NOV. 19
1932

NEW 59 TUBE

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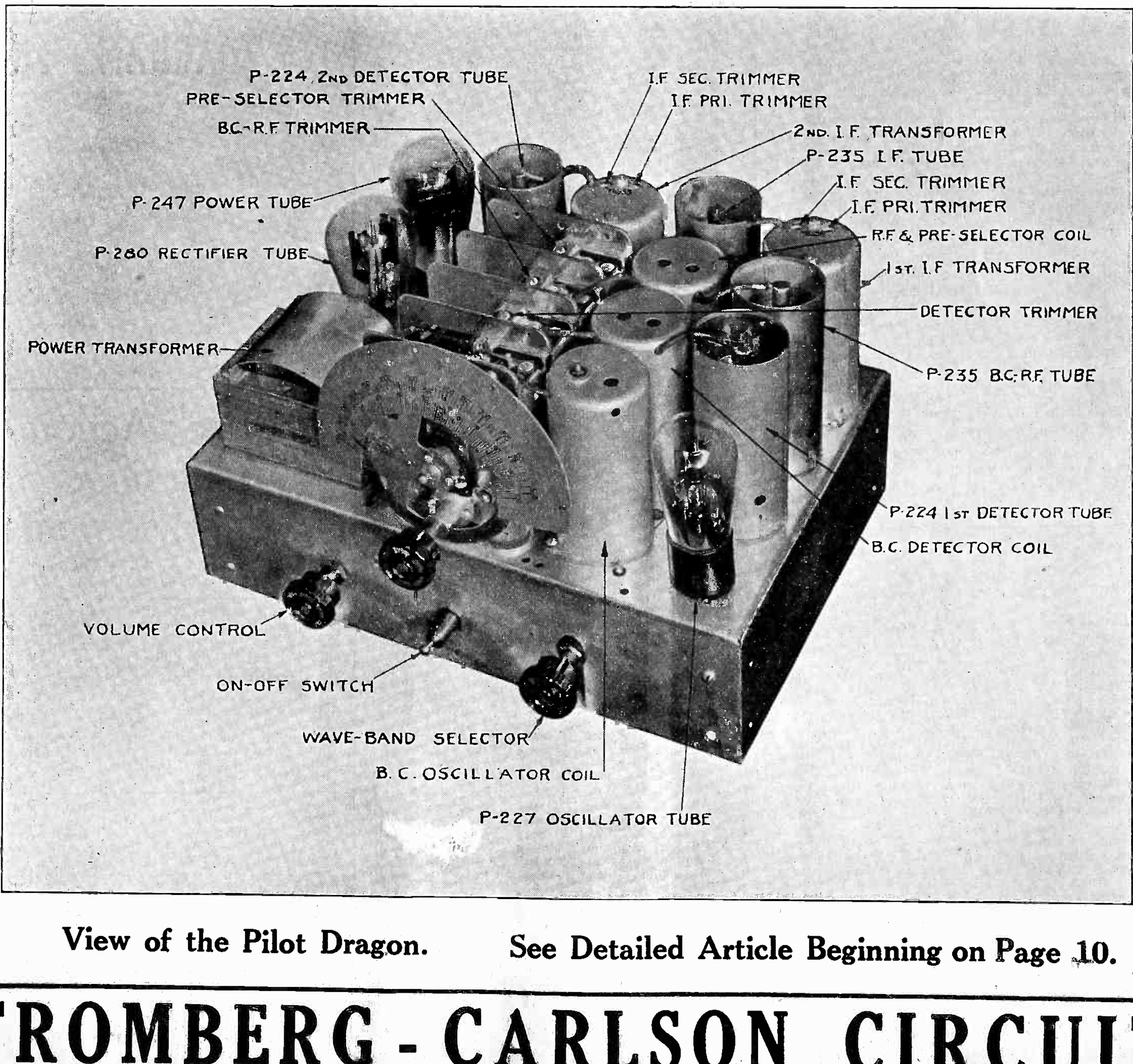
How to Make a Simple Tangent Galvanometer

What Intermediate Frequency Is Best?

The ALL-WAVE DRAGON



View of the Pilot Dragon. See Detailed Article Beginning on Page 10.

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FULL DATA ON NEW 59 TUBE

Output Valve Has Heater and Independent Cathode

The following is the contents of "Preliminary Technical Information on the New Triple-Grid Power Amplifier Tube, Unipotential Cathode Type, RCA-59, Cunningham C-59," and is published by permission of the two companies.

THE 59 is a triple-grid power amplifier tube of the heater-cathode type recommended for use in the output stage of a-c operated receivers. The triple-grid construction of this tube, with external connections for each grid, makes possible its application as

(1) a Class A Power Amplifier Triode,
(2) a Class A Power Amplifier Pentode, and
(3) a Class B Power Amplifier Triode.

The three-fold application of the 59 to audio power-amplifier circuits is accomplished by different connections of the three grids incorporated in the tube's structure. Thus, one arrangement of grid electrodes provides a triode for Class A service with a relatively low amplification factor, a low plate resistance, and a high mutual conductance; while another provides a triode with an amplification factor so high that negative grid bias is not required for its operation as a Class B power amplifier. A pair of 59's so connected in a Class B output stage is capable of supplying an exceptionally large amount of power; while a single 59 operated in the driver stage as a Class A amplifier, will deliver sufficient power to drive the pair of 59's in the output stage. A third arrangement of the grids makes possible the use of the 59 as a Class A power output pentode capable of delivering a large amount of power with relatively small signal voltage input.

The heater-cathode construction employed in the 59 is another step forward in obtaining uniformly low hum-level in high quality power amplifier design. The advantages to be gained by the use of heater-cathode tubes in the power output stage cannot, of course, be realized unless all preceding stages are coordinated in design to the same high quality performance.

In appearance, the 59 is characterized by the dome-top bulb, the rugged electrode assembly, and the 7-pin base to provide terminals for each electrode.

Class A vs. Class B Amplification

In Class A service the grid of the tube is maintained negative with respect to the cathode by an amount such that some plate current flows at all times, and such that the grid takes no appreciable current during the most positive swing of the signal voltage. These operating conditions are obtained when the normal bias without signal gives sufficient operating plate current to permit the application of a peak signal having twice the bias value without reducing the plate current below a certain predetermined minimum value under the load conditions employed, or without swinging the grid positive. Thus, the value of grid signal voltage which can be applied to any given type of tube is limited and this results in limited power output. Theoretically, the maximum plate circuit efficiency for Class A operation is 50%, assuming a sine wave input signal. The actual plate circuit efficiencies, however, are of the order of 20% for triodes and 40% for pentodes.

