouble on the part of experimenters who have tried the 55 on their own hook without giving full consideration to the effects they were producing.

Another troublesome factor has been the hookup of the automatic volume control so that the grids of the controlled tubes will be negative at no signal, as well as more negative when there is a signal. The increase in negative bias decreases the amplification and that is how a. v. c. works. Often a. v. c. hookups result in positive grids at no signal or on weak signals.

Here the problem has been solved by using a center-tapped radio frequency choke, inserted inside the form on which the tuned winding is placed. This choke is so constructed that it will fit tightly inside the customary form that has 1 inch outside diameter. It should be placed with outleads on top, these leads being brought over the top of the 1-inch form, and down the outside of the form, through the apertures in the coil form's base bracket to the required destinations.

Different Chokes Tried

The choke used at first had 800 turns, center-tapped, the natural period of which is below the lowest broadcast frequency, but this did not work out very well, for while the low radio frequency stations came in strongly, the effective resistance at the high frequency end was so great that there was a mere jumble of stations. Besides, when the circuit was permitted to squeal (by purposeful alteration of constants) the oscillation was intense at the low frequency end but absent below 800 kc.

Next a choke was tried having 200 turns, center-tapped, the natural period being at about the geometric mean of the broadcast band (that mean is 900 kc), and this improved matters very considerably. When the squeal test was made there was oscillation all over the dial, but more intense from middle frequencies down. So a 100-turn coil was used and this worked so much better that, even after smaller values were tried, it proved the most acceptable.

The solution of the negative bias preservation is very simple, if one uses direct coupling between diode and triode of the 55, making the amplifier tube a diode-biased triode. The cathode is grounded. The load resistor (0.5 meg.) is connected between center tap of choke and ground. When a signal is introduced there is a voltage developed across the load resistor, due to the flow of rectified current from cathode to the anode outside the tube. The cathode is grounded, the individual biasing resistors of the r-f tubes are grounded, and the ground lead (or equivalent chassis) represents the negative side of the receiver. Since the 55 load resistor is connected with its positive side (cathode) to ground, i.e., to negative side of the receiver, any difference in voltage due to the signal must be negative. So it is. That is how the negative bias is increased and amplification decreased in proportion to the signal strength, while a negative bias prevails even at no signal. Moreover, the proportion is substantially linear, for the diode with a high value load resistor is substantially linear in its detection. Linearity means in effect highest possible quality.

Capitalization of Excess

Actually the load resistance is somewhat less than 0.5 meg., for it can be seen there is a 2 meg. resistor on the other side of which is a relatively large bypass condenser (considering audio frequencies) therefore the 2 meg. resistor is substantially in parallel with the 0.5 meg., and the net effective resistance or load on the anode is about 0.4 meg. It would be exactly 0.4 meg. except for other resistors, including the plate resistance of the controlled tubes.

Now we have diode full-wave detection and we wonder whether this is not dangerous to sensitivity, since we know that if we divide a voltage input in half, as for full-wave rectification, compared to half-wave rectification, using the same total secondary winding, the voltage will be halved.

This would be serious, perhaps, in any system where we did not have to reduce the gain anyway to attain freedom from squealing. In a five-tube t-r-f set of the general type it is well known that biasing resistors for r-f tubes are higher than recommended for general practice, and the reason is that the set would squeal otherwise. In other words, the tube operation has to be reduced to the point where reception begins. This is far more than a reduction of 50 per cent., so we simply transfer the reduction to the detector, and as proof that the result is satisfactory, we can tune the receiver and get as much volume of sound from our local stations as we did on any other comparable set.

Assurances Given

Another consideration is the fact that a. v. c. is based on reduction of sensitivity as signal intensity increases. We do not waste anything when we make this reduction, either. We simply take the excess from the squealing region, in other words, instead of actually wasting the otherwise unnecessary excess, by using high values of biasing resistors, skinny primaries and detuned circuits, we actually put it to good use. I can assure you that the sensitivity of the receiver is as high as that of the general run of five-tube t-r-f sets that have no a. v. c., that the tone is something that will bring new realization of the enjoyment of your favorite programs on local stations, and that the stability is complete.

It was found that the bypass condensers across the diode load resistor had to be of not much less than the specified values to prevent r. f. from getting into the two-stage audio channel, when r-f oscillation is obtained. Actually a 20-100 mmfd. condenser was tried across the anode load resistor end varied. The oscillation was greatest at the minimum capacity. There was some left at maximum capacity.

Also, for the same reason a plate bypass condenser was found necessary in the triode section (plate to ground), for without it there was squealing again.

Therefore if for any reason one runs into less selectivity than what is to be expected from three tuned circuits, one may be a little too far below the oscillation point, and may bring up the sensitivity and the selectivity by selection of a smaller value of bypass condenser across the anode load resistor or across plate and cathode, or both. They are shown now as 0.00025 mfd. each.

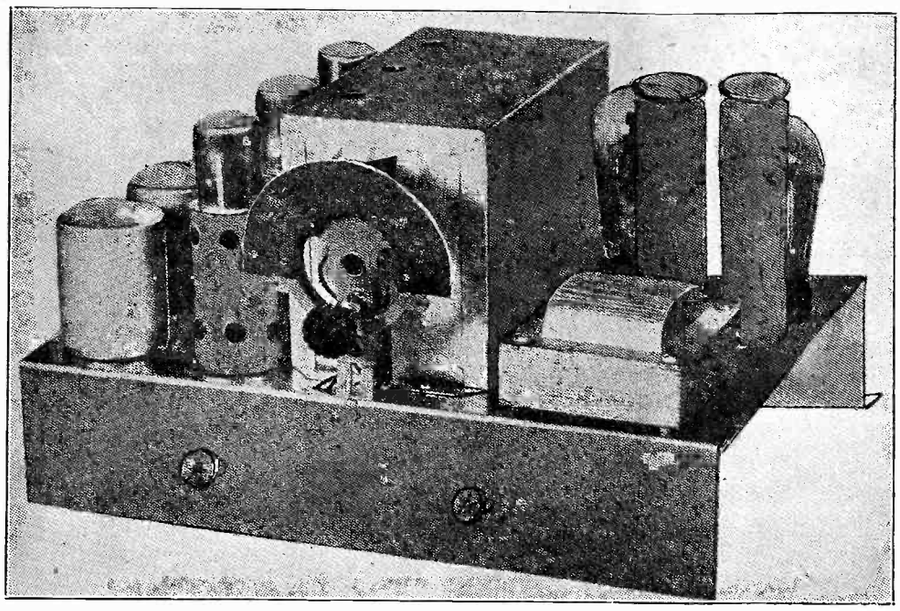
The circuit has automatic selectivity control whereby the set is more selective on weak signals than on strong ones, and therefore the high audio frequency noises are reduced. This of course constitutes automatic tone control, in that the same operation that is performed manually with a variable resistor in series with a fixed condenser is performed automatically by cutting sidebands on weak carriers by alteration of the plate resistance of the 58 tubes.

How Fidelity Control Works

When the suppressor is varied in the negative direction the plate resistance *decreases*, which is the unusual feature of these tubes, and distinguishes them from the '24A and '35. Therefore on strong local stations the selectivity is least, but on weak stations it is most. Do we not want most selectivity on weak and distant stations? Would we not like to pass all the audio frequencies without any suggestion of sideband cutting, for enjoyment of local stations, and wouldn't we be only too glad to cut sidebands or do something else like that for closer selectivity in bringing in weak stations?

For negative voltage values, 0-40 volts, for 3 volts fixed control grid bias, the mutual conductance change is 64-to-1 and the simultaneous change in plate resistance is from 0.8 to 0.05 meg. To repeat, the higher the negative voltage on the suppressor, the lower the plate resistance.

(*Continued on next page*)



(*Continued from preceding page*)

Since the strongest stations will produce the greatest negative suppressor voltage (for it is the same voltage as the fixed bias and extra amount of negative control grid bias obtained from exactly the same source) these stations will produce the lowest plate impedance, and the selectivity will be lowest. Therefore, in a set like this, if one is troubled with excessive pickup from some station close to the receiver, the automatic selectivity and tone control should not be used, for the obvious reason that here is one example when the selectivity need is greatest when the input is greatest. Such a station would cover a greater number of divisions of the dial with the automatic selectivity control than without it, and therefore the suppressors for such purposes should be connected to the cathodes, as usual, instead of to the a-v-c.

Theory of Fidelity Control

In a paper entitled "Technical Discussion of the Application of the Type 58 Tube to Control of Fidelity" (page 9, June 18th issue) the theory of the automatic selectivity and tone control was set forth, and two curves were printed, one showing the relationship between mutual conductance and suppressor volts, and the other the relationship between plate resistance and suppressor volts. Since the mutual conductance (gm) is the reciprocal of the plate resistance (rp), the mutual conductance increases as the plate resistance decreases. In this article the following was stated:

"Examination of the plate resistance-grid voltage curve of the '24A shows that, although the rp is in shunt with the tuned plate circuit of an amplifier, rp increases with increase in grid voltage. Therefore rp is highest and provides maximum selectivity when the volume control bias is adjusted for local reception from a powerful station, while it is at minimum when the volume control bias is adjusted for distant reception from a weak station. Since selectivity requirements, aside from fidelity considerations, are most severe when receiving distant stations, it is evident that the rp change is opposite to the desired effect.

Change in Right Direction

"In contrast to results with the '24A, the plate resistance-suppressor voltage for the 58 shows, for fixed values of control grid voltages, decreasing rp when the suppressor voltage is varied from 0 to —40 volts. This effect is in the right direction for selectivity and fidelity control and may be conveniently utilized for automatic control of these functions by connecting the suppressor to the a-v-c resistor supplying variable control grid bias for the r-f and i-f tubes of a receiver."

Because of the inverse relationship between selectivity and carrier intensity, compared to the usual relationship, it is almost vital to have the manual volume control govern the input, and thus permit of invoking the greatly increased selectivity due to the lowered input. That is why the manual volume control is the slider of a potentiometer that moves the aerial input up and down the fixed element. The total resistance is always across the primary, so that the selectivity of this stage is not disturbed manually when the signal input is lessened due to the automatic selectivity control. And this control, on weak signals, is also a noise suppression control, so there is no a-v-c hiss on channels between stations.

Another new feature in this receiver is that of the potentiometer across the dynamic speaker's field. The inductance is also the B supply choke. A condenser of 0.1 mfd., one section of a triple unit, is connected with red wire to the arm of this potentiometer, and the arm is slid until the hum is least. Another point about hum is to try reversing the connections of the primary of the output transformer (putting to plate the lead that formerly went to B plus and to B plus the lead that formerly went to plate).

Phase Shifter

The potentiometer and condenser in this circuit constitute a phase shifter, and while not guaranteed to reduce the hum materially in all installations, will do so in some, particularly where the filtration has not been as good as it might be. If the arm is to the extreme left (viewing the circuit diagram) of course the capacity is shorted, and is the same as if absent. When the arm is moved the hum may not change at first, but then gradually may get smaller, and later will increase materially, when the arm gets near the B minus lead of the power transformer. The arm should be left at rest where the hum is least. In a few instances, with tapped choke, the combination increases hum, so it is not necessary with tapped choke to use this system.

One of the valuable objects of this device is that it enables the biases for other types of output tube than the 47 or 59, both of which will work well on the same type of speaker. Also the biases are about the same (16.5 volts for the 47 and 18 volts for the 59). But if the output tube is to be a triode, which may be a '45, a 56 or even a 59 used in triode connection, then the biases are higher, and the 300-ohm tap may be ignored for grid return, and such return made instead to the slider of the potentiometer.

Adjustment for Bias

Then measure the plate voltage, see what plate current is recommended for required negative bias at that applied plate voltage, and adjust the arm until the recommended current flows.

If you have only a voltmeter, measure the total voltage drop across the field, divide the required bias voltage into that, remember that the bias is between arm and ground, and then set the arm so that the voltages you read from arm to ground and arm to B minus bear the same proportion as the calculation. The reason why the actual voltage measurement is not recommended between arm and ground and arm and B minus of the power transformer is that the current through the potentiometer is so small that your meter likely will not give accurate voltage readings.

The grid leak in the output stage is shown as 5 meg., although this is about ten times as great as the recommendation, in view of the otherwise present danger of grid current, which would tend to make the power tube lose bias. However, with a-v-c the predetermined level is not exceeded, and therefore this level is selcted below the point of grid current flow in the power tube. The high value of resistor greatly improves the low-note response and moreover reduces hum appreciably. The total hum component finally is less than the allowable limit of 5 per cent., and is nearer 2 per cent., in general results. The use of the 59 tube facilitates this achievement, because it is

Directions for Winding Coils

Due to the resistor-capacity filters, and the resultant high minimum capacity in the tuned circuits, it was found necessary to use special tuning condensers, of 0.00042 mfd., which with 40 mmfd. distributed capacities accounted for 0.00046 mfd., and required 181 microhenries inductance to tune to just a trifle lower than 540 kc (98 on the dial for 540 kc). Then 1,500 kc came in at 2 on the dial.

The inductance of 181 microhenries may be obtained by winding 109 turns of No. 32 enamel wire on 1 inch outside diameter. The primaries are all the same and consist of 15 turns of any insulated fine wire, separated from the secondary by insulating fabric, and wound nearer the bottom of the secondaries. The coils are connected alike, with bottom to ground and top to grid, for the secondaries, and with top of primary to ground or B plus and bottom to aerial or plate.

Some who can not get No. 32 enamel wire can get No. 28 enamel and may wind the secondaries, using 125 turns of this size wire, instead of 109 turns of No. 32 enamel. If the primaries are wound with the same size wire, No. 28, use 20 turns instead of the 15 prescribed, for fine wire. The coils should be in aluminum shields at least 2 inches in diameter, 2½ inches high.

The center-tapped choke coil used for pickup to feed the diode is a honeycomb of about 1 inch outside diameter, and as winding such coils requires a special machine, there is no need to give the directions. These coils are commercial products, and RADIO WORLD's Trade Editor will be glad to assist readers inquiring about parts.

Changing a T-R-F Set Into a Superheterodyne

By Constantin Edmonds

of the indirectly heated type, the cathode being independent, as in the 58.

All five tubes in the Diode Diamond, by the way, are of recent development. The 58, 55 and 82 were announced last summer, and the 59 only a few weeks ago. Each one of these tubes is a valuable contribution. The superiority of the 58 over previous remote cutoff tubes may be inferred from the foregoing discussion, the 59 has the advantage stated, and besides may be adopted to other uses (such as a triode, with greater handling capacity but lower amplification constant), while the 82 is a smooth rectifier, of the mercury vapor type.

Mounting the Dial

As for the layout and construction, the chassis is assumed to be resting on a table with front toward you. There are two minor controls on it, the volume-control at left and the shaft type a.c. switch at right. A combination control-and-switch could be used, but would have to be a center, and there is no room there, due to the dial bracket.

The dial bracket passes through an opening in the chassis and is fastened to the front flap of the chassis. There is a distance between bracket and rear of front wall of chassis of about 5/8 inch. It is necessary to drill a hole just under the slot in this bracket, which can be done easily by placing the bracket on a workbench and bearing down on it heavily while drilling. Then when a 6/32 machine screw is passed through the dial mounting hole at panel front and a threaded brass bushing of 5/8 inch length engages the protruding screw, the dial bracket is fastened to the front panel simply by continuing to drive home the screw through the hole drilled in the bracket. If the 5/8-inch threaded bushing is put on so that only about 1/32 of an inch of the screw protrudes through the bushing, the screw may be tilted downward slightly to engage the hole in the dial bracket. A nut at the far end of the screw, after the screw has passed through the bracket hole, is optional.

The volume control must be mounted before the socket just behind it is put on, otherwise it will not be possible to put on this control. The chassis hole for the bracket is large enough so that the shielded tuning condenser may be mounted independently, and still the dial can be put on. With most chasses the dial has to be on the condenser before the condenser may be safely mounted.

Condenser Leads

The chassis has been carefully prepared. All parts fit nicely. The arrangement to be followed is the one illustrated, with coils at left, tubes next, tuning condenser next, with power transformer and rectifier tube at extreme right. The two 8 mfd. electrolytic condensers are just behind the power transformer and the one next to the tuning condenser has insulating washers, because its special lug goes to B minus of the power transformer, not to ground. The case of the other one goes to ground, hence needs no insulation. An extra hole at rear of chassis should be enlarged to 1/4 inch diameter to take the 30-ohm adjuster. The dial is of the travelling light type, 0-100, left to right (plates close to right). From the three-gang tuning condenser the stator leads are brought through pre-drilled holes, large ones to extreme left, and over to the proper connections to secondaries of the tuning coils. Then the leads to the tubes are brought from these points up inside the tube shields to grid caps. Holes for these leads are drilled in the chassis, and the tube shields should be put on so that their slotted openings to accept these leads are right in line with the mounting screws of the sockets and shield bases.

In mounting the sockets, put the wafers next to the bottom of the chassis, the sockets under them, while at top the tube shield bases are put on, and the mounting screws dropped through the unit openings (tube shield, chassis, wafer and socket). The wafer for the 59 tube is slightly larger than the other wafers.

It is preferable to mount the volume control first, the sockets, wafers and tube shield bases next, and then put on the tuning condenser and dial.

When this circuit is built and trimmers and hum adjusters properly set, the quality of reproduction will be such as to cause the greatest possible delight, not only to the radio-wise but to the run of listeners who, not knowing the causes, will marvel at the striking purity of tone. This purity is due to diode full-wave linear detection, automatic fidelity control and diode-biasing of the triode unit of the 55.

MANY possessors of a five-tube tuned radio frequency set would like to try their hand at a superheterodyne, using the same number of tubes. Usually such sets, if of the a-c type, would have '35 and '24 tubes, with pentode and 280, therefore a diagram is shown enabling the revamping of the circuit, with such tubes. There are two '24's instead of two '35's.

The circuit selected was one having a stage of t-r-f, a tuned modulator and a tuned oscillator. The trick was to get one tube to function both as modulator and oscillator, without requiring any special coils or other special parts.

The cathode of the autodyne tube (first '24) was connected to a pickup winding, equivalent to a large primary, the secondary was tuned and padded for oscillation frequencies desired, while screen current was returned for the oscillation purpose.

Resistor Versus Choke

At first a resistor was tried in the screen circuit, with bypass condenser connected from screen to the stator of the oscillator tuning condenser, and while this worked it had disadvantages. The larger the resistor the lower the screen voltage, and the smaller the resistor the greater the damping of the oscillator tuning by a parallel resistor. The damping arose from the fact that the screen B lead is grounded to radio frequency potentials hence is the same as ground, so if the bypass condenser were infinite the resistor would be in effect across the tuned circuit.