Distinguishing features of this class of service are that no appreciable power is required by the grid and that essentially undistorted power output may be obtained either with a single tube or with two tubes in a push-pull circuit, the latter being the nearest approach to distortionless amplification known. However, comparatively low power output is obtained at low efficiency. Furthermore, rated plate current is required from the power supply regardless of whether or not signal voltage is applied to the grid.

In Class B service the tube is operated so that the plate current is practically zero with no grid excitation. When a signal of sufficient magnitude is applied to the grid, there will be no plate current flow over a substantial part of the negative excursions of the signal voltage. A considerable amount of second and higher even-ordered harmonic distortion is thus introduced into the power output of a single tube. However, with two tubes in a balanced push-pull circuit, the even harmonics are eliminated from the power output. In such a circuit, therefore, two tubes may be employed as Class B amoutput.

Class B Service

In Class B service it is possible to drive the grids of the two amplifier tubes positive to a certain amount and still obtain reasonably undistorted output, provided that sufficient input power is available to supply the grid current required by the positive grids. This power is conveniently supplied by a Class A power amplifier feeding the grids of the output tubes through a push-pull transformer having proper characteristics. Usually this transformer has a step-down ratio.

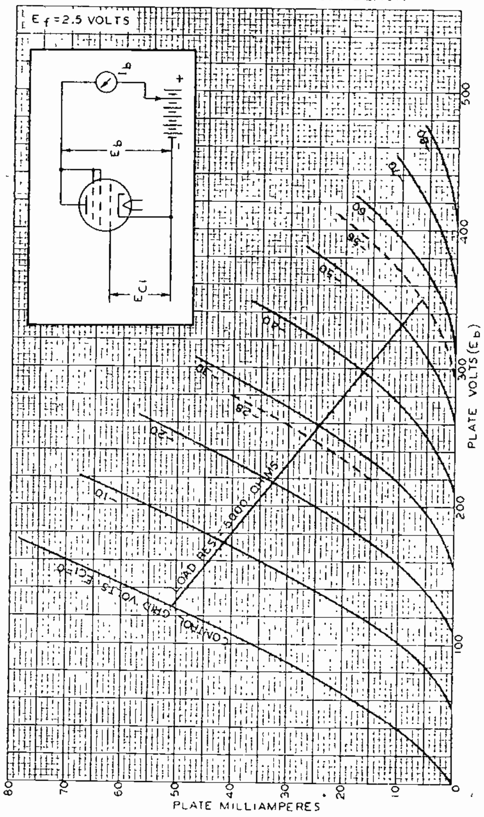
By designing Class B amplifier tubes with a sufficiently high mufactor, it is possible to operate them with zero grid bias, and so dispense with biasing resistors whose effect would be to produce considerable loss in sensitivity because of degenerative effects. Since provision for grid bias is unnecessary with such tubes, the entire voltage of the rectifier is available for plate supply.

Distinguishing features of this class of service are that very high output of good quality may be obtained with fairly small tubes operating at relatively low plate voltage; and that unusual overall economy of power consumption is possible because the plate current is very low when no signal is applied to the grid. To give these advantages, the Class B amplifier circuit requires the use of two tubes in a balanced output stage preceded by a driver stage capable of supplying considerable undistorted power and the use of a power supply capable of maintaining good voltage regulation regardless of the variation of average plate current with signal intensity. It should be noted that the distortion present in the high power output of Class B amplifiers is usually negligible but is always somewhat higher for

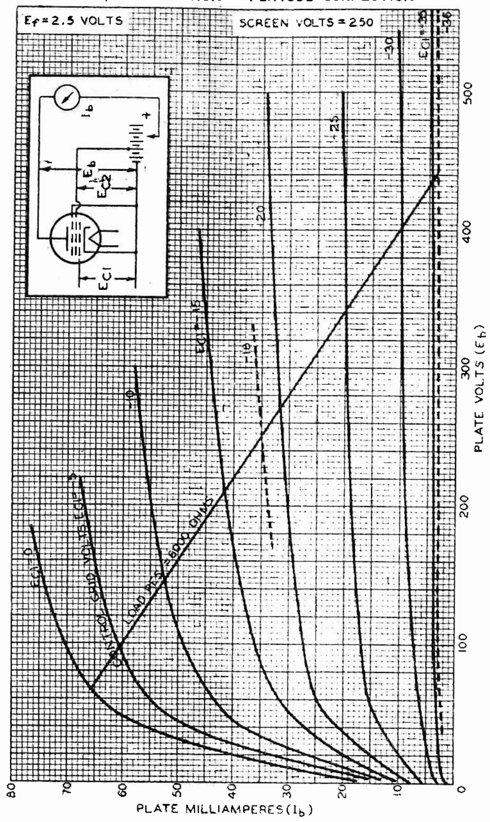
(*Continued on next page*)

Curves on the New 59

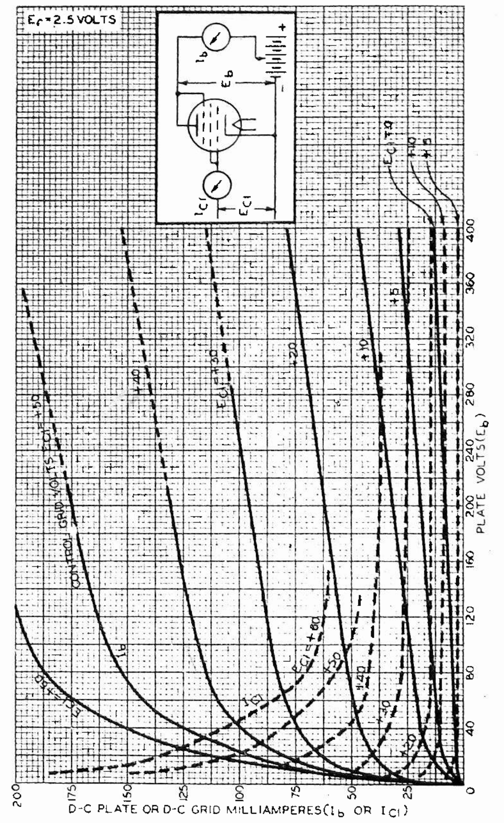
AVERAGE PLATE CHARACTERISTICS
CLASS A OPERATION - TRIODE CONNECTION



AVERAGE PLATE CHARACTERISTICS
CLASS A OPERATION - PENTODE CONNECTION



AVERAGE PLATE CHARACTERISTICS
CLASS B OPERATION



(Continued from preceding page)
the ordinary range of signals than that obtained with Class A amplifiers employing much larger tubes capable of operating at the same maximum power output.

Class B amplifiers, however, have the distinct advantage of providing with relatively small tubes a reserve of power delivering ability to meet requirement for an extended volume range.

TENTATIVE RATING AND CHARACTERISTICS OF THE 59

Heater Voltage (A.C. or D.C.)	2.5 Volts
Heater Current	2.0 Amperes
Maximum Overall Length	5 3-8 Amperes
Maximum Diameter	2 1-16 Amperes
Bulb	ST-16
Base (Refer to Outline Dwg. No. 92S-4196)	Medium 7-Pin

Class "A" Power Amplifier-Triode Connection

(Grids No. 2 and No. 3 tied to plate; grid No. 1 is control-grid)

Operating Conditions and Characteristics:

Heater Voltage	2.5	Volts
Plate Voltage	250 max.	Volts
Grid Voltage (grid No. 1 only)	-28	Volts
Amplification Factor	6.0	
Plate Resistance	2400	Ohms
Mutual Conductance	2600	Micromhos
Plate Current	26	Milliamperes
Load Resistance (optimum for max. U. P. O.)½*	5000	Volts
Undistorted Power Output (5% 2nd harmonic)	1250	Milliwatts

Class "A" Power Amplifier-Pentode Connection

(Grid No. 3 tied to cathode; grid No. 2 is screen; grid No. 1 is control-grid)

Operating Conditions and Characteristics:

Heater Voltage	2.5	Volts
Plate Voltage	250 max.	Volts
Screen Voltage (grid No. 2)	250 max.	Volts
Grid Voltage (grid No. 1)	-18	Volts
Amplification Factor	100	
Plate Resistance	40000	Ohms
Mutual Conductance	2500	Micromhos
Plate Current	35	Milliamperes
Screen Current	9	Milliamperes
Load Resistance*	6000	Ohms
Power Output (7% total distortion)	3.0	Watts

*Approximately twice this value is recommended for load of driver for Class B stage.

* A load resistance of 7000 ohms will give the same power output as 6000 ohms but with 20% greater distortion.

Class "B" Power Amplifier-Triode Connection

(Grid No. 3 tied to plate; grids No. 2 and No. 1

Plate Voltage	400 max.		Volts
Dynamic Peak Plate Current	200 max.		Milliamperes
Average Plate Dissipation	10 max.		Watts
Average Grid Dissipation (grids No. 1 and No. 2 together)	1.5 max.		Watts
Typical Operation (2 tubes):			
Heater Voltage	2.5	2.5	Volts
Plate Voltage	300	400	Volts
Grid Voltage (grids No. 1 and No. 2 together)	0	0	Volts
Static Plate (Current (per tube)	10	13	Milliamperes
Load Resistance (plate to plate)	4600	6000	Ohms
Nominal Power Output (2 tubes)	15	20	Watts

Installation

The base of the 59 is of the medium 7-pin type. Its pins fit the standard seven-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with the filament pin pins one vertically above the other. Base connections and external dimensions of the 59 are given in the outline drawings.

The bulb of this tube may become very hot under certain conditions of operation. Under operating conditions, the surface temperature on the hottest part of the bulb should not exceed 150° F. as measured by a small thermo-copule. Sufficient air should circulate freely around the tube to prevent overheating.

The heater is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value for full-load operating conditions at average line voltage.

The cathode should preferably be connected directly to a mid-tap on the heater winding. If this practice is not followed, the potential difference between heater and cathode should be limited to 45 volts.

The grids for any particular type of amplifier service should be connected so as to give resultant tube characteristics suited to that service. Detailed information on connections is given under "APPLICATION."

Application

The 59 by virtue of its triple-grid structure and its three-fold utility as a power amplifier tube, allows the set engineer considerable latitude in the audio amplifier design of a-c receivers to meet various market demands.

For Class A triode operation of the 59, the two grids (No. 3 and No. 2) immediately adjacent to the plate are connected to the plate, while the third one (No. 1) is employed for control purposes. Operation of the tube is then similar to any Class A power amplifier triode (refer to Rating and Characteristics for operating conditions).

As a Class A amplifier triode, the 59 may be employed in the driver stage of Class B amplifier circuits, and thus reduce the number of tube types necessary in a receiver.

The tabulated values for Class A operation of this type as given under Rating and Characteristics are for its operation as a power output tube. When it is used as the driver for a Class B stage, the load requirements are changed as indicated in the under Rating and Characteristics. This change is recommended in order to minimize distortion due to the driver stage.

Grid Load Resistor

The d-c resistance in the grid circuit of the 59 operating as a Class A amplifier (either with triode or pentode connection) should not exceed 0.5 megohm if self-bias is used. Without self-bias, the resistance should not exceed 10000 ohms. The use of resistance higher than these may cause the tube to lose bias due to grid current with the result that the plate current will rise to a value sufficiently high to damage the tube.

For Class A Pentode operation of the 59, the grid (No. 3) adjacent to the plate is tied to the cathode and thus serves as the suppressor, while the other two grids (No. 2 and No. 1) serve as the screen-grid and control-grid respectively. Operation of the tube is then similar to any Class A power output pentode (refer to Rating and Characteristics for operating conditions).

For Class B triode operation of the 59, the grid (No. 3) adjacent to the plate is tied to the plate, while the other two grids (No. 2 and No. 1) are connected together to serve as a single control-grid. No grid bias is necessary with this connection. This feature is particularly important because it prevents the variation of bias with applied signal which would otherwise exist if any self-bias arrangement were employed.

Grid Circuit Power

During operation of this tube as a Class B amplifier, the interconnected grids No. 1 and No. 2 are swung positive each half cycle. Considerable power is required to do this under ordinary conditions. If, however, the secondary emissivity of the grids were made nearly equal to unity, the required power to swing the grids could be appreciably decreased. Tubes possessing this feature have been constructed, but the secondary emissivity is not independent of signal voltage and frequently causes negative grid current. Furthermore, secondary emission behaves erratically during the life of the tube. Thus, to have a Class B tube which will give uniform results throughout its life, it is preferable from the tube design standpoint, as in the case of the 59 with Class B connections, to eliminate secondary emission insofar as possible even at the expense of greater driving power. Unless tubes for use as Class B amplifiers are capable of producing uniform results throughout their life, it is practically impossible to design circuits to use them.