A high inductance choke coil may have a small d-c resistance, and in fact the resistance of a 10 millihenry choke, as commercially obtainable, is about 25 ohms, and the inductance is high enough not to shrink the effective inductance when the choke is substantially across it. So a choke of 800 turns was used and the screen current (r-f) was led to the oscillator tuning circuit by a 0.00025 mfd. fixed condenser. This value is not critical.

If oscillation is absent, reverse the connections to the cathode pickup winding.

The actual coil and condenser system used consisted of r-f tuning coils of 30-turn primaries, secondaries of 145 microhenries inductance (127 turns of No. 31 enamel wire on 1 inch diameter, primaries wound over secondaries near the bottom thereof, bottom of secondary to ground). For an intermediate frequency of 450 kc the oscillator secondary should consist 130 microhenries (80 turns of No. 28 enamel wire on 1 inch diameter) and pickup of 40 turns of any fine insulated wire, wound over the secondary as previously. There should be an insulating wrapper, of fabric or paper, between primary and secondary.

Frequency Range

The tuning condenser, with all capacities included (trimmers, tube capacity, coil capacity, wiring capacity, etc.) was 0.00044 mfd. and assuming a minimum of 50 mmfd. the r-f section tuned from 1510 to 511.8 kc, a wide span. For tracking it is necessary with such a condenser to have a total effective capacity of 0.00023 mfd., therefore the padding condenser should be 483 mmfd., but since it is adjustable a range of from 400 to 600 mmfd. would be satisfactory, or select a fixed condenser of a little less than that capacity used, with an adjustable one across it, of sufficiently large maximum to make up the difference, but having a small minimum. Thus 0.0004 mfd. and a 100 mmfd. trimmer would be a suitable combination.

In a case like this it is better to use a high intermediate frequency, because of reduced image interference, in fact at 450 kc intermediate there could not be any below 900 kc., as there are no broadcasting stations below 540 kc. Other than broadcasting might appear even then as image interference, but as a practical problem this hardly can be said to exist.

However, those who desire to use 175 kc intermediate frequency with 0.00035 mfd. three-gang may do so by using the same r-f coils as previously described, an oscillator coil of 191 microhenries (126 turns of No. 30 enamel wire on 1 inch diameter, 40-turn pickup winding as before). The padding condenser then should be adjustable from 700-1000 mmfd. The actual capacity needed is 920 mmfd.

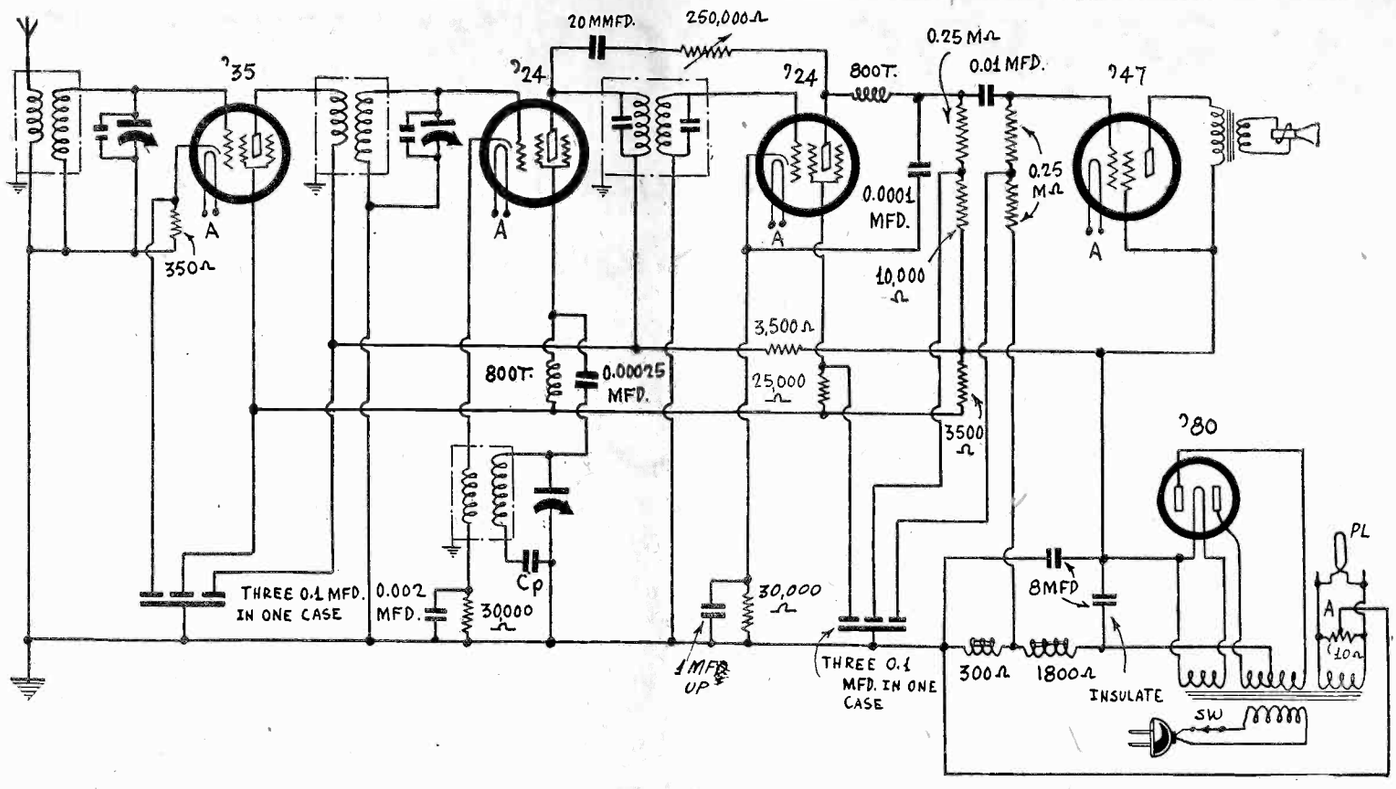
Regeneration Option

As can be seen, there is no intermediate frequency amplifying tube, but if desired, the same effect may be obtained as if one were there, by regenerating the second detector, which handles the intermediate frequency. A small capacity is put in series with a large resistor, and either one is varied. The diagram shows 20 mmfd. (any small equalizer set at or near minimum) and 250,000 ohm rheostat.

The adjustment for regeneration is made once and left thus.

The only extra part of any consequence that has to be accommodated is the intermediate transformer, but as this is obtainable commercially in a 2-inch diameter shield, about 2.5 inches high, there is room for the coil beneath most chassis tops.

(*Continued on next page*)



(*Continued from preceding page*)

If a transformer is used that requires only two 6/32 mounting hole, the coil then may be placed under the tuning condenser. To do this job you would have to remove the condenser, attach the coil by putting in the screws from the top, and then replace the condenser. In mounting the coil put a couple of nuts on the screws, underneath the chassis, before engaging the threaded coil spades, to allow room for the coil outleads. The transformer would be adjusted as to frequency from the bottom of the chassis.

If the set you have is of the usual mechanical layout, with the coils in line, front to back, on one or the other side of the condenser, and the tubes likewise aligned, the r-f tube and its coil may be side by side at front, autodyne tube next, and second detector at rear, with oscillation coil beside it. Then to make the preliminary test of the tuner alone (with audio) all that is needed is to put the grid cap intended for the autodyne tube instead on the ultimate second detector. Now the circuit is a four-tube t-r-f, and the dial settings may be noted.

The padding procedure will not be detailed, as it has been covered in previous issues, particularly in the series of superheterodyne articles by J. E. Anderson now running in these columns. The essence of the test of the superheterodyne is that when the set is worked as a super the same dial readings shall prevail for the same input signal frequencies as when the set was used in t-r-f fashion. The padding condener is adjusted to some low frequency, by the known t-r-f dial setting, and then a check-up made of the high frequency end to get the coincidence there also.

ALTHOUGH I am a sound engineer, and not primarily interested in radio, have been buying RADIO WORLD for a long time now, and have had much valuable information regarding power amplifiers. I only wish that there was a magazine devoted solely to the gentle art of getting the most and best out of audio amplification. At any rate, RADIO WORLD seldom misses a week but that it has some article of especial interest to me in my capacity of sound engineer, specializing in theatre sound installations.

H. E. KINNEAR,
c/o Audien Equipment Co.,
270 Fort St., Winnipeg, Manitoba, Canada.

DX Corner

A suggestion for a good ground for those living where ground wire may reach the earth to an open space is to bury an old auto radiator and pack around it about twenty pounds of ice-cream salt. A depth of five feet should prove sufficient for the radiator.

In North Carolina, where summer reception is very bad, the above ground, with a 275 foot aerial and 55 foot lead-in, proved very effective and brought in KGO and KNX, reports George H. Baldwin. These stations were received on a standard factory-wired five-tube set. In Florida the same set logged 197 stations. He also finds that in all cases it aids greatly in DX-ing to keep ground and aerial leads widely apart.

What has been found to be quite effective in a great many cases with regard to aerial lead-ins is to continue the regular lead-in for a short distance, and where it passes a roof of a house to continue say ten feet above that with a shielded lead-in wire right to the aerial post on the receiver. This shielded lead-in of course is to be grounded from the shield covering.

J. S. White, 3054 Kingsbridge Ave., N. Y. City, sends in a report of having received more than 470 stations, in the United States, Canada and Mexico on a four-tube receiver built from a kit. His best record is 2CH, Sydney, Australia, a 1000-watt station on 248 meters, or 1210 k.c. This is close to 11,000 miles from the East Coast and surely some catch. The verification of the reception from 2CH was loaned to this office, so this is more than a DX-er's dream.

Capt. S. V. Rogers, Kearney, N. J., reports good catches on a seven-tube superheterodyne built from a kit. He lives practically under the WOR transmitter, but pulls in XER, Mexico City. Another good catch is WTAR, Norfolk, Va. The captain is a real DX-er and is interested in conferring with real DX-ers in his vicinity. He may be phoned at Kearney 2-1149 J and appointment made.

There is still a number of DX-ers who surely have some fine records and also good suggestions and ideas that should prove interesting and helpful to the other fellow, but as yet have not sent them along. The response has been very fine, though only a few letters have been published. A lot of this material is being gotten in shape together with other interesting matter, so at a very early date the column will look "something like." If you get a thrill out of DX-ing and are really interested, you must have had some peculiar or valuable experience sometime or other, or pulled in some hard-to-get station. Just send that information along. The reason for asking you to write is that we know that a great many will enjoy DX column and hear of the other fellows' experiences. You yourself should do your part and get your brother DX-ers to do likewise and with that cooperation we should be able to keep you fully entertained all winter.

A. D. MacNicol, C. M. R. T., of 502 N. Brodie St., Ft. William, Ont., Canada, writes: "I think it is a great idea to have a column for DX-ers and hope it will be carried out, as there is still a large number of people who get a great kick out of DX."

N. H. Booth, 349 Cumberland St., Pittsburg, Calif., sends his O.K. of the idea and says: "I am very much interested in getting distance, both broadcast and short-wave, and would enjoy a column on distance getting, both experiences and comments and helpful suggestions."

NEW REMOTE CONTROL

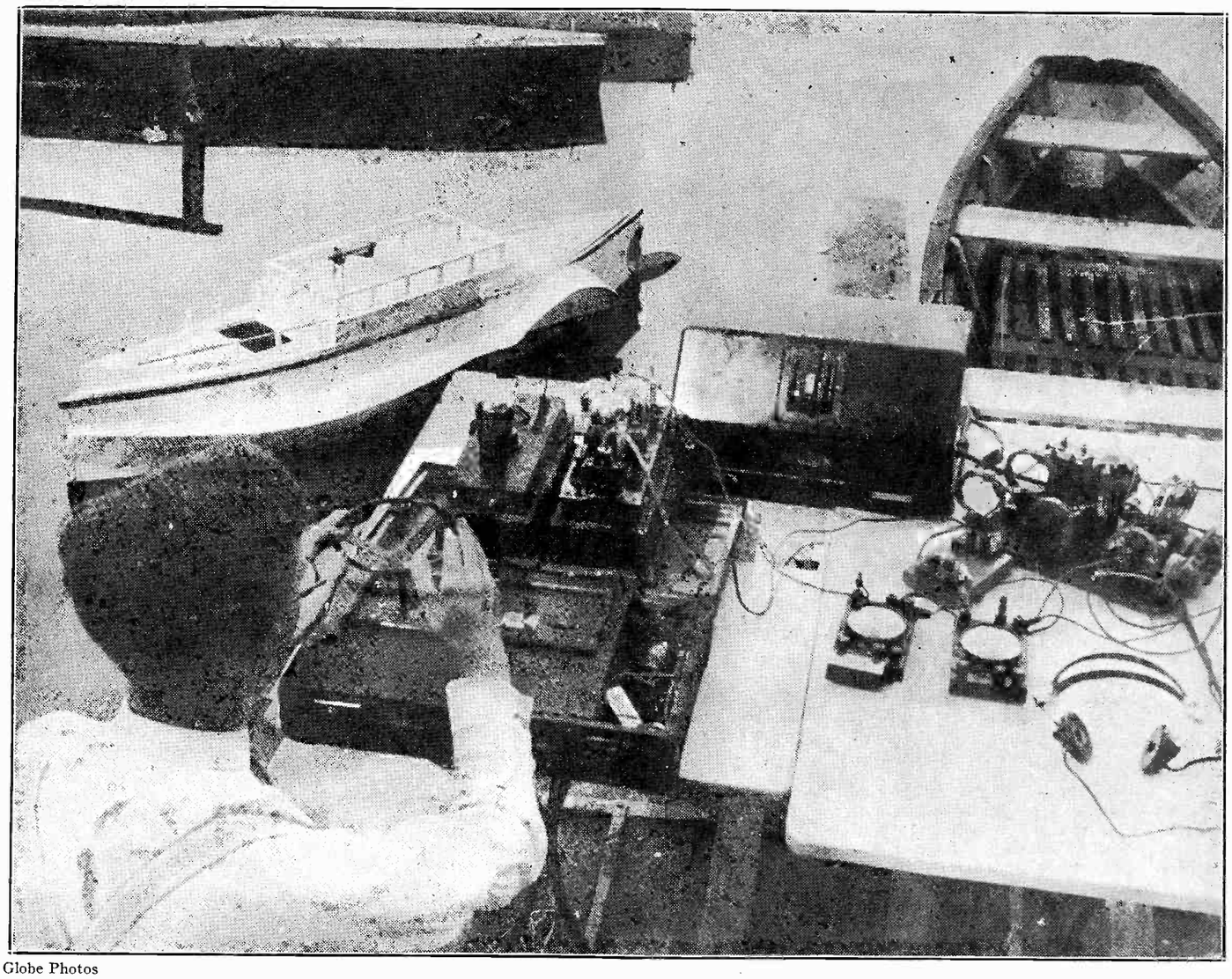
Premier Electric Co., Chicago, Ill., announces a new remote control for auto radio. This unit is for steering post attachment.

DAVEN AGAIN ACTIVE

The Daven Co., 158 Summit Street, Newark, N. J., announces new volume indicators. These instruments may be used in the radio and acoustic engineering field.

A SCHOOLBOY'S FEAT

Lad Builds Model Boat and Controls it from a Distance by Short Waves



Globe Photos

Rudolph Weber, a German schoolboy, at the controls of a short-wave radio transmitter with which he controls a model boat. He constructed all the apparatus himself, including the boat. He is 13 years old.

REMOTE control of machines by radio has been delved into considerably by many investigators. Ships at sea, airplanes in the air, and automobiles on land have been controlled completely at a distance by means of radio waves. Perhaps the most outstanding experiment of this was conducted by the U. S. Navy Department when the battleship Utah was controlled from another ship by radio waves. All the usual movements were executed by merely turning dials and throwing switches and the big ship responded just as quickly as if the same commands had been transmitted over the regular ship communication channels to human recipients.

When remote control by radio is done the various operations are performed by relays. A wave of a certain length is transmitted and this is picked up and amplified by a receiver which operates a relay and this relay in turn controls machinery which performs the function desired. It may be the turning of the rudder in one direction or the other. Another controls the engine throttle, another some other device. There is no other limit the to the number of operations that can be performed than wavelengths that can be received separately. And this is not all, for by a code system the same wave can be made to perform many different tasks.

Remote Control Expert

One of the prominent investigators in this country along this line is John Hays Hammond, who has invented a large number of remote control devices. It was his devices that were used on the battleship Utah.

There is nothing essentially complex about remote control devices. A running motor can be made to do certain jobs if it is started, and it can be started and stopped with a radio wave just as simply as a loudspeaker can be made to speak with a radio wave. Suppose, for example, that we want to turn a ship a certain number of points to starboard. A motor geared to the rudder can be started with a radio wave controlling a relay in the motor supply circuit. Suppose that this relay will stay closed only so long as a certain radio wave is on the air. If it is known how many degrees the rudder will turn in a given time it is only necessary to keep the radio wave on the air for that length of time. The rudder keeps turning as long as the wave is on the air and stops the instant the wave is stopped. If it becomes necessary to reverse the rudder the motor driving it could be started in the reverse direction, and this could be done with another wave and a relay. It could also be done with the same wave by means of a different sequence of signals. If the motor were started again the rudder would turn still further in the same direction, but if before starting the motor were reversed the rudder would turn in the desired direction the instant the motor started.

What applies to the rudder also applies to any other operation. One of the operations, for example, that was performed on the battleship Utah was blowing the whistle, That is a simple one, for it requires only a relay acting on a lever. It falls in the same category as the teletyper, except that it is simpler. In the teletype machine five relays must be operated in a certain sequence. The five relays permit 32 different combinations. (*Continued on page* 19)

UNCANNY SENSITIVITY IN NEW AUTO SUPER

By J. E. Anderson

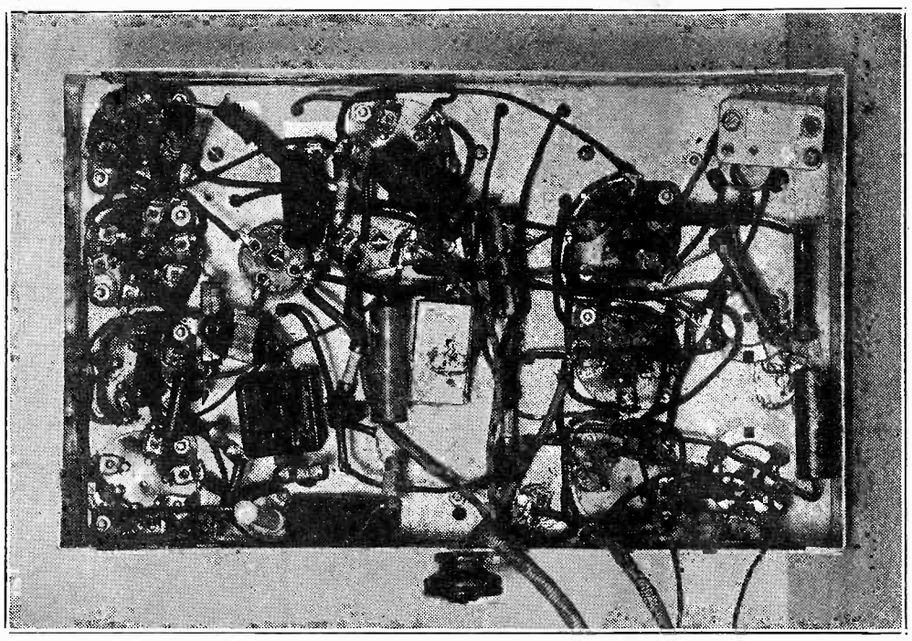


Fig. 3
Bottom view of the 898 automobile receiver

[*Herewith is the second and final instalment of the article on the new Anderson auto superheterodyne, the* 898. *The tracking method was described in part, and the subject begins this week's instalment.*—EDITOR.]

NEXT provide a modulated signal of 1,500 kc., tuning condenser set at about 5 on the dial, and tune all the trimmers on the gang condenser until the signal comes through strongest. Then provide a signal of 1,450 kc. Tune it in with the gang condenser as accurately as possible. Retrim accurately. Chances are that extremely little readjustment is necessary, if any at all. But 1,450 kc is the best point at which to trim and the 1,500 kc trimming was only done to insure that 1,500 kc would fall inside the tuning range.

When the circuit has been trimmed at 1,450 kc, provide a modulated signal of 600 kc. Remove the grid clips from the 236 and the 85 tubes. Connect the cap of the 85 to the clip removed from the 236, not to the cap of the 236. Make this connection as direct as possible. Tune in to the 600 kc signal. Leave the condenser exactly where the 600 kc signal comes in. Then restore the circuit as it should be. That is, put all the clips where they belong. Then tune in the 600 kc signal with the padding condenser alone. Touch nothing else. That completes the adjustment.

In case no 1,450 kc or 600 kc signals are available use the nearest signals to these frequencies.

When the set was operated by a critic who had been on the lookout for a supersensitive set his criticism was that it was too sensitive. He used the expression in an approving sense.

In the circuit as described last week the manual volume control was placed so that it controlled the gain in the radio and intermediate frequency amplifiers while the audio amplifier was operated full blast. Now, some persons prefer to have the manual volume control in the audio amplifier, especially when the circuit is equipped with automatic volume control. For those who wish to build the circuit in this way we are reproducing a diagram of virtually the same circuit but so arranged that the manual control varies the audio amplification only, leaving the automatic volume control to hold the gain in the radio and intermediate amplifiers to the required value.

Changed Chararacteristics

This modification introduces considerable operating characteristics. The circuit appears to be more noisy between stations, for one thing. The reason for this is clear. The radio and intermediate frequency circuits are always in the most sensitive condition except when a carrier is present, and then it is only sensitive enough clearly to bring out the signal. To tune this set to greatest signal on any station the best guide is the amount of noise present in the output. Tune for least noise in every instance. That coincides with greatest signal strength as well as with clearest signal. Judging the tuning by the least-noise method is equivalent to tuning by meter, in which case the circuit is tuned for least deflection of the meter. In a superheterodyne not provided with good automatic volume control the noise is usually maximum when the signal is tuned in exactly. It is possible that the total amount of noise in the two cases at exact resonance is the same, assuming the same sensitivity.

Circuit Behavior

In the modified circuit the second intermediate amplifier was put on the automatic volume control as well as the first and the radio frequency amplifier. This improvided the control and compensated for the removal of the manual control from the high frequency amplifiers.

The positive action of the automatic volume control is evident on sweeping the tuning range with the condenser. When the manual volume control is set at a given audio output, most stations come in with about the same volume. Two stations were particularly noticeable, WLW and WOR. Although WOR is a strong local and WLW a distant station it was impossible to tell any difference between the volumes of the two. There was slightly more noise on WLW. While these stations are only 10 kc apart, there was no interference between them.

The same leveling of the volume was observed on distant stations also. The only difference between many distant stations was in the amount of noise. The weaker the station, either by virtue of distance or low power, the more the noise.

Open Leads

It will be noticed that there are several open leads on the diagram. First of all, all the heater leads and the field coil leads are open. All leads terminating in (—) are to be connected together and all those terminating in (+) are to be connected. Note particularly that the cathode leads of the three controlled tubes terminate in (+). The cathodes of the radio frequency amplifier and that of the first intermediate amplifier are connected together on one 300 ohm bias resistor and the other side of this resistor terminates in the plus sign, indicating that it should be connected to the positive side of the heater circuit. The cathode of the second intermediate amplifier is first connected to a 300 ohm resistor and then it goes to the positive side of the heater circuit.

Hp on the remote control socket terminates in A "hot." This means that this should be connected to the live side of the car storage battery. Hk on this socket terminates in the symbol X. A lead from the chassis terminates in the symbol Y. The note below the symbols indicates how these are to be connected.

It will be noticed that the heater circuit is floating until the Y connection has been made to one side or the other of the heater circuit. All grid and cathode connections are so made that it makes no difference how X and Y are connected. But this is only true if the connections are made are shown. Always connect B minus to the positive side of the heater circuit. This connection may be made either at the storage battery or to the positive side of the circuit in the chassis.

Change in Manual Control

When the manual volume control is connected to control the high frequency amplification the value of the potentiometer resistance is 10,000 ohms. When the control is in the audio amplifier this value is not enough because it must be used as a grid leak. The value used is 250,000 ohms, but half a megohm will work just as well. The remote controls may be had in any value of resistance.

More filter condensers and resistors are used in this circuit because it was found that it would oscillator on the higher radio frequencies. The oscillation did not prevent the clear reception of fairly strong

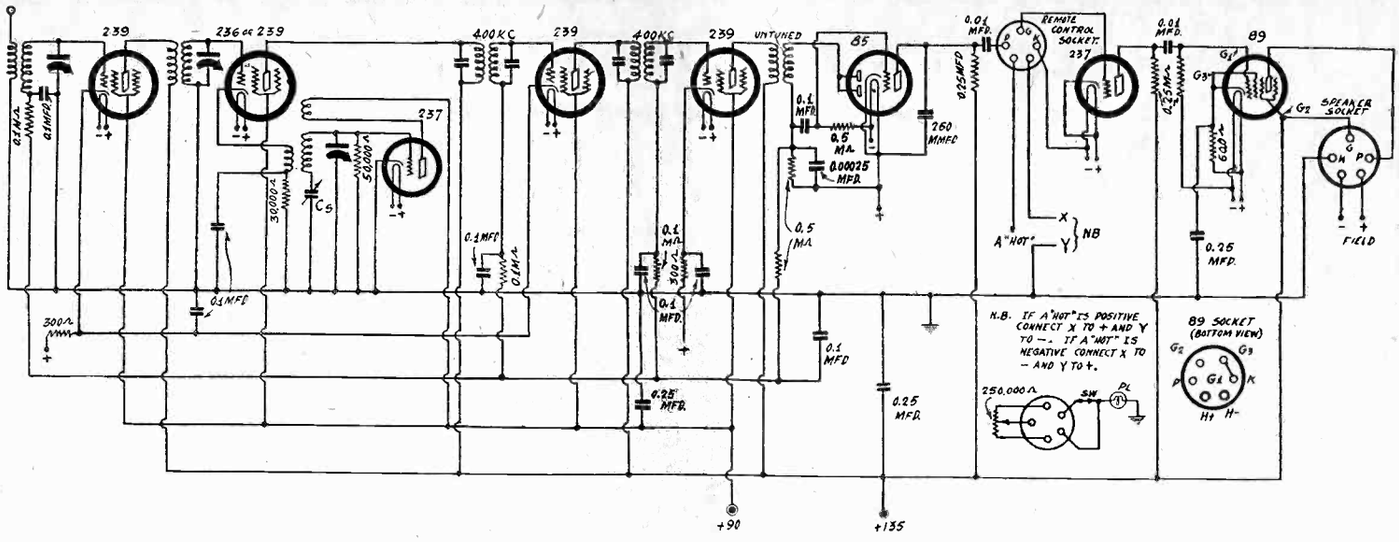


FIG. 4

The circuit diagram of the 898 automobile receiver arranged so that the manual volume control is in the audio amplifier.

stations in the oscillating region because as soon as a carrier of some strength was reached the automatic volume control would make the bias high enough to stop the oscillation. But the oscillation would persist on very weak stations. It was an annoyance and the extra filtering was well worth while.

In the original circuit the radio frequency amplifier tube and the mixer were placed side by side on the chassis. It was found that the tendency to oscillate was less when the oscillator was placed between the two tubes, just as it was done in the 631 automobile receiver. It was well to retain this arrangement whether or not the manual volume control is placed in the high frequency circuit or in the audio frequency circuit. Of course, the oscillator and radio frequency coils affected were also inter-charged.

Short Aerial Enough

Despite this change in the tube arrangement and the added filtering there was oscillation when no antenna was used, but it only required a short wire for antenna to stop it. The average automobile antenna will stop the oscillation. In some exceptional case where it will not, a 10,000 ohm resistor connected across the antenna coil will do it. This, of course, will cut the sensitivity slightly but it will never be noticed for there is gain to throw away in most cases.

Connections of 89

The connections of the various elements of the power tube are shown on the inverted socket inserted. The control grid G1 is the cap of the tube. The suppressor grid G3 is next to G on the socket and is connected to it. The screen grid is next the plate and this is returned to the same high voltage as the plate. The loudspeaker plug has been wired so that the proper connections are made if G2 is connected to the G lug on the speaker socket and P is connected to P on the speaker socket. If the speaker has a five lead cable, the extra lead is connected to the frame of the speaker, and therefore this lead is connected to the chassis of the set. In case the speaker is provided with a four prong plug the ground lead is omitted.

Remote Control

The internal connections of the remote control are shown in the insert drawing under the note pertaining to the connections of X and Y. The ground symbol at the pilot light means the frame of either the car or that of the receiver. Actually, the grounding of the pilot light is done in the remote control unit.

In the first circuit described last week there was an 800 turn choke in the plate circuit of the 85. This is omitted in the modified circuit. A choke was tried in this circuit also but there was no apparent difference in the results. Theoretically it serves a definite purpose, but in practice it does not seem to make any difference whether that purpose is served or not. The second 250 mmfd. by-pass condenser is also omitted because it was used only to make the choke effective.

Note also that the grid leak for the power tube was reduced from 0.5 to 0.25 megohms. The reduction was made because there was a slight tendency to motorboat with the higher value. The test was made on a high resistance B battery eliminator. With good B batteries there was no evidence of motorboating even with the higher grid leak. The lower value is recommended regardless of where the manual volume control is placed. The power tube will take a stronger signal without overloading.

Removing One Tube

Sometimes it will not be necessary to use the 237 audio amplifier because of the high gain in the circuit. It can be removed by a simple device. Take an old tube base of the 5-prong type. To the G prong solder a flexible lead terminating in a grid clip. Insert this socket in place of the 237. Remove the grid clip from the 89 and replace it by the one attached to the base just inserted in place of the 237. The change merely connects the slider on the manual volume control to the cap of the power tube. There is no change in bias on the power tube because the grid returns of the two tubes are made to the same point.

LIST OF PARTS

Coils

Two midget shielded r-f transformers for 350 mmfd. condensers
One oscillator coil for 350 mmfd. condenser and 400 kc intermediate
Two doubly tuned and shielded i-f transformers, 400 kc
One untuned intermediate transformer as described (two 800 turn chokes)
One 10 m.h. r-f choke (800 turn duolateral coil)

Condensers

One three-gang tuning condenser 350 mmfd. per section
One 350-450 mmfd. adjustable padding condenser
Eight 0.1 mfd. by-pass condensers
Three 0.25 mfd. by-pass condensers
Two 0.01 mfd. condensers
Three 0.00025 mfd. condensers

Resistors

One 600 ohm bias resistor
Two 300 ohm bias resistors
One 30,000 ohm resistor
One 50,000 ohm resistor
Three 0.1 megohm resistor
Three 0.5 megohm resistors
Three 0.25 megohm resistors

Other Requirements

Eight 5-contact sockets
Two 6-contact sockets
Six grid clips
One remote control unit comprising dial, 250,000 ohm potentiometer, cable, condenser pulley, and filament switch
One battery box
One chassis and chassis box
Two shielded battery cables, one three lead for B supply and one two lead for A.
One dynamic speaker with six volt field and 89 tube matching transformer
One 236 tube
Two 237 tubes
Three 239 tubes
One 85 tube
One 89 tube

Tube List Prices

Type	List Price	Type	List Price	Type	List Price
11	$3.00	'32	2.35	56	1.30
12	3.00	'33	2.80	57	1.65
112-A	1.55	'34	2.80	58	1.65
'20	3.00	'35	1.65	59	2.50
'71-A	.95	'36	2.80	'80	1.05
UV-'99	2.75	'37	1.80	'81	5.20
UX-'99	2.55	'38	2.80	82	1.30
'100-A	4.00	'39	2.80	83	1.55
'01-A	.80	'40	3.00	'74	4.90
'10	7.25	'41	2.85	'76	6.70
'22	3.15	'45	1.15	'41	10.40
'24-A	1.65	46	1.55	'68	7.50
'26	.85	47	1.60	'64	2.10
'27	1.05	48	2.80	'52	28.00
'30	1.65	'50	6.20	'65	15.00
'31	1.65	55	1.60	'66	10.50

EQUALIZED SENSITI

By Ala
Thor

THE PATHFINDER seven-tube superheterodyne found a cordial reception among set builders because of its sensitivity and selectivity, as well as because of its great output. Since that set was first announced the new 59 power tube has made its appearance, and many have already requested details of how to incorporate this tube in the original circuit. The sponsors of the set have met this demand and have altered the original circuit to accommodate the new tube.

Very few changes, indeed, are necessary to fit the set to the new tube. First of all, a seven-contact socket is required, for the tube has seven prongs on the base. Two of these prongs are for the filaments, one for the cathode, for the new tube is of the indirectly heated type, one is for the screen grid, one for the suppressor grid, one for the plate, and finally one for the control grid.

The cathode and the suppressor grid are connected together and the two grounded. Grid bias is obtained in the same manner as when the 47 tube was used, namely, through a drop in the 300 ohm section of the field coil. The grounding of the cathode is equivalent to grounding the center of the filament transformer winding used for the 47. That is, the ground on the winding A served to ground the cathode of the 47, but the cathode of the 59, being independent of the filament must be grounded separately. The ground on the center of the winding should be retained.

Other Changes

In the original circuit the slider of the volume control potentiometer was grounded. This made the operating bias on the automatically controlled tubes positive under certain circumstances. In the present version of the set the slider on the potentiometer is connected to the cathode of the detector tube. In his connection the minimum bias on the automatically controlled tubes is determined by the bias resistances for those tubes and the automatic bias starts with this bias and adds to it by amounts depending on the strength of the signal. Thus at no time can the bias on the controlled tubes be positive.

Changing the connection of the slider of the potentiometer made another change necessary. It will be noted that the slider as well as the cathode of the detector are connected to the positive end of a 1,000 ohm resistor R3 in the voltage divider. Previously this resistance was 2,000 ohms. The lead from the slider of the potentiometer carries the plate and screen currents of the two controlled tubes and this current now flows through R3. Hence if the same resistance were used, the bias on the 55, which is determined by the drop in R3, would be too high. The lower resistance makes it correct.

Improvement in Circuit

Just what are the improvements, if any, due to the use of the 59 in place of the 47? For one hting, the 59 tube is of the cathode type and the a-c on the filament does not enter the signal circuit at any part. Hence the hum level is considerably lower. That is the principle advantage of the new tube over the old. That alone would make the use of the new tube worth while.

The 59 also has a higher undistorted output than the 47, 3 watts as against 2.5 watts. To get this output, however, a slightly greater input is required, but not in proportion to the increased output wattage. Moreover, there is more than enough gain in the circuit to load up either tube, so the 59 can always be given all it can stand. Again, the fact that the 59 has a greater output means that for the same moderate output from the two tubes, the distortion in the 59 will be considerably less than that in the 47.

While there is an automatic volume control in the set, its effect is not strongly evident on turning the dials because of the fact that the manual volume control is in the high frequency level. It is evident, however, on fading stations—evident by the absence of fluctuation. Also because of the location of the manual volume control there is comparatively little interchannel noise, or at least the set may be operated so that there is relatively little. If the manual volume control is set at full amplification, the usual interchannel noise will be present, and the automatic volume control is then called on to do its full job. But ordinarily the manual volume control would be set so that the noise is subdued.

Equality of Sensitivity

The antenna coupling transformer is of the ordinary two-winding type but the second "transformer" is of the capacity type. That is, the second tuned circuit is coupled to the plate ahead by means of capacity. The choke used in this coupler resonates at a frequency near the lower end of the broadcast band and for that reason the gain at the lower frequencies is boosted. Therefore the gain in the radio frequency amplifier is practically uniform from one end of the tuning band to the other.

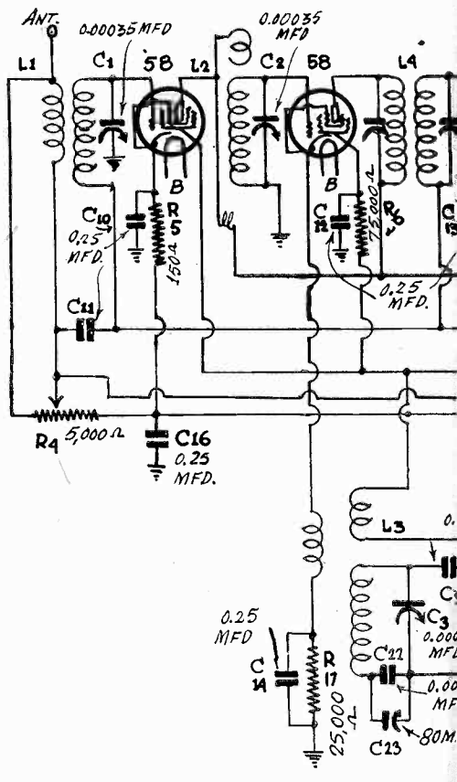
Most of the amplification in the receiver occurs at the intermediate frequency, and that remains the same regardless of the carrier frequency received. Hence, there is little variation in the sensitivity in the receiver as a whole.