Power from Driver Stage

The direct current requirements of Class B circuits are subject to fluctuation under operating conditions. The power supply, therefore, should have as good regulation as possible to maintain proper operating voltages regardless of the current drain. For this purpose, a suitably designed B-eliminator may be employed. A rectifier tube of the mercury-vapor type is recommended because it has a low and practically constant space-charge-voltage drop within its operating limitations. As a further means of obtaining good regulation, the filter chokes and transformer windings of the B-eliminator should have as low resistance as possible. In the design of a power supply for a Class B amplifier, consideration should be given to the peak current demand of the amplifier.

As previously pointed out, the grid (No. 1 and No. 2) of the 59 is operated sufficiently positive to cause grid current to flow in its input circuit. This feature imposes a further requirement on the preceding amplifier stage. It must supply not only the necessary input voltage, but it must be capable of doing so under conditions where appreciable power is taken by the grid of the Class B amplifier tube. Since the power necessary to swing the grid positive is partially dependent on the plate load of the Class B tube, and since the efficiency of power transfer from the preceding stage is dependent on transformer design, it is apparent that the design of a Class B audio power amplifier requires that more than ordinary attention be given to the effects produced by the component parts of the circuit. These effects may be produced in the first-stage amplifier by the design factors of the power-output stage. For this reason, the design of a Class B audio amplifier with its driver stage is somewhat more involved than for a Class A system, and must be checked for each change in the component parts.

A complete discussion of design features for Class B amplifier would be rather extensive, but certain outstanding points may be mentioned. The interstage transformer is the link interconnecting the driver and the Class B stage. It is usually of the step-down type, that is, the primary input voltage is higher than the secondary voltage supplied to the grids of the power output tubes. Depending upon conditions, the ratio of the primary of the interstage transformer to one-half its secondary may range between 1.5/1 and 5.5/1.

The transformer step-down ratio is dependent on the following factors:—

1. Type of driver tube
2. Type of power tube
3. Load on power tube
4. Permissible distortion
5. Transformer efficiency (peak power)

Practical Non-Reactance

The primary impedance of the interstage transformer should be essentially the same as if the transformer were to be operated with no load, that is, into an open grid. Since power is transferred, the transformer should have reasonable power efficiency. It should be noted that the power output and distortion are often critically dependent upon the circuit constants which should, therefore, be made as near independent of frequency as possible. This applies particularly to the interstage coupling transformer and to the loudspeaker. Since it is difficult to compensate for leakage reactance of the coupling transformer without excessive loss of h-f response, the leakage reactance of this transformer should be as low as possible.

The type of driver tube chosen should be capable of handling sufficient power to operate the Class B amplifier stage. Allowance should be made for transformer efficiency. It is most important, if low distortion is desired, that the driver tube be worked into a load resistance higher than the normal value for optimum power output as a Class A power amplifier, since distortion produced by the driver stage and the power stage will be present in the output.

The following notes on Class B Amplifier circuits are of value from the design standpoint:—

The load on the driver tube or tubes is chosen higher than for undistorted power rating to hold overall distortion to a minimum. For a single triode driver, its minimum plate load should be approximately 2 to 4 times the plate resistance of the driver tube. For a push-pull triode driver stage, its minimum plate load per tube should be approximately equal to the plate resistance of an individual tube. This ratio for push-pull operation is permissible principally because of elimination of second harmonic distortion. This minimum plate load is the value used for calculating peak power transformer efficiency.

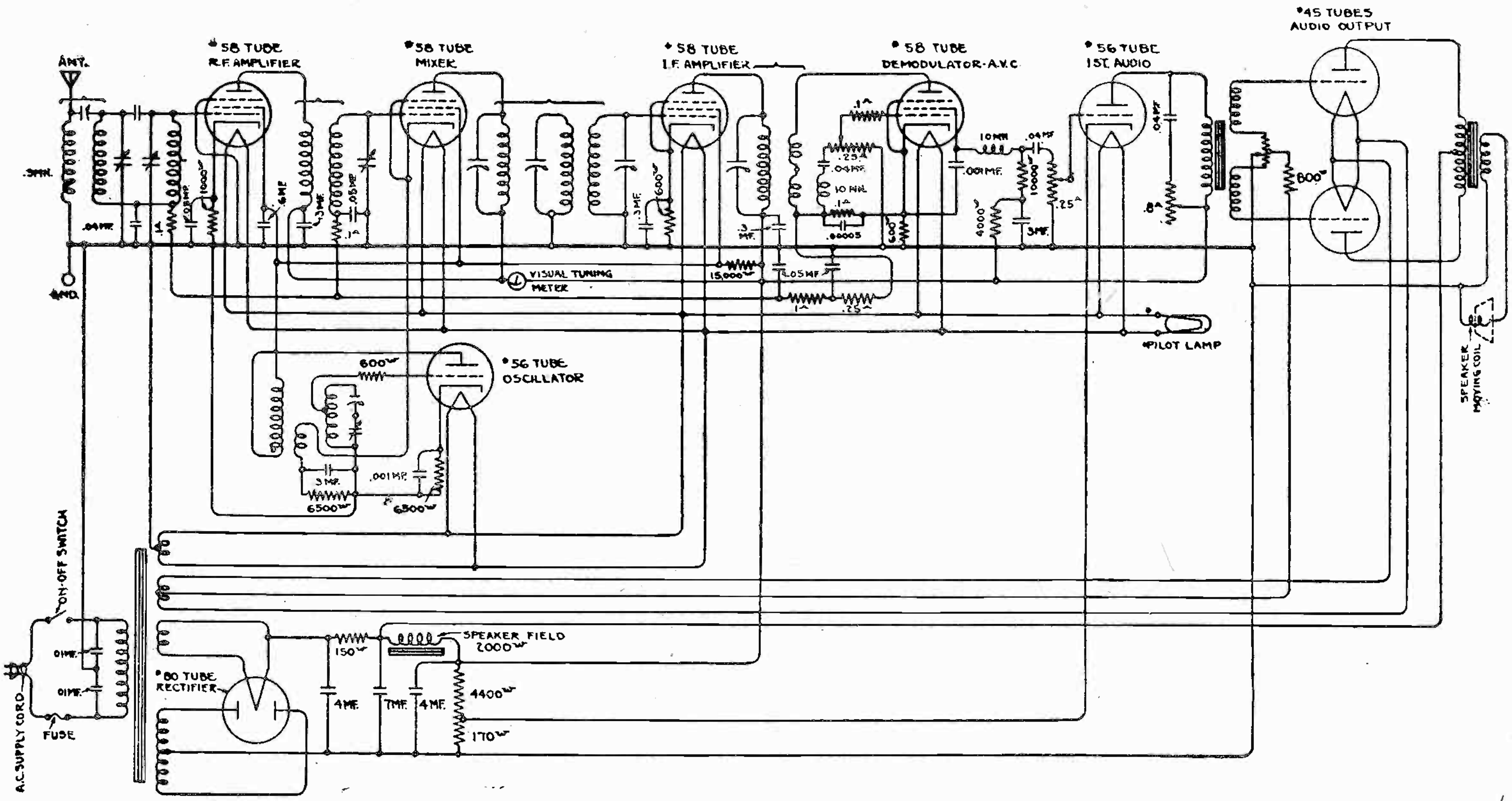
An interstage transformer with high step-down ratio causes low distortion in the Class B input circuit, but limits the available signal. A satisfactory transformer design makes use of grid distortion to cancel a part of the distortion produced in the plate circuit of a Class B stage. For this reason, the transformer step-down ratio must not be too great. Resistance losses of the primary and econdary may be distributed on the basis of the most economical design. It is important to consider that only one-half of the secondary furnishes power at a time.

The load values for the Class B amplifier stage given under Rating and Characteristics will change slightly with available input if maximum output and low distortion are desired. It is important to consider that only one-half of the primary of the output transformer furnishes power at one time.

Tube List Prices

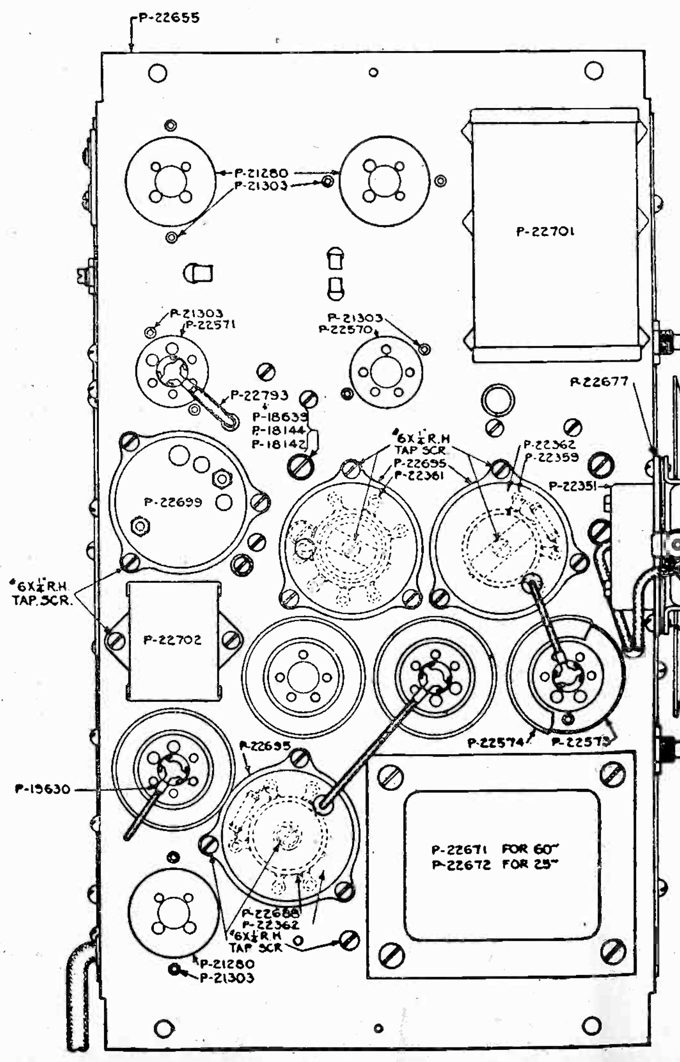
Type	*List Price*	*Type*	*List Price*	*Type*	*Price List*
11	$3.00	'32	2.35	57	1.65
12	3.00	'33	2.80	58	1.65
112-A	1.55	'34	2.80	59	2.50
'20	3.00	'35	1.65	'80	1.05
'71-A	.95	'36	2.80	'81	5.20
UV-'99	2.75	'37	1.80	82	1.30
UX-'99	2.55	'38	2.80	83	1.55
'100-A	4.00	'39	2.80	'74	4.90
'01-A	.80	'40	3.00	'76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

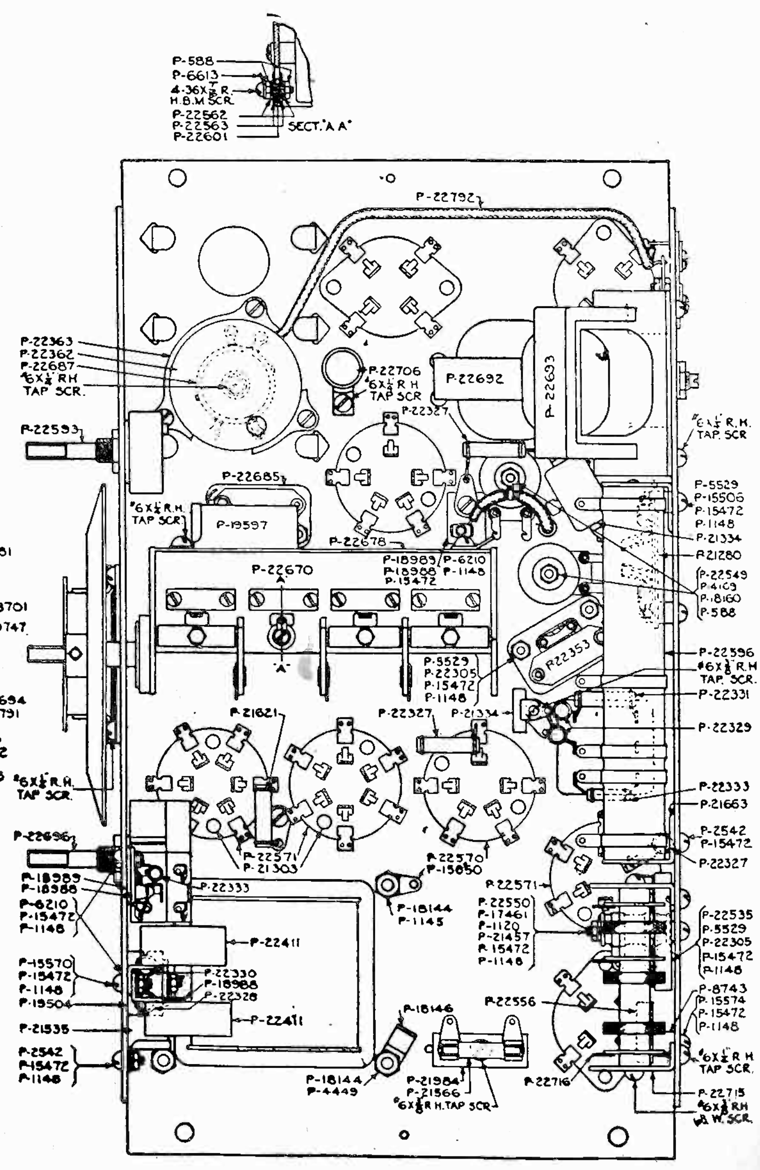
STROMBERG-CARLSON'S LATEST CIRCUITS



Schematic Circuit of No. 37 Receiver.