There are really two stages of audio amplification in receiver because the 55 triode operates purely as an audio amplifier. There is a voltage gain of nearly seven times in this triode. In the pentode the voltage gain is 13, assuming the correct load of 6,000 ohms. This gain is the ratio between the voltage on the grid and that across the primary of the speaker transformer. Thus the total audio voltage gain is over 90 times.

Noise Elimination

Across the primary of the power transformer is a 0.00025 mfd. condenser C8 which is used to remove some of the line noises. To make this most effective try the line plug both ways and retain the one that gives less noise, if there is any difference. Grounding of the centers of the two 2.5 volt windings also helps to eliminate noise, especially hum. In the grid circuit of the 59 is a filter consisting of a 100,000 ohm resistor R13 and a 0.25 mfd. condenser C15, which serves to remove hum. This is needed when a heater type tube is used as well as when a 47 is used because the hum that it filters out comes from the field winding. This is not changed when the tube is changed.

The speaker transformer is not shown to be grounded, but there is a ground on the field coil. Therefore, the transformer is also grounded for the field structure and the transformer core are metallically connected. This grounding helps to reduce hum. Another thing that some-



The circuit diagram of the Path

times helps to reduce hum is to groun one side of the voice coil. If this is no already done in the speaker it is well t try it in case there is hum present.

As a means of reducing high frequenc noise on distant stations the tone contr may be used. This consists of a 0.1 mf condenser and a quarter megohm resisto across the primary of the speaker trans former. The lower the value of the re sistance in series with the condenser th more the high frequencies are shunte away from the speaker. While the us of the tone control makes reproductio less than natural, it is often useful in cut ting out hiss and other high audio fre quency noises, leaving a signal that i pleasing, although not natural. When th resistance is set at maximum value th reduction of the noise is practically ni while when it is set at minimum the re duction is great. Therefore, there is wide range of "tone quality" availabl The load impedance, that is the impe dance of the speaker, is 6,000 ohms, an this is virtually independent of frequenc At 10,000 cycles, which is in the regio of hiss and which is also the heterodyn between adjacent channels, the reactanc of the condenser is only 159 ohms, s that at this frequency the tone contr is virtually a short circuit when the rheo stat is set at zero. This accounts for th great reduction in the noise.

Variation in Plate Current

We have already discussed the chang of the return of the cathode of the con trolled tubes and the effect on the bias o the triode of the 55. When a very stron signal comes through the grid bias on th controlled tubes goes up and that in turn

ITY IN PATHFINDER

lannion

Co.

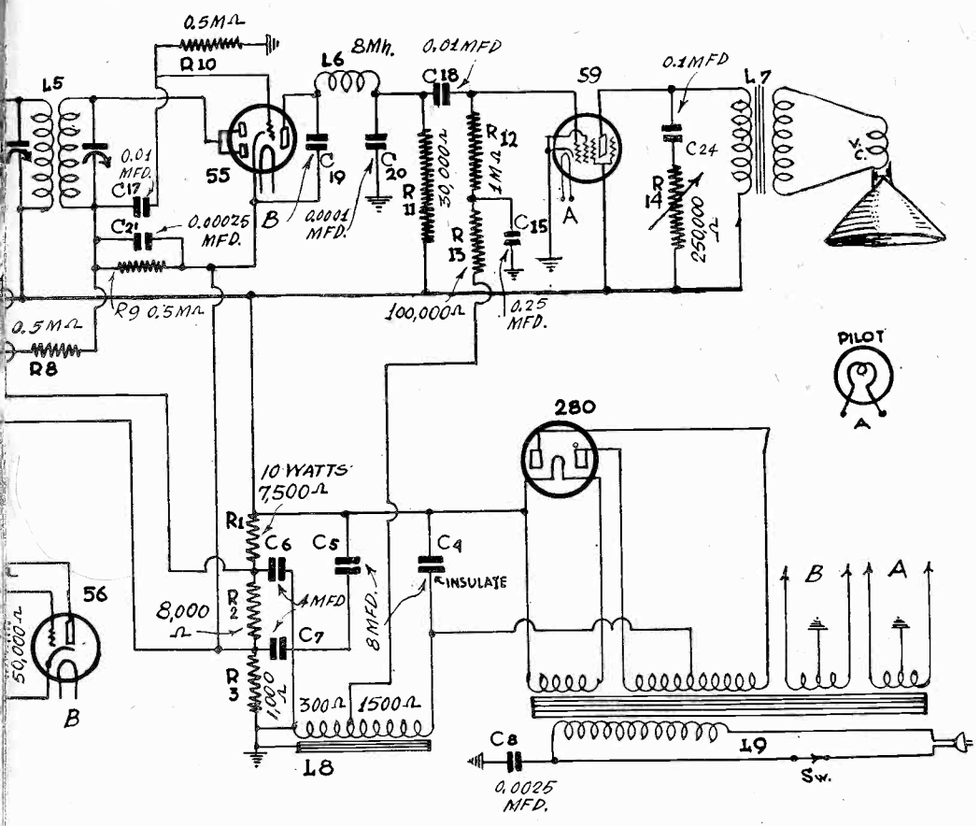


FIG. 1

seven-tube superheterodyne in which the 59 tube is used as power tube.

ractically cuts off the plate and screen urrents of these tubes. Since this cur-nt flows through R3, the bias on the 55 iode goes down on a strong signal. That an unfortunate situation but the change preferable to having a positive bias on e controlled tubes on weak signals. In is particular circuit no harm results y the decreased bias on the 55 because ie current cannot increase excessively ue to the 30,000 ohm resistance in the late circuit. The only question is hether the minimum bias is sufficient to aintain the grid positive regardless of ie strength of the signal. There is no oubt that it is sufficient. Using the gain alues that we previously obtained we find iat the peak signal voltage on the 55 iode does not exceed 1.75 volts. The inimum bias on the 55 is several mes that value. That is, it would be ore than sufficient even if the screen id plate currents of the controlled tubes ere completely cut off.

When the 55 is followed by a trans-rmer, with the primary directly in the late circuit, the plate current is usually xcessive, and in that case the bias varia-on would be serious. The transformer ten burns out. But we do not have iat situation in this case.

Trouble Shooting

In any sensitive receiver there is likely be trouble before the set is finally djusted. One of the troubles that some-mes occurs is oscillation in the radio equency amplifier. This occurs at times espite the use of shielded coils. Very ften the trouble can be remedied by oving a single wire. For example, in ne case there was a strong oscillation when a short antenna was used. There was none when a long antenna was connected to the circuit. But it was desirable to stop the oscillation when the short antenna was employed. Examining the circuit showed that the lead from the first tuning condenser C1 to the top of the secondary of first tuned transformer ran within 1/16 inch of the plate prong on the first 58. When this lead was pushed about 1-4 of an inch from the plate prong the circuit became quite stable. This particular lead, of course, is under the subpanel.

In this circuit there is only one weak point of this kind. The next plate is connected to a transformer tuned to another frequency entirely and there is little coupling. But there may be similar critical points which can be found only by inspection after the job has been finished.

Coupling may also exist between the grid leads of the two 58 tubes on top of the set. They may be several inches apart and yet the coupling may be sufficient to cause oscillation, especially on the higher frequency half of the tuning range. As before, when such trouble occurs, it is usually possible to stop the oscillation by pushing the leads a little farther apart. If the leads are kept inside the tube shields as far as possible this trouble is minimized.

These comments are not to be understood to mean that this set in particular is subject to these difficulties. They apply to all equally sensitive receivers, and oscillation from these troubles is the exception rather than the rule.

Blocking

Another trouble that may arise is blocking in the power tube grid circuit. This will occur if the signal voltage is excessive on the low notes, that is, so high that the grid takes current. In case that should occur one remedy, and the best one, is to reduce the value of the grid leak. It is now indicated at one megohm, but it may be reduced to one-quarter megohm if necessary. Even when it is reduced to this value the total value of the grid leak resistance is 350,000 ohms, for the filter resistance must also be considered.

LIST OF PARTS

Coils

L1—One antenna coil, shielded, for 350 mmfd. condenser.
L2—One capacity coupled r-f coil, shielded, for 350 mmfd. condenser.
L3—One shielded oscillator coil for 350 mmfd. condenser and 175 kc. I-f.
L4, L5—Two shielded doubly tuned 175 kc. intermediate transformers.
L6—One 80 millihenry r-f choke coil.

Condensers

C1, C2, C3—One 3-gang, 350 mmfd. tuning condenser assembly.
C4, C5—Two 8 mfd. electrolytic condensers.
C6, C7—Two 4 mfd. by-pass condensers.
C8—One 0.0025 mfd. condenser.
C9, C22—Two 0.001 mfd. condensers.
C10 to C16, inclusive, seven 0.25 mfd. by-pass condensers.
C17, C18—Two 0.01 mfd. mica condensers.
C19, C20—Two 0.0001 mfd., condensers.
C21—One 0.00025 mfd. condenser.
C23—One 80 mmfd. equalizer condenser.
C24—One 0.1 mfd., 400 volts, condenser.

Resistors

R1—One 7,500 ohm, 10 watt resistor.
R2—One 8,000 ohm, 2 watt resistor.
R3—One 1,000 ohm, 2 watt resistor.
R4—One 5,000 ohm potentiometer., with line switch.
R5—One 150 ohm resistor, one watt.
R6—One 7,500 ohm, one watt resistor.
R7—One 500 ohm bias resistor, one watt.
R8, R9, R10—Three 0.5 megohm resistors, one watt.
R11—One 30,000 ohm, one watt resistor.
R12—One one-megohm, one watt resistor.
R13—One 100,000 ohm, one watt resistor.
R14—One 250,000 ohm variable resistor.
R15—One 10,000 ohm, one watt resistor.
R16—One 50,000 ohm, one watt resistor.
R17—One 25,000 ohm, one watt resistor.

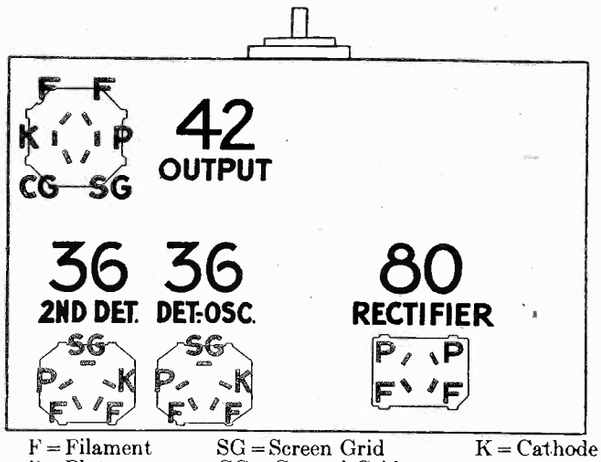
Other Requirements

One drilled chassis.
Eight wafer type sockets (Four 6-pin, one 5-pin, one 4-pin, and one 7-pin).
Insulating Washer for C4.
Antenna and ground binding posts.
One roll of hook-up wire.
One package of hardware.
One line cord and plug.

STANDARD COLOR CODE

Megohms	*Ohms* Resistance	*Body*	*Dot*	*End*
.....	150	.....	.....	.....
0.0005	500	Green	Brown	Black
0.002	1,000	Red	Brown	Black
0.0075	7,500	.....	.....	.....
0.008	8,000	Gray	Red	Black
0.01	10,000	Brown	Orange	Black
0.025	25,000	Red	Orange	Green
0.03	30,000	Orange	Orange	Black
0.05	50,000	Green	Orange	Black
0.1	100 000	Brown	Yellow	Black
0.25	250,000	Red	Yellow	Green
0.5	500,000	Green	Yellow	Black
1.0	1,000,000	Brown		Black

PHILCO'S 4-TUBE SUPERHETERODYNE



F = Filament SG = Screen Grid K = Cathode
P = Plate CG = Control Grid

Fig. 1—Tube Sockets, Under Side of Chassis

CAUTION: Never connect the chassis to the power supply unless the speaker is connected and all tubes are in place.

THE Philco Model 80 a-c receiver is a four-tube superheterodyne. The tubes are an autodyne oscillator, a detector, and output tube, and a B supply rectifier. That is reducing the number of tubes to the lowest possible for an a-c set.

How is it possible to build a superheterodyne with so few tubes? How are the sensitivity and selectivity obtained? How is it possible to suppress the image interference?

Selectivity is obtained by using highly selective circuits in both the radio frequency and the intermediate frequency levels. Sensitivity is obtained by using selective circuits, by regeneration in the intermediate level, and by using high gain tubes.

The 36 automobile tube is used as oscillator and mixer and the same type of tube is also used as second detector. The output tube is a 42, which is a high gain power tube in the automobile group of tubes. The autodyne circuit is typical of oscillator-detectors utilizing screen grid tubes. The radio frequency signal is impressed on the grid through a tuned circuit. The oscillating coil is in the plate circuit and acts as a tickler. The secondary of this coil is in the cathode circuit. There are three windings on the oscillator, the resonant circuit being inductively coupled to the plate winding.

TABLE 1—TUBE SOCKET DATA*—Power Line Voltage 115 Volts

Tube Type	Circuit	Filament Volts F to F	Plate Volts P to K	Screen Grid Volts SG to K	Control Grid Volts CG to K	Cathode Volts K to F
36	Det.—Osc.	6.3	245	165	6.4	8.4
36	2nd Det.	6.3	40	15	.4	0
42	Output	6.3	240	255	.4	0
80	Rectifier	5.0	340/Plate	...	...	...

*All of the above readings were taken from the under side of the chassis, using test prods and leads with a suitable A.C. voltmeter for filament voltages and a high resistance multi-range D.C. voltmeter for all other readings. Volume control at maximum and station selector turned to low frequency end. Readings taken with a radio set tester and plug-in adapter will not be satisfactory.

Table 2—Power Transformer Data

Terminals	A. C. Volts	Circuit	Color
1-2	105 to 125	Primary	White
3-5	6.3	Filament	Black
6-7	5.0	Filament of 80	Blue
8-10	630	Plates of 80	Yellow
4	...	Center Tap of 3-5	Black Yellow Tracer
9	...	Center Tap of 8-10	Yellow Green Tracer

Table 3—Resistor Data

Nos. on Figs. 2 and 3	Resistance Ohms	P'wr. (Watts)	Color Body	Color Tip	Color Dot
(36)	325	..	Wire	Wound	
(9)	9,000	1.	White	Black	Red
(6) (20)	10,000	.5	Brown	Black	Orange
(11)	16,000	5.	Brown	Blue	Orange
(22)	240,000	.5	Red	Yellow	Yellow
(26)	490,000	.5	Yellow	White	Yellow
(19)	1,000,000	.5	Brown	Black	Green
(15)	4,000,000	.5	Yellow	Black	Green

The Intermediate Circuit

The plate winding also forms a part of the first intermediate frequency circuit as does the series padding condenser in the oscillator. The padding adjustment and the tuning of the primary can be done independently because there is another adjustable condenser, outside the oscillator circuit but in the intermediate circuit. This condenser is marked (7) on the circuit diagram while the padding condenser is marked (12).

The only intermediate frequency transformer contains a primary and a tapped secondary. Only the larger portion of the tapped winding is tuned with a condenser (17). The smaller portion is used as a tickler and is connected in the plate circuit of the second detector. The amount of feedback is adjusted by means of a condenser (18), which is connected between the tickler coil and the plate. Most of the sensitivity of the receiver is obtained by adjusting the regeneration. The adjustment can be made almost to the point of oscillation and left that way, for the frequency is fixed and there will be

(*Continued on page* 16)

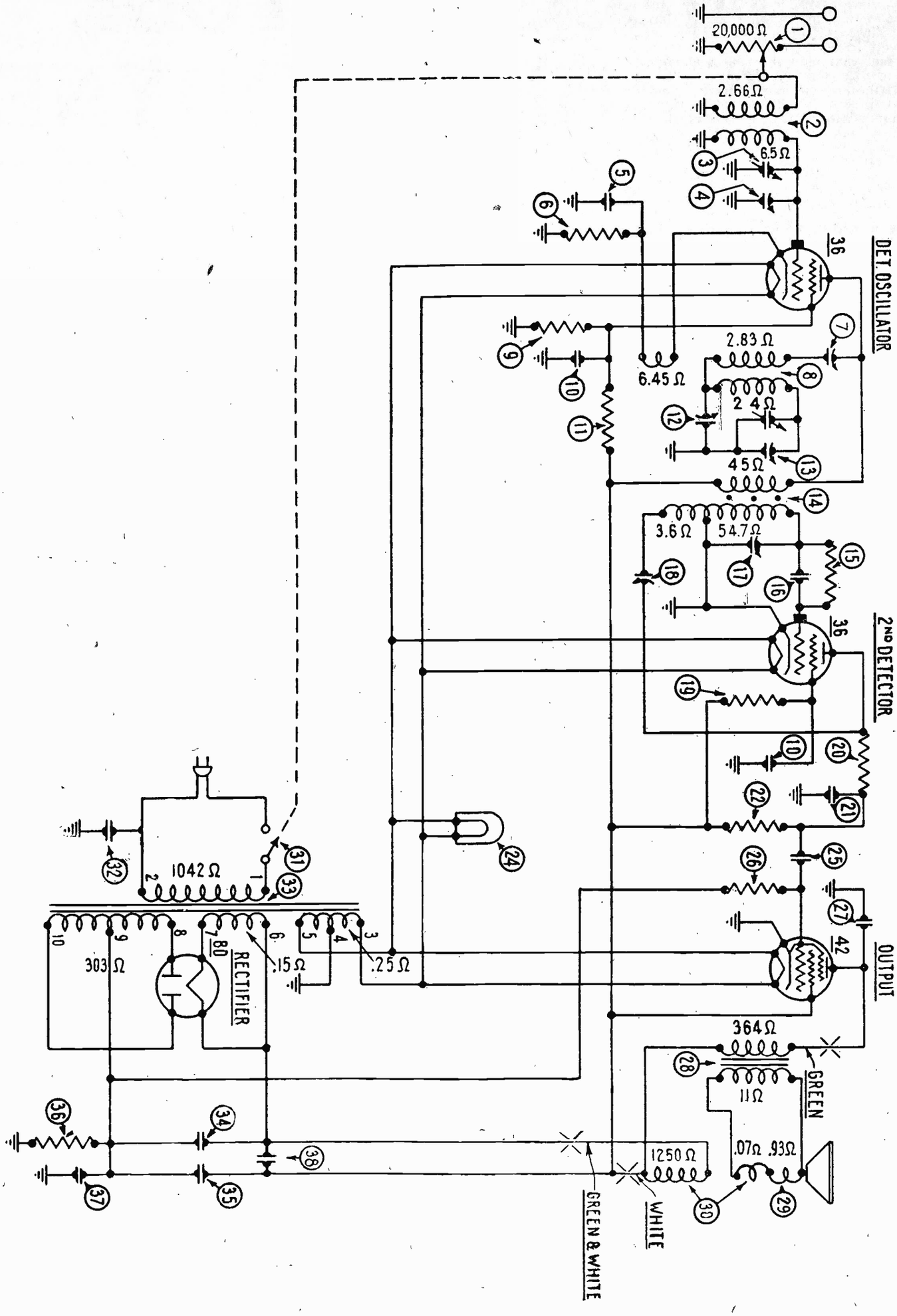


Fig. 2—Schematic Wiring Diagram

(*Continued from page* 14)

no variation in the feedback due to variation in frequency.