THE Stromberg-Carlson No. 37 radio receiver is a nine-tube superheterodyne of many advanced features. It employs four 58s, two 56s, two 45s, and





one '80. The output tubes are Class A push-pull.

The four 58 triple-grid tubes are used as r-f amplifier, mixer, i-f amplifier and demodulator-a. v. c. The two 56 tubes are used as oscillator and first audio amplifier, and the two 45 tubes are used in the push-pull output stage. The '80 is used as rectifier in the B supply.

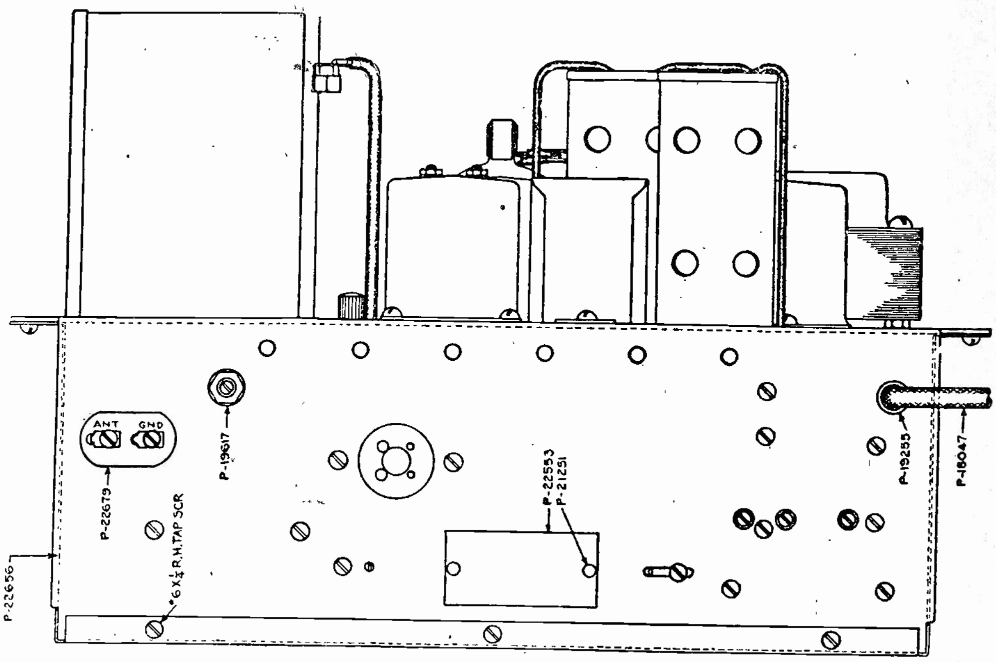
A bi-resonator is used to couple the antenna to the r-f amplifier to prevent any cross modulation. The r-f amplifier is coupled to the mixer by an ordinary tuned r-f transformer. This gives three tuning circuits (four gang tuning capacitor) for r-f selectivity ahead of the mixer tube, thus the image response ratio is exceedingly high. The oscillator is coupled to the cathode circuit of the mixer tube in the regular manner. The i-f output of the mixer tube is fed into a tri-resonator (three-tuned circuit transformer) and thence to the i-f amplifier tube. This tube is coupled to the diode-triode demodulator and a. v. c. tube by a single tuned circuit transformer.

The a. v. c. voltage and the rectified audio voltage are built up across the diode load resistor. The a. v. c. voltage is fed back to the grids of the first two tubes through a suitable filter. The audio voltage is fed to the first potentiometer of the dual volume control and from there applied through the movable contact to the grid of the triode portion of the diode-triode. The screen of the tube acts as the plate of the triode portion of the system, thus forming a triode audio amplifier in conjunction with the diode rectifier.

The output of this "plate" circuit is coupled to the second unit of the dual volume control which feeds the grid of the first audio tube. The output of this first audio stage is coupled to the push-pull output triodes. The adjustable automatic clarifier system is connected across the primary of the push-pull input transformer. The output transformer feeds the signal from the power triodes to the high quality electro-dynamic speaker.

The power supply system employs two stages of filter, the first being of the resistance type and the second using the field of the speaker as a choke. The plate supply for the output tubes is tapped off between these filter sections, while the remainder of the voltages are supplied from the voltage divider resistor.

A visual tuning meter is inserted in the common plate lead to the first two tubes,



one of which is the mixer. Thus the meter responds to the rectified component of the plate currents of these tubes and that component is greatest at exact resonance.

For all the many unusual features in this circuit it is extremely simple. There is nothing superfluous in it, which cannot be said of all receivers. Yet nothing that good design calls for is omitted.

The most unusual part, perhaps, is the second detector. The automatic volume control circuit includes the plate as anode and the plate is returned directly to the cathode. The automatic voltage, therefore, starts at the positive value determined by the bias on the second detector tube. This voltage is compensated for in the controlled tubes, for they have fixed bias resistors higher than usual. The detector tube is used as an audio frequency amplifier by utilizing the control grid in the usual manner and the screen grid as the plate. There will be a considerable audio gain in the 58 and the following 56, but this gain is completely controlled by means of two 0.25 megohm potentiometers, both acting as grid leaks and both controlled by the same knob.

Another feature is the design of the oscillator. In the first place, it is biased by means of a resistor in the cathode lead. The grid connects through a 600-ohm resistor to a tap on the tuned coil. Excessive oscillation is eliminated by these devices.