When regeneration was tried in the intermediate amplifier in the early days of the superheterodyne it was found that the circuit became too selective, so selective in fact that only the lowest audio notes came through. One reason for this was that the intermediate frequency was very low. In the present superheterodyne the intermediate frequency is 450 kc. With such a high frequency regeneration is just as successful as it is at the lower frequency end of the broadcast band. Of course, condenser (18) provides a means of adjusting the regeneration and hence of the selectivity.

Suppression of Image Interference

The use of an intermediate frequency of 450 kc also answers the question of image interference. Little selectivity is required in the radio frequency amplifier to suppress an interfering signal removed by 900 kc from the station desired. No trouble will be experienced from image interference, but there is one possibility of trouble and that is beating between a station carrier of about 900 kc and the second harmonic of the intermediate frequency. This would not prevent clear reception on 910 kc and on 890 kc because the beat frequency changes very rapidly and the heterodyne would be above audibility by the time either of these signals were tuned in exactly. The interference that might result on the 900 kc channel is prevented by preventing the harmonic from getting back to the mixer.

The heterodyning at three times the intermediate frequency, namely, 1,350 kc, is extremely weak because the third harmonic is weak. This subject of harmonic interference is mentioned only because it is a typical problem in superheterodyne design. The difficulty is likely to be much more severe in a receiver having many tubes than in a simple circuit like the one under discussion.

[*This is one of a series of weekly articles on commercial receivers, exponding the theory and practice, and giving the replacement information essential to service men.*—EDITOR.]

Adjusting Model 80

Facing the back of the chassis, the compensating condenser at the right with the micarta hex head nut should be adjusted for maximum sensitivity at the time of installation. This adjustment should be done in the following manner.

Place the radio in operation as described below, tuning to a station near the middle of the dial. Turn the adjusting screw clockwise with a screwdriver until a swishing sound is heard and until a squeal is heard when different stations are tuned in. Now turn the screw counter-clockwise until the swishing sound just ceases. Continue to turn in the same direction about one quarter of a revolution beyond this point. Tune to different stations over the dial, noting that the squeal is not present on any stations received. If such a noise is present at any section of the dial, the adjusting screw should be turned farther in a counter-clockwise direction until the noise stops. Should the type 36 tube under the metal shield ever be replaced, this adjustment should be repeated.

Under normal conditions, it will never be necessary to re-adjust any of the other compensating condensers. If for any reason such adjustment should be required, it should not be attempted without first receiving the proper instructions and equipment from your Philco distributor. The Philco Model 095 B oscillator has been especially designed for use in this work, and will be found the most inexpensive and the most reliable for the purpose.

Replacement Parts Model 80

No. on Figs. 2 and 3	Description	Part No.
(1)	Volume Control—Combined with On-Off Switch	7439
(2)	Antenna Transformer	05831
(3)	Tuning Condenser Assembly	05794
(4)	Compensating Condenser—Antenna—Part of Tuning Con. Assembly	
(5)	Condenser (710 Mmf.) White and Yellow	4520
(6)	Resistor (10,000 Ohms)	4412
(7)	Compensating Condenser—I. F. Primary	04000-A
(8)	Oscillator Coil	05832
(9)	Resistor (9,000 Ohms)	7501
(10)	Condenser (.09 Twin)	4989-B
(11)	Resistor (16,000 Ohms)	7500
(12)	Compensating Condenser—Low Frequency:	04000-S
(13)	Compensating Condenser—High Frequency—Part of Tuning Con. Assembly	
(14)	I.F. Transformer	05834
(15)	Resistor (4,000,000 Ohms) Mounted on I.F. Transformer	6010
(16)	Condenser (50 Mmf.) White—Mounted on I.F. Transformer	3774
(17)	Compensating Condenser—I.F. Secondary	04000-D
(18)	Compensating Condenser	04000
(19)	Resistor (1,000,000 Ohms)	4409*
(20)	Resistor (10,000 Ohms)	4412
(21)	Condenser (1,000 Mmf.) Green and White	5215
(22)	Resistor (240,000 Ohms)	4410
(24)	Pilot Light	6608
(25)	Condenser (.015 Mfd.)	3793-B
(26)	Resistor (490,000 Ohms)	4517*
(27)	Condenser (.006 Mfd.)	7625-B*
(28)	Output Transformer	2660
(29)	Voice Coil and Cone Assembly	02861
(30)	Speaker Field and Bucking Coil Assembled with Pot	02677*
(31)	On-Off Switch—Combined with Volume Control	7439
(32)	Condenser (.01 Mfd.)	3903-AH*
(33)	Power Transformer 50-60 Cycles	7421
	Power Transformer 25-40 Cycles	7422
	Power Transformer 50-60 Cycles, 230 Volts	7423
(34)	Electrolytic Condenser (8.0 Mfd.)	6707
(35)	Electrolytic Condenser (4.0 Mfd.)	7467
(36)	Resistor (325 Ohms) Wire Wound	7465*
(37)	Electrolytic Condenser—Dry—(10 Mfd.)	7440*
(38)	Condenser (.01 Mfd.)	3903-AJ*
	Bezel	7417
	Dial Complete	05828
	Tube Shield	7172
	Knob (Large)	03063
	Knob (Small)	03064
	Knob Spring	5262
	Grid Clip	4897
	Four Prong Socket Asembly	5026
	Five Prong Socket Assembly	4956
	Six Prong Socket Assembly	6417
	Chassis Mounting Screw	W-567
	Chassis Mounting Washer	W-315
	Rubber Washer	5189
	Pilot Lamp Shield	5760

*A number of circuit changes were made on chassis of run No. 5 and above. his run number is rubber stamped in a star on the back of the chassis. Referring to Figs. 2 and 3, the condenser (27) connects to the B- end of resistor (26) instead of to ground. The bucking coil—that section of (30) in series with the voice coil—is shorted out. The 10 mfd. dry electrolytic condenser (37) is eliminated, and replaced with a substitute .015 section combined with (32), part 3793R. The .01 mfd. condenser (38) is eliminated. The positions of (19) (26) and (36) are changed in the chassis from that shown in Fig. 3.

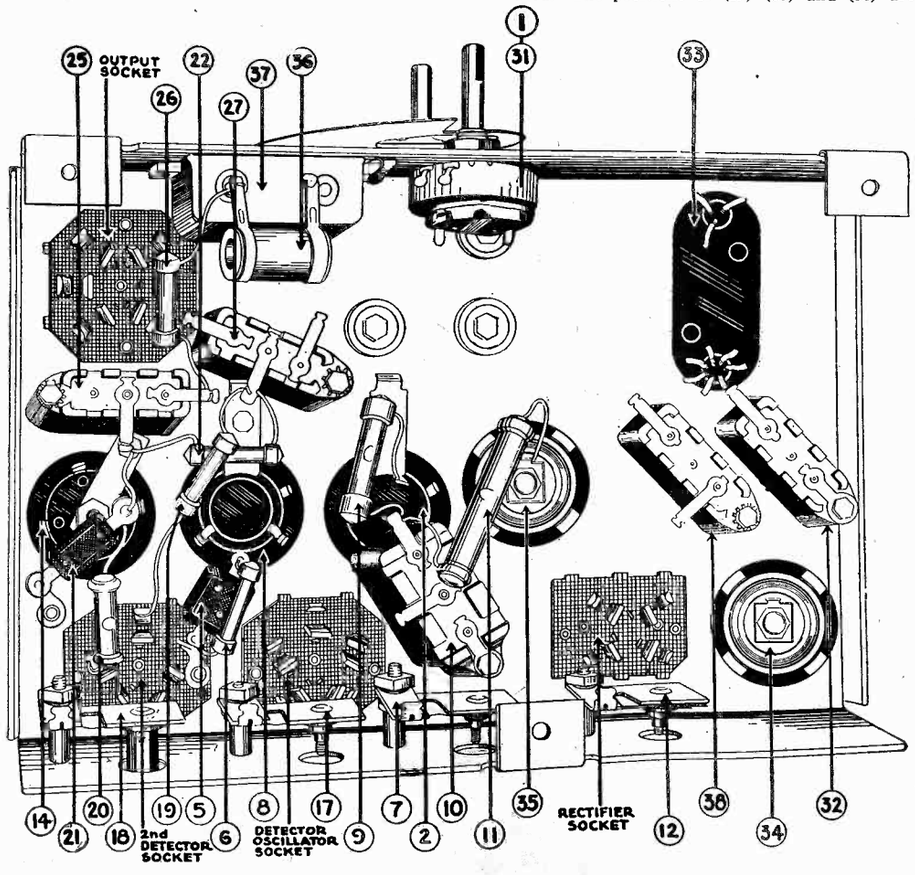


Fig. 3—Bottom View of Chassis, Showing Parts

Super for Tuning 10 kc Beside Local

SINCE I DESIRE utmost practical selectivity, to be able to tune out WOR and tune in WLW, although WOR is a local and WLW a DX station 10 kc removed, will you please recommend a good t-r-f circuit to do the trick? A friend of mine sings three times a week at WLW and I want to listen in then.——O. W. Q., Ramsay, N. J.

A t-r-f set can not be relied on for such service. While t-r-f may develop very high sensitivity, it does not cope with the superheterodyne in the tussel for selectivity, and therefore we suggest you build a super. A six-tube a-c super will do the trick, or if parallel or push-pull output tubes are used, a seven-tube super. We refer you to the diagram of the 597 receiver published in the November 12th issue. This is for a-c operation.

WEEKLY PHILOSOPHY

THAT FAMOUS CORNER has been turned—if we are to judge by the contracts recently signed up by the big broadcasting chains; also by the contracts that have been handed to a large number of high-salaried artists who have been tied down for another year by some of the most important program sponsors.

And can you imagine the increase in sponsored programs if, as and when there comes a change in M. Volstead's fairly well-known law! Ouch or hoopla—according to how you feel about it!

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.

Type of Tuning Condenser

FOR COVERING several frequency bands, for instance, broadcast channel and short waves, perhaps down to 15 meters, which type of tuning condenser is preferable, as to frequency change?—I. W. D., Warm Springs, Ga.

For wide wave coverage, such as you suggest, in reality there is little choice. For any single band, of course, the straight frequency line condenser will give you approximately equal dial separation for equal frequency differences. In the broadcast band (commercial receivers, etc.) the straight frequency line condenser is virtually never used. No matter what type of condenser is selected, after you have finished tuning the lowest band and go to the next highest one you will be using the high capacity settings for higher frequencies than the low capacity settings were used for in the previous band, so this tends to defeat the preference for any particular type. However, if the subject is viewed first from the band of shortest wavelengths, and one considers the crowding that a straight capacity line condenser would create at the higher frequency end of that band, then on that basis straight frequency line tuning would be much preferable, and even if the advantage is not so pronounced (because purely relative) in the lower frequency bands. Yet even in short-wave work straight frequency line condensers are the exception rather than the rule.

* * *

Supers with Few Tubes

IN THE CONSTRUCTION of superheterodynes using minimum number of tubes I note that the intermediate frequency is high, but still I do not see how the high intermediate frequency helps much, because the intermediate transformer is tuned to a frequency rather close to the lowest broadcast frequency.—I. L. W., Winnipeg, Manitoba, Can.

It is true that if the intermediate frequency is high, e.g., 450 kc or higher, it becomes rather close to the lowest broadcast frequency, regarding the subject of closeness in its larger aspects, and therefore the signal as t-r-f might get though, but you will note that when the minimum number of tubes is used that the second detector is regenerated, and therefore the selectivity at the intermediate frequency is far greater than that obtained with simply a stage of i-f without regeneration. In fact, some of these small supers have no tube serving the sole purpose of intermediate amplifier, but couple the first detector to the second. Regenerating the second detector atones for the absence of the intermediate tube, since in fact that is selective amplification at the intermediate level, albeit in the second detector. Some of the circuits using few tubes in supers are very ingenious, and the performance is pretty good.

* * *

Selectivity and the Diode Heater

IS IT a fact that receivers in which diode detectors are used are less selective than other receivers? If that is the case, why is it? What causs reduction in selectivity?—A. B., New York, N. Y.

Whether or not a diode causes a reduction in the selectivity depends on the damping on the tuned circuit by the diode. If the load resistance is low, considerable power is expended both in the diode and in the load resistance, and this power must come from the tuned circuit. That means more resistance in the tuned circuit and greater damping. The result is reduced selectivity and sensitivity. On the other hand, if the load resistance is high, little power is expended both in the diode and in the load resistance. Therefore little power is taken from the tuned circuit and the selectivity and sensitivity are good. If we isolate the tuned circuit by a very small condenser the selectivity is retained because little power can be taken from the tuned circuit. But this has a tendency to cut the sensitivity because only a small current can go through the small condenser. Some claim that diodes are too selective and that as a consequence the high audio notes are cut. This effect is probably due mostly to the use of too large a filter condenser across the load resistance of the diode.

* * *

Type Power Tube

CAN YOU TELL me where I might obtain heater type power output tubes such as were announced in last week's issue as forthcoming?—O. D.

The tube you refer to, as made by the general run of manufacturers, is the 59, which is detailed in the present issue, and which all the supply houses should now have in stock. Write to them as to the probable date on which they will be able to make deliveries.

* * *

Total Distributed Capacity

WILL YOU please give me some idea of the distributed capacities to be expected in a normal tuned circuit? Take the 56 tube, a solenoid, a 0.00035 mfd. condenser and the usual broadcast frequencies as your guide.—C. P., Bangor, Me.

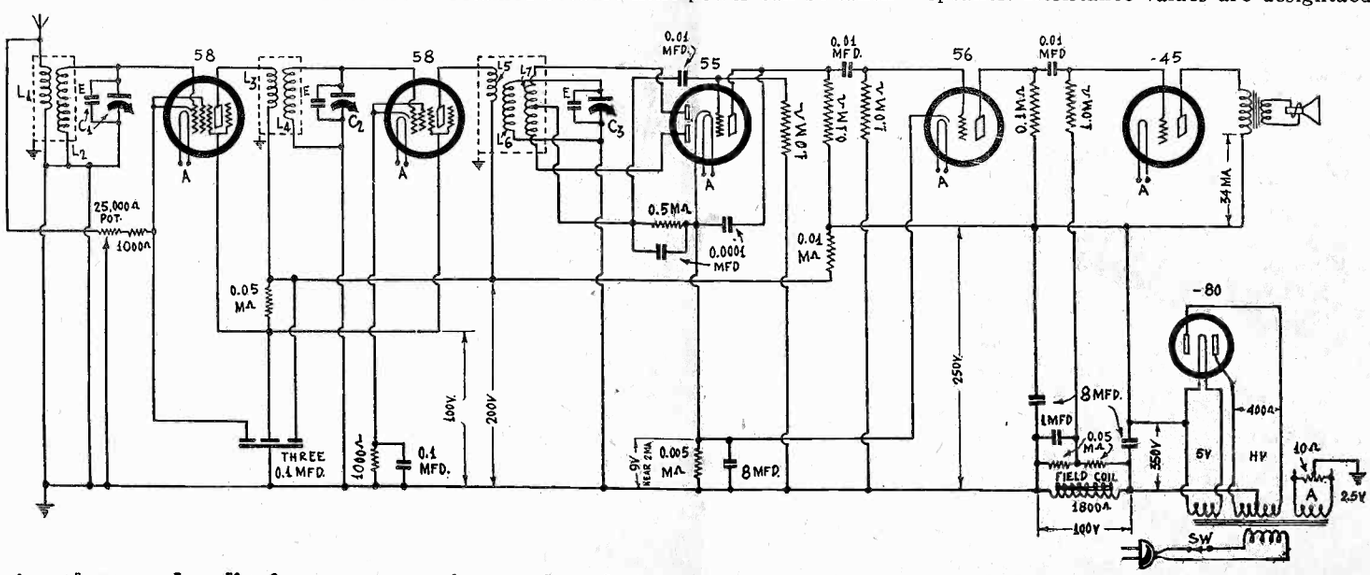
The total of these capacities, which may be grouped as the sum distributed capacity, normally will be between 40 and 50 mmfd. This seems rather high, at first glance, but the tuning condenser may have 25 mmfd. minimum, the tube (grid to cathode) 5 more, and the coil 3 more, the rest being accounted for by the capacity effects due to coupling (as where primary is over secondary), wiring, shields, etc.

* * *

T-R-F Set with '45 Output

IS IT all right to have one resistance-coupled audio stage in a t-r-f set, a-c operated, for '45 output tube? This is my favorite output tube. Please show a circuit,—E. D. W., Frankfort, Ky.

No. Even a total of two stages audio would not be quite enough. We show a circuit with three audio stages, and this produces abundant volume, with the splendid quality of which the triode output tubes are capable. Two r-f stages, a 55 full-wave detector, and three audio stages are diagrammed. The B supply choke is in the negative leg of the rectifier circuit as is in fact the field coil of a dynamic speaker. Resistance values are designtaed.



A six-tube tuned radio frequency receiver, using three stages of resistance-coupled audio. The first audio tube is the triode unit of the 55, the second is the 56 and the last one is the '45 power tube. That much audio is needed to drive the '45.

PADDING A TRAP

Close Adherence in Image Frequency Reduction

By J. E. Anderson

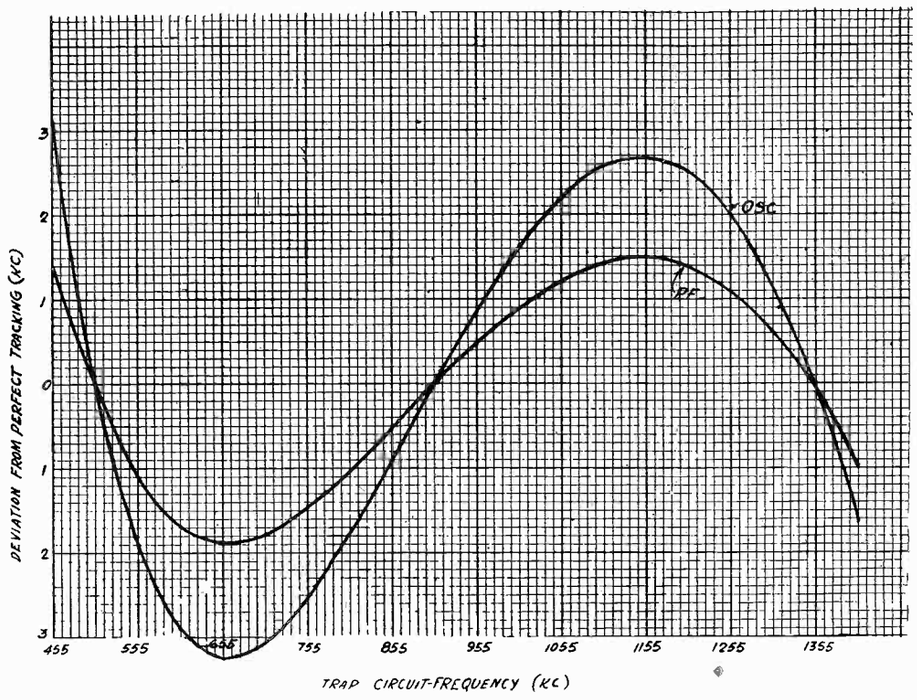


FIG. 1

Two tracking curves, one of the r-f under and the other of the oscillator, showing how these circuits will track with the trap circuit. The r-f tunes to the signal, the trap to the image-causing frequency and the oscillator to the higher oscillator frequency.

LAST week we suggested the possibility of eliminating image interference in a superheterodyne by constructing a trap circuit tuned to the frequency that would cause this interference and to track it with the oscillator and radio frequency circuits. It was suggested that this could be done by padding the radio frequency and the oscillator circuits so that the first would always be f kilocycles higher than the trap circuit and so that the oscillator would always be 2f kilocycles higher. If this were done the same type of circuit could be used for both the radio frequency and the oscillator circuits and the padding theory previously given would apply.

Amount of Detuning

Theoretical padding has since been worked out on the basis of an intermediate frequency of 95 kilocycles, covering the usual broadcast band. The resulting tracking curves are reproduced in Fig. 1. The frequencies along the axis of abscissas are the natural frequencies of the trap circuit and the frequencies along the axis of ordinates give the number of kilocycles deviation from perfect tracking. In respect to the radio frequency curve the zero line represents 95 kilocycles and in respect to the oscillator curve it represents 190 kilocycles. The three tie-down frequencies are 655, 905, and 1,355 kc, which correspond with the three radio frequencies 600, 1,000, and 1,450 kc. The maximum deviation on the radio frequency curve is less than 2 per cent. and the maximum deviation on the oscillator curve is approximately 1.7 per cent. These percentages are a little higher than those obtained for simple padding in the regular superheterodyne, which accuracy was usually of the order of one per cent.

The amount of detuning is really determined by the intermediate frequency selector and by the oscillator. That is, it will be the radio frequency circuit and the trap that will be off resonance by the amount indicated by the curves. As an example of detuning let us take the case at the low frequency end. We start with a trap circuit natural frequency of 455 kc. The oscillator frequency corresponding to this is 648.1 kc. The signal frequency that will be brought in will be 95 kc. less than this, or 553.1 kc. But the radio frequency tracking curve shows that the natural frequency of r-f circuit is 551.38 kc. Hence the r-f circuit is 1.72 kc. off tune. The image-causing frequency will be the oscillator frequency less 190 kc., or 458.1 kc. But the trap circuit is tuned to 455 kc. Hence the trap circuit will be off tune by 3.1 kc.

It will be noted that the deviation of the trap circuit is obtained directly from the oscillator tracking curve and that that of the r-f circuit is obtained from the difference between the two curves, provided that the readings are taken along the ordinates corresponding to the trap circuit frequencies.

Why Low I-F

Why was such a low intermediate frequency used in computing the tracking curves? In every superheterodyne there are conflicting factors, some calling for the use of a low intermediate frequency and others for a high one. The main factor that calls for a high intermediate frequency is image interference. The higher the intermediate frequency the easier it becomes to eliminate the interference. The main factor that calls for a low intermediate frequency is harmonic interference, that is, heterodyning between harmonics of the intermediate frequency and the signal frequency. The lower the intermediate frequency the less this trouble will be because only the higher harmonics can fall in the tuning range, and the higher harmonics are made weak. Not only are they weak but they change with great rapidity so that any whistle that is heard can be made higher than the highest audible note without detuning the receiver by an appreciable amount. Suppose, for example, that intermediate frequency is 95 kc. and that we wish to receive 970 kc., which is the sixth harmonic of the intermediate frequency. The oscillator is set at 665 kc. to bring in the 570 kc. signal. But the sixth harmonic of the 95 kc. may be strong enough to beat audibly with the 570 kc. signal. If then we change the oscillator setting by 2,000 cycles the heterodyne is made higher than 12,000 cycles. A change of 2,000 cycles in the oscillator does not detune the circuit appreciably unless the intermediate frequency selector is excessively sharp.

The low intermediate frequency, therefore, was used because the trap circuit eliminated image interference and the low frequency itself minimized harmonic heterodynes. There is another advantage in using a low intermediate frequency, when we do not have to use a high one, and that is greater stability.

Problem of Construction

The tracking curves in Fig. 1 are computed. It may not be possible to get as close tracking in an actual case because of reactances introduced into the various tuned circuits by coupling. But it is quite possible to make the trap circuit track sufficiently well to suppress the image-causing frequency.

The trap circuit may be a series-resonant shunt across the line somewhere, but it should be placed where it will not short the line when it is not supposed to act as a short. It may also be a rejector circuit in which a parallel-resonant circuit is put in series with the line. This may be done by connecting a small winding in series with the line and then coupling this to the trap circuit. This inductively coupled rejector circuit was shown on page 15, Dec. 3d issue. The three tuned circuits involved in the padding in Fig. 1 are also shown there.

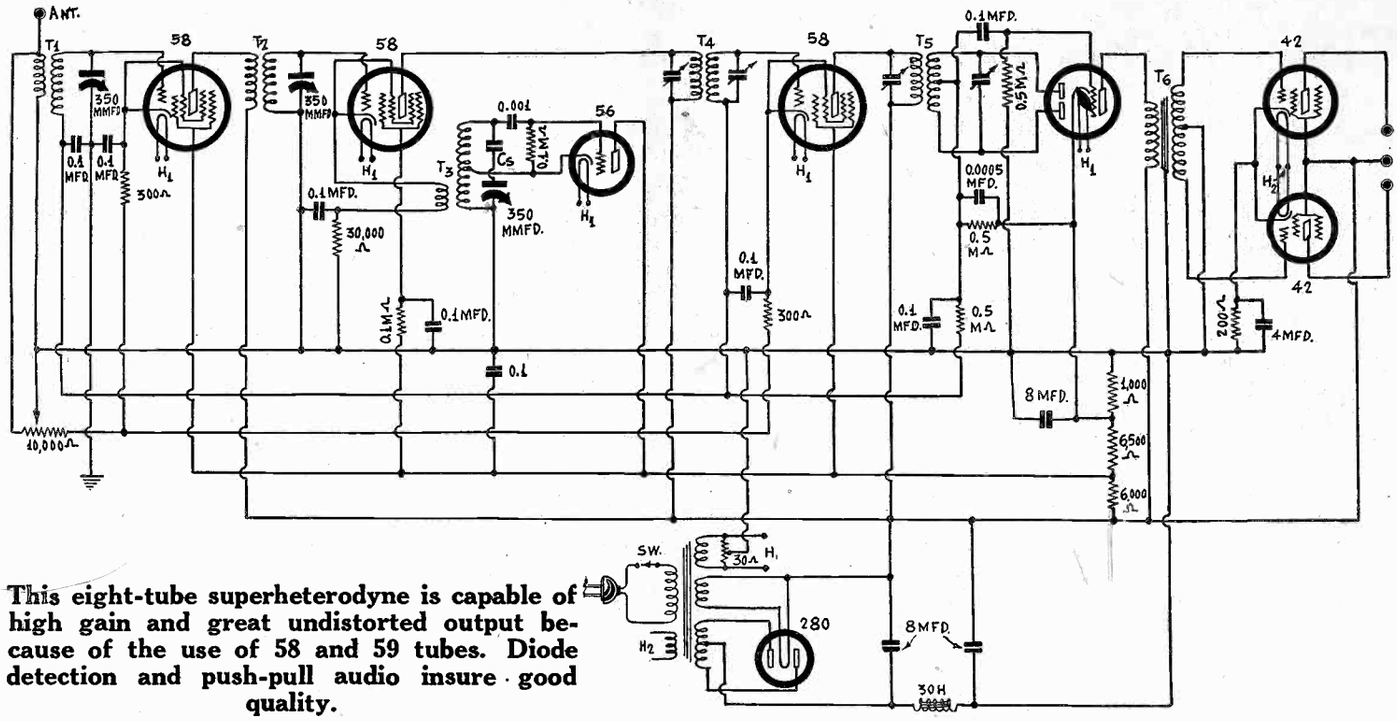
Computed Values

The values used in computing the curves in Fig. 1 were as follows: $F_o = 505$ kc., $F_1 = 905$ kc., $F_2 = 1{,}355$ kc., $f = 95$ kc. for r-f, and $2f = 190$ kc for oscillator. The r-f padding values were $C_m = 0.0076C_o$, $C_s = 4.6988C_o$, $L = 0.8538L_o$. In both sets L_o is the inductance in the trap circuit and C_o is the capacity in that circuit at F_o. The curves were computed without making any assumptions regarding the value of either L_o or C_o, but they are such that they resonate at 505 kc.

The ratio of L_o and C_o will depend on the frequency range to be covered. If we are to cover the broadcast band with the receiver, the trap circuit should cover the range 455 to 1,405 kc. That is a ratio of 3.09. The ratio of the extreme frequencies

(*Continued on next page*)

"LATEST WRINKLE" SUPER



This eight-tube superheterodyne is capable of high gain and great undistorted output because of the use of 58 and 59 tubes. Diode detection and push-pull audio insure good quality.

This eight-tube superheterodyne contains all the latest wrinkles except noise suppression control. It incorporates 58 tubes for radio frequency amplification, mixing, and intermediate amplification. It has automatic volume control, full wave diode detection, push-pull output, and manual volume control. The output tubes are marked 42, but they are of the cathode type, like the 59. In fact the output tubes are 59's with an earlier code number. If seven-contact sockets are used for them the 59's may be used without making any changes in the design.

The oscillator is of the simple Hartley type, which is one of the most dependable as one of the simplest oscillators. The cathodes of the controlled tubes now return to ground, through the center of the manual volume control potentiometer, but it is advisable to make this return to the cathode of the 55, which is connected about 20 volts above ground on the potentiometer. The set is in the 75-watt class.

(*Continued from preceding page*)

in the broadcast band is only 2.73. Since ordinary radio frequency tuners just barely cover the broadcast band it is not likely that they will cover the trap circuit band as well. It becomes necessary to use larger tuning condensers. One three-gang condenser has a maximum capacity of 440 kc, counting a small adjustable minimum. With this condenser L_o would have to be 278 microhenries. The r-f inductance then becomes 237 microhenries and the oscillator inductance 206.8 microhenries.

The value of C_o becomes 356.5 mmfd. The C_m for the r-f circuit becomes 2.7 mmfd. and C_m for the oscillator 5.06 mmfd. The values of C_s become 1,675 mmfd. for the r-f circuit and 846 for the oscillator.

Suppression of Image

Suppose the r-f circuit has selectivity of 75, which is not an excessive value to assume. The image-causing frequency will first be suppressed by this tuner by an amount depending on the frequency ratio. Let the radio frequency desired be 550 kc. The oscillator will be set at 645 kc. But this oscillator frequency will also bring in 740 kc, if this can get through. The r-f tuner must then suppress 740 kc and accept 550 kc. The relative suppression of voltages will be 0.02 with the selectivity assumed. That is, if the resonant voltage is one volt at 550 kc it will be about 0.02 volt at 740 kc.

Now if we have a trap resonant at 740 kc and if that suppresses the 740 kc signal by the same ratio the final relative value will be 0.0004. Due to the facts that we cannot use very close coupling between the trap and the rest of the circuit and that there will be a certain lack of tracking, the relative suppression will undoubtedly be less, but there is much to spare. Whether such an arrangement will work out satisfactorily remains to be determined by trial. A circuit of this type will be set up for the test.

Boy's Remote Control Operates Model Ship

(*Continued from page 9*)

The photograph shows German schoolboy named Rudolph Weber using a short-wave apparatus with which he controls a model boat. He has constructed all the devices himself, including the model boat and the radio transmitter. In front of him on the table are the various control devices. At the right are various meters showing him that the transmitter is working properly. Just what the radio receiver is doing in the picture is not explained.

The boy who has constructed the devices and who is a strong competitor of Mr. Hammond is still in the primary grades in the school of Drossen in Neumark, Germany.

Different Sequences

We referred to the possibility of using different sequences on the same radio wave for performing different functions. One example, the teletyper, we also mentioned. While this is ordinarily operated on wire lines it is just as applicable to radio. Another type of sequence is used on automatic telephones. It is also possible to use different audio modulations on one wave, one audio frequency performing one function, another another function, and so on. By audio selective devices at the receiving end it would be possible to employ perhaps a 100 different frequencies to perform as many functions, in succession and even simultaneously. This has also been applied to remote control devices. We recall the mechanical robot, or mechanical dog, that responded to the master's and performed different functions according to the tone whistled. This was used on an electrical power system between the power house and the office. Every time the office manager whistle the robot would perform a certain task at the power house and report back.

Remote Control in Aviation

Another type of remote control is used in aviation. When a flyer is about to land at night on a dark field, he sends a beam of light, or a certain tone, or a certain radio wave, and the landing lights on the field are turned on. This makes unnecessary the burning of the lights all the time and saves the attendance of a man on the field.

Remote controls using radio waves have also been applied to aerial and marine torpedoes. The use of remote control on them is an obvious advantage. It is not necessary to aim right at the first since the course can be altered at will, as long as the man at the control can see the moving torpedo, or by some other means know where it is. Moreover, if it misses the mark the first time it can be brought back for another trial. And it is not necessary to waste any of the costly projectiles.

A THOUGHT FOR THE WEEK

THE diode detector was one of the first ones used, and in fact the first tube detector. It was more sensitive than its predecessors but less sensitive than its triode successors. So diode with triode amplifier tube in the same envelope came into existence. After preliminary trials it is established that the diode is the best quality detector, and as a result it is expected that virtually all tube receivers finally will use the diode, unless or until such a device emerges as the "monode," whatever that might be.

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.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. B. Anderson, technical editor; J. Murray Barron, advertising manager.

THE CONSENT DECREE

WHEN the time came to inform the stockholders of the terms of the consent decree entered in the Federal Court for the disintegration of ownership of Radio Corporation of America, naturally the president, David Sarnoff, sought to put as good a complexion on the situation as possible, but he had no difficulty. While the Federal Government sought to sever the interlocking ownership ties that bound RCA to Westinghouse Electric & Manufacturing Company and to General Electric Company, and obliterate the exclusive cross-licensing agreements, aims to which RCA scarcely could offer a gushing welcome, nevertheless RCA's good will and financial condition are improved by the terms of the contracts incidental to the decrees, and moreover its own scope of possible activity is enlarged.

Since the formation of RCA, beginning with the days of the Marconi Wireless Company, there has been a gradual consolidation of radio interests, a mutuality of ownership, and finally what the Government was persuaded to regard as a monopoly in restraint of the United States anti-trust laws. While any violation of law is denied by the defendants, and the decree is specifically clear about the reservation of any such admission, nevertheless radio in nearly all its branches was generally regarded by the public as being obviously bottled up in the combination of interests. The spectre of the octopus was too gigantic in the public mind to be rubbed out by mere words attesting to its legality. The close combination was a fact, whether legal or illegal.

One would expect, since RCA was the chief defendant, that it might emerge from the fray somewhat damaged in repute and purse, but in fact RCA's position is morally stronger for the severance of intimate relationships with the two large electrical companies and the cancellation of the exclusive cross-licensing agreements. The coincidental contracts improve its position financially. It is impossible to see any financial penalty to RCA in the generosity with which Westinghouse and General Electric have treated it in respect to the floating debt owed by RCA to these two concerns. As a side issue the RCA Building was purchased by General Electric at book value, $4,745,000, while $4,255,000 in ten-year debentures were issued by RCA to the two companies, these transactions cancelling the $17,938,733 debt to the two of them, the difference, $8,938,-733 being discharged in consideration of the new agreements.

Since RCA is to move into Radio City ultimately, it will have no need for the beautiful office building it recently erected, and it is a treat under such circumstances to have a creditor take over an asset at book value in a depressed market, and join with a co-creditor in virtually writing off a difference of nearly $9,-000,000. Then, too, RCA was under heavy commitments for leases in Radio City, or Rockefeller Center, as it is now more commonly called, and since the requirements will be much less than previously anticipated, RCA pays some $5,000,000 to Rockefeller Center for the privilege of withdrawing from the excess of the lease commitments over requirements based on existing conditions. This amount is funded, in that Class A preferred stock is issued to Radio City, 100,000 shares at $50 par value. Mr. Sarnoff in his letter to the stockholders says the value of the modification of the lease is fully commensurate with value of the stock issued.

Since the terms of the consent decree require that General Electric and Westinghouse dispose of half of their stock holdings in RCA in three months, the shares will be ratably distributed to the stockholders of these companies, and within three years the divestment is to be completed. On what terms the distribution will be made has not been stated, but as to the one-half required in the three-month period it seems reasonable that the RCA stock will go to the stockholders of the two companies as a gift, which would strike some consoling balance with the $9,000,000 write-off.