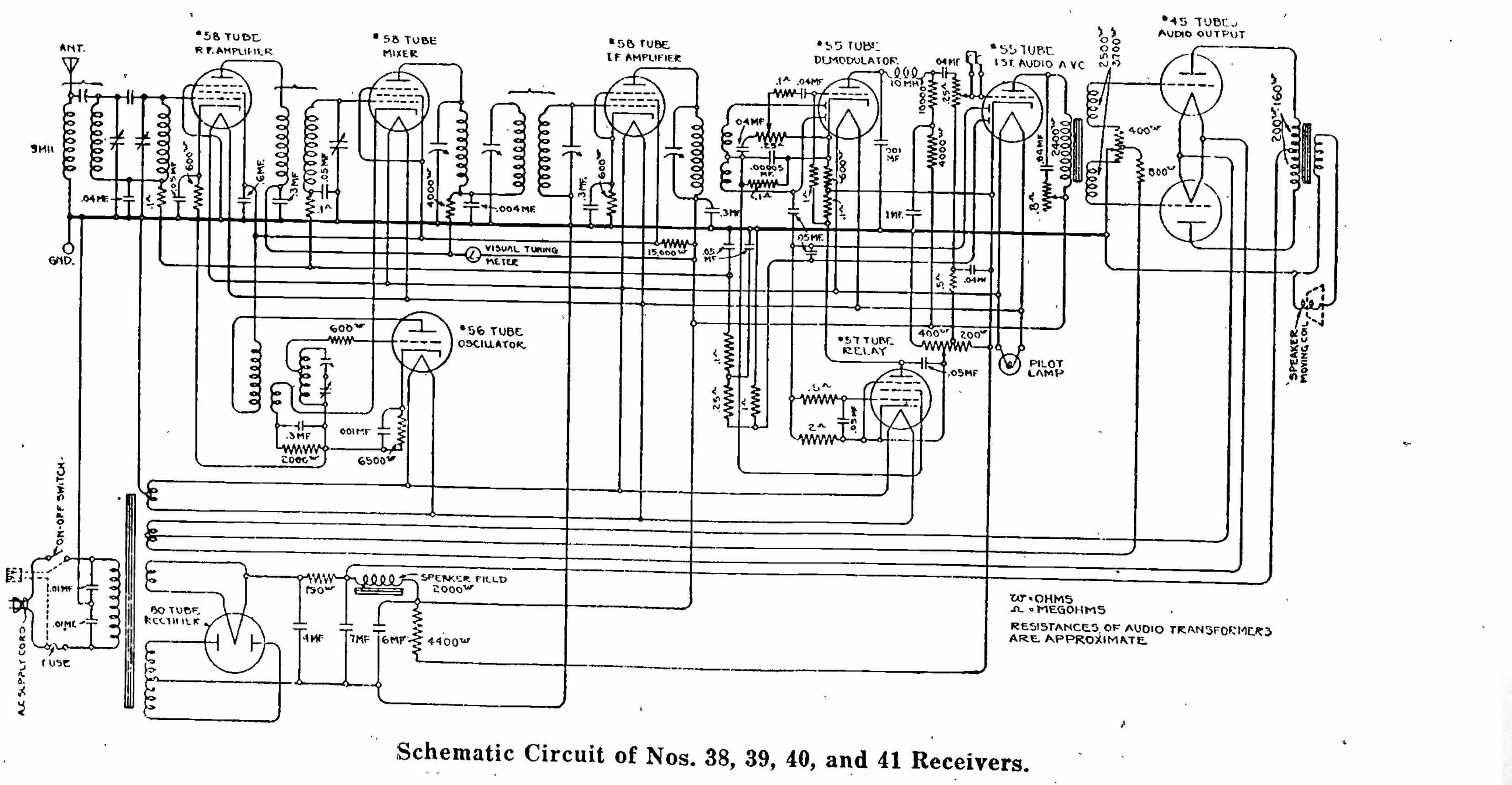
THE Stromberg-Carlson Models Nos. 38, 39, 40 and 41 receivers are 10-tube superheterodynes utilizing three 58s, one 57, one 56, two 55s, two 45s and one '80 tubes. They require 110 watts of power to operate and they give out an undistorted electrical power output of 3.2 watts.

The three 58 tubes are used as r-f amplifier, mixer and i-f amplifier. The 57 tube is used as the "relay" tube in the "Q" circuit. The 56 is used as oscillator and the two 55s are used as a. v. c., detector and audio amplifier. The two 45 tubes are used in a push-pull output stage and the '80 as a rectifier in the power supply.

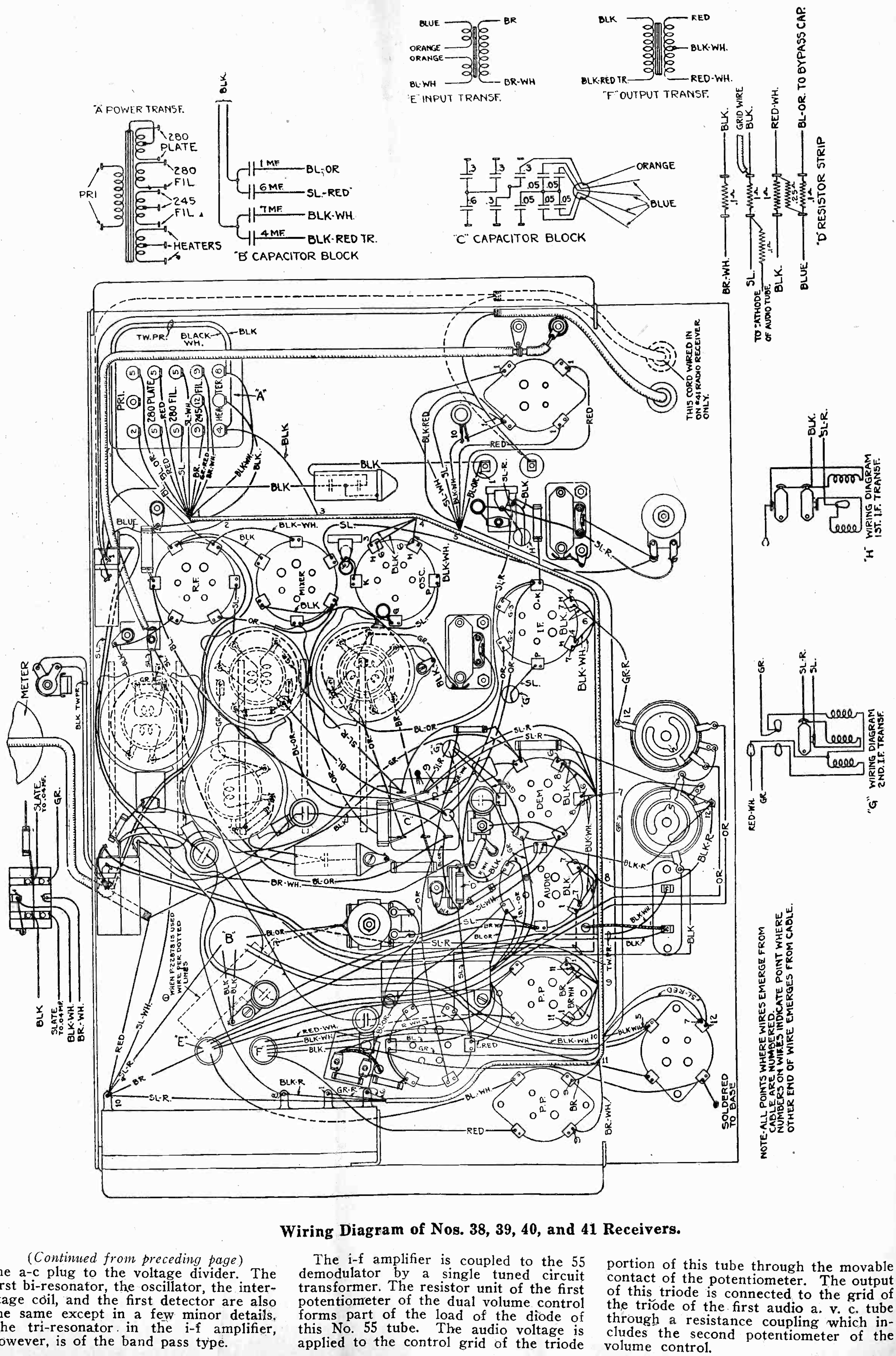
The "relay" tube in the "Q" circuit means that the tube functions as a noise suppression tube.