Instead of being devastating, therefore, the decree and its concomitant contracts rather offer high encouragement both in public confidence in RCA and in the prospects of improved operations. Financially RCA is having about the same tough sledding as nearly all other concerns, large or small, as its consolidated statement of income and surplus for the ten months ended October 31st clearly shows. Effect is given to the changes embodied in the decree, showing an operating loss of $662,-699.66, to which is to be added $343,019.24, dividends paid on Class A preferred stock, making the total deficit $1,005,688.90. The surplus at the beginning of the year was $11,327,789.90, leaving a surplus of $10,-322,100.17. Total gross income, all sources, for the period was $56,225,293.

Besides the not unfavorable financial result to RCA consequent on the signing of the decree there is the further assurance of the corporation's continued stabilizing effect on the radio industry by virtue of its retained authority to license set, power amplifier and tube manufacturers. This authority is actually extended, in that RCA may now license also for purposes formerly reserved by General Electric and Westinghouse, and in some cases American Telephone & Telegraph Company, exclusively to themselves. These purposes include photo-electric cell uses, transmitting tubes and transmitters, oscillators and other patent-covered fields, not to mention inventions not yet even conceived.

A VALUABLE WORK

Every one interested in radio technique owes a debt of gratitude to Edward M. Shiepe, engineer, graduate of the Massachusetts Institute of Technology, for his valuable contribution to the practical literature of the science in formulating his inductance charts. So far as we know there had never been any previous charting of the popular wire sizes for popular diameters of tubing in the construction of solenoids, so that, knowing the frequency and capacity, one could turn to a chart to ascertain the inductance and to another chart concerning the wire size intended to be used, and find out just how many turns were required.

The calculation of inductance is sometimes a little long in the solving, because of the trial-and-error procedure necessitated. Having spent some 400 hours in his task, Mr. Shiepe has found the exact inductance and communicated his values to precisely executed curves.

Since the actual inductance required can never be so quickly obtained as from a curve, Mr. Shiepe has plotted frequency, inductance and capacity on one graph sheet, so obtain the inductance from the chart at a glance, and then from table of number of turns for the particular size wire obtain the number of turns for all the prevalent diameters. The whole process is quickly and accurately consummated.

Therefore, besides the general chart relating inductance, capacity and frequency, there is a separate chart for each wire size (of given types of insulation), so that the desired inductance is consulted in reference to the unknown, or number of turns to wind. Everyone who experiments with radio or is engaged in factory endeavors will find Mr. Shiepe's authentic work the gift of a meticulous and assiduous engineer to a vast group that has a natural fondness for precision shortcuts.

A MEASURE OF SAMENESS

Those interested in the purchase or sale of radio merchandise are undergoing somewhat the same experiences during a depression as during the boom. Merchandise is as hard to get now as it was then, although the reason is different. Then the demand was so great that to cope with it required equipment and facilities beyond any reasonable expectation. Now the demand is so small that manufacturers of parts are not only avoiding carrying stock, but must delay the filling of anything like substantial orders until they can get the raw material, which may take weeks. The result is that many manufacturers are far behind orders, mail order houses and others commonly experience a wait of a month or more, between order and receipt of merchandise, and this condition is reflected back on the public, that wonders why the retail outlet has not a constant supply of what it generally offers for sale.

Nevertheless we need not be persuaded to the false conclusion that a boom and a depression are one and the same thing. We know they are painfully different. We also know what causes a depression, but we are trying to find out what is necessary to cure one. The political economists and the leading industrialists do not know the solution. Maybe some clerk in a retail radio store could show the way.

Intermediate Frequency Choice

In designing a short-wave superheterodyne the question arises what intermediate frequency may be used.

If the broadcast band is excluded it is permissible to go up as high as 1,200 kc, for this is not too close to 1,500 kc, the short wave limit. And a frequency as high as that can be used for signal frequencies up to 30,000 kc without difficulty. In case the receiver is to be used for very high frequencies only, say above 5,000 kc, it would be desirable to use a frequency as high as 3,000 or 4,000 kc, for this would make the tuner less critical and it would separate the natural frequencies of the radio and the oscillator tuners so that the chance of their acting as one would be minimized.

STATION SPARKS

By Alice Remsen

The White Witch

FOR "MOON RIVER"

(WLW, at midnight)

A white witch is dancing on the water,
A witch with silver arms;
Spray is dripping from her moon-drenched fingers.
O white witch, cast your spell upon me!
Bewilder my senses with your beauty
Before the dawn breaks my enchantment!
Kiss me, O white witch!
Shower me with silver diamonds from your hair.
Lead me up the shimmering pathway
That burnishes the water.
Lend wings to my feet—
That I may catch the fringe of your ecstasy
Before it passes beyond my reach.

—A. R.

* * *

If you listen in to the delightful "Moon River" program, you too will be filled with ecstasy, and will visualize the moon witch rising from the trembling water enveloped in a silvery mist. . . . A really gorgeous program. Listen to it. You'll like Arthur Ainsworth's voice.

* * *

The Radio Rialto

My second week in Cincinnati is almost over and I'm sort of getting used to it. . . At first, I must confess I was homesick for the old rialto and my dear friends, and I was worried about getting news to you, but I've figured it out this way: of course, you'll be interested in what's going on around here in the Middle West, because it'll be new stamping ground for some of you, and if you know this part of the country it will bring back memories—and, what's more, I am receiving news from the old rialto right along; my old pals see to that, and after all, time and space mean nothing to radio. . . .

Billie Dauscha arrived in these here parts a few days ago. . . Of course, you remember Billie. . . she has been on many of your favorite radio programs; just lately on WJZ with Andy Sannella, and Hearst's station, WINS. . . Billie came by plane. . . took only seven hours to get here via American Airways; we were out to the airport yesterday taking pictures, and those planes are marvelous things, compact, clean-cut. . . I've always been scared of 'em. . . Ed Wynn is here this week; he is broadcasting from the theatre, selling tickets for it and giving the surplus to the unemployed; he's on the air from WSAI at exactly the same time as I am on WLW, so I might rate him as opposition. . . Don Voorhees and Graham McNamee came in from New York to be present at the broadcast on Tuesday. . . Winn opened to capacity and will probably do good business at the Shubert this week as he is well liked in this city. . . My old sidekick from NBC, Earl Oxford, is with him. . . Earl and I worked together on "Matinee Gems," over WJZ three years ago. . . .

The Mooney Brothers, known as "The Sunshine Boys," are doing nicely on WLW. . . There's one little lady here who is just as sweet as honey, and that's Grace Clauve Raine. . . She's no bigger than a pint o' cider, with tiny little feet and hands, but those hands can play piano just the same, and direct vocal quartettes and choruses. . . Listened to her rehearse "Pinafore" the other evening and must say that she has a real flair for Gilbert and Sullivan. Her musical stock company are like well-trained soldiers and really surprised me at the way they read G. & S.'s tricky score. . . There's a clever boy here named Don Becker, a Kentucky lad, just a youngster. . . He writes a series of spooky radio programs called "Tales of Terror"—and if you like your hair to stand up straight, your blood to curdle and your skin to be covered with goose pimples—just listen in to Don's program, Monday and Tuesday evenings at 10:30. . . My radio's on, and Frances Ingram is conducting her "Thru the Looking Glass" program over WABC. . . I recognize the character of Marian the chatty lassie. . . it's the talkative Marcella Shields. . . her voice sounds like home. . . .

We are very ritzy here at the Netherland Plaza Hotel. . . Graham McNamee, Don Voorhees, and Ben Larsen, NBC control engineer, paid us a flying visit; didn't stay long. . . took charge of Ed Wynn's broadcast and then departed for New York by plane. . . This flying business is getting to be quite the thing. . . Gus Arnheim is leaving the Netherlands Plaza for his old stamping ground out among the sunshine and flowers of California. . . Jan Garber and his band will follow Gus in here. . . Henry Theis is moving his band from the Hotel Gibson in Cincinnati to the Club Oriole in Detroit; of course, Carl Grayson, his singer, goes with him. . . Met up with two good music boys here—Billy White of Feist's (no relation to Johnny of the same firm, but ust as good a fellow), Mr. Schwartz of Witmark, and Kern Aylward of Berlin's. . . had lunch with them yesterday. . . Abe Farb of Miller's also came up to the studio; he's a nice little fellow. . . And who do you think is coming in to take Theis's place at the Gibson—none other than our old pal, Larry Funk. . . you surely remember him and his Band of a Thousand Melodies, Tea Timers and other titles over WJZ. . . Larry and I are old friends and worked together over NBC. . . it will be mighty good to see the boy again and reminisce over old times. . . .

A piece of news seeps through the ether from NBC. . . Carveth Wells is back from his exploration trip and will be back on the air with his weekly broadcasts for the Continental Oil Company over an NBC network . . look for this in your local program announcements . . . it's well worth while. . . Do you know that Edith Meiser is an actress and played parts in "Fata Morgana," "The Guardsman" and "The Chief Thing" before she went into the business of writing radio scripts? . . and that Ford Bond used to be a singer before he became an announcer? . . He made his debut over Station WHAS in Louisville, Kentucky, his home town. He also sang tenor solos on the same program. . . This happened in 1922 and in 1929 he joined the announcerial staff of NBC and has remained with them ever since. . . I'll tell you a little secret about Ford; he writes short stories and reads them to his friends on the slightest provocation . . . but you don't mind it, the stories are not bad and his voice is so soothing and mellow—like a Southern 'cello. . . Donald Novis, that sweet singer of NBC, comes naturally by his music . . . his mother was Charlotte Lorris, a well-known concert pianist of Pasadena, Cal.; his father was the late Frederick Novis, a church soloist and concert singer; his brother Edward studied voice abroad, and his sister Mary is also a concert singer. . . The only unmusical member of the family is Don's brother Harold, who is a physical education instructor in California . . . Have you heard Irving Bibo's latest song, "I Was Taken by Storm"? . . . very good dramatic ballad; you'll be hearing it plenty over the ether. . . Dear Gene Brown and Bissell Brooke of Baltimore, I have not forgotten you—but hardly have a moment to spare; I'll surprise you one of these days with a nice fat letter. . . One thing I can tell you about WLW, Cincinnati. . . I've landed among the best bunch of people I've met in some time. . . their morale is marvelous . . . just like one big happy family . . . and they are all so obliging, the artists, musicians, directors, secretaries, executives—even the telephone operators and elevator boys just can't do enough to make one feel at home. . . .

Goodness gracious! must get some CBS news in for you—well, here's what I've heard: Morton Downey has re-signed with Columbia. . . Kate Smith is in Hollywood. . . "Marge" puts in all day Sundays riding horseback on Chicago bridle paths. . . Two of the Mills Brothers had their tonsils removed recently. . . Vaughn de Leath is still playing vaudeville. . . Elsie Hitz collects buttons. . . Whispering Jack Smith lets his mother select all his clothes. . . Ozzie Nelson and "Scrappy" Lambert attended Rutgers University. . . David Percy is Columbia's "Wandering Boy". . . Augustus Barratt writes the scripts of "The Magic Voice"; Elsie Hitz plays it. . . .

Well, perhaps I haven't done so badly in the matter of news for an out-of-towner—have I? But must get along to rehearsal so with a yearning glance backward toward New York I'll say so long until next week.

* * *

Biographical Brevities

ABOUT BILLIE DAUSCHA

Billie was born in the heart of the city of New York. . . her family has been residing there for the last there generations her great-grandfather coming from Prague, Bohemia, in the early eighties. . . Billie went to Public School No. 6 at 85th St. and Madison Avenue and graduated from Evander Childs High School not so very long ago. . . She was always stage struck, and when the opportunity came to join Morris Gest's production, "Afgar," as a show girl in 1920, she took advantage of it. . . She was known as the youngest show girl on Broadway. . . After that came vaudeville and night clubs . . but Billie got tired of that, and when Walter Neff of WOR heard her and decided that she was good material for radio—well, Billie decided so too. . . that was four years ago and she's been on radio ever since. . . Over WOR she was with "Tuneful Tales," "Checker Cabbies," "Playhouse" and "Tea Timers". . . she then graduated to the chains and appeared on La Palina, True Story, Blue Coal and Detective Stories with The Shadow. . . Billie was usually cast as a tough girl, a character she plays very well. . . on WJZ she appeared on the Rinso program and more recently with Andy Sanella and his orchestra on a very excellent sustaining program. . . Billie is tall and stately, very handsome, with dark brown eyes and long hair . . . has a charming contralto voice and a very jolly personality. . . She is now a featured member of the vocal staff of WLW in Cincinnati, where so many radio stars have been made. . . Listen to her Monday nights at 8:30.

WORTH THINKING OVER

A STATION ANNOUNCES that it will offer "a pantomime feature" over the air in the near future—and it doesn't say a word about television.

It's a good trick—if it can be done!

Tritle Is Elected Head of N.E.M.A.

J. S. Tritle, vice-president and general manager of the Westinghouse Electric & Manufacturing Company, was elected president of the National Electrical Manufacturers' Association, to succeed John H. Trumbull, former Governor of Connecticut, at the recent annual meeting of the organization.

N.E.M.A. was organized to coordinate and unify the activities of the various branches of the electrical manufacturing industry.

Leaving Yale at the inception of the business depression of 1893 Mr. Tritle cast his lot with the electrical industry. Later Mr. Tritle entered the electrical contracting field and in 1903 went to work for the Louisiana Purchase Exposition Company as chief of all construction for the St. Louis World's Fair. Immediately thereafter he joined the Westinghouse Company, becoming manager of the Kansas City office. When the Kansas City and St. Louis offices of the Company were combined he was made manager of the extended territory. His success in this field brought him to headquarters on executive activities—his capacity for which finally placed him as general manager in charge of all operations.

NOVELTIES MOVE

The trade reports novelties moving fairly well. A small a-c, d-c combination set in a moulded Bakelite cabinet, a set in a folding "bar" and another under a bridge table are included.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.*

J. S. Michie, 3597 Jeanne Mance, Montreal, Canada
Wayland P. James, 331 Stonemille Rd., Dayton, Ohio
Russel Pilch, 1032 N. 20th St., Milwaukee, Wisc.
William Carley, 229 No. 2nd St., Nashville, Tenn.
O. R. Cedziwoda, Box 356, Tyler, Texas.
L. F. Henry, P. O. Box 1846, Manila, P. I.
Universal Radio Co., M. K. Tang, Mgr., 28, Des Voeux Road, Central, Hong Kong, China.
H. Liston, 524 E. 2nd St., Salt Lake City, Utah
Flynt C. Hobgood, Marion, Miss.
F. C. Hartwick, F. C. Hartwick Co., 2046 Market St., San Francisco, Calif.
Edward Richter, Jr., 94 W. 10th St., Ashland, Ohio
Hyde Gowan, Box 502, Studio City, N. Hollywood, Calif.
Bert E. Thompson, Box 70, R. 1, Bladen, Ohio
M. C. Burr, 1121 E. 38th St., Savannah, Georgia
Ed. Heise, 6119 Giddings Ave., Chicago, Ill.
A. O. McIntyre, Good Pine, La.
Harold J. Sheerer, 8 Less St., Somerville, Mass.
H. M. Hyre, 557 S. Main St., Brookfield, Mo.
E. W. Nelson, 81 Hereford, Hartwell, Cincinnati, Ohio.
V. Knight, 6230 E. 15th St., Kansas City, Mo.
D. L. Ferguson, 3220 32nd Ave., N., Birmingham, Ala.
Fritz D. Anderson, 1025 S. 10th Ave., Maywood, Ill.
F. R. Swearingen, 431 North St., Steubenville, Ohio
Frank Jones, 228 Gogebic St., Ironwood, Mich.
R. W. Paque, Route 6, Green Bay, Wisc.
John O. Cowell, 218 Mason St., Calumet City, Ill.
John C. Schmidt, 1006 W. Edgeware Rd., Los Angeles, Calif.
Art A. Johnson Garage, 320 S. Church St., Rockford, Ill.
A. W. Kauffman, 3960 Schiller Pl., St. Louis, Mo.
Philip Volz, 188 Main St., Orange, N. J.
Tremont Electrical Supply Co., 228 Tremont Ave., Boston, Mass.
Kronson Service Co., 143 E. Genesee St., Buffalo, N. Y.
Brehm Radio Co., 2319 M St., Omaha, Nebr.
Rudolph N. Koch, Radio Service, Prestonburg, Ky.
A. O. McIntyre, Good Pine, La.
John T. Hunt, Radio Labs., Greentown, Ind.
George B. Ebeck, 1586 Kent, Columbus, Ohio.

SHORT-WAVE CLUB

John Salagan, 238 Howard, Buffalo, N. Y.
Eldon Smith, 113 West High Street. Orrville, Ohio.

TRADIOGRAMS

By J. Murray Barron

Fada Radio & Electric Corp., of Long Island City, N. Y. City, has just released the November issue of "Fada Sales," in which appears an interesting article entitled "Positive Radio Salesmanship," by Louis J. Chatten, general sales manager. It should prove of great value to retail radio salesmen.

* * *

Servicemen, experimenters and others should be interested in an especially attractive line of filter, cartridge and bypass condensers now being merchandised by the Postal Radio Corp., 135-137 Liberty Street, N. Y. City. These condensers are put out under an unique plan of not only being guaranteed for a full year against leakage, noise and breakdown, but with a free replacement understanding. The Postal Corp. is rapidly pushing ahead on all its lines and showing a decided increase in business, both with servicemen and experimenters. There is a special trade proposition for jobbers and distributors.

* * *

Many manufacturers are overlooking some very good business in television. Although no startling improvements have been offered by the manufacturers in television there is considerable interest in the subject and much business to be had by a live organization with a good popular-priced scanning disc.

Cable Radio Corp., 230 North Ninth Street, Brooklyn, N. Y., has some interesting and educational booklets on tubes, including television tubes, also photo-electric tubes.

* * *

Blair Radio Laboratories, 18 Warren Street, N. Y. City, is in full swing on its power amplifier line and has a new price list and bulletin which includes much technical data.

* * *

Servicemen and experimenters were attracted to Leeds Radio Store on Vesey Street near Church Street, N. Y. City, by an unusual large display of tube testers of all description. Rarely has such a varied lot been seen on display.

* * *

A. M. Flechtheim & Co., 136 Liberty St., N. Y. City, is now merchandising a complete line of dry electrolytic condensers rated at 500 volts d. c. peak, in inverted, upright and cardboard containers.

* * *

B. Jospeh, who had been associated with the Federated Purchaser Inc., N. Y. City, as Advertising manager, is now with the Baltimore Radio Corp., 725 Broadway, N. Y. City, and will act in same capacity.

* * *

Radio City Products Co., 48 West Broadway, N. Y. City, reports there is great response from the trade for the multidapter. Servicemen and others who are interested in a tester to handle the new tubes may recevie free descriptive circular.

* * *

The Rocke-Mingins Co., 5 Laight St., N. Y. City, is a newly-formed radio outlet and jobbing house. Both Arthur Rocke and L. H. Mingins have been associated with the radio industry since the early days.

* * *

Thordarson Electric Mfg., Co., 500 W. Huron St., Chicago, Ill., has a bulletin, SD 144, with complete data on type 46 Class B Amplifiers. It is free for the trade or large users of transformers.

30,000,000 Sets Now In Use

Washington.

It is estimated that there are from thirty to forty million receivers in use in the world today, and fully half of these are in the United States, according to information from the Department of Commerce. Also half of the world's broadcasting stations are in this country according to the report.

American radio exporters who heretofore have met with little competition in foreign countries are now meeting with stiff competition on account o fthe world-wide depression. "The status of radio in Europe," the department stated, "is still complicated so far as it affects United States apparatus, a fact which makes it essential for American exporters to be cognizant of the existing situation in individual markets.

The Department of Commerce has issued a comprehensive report entitled "Radio Markets of the World, 1932" as an aid in supplying the information radio exporters need.

NEW INCORPORATIONS

Radio Transportation Co., Linden, N. J., trucking and hauling—Atty., Richard F. Potter, New Brunswick, N. J.

O'Donnell Electric Co., New York City—Atty., M. S. Glennon, 475 Fifth Avenue, New York City.

E. Brodbeck & Sons, Mount Vernon, N. Y., musical instruments—Atty., W. Feinberg, Mount Vernon, N. Y.

Lyman Radio Mfg. Co., New York City—Atty., W. W. Suffin, 1440 Broadway, New York City.

Molin's Service, Buffalo, N. Y., garage, radio business—Atty., E. Rubenstein, Buffalo, N. Y.

Walter Winchell Corp., New York City—Attys., O'Brien, Malevinsky & Driscoll, Times Square, New York City.

Federated Purchaser, Inc., of Chicago, Newark, N. J., radio and electrical appliances—Attys., Grieger & Hirsch, Brooklyn, N. Y.

United Broadcasting Corp., Maywood, N. J.—Atty., S. Donald Perlman, Passaic, N. J.

H. A. Lain, New York City, electrical business—Atty., A. D. Kaufman, 290 Broadway, New York City.

CORPORATION REPORTS

Columbia Broadcasting System, Inc., and subsidiaries—Six months ended June 30: Net income, $1,459,263. No comparison given. Year ended Dec. 26, 1931: Net income, $2,346,768, against $874,716 for preceding year.

Kelvinator Corporation and subsidiaries—Year ended Sept. 30: Net profit after Federal taxes and other charges, including dividends received from Refrigerator Discount Corporation, $102,701, equivalent to 8 cents a share on 1,196,784 no par common shares, against $1,761,709, or $1.53 a share on 1,147,302 shares, in preceding fiscal year.

Davega Stores Corporation—Six months ended Sept. 24th: Net loss after taxes, depreciation, amortization and other charges, $209,333, compared with $233,878 loss for corresponding period last year. This year there was charged to reserve for contingencies, $170,421, representing losses on liquidation of Western retail companies, including Atlas-Lesser Stores, Inc., and Atlas-Serlin Stores, Inc., former subsidiaries. Current assets on Sept. 24, including $887,619 cash, amounted to $2,291,988; current liabilities, $554,258.

CORPORATE CHANGES

Capital Increase

Colonial Radio Corp., New York City, $540,000 to $1,540,000.

Surrender of Authority

Baird Television Corp., Delaware.

SCHEDULES FILED

Morison Electrical Supply Co., Inc., 15 East 40th St., New York City—Liabilities $238,091, assets $263,221, main items being unliquidated claims, $71,300; accounts, $64,092; stock, $44.790. Principal creditors listed are Bankers Commercial Security Co., Inc., $83,400, secured; General Contract Purchase Corp., $85,000, secured; Guaranty Trust Co., $9,611; Easy Washing Machine Co., $7,284.

DAMAGE SUITS

Suit, involving a damage claim of $900,000, has been filed by Broadcasting Station WIBO, Chicago, against Station WBBM, Chicago.

BONDS LISTED

Radio-Keith-Orpheum Corporation ten-year 6 per cent gold debentures, to the amount of $463,800, due on Dec. 1, 1941, admitted to list of The New York Stock Exchange.

Quick-Action Classified Advertisements

7c a Word — $1.00 Minmium
Cash With Order

NEW AMERICAN BOSCH VIBRO POWER RADIO. Only American Bosch has vibro power, new discovery in radio. Get our prices before buying elsewhere. We will save you 25% on your radio purchase. McGuire Distributing Co., Bosch Radio From Factory to Customer, Doeville. Tennessee.

SPECIAL AGENTS (INVESTIGATORS) NEEDED everywhere. Experience unnecessary. Send dime for details (no school) . Write NATIONAL INTELLIGENCE SERVICE. Box 39, Waukegan, Illinois.

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.

THE FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair—Revised New Edition. Ford Car authority. Victor W. Page. 708 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

8 MFD. CONDENSER

Four for Only $1.47

We are able to offer brand-new 8 mfd. wet electrolytic condensers, with insulating washers, mounting nut and lugs at four for $1.47. These condensers are freshly made for us in quantity by Polymet Manufacturing Co. and are highly recommended by us for assurance of full capacity and for their ruggedness. They are of the inverted mounting type. Single condenser, lugs, washers, nuts. Cat. Poly-8 @.....49c
Four for the price of three, i.e., $1.47

DIRECT RADIO CO.
143 West 45th St. New York City

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. 852**
- ☐ **0-50 Voltmeter D.C. ..... No. 857**
- ☐ **6-Volt Charge Tester D.C. ..... No. 22**
- ☐ **0-10 Amperes D.C. ..... No. 853**
- ☐ **0-25 Milliamperes D.C. ..... No. 851**
- ☐ **0-50 Milliamperes D.C. ..... No. 854**
- ☐ **0-100 Milliamperes D.C. ..... No. 855**
- ☐ **0-300 Milliamperes D.C. ..... No. 856**
- ☐ **0-400 Milliamperes D.C. ..... No. 85**

NAME .....

ADDRESS .....

CITY ..... **STATE**.....

No More Need to Calculate Inductance!

Correct Answer Obtained from Charts in 10 Seconds!

PRECISION charts have been prepared by Edward M. Shiepe, E.E. (Massachusetts Institute of Technology) relating inductance, capacity and frequency, and giving the number of turns of different sized wires for attaining inductance values for solenoid form diameters of ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1¾, 2, 2¼, 2½, 2¾ and 3".

The tri-relationship chart (inductance, capacity and frequency plotted, so that when any two are known the unknown may be read directly in 10 seconds) is necessary for use of the inductance table that covers any particular wire size for all the specified form diameters.

The charts are on 9 x 12" photostat sheets, white lines on a black field.

The tri-relationship chart covers inductance values of 0.1 to 10,000 microhenries, capacity values of 50 to 600 mmfd. and frequency values of from 100 to 20,000 kc.

The tri-relationship chart is Cat. CHT-TRI, @ $1.00

WHILE any one of the three quantities may be determined, the chief purpose of the tri-relationship chart is to give instant reading of the inductance needed when capacity and frequency are known.

The turns charts (number of turns needed for specified inductance) are thirty-six in number, one for each of the following different wire sizes and insulations: Enamel Nos. 14, 16, 18, 20, 22, 24, 26, 28, 30; Single Silk Covered, Nos. 14, 16, 18, 20, 22, 24, 26, 28, 30; Double Silk Covered or Single Cotton Covered (same data apply to both), Nos. 14, 16, 18, 20, 22, 24, 26, 28, 30; Double Cotton Covered, Nos. 14, 16, 18, 20, 22, 24, 26, 28, 30.

Each turns chart gives the number of turns for inductance ranges well in excess of commercial uses of particular wire sizes on the specified diameters. Short waves included for larger diameter wires, very long waves for finer diameter wires.

The turns charts are Cat. CHT-TNS followed by the wire size and insulation. Thus, turns chart for No. 30 Double Cotton Covered would be Cat. CHT-TNS—30—DCC. The price is $1.00 each.

The accuracy of these charts is so high that it may be relied on in engineering practice.

All charts are on a logarithmic 5x3-cycle basis.

RADIO WORLD, 145 West 45th Street, NEW YORK, N. Y.

SOLDERING IRON FREE!

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

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

BOOKS AT A PRICE

"The Superheterodyne," by J. E. Anderson and Herman Bernard. A treatise on the theory and practice of the outstanding circuit of the day. Special problems of superheterodynes treated authoritatively. Per copy. (Cat. AB-SH), postpaid..50c

"Foothold on Radio," by Anderson and Bernard. A simple and elementary exposition of how broadcasting is conducted, with some receiver circuits and an explanation of their functioning. (Cat. AB-FH), postpaid 25c

Guaranty Radio Goods Co., 145 W. 45th St., N. Y. City

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 20, 21, 22 screen grid; Eveready series 50 screen grid; Erla 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.

MODULATED OSCILLATORS

Broadcast and Intermediate Frequencies

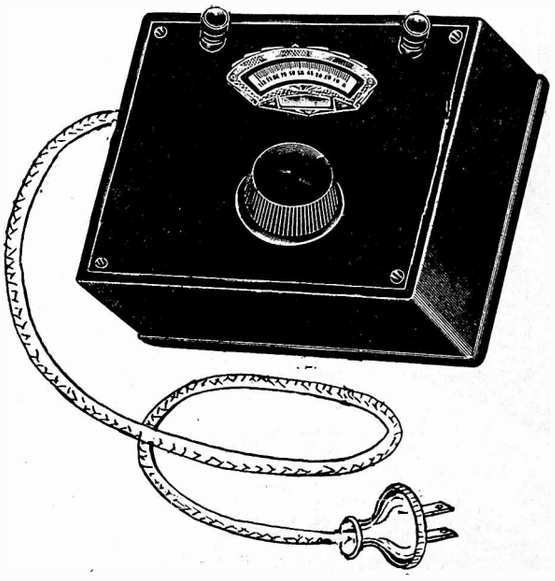
An a-c operated modulated oscillator (105-120 v., 50-60 c.), fully covering the broadcast band (1500 to 540 kc.) and all the commercial intermediate frequencies (115, 130, 172.5, 175, 177.5, 260, 400 and 450 kc.). The vernier dial has scale calibrated in broadcast frequencies, while the eight intermediate frequencies are also recorded directly on the scale. No chart references necessary. Accuracy is 3 per cent. or better, averaging better than 2 per cent. Broadcast calibration is for 5 kc. divisions at low frequency end, 10 kc. in the middle and 20 kc. at the high frequency end.

Fundamental frequencies of oscillation will be from 150 to 540 kc, so that some intermediate frequencies may be tested on the fundamental, others on the second harmonic, while the broadcast band is taken care of by the tenth harmonic. No switching necessary despite wide frequency coverage. Sharp tuning, clear squeals in heterodyning, and strong modulation by the 60-cycle line frequency. No hum except at resonance. Frequency stability is of a high order, due to stabilized grid circuit. Calibration is for a 56 tube.

Cat. WOSC, @ $6.93
(56 tube is 87c extra)

Same as above, except for battery operation, with high audio frequency modulation, and requiring 3-volt dry battery and 22.5 volt B battery (not furnished). Tube required is the '30.

Cat. WOSCB, @ $6.53
(230 tube is $1.08 extra)



The modulated oscillator has vernier dial calibrated directly in frequencies, covering broadcasts and intermediate. The tube is inserted by removing the panel. Two output posts provided.

Direct Radio Co., 143 West 45th Street, New York, N. Y.

UNANIMOUS!

. . . and we laughed when a dealer first asked us if we sold copies of a book telling how to build CRYSTAL SETS.

"THE *young folks are building crystal sets again. We are in receipt of many calls for inexpensive booklets showing how to build various types of crystal sets—but nowhere is such a book available.*" This from one of our subscribers. Sounded rather queer to us. Who wants to build a crystal set these days? We found the answer by chasing up and down the street, calling on a lot of radio stores. *Certainly* . . . all of them wanted a book that tells how to build crystal sets, simply because the younger generation is at it again . . . building the same kinds of sets that you and I built when we were boys. Little folks still get a thrill out of building something that *works*. In our rounds about town we picked up enough pre-publication orders to assure us that their was a genuine demand for a good practical book on building crystal sets. So we are getting such a book ready for press . . . right now. It shows how to build a half dozen different kinds of crystal sets. Step by step, it tells, in ten-year-old language, just how to make these sets. Shows, pictorially, how to wind the coil, make the detector, put the set together, wire it and *MAKE IT WORK*. Nothing else but dope on crystal sets in this book. Twenty-five cents per copy is the retail price, with generous discounts to dealers and jobbers. Ready for shipment on December 15th. A dollar bill brings you six copies, postpaid, on a trial order. Put them on your counter and *WATCH THEM SELL*.

Publishers of "RADIO", Pacific Building, San Francisco, Calif.

Send me, postpaid, 6 copies of "How to Build Crystal Sets," I enclose $1.00 *in full payment. It is understood that the books are to be mailed on or before December 20th.*

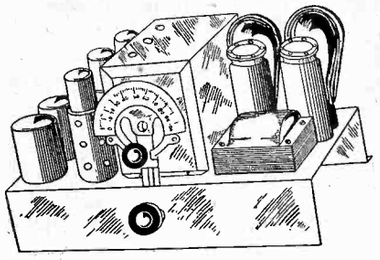
Name .....

Street and No. .....

City and State .....

DIAMOND PARTS

FIVE-TUBE MODEL



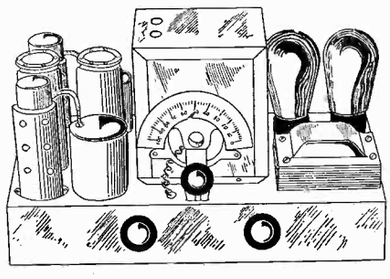
A-C operated circuit, 50-60 cycles, 105-120 volts, using two 58 t-r-f stages, 57 power detector and 47 output, with '80 rectifier. Three gang shielded condenser and shielded coils in a sensitive, selective and pure-tone circuit. Dynamic speaker field coil used as B supply choke. Complete kit of parts, including 8" Rola speaker and all else (except tubes and cabinet). Cat. D5CK @.....$15.69
Wired model, Cat. D5CW (less cabinet) @.... 17.19

Kit of five Eveready-Raytheon tubes for this circuit. Cat. D5T 4.97

FOUNDATION UNIT, consisting of drilled metal subpanel, 13¾ x 8⅝ x 2¼"; three-gang Scovill 0.00035 mfd., brass plates, trimmers, full shield; shields for the 58 and 57 tubes; six sockets (one for speaker plug); two 8 mfd. electrolytic condensers; set of three coils. Cat. D5FU..... 6.19

Diode Diamond, same prices.

FOUR-TUBE MODEL

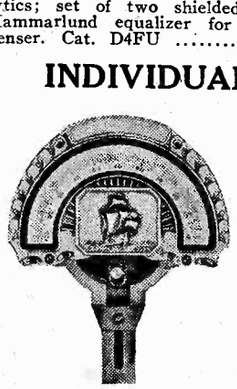


The four-tube model is similar, except that there is one stage of t-r-f, and a two-gang condenser is used. Tubes required, one 58, one 57, one 47 and one '80. Complete kit, including 8" Rola dynamic speaker (less tubes, less cabinet). Cat. D4CK $13.58

Kit of four Eveready-Raytheon tubes for this circuit. Cat 4D.TK 3.89

FOUNDATION UNIT, consisting of drilled metal plated subpanel 13¾ x 2½ x 7"; two-gang 0.00035 mfd. SFL condenser; full shield; two shields for 58-57; center-tapped 200-turn honeycomb coil; five sockets (one for speaker plug); two 8 mfd. electrolytics; set of two shielded coils; 20-100 mmfd. Hammarlund equalizer for antenna series condenser. Cat. D4FU $5.48

INDIVIDUAL PARTS



Travelling light vernier dial, full-vision, 6-to-1 vernier, projected indication prevents parallax; takes ¼" or ⅜" shaft; dial, bracket, lamp, escutcheon.

0-100 for 5-tube Diamond, Cat. CRD-0, @ $0.91.

100-0 for 4-tube Diamond, Cat. CRD-100, @ $0.91.

[If dial is desired for other circuits state whether condenser closes to the left or to the right.]

8 mfd. Polymet electrolytic, insulating washers, extra lug. Cat. POLY-8 @.....$0.49
Three 0.1 mfd. in one shield case, 250 volt d-c rating. Cat. S-31 @..... .29
Rola 8" dynamic for 47, with 1800 ohm field coil tapped @ 300 ohms. Cat. FP @..... 3.63
2 coils for 4-tube. Cat. DP @..... .90
3 coils for 5-tube. Cat. DT @..... 1.35

DIRECT RADIO CO.

143 WEST 45th STREET
NEW YORK, N. Y.

PHONO PICKUP

Rubber-damped phonograph pickup; eliminating pick-up noises. Designed for full tonal range with fidelity. Price. $4.50.

Direct Radio Co., 143 W. 45th St., N. Y. City

WAFER SOCKETS

6/32 mounting holes, 1-11/16 inches apart; central socket hole recommended, 1⅜ inches, although 1¼ inches may be used.

UX, with insulator.....10c
UY, with insulator.....10c
Six-pin, with insulator.....11c
Seven-pin, with insulator.....12c

DIRECT RADIO CO.
145 WEST 45th STREET, N. Y. CITY

BLUEPRINTS

627. Five-tube tuned radio frequency, A-C operated; covers 200 to 550 meters (broadcast band), with optional additional coverage from 80 to 204 meters, for police calls, television, airplane, amateurs, etc. Variable mu and pentode tubes. Order BP-627, @ .....25¢

628-B. Six-tube short-wave set, A-C operated; 15 to 200 meters; no plug-in coils. Intermediate frequency, 1,600 kc. Variable mu and pentode tubes. Order BP-628-B @ .....25¢

RADIO WORLD
145 WEST 45TH ST., NEW YORK, N. Y.

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