There are many similarities between this circuit and that of the No. 37. The power supply is virtually the same from

(Contnued on next page)



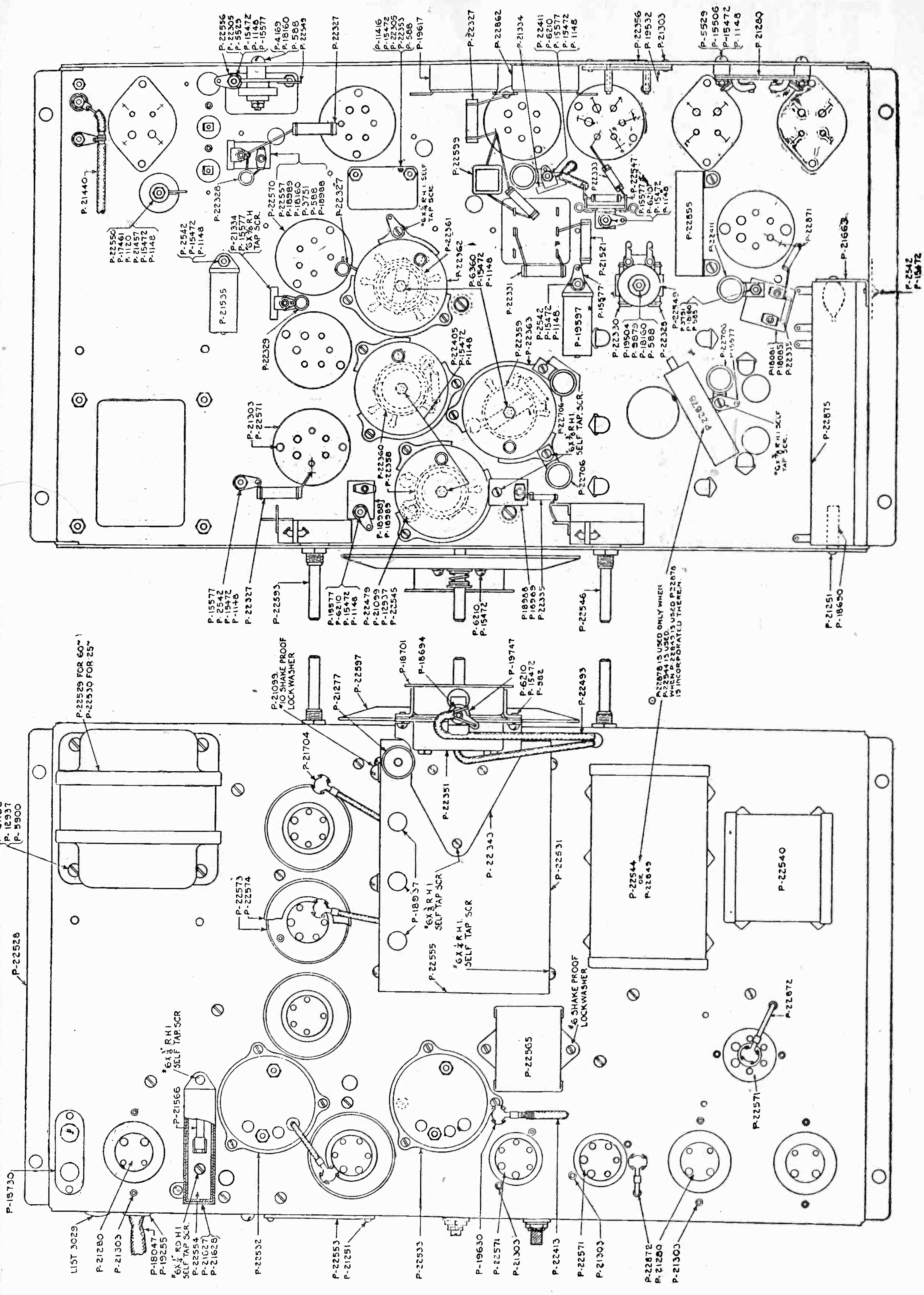
Schematic Circuit of Nos. 38, 39, 40, and 41 Receivers.



Wiring Diagram of Nos. 38, 39, 40, and 41 Receivers.

(*Continued from preceding page*)
the a-c plug to the voltage divider. The first bi-resonator, the oscillator, the inter-stage coil, and the first detector are also the same except in a few minor details. The tri-resonator in the i-f amplifier, however, is of the band pass type.

The i-f amplifier is coupled to the 55 demodulator by a single tuned circuit transformer. The resistor unit of the first potentiometer of the dual volume control forms part of the load of the diode of this No. 55 tube. The audio voltage is applied to the control grid of the triode portion of this tube through the movable contact of the potentiometer. The output of this triode is connected to the grid of the triode of the first audio a. v. c. tube through a resistance coupling which includes the second potentiometer of the volume control.



Chassis Assembly of Nos. 38, 39, 40, and 41 Receivers.

THE PILOT DRAGON

18 to 555 Meters by Switching; 115 kc Intermediate Used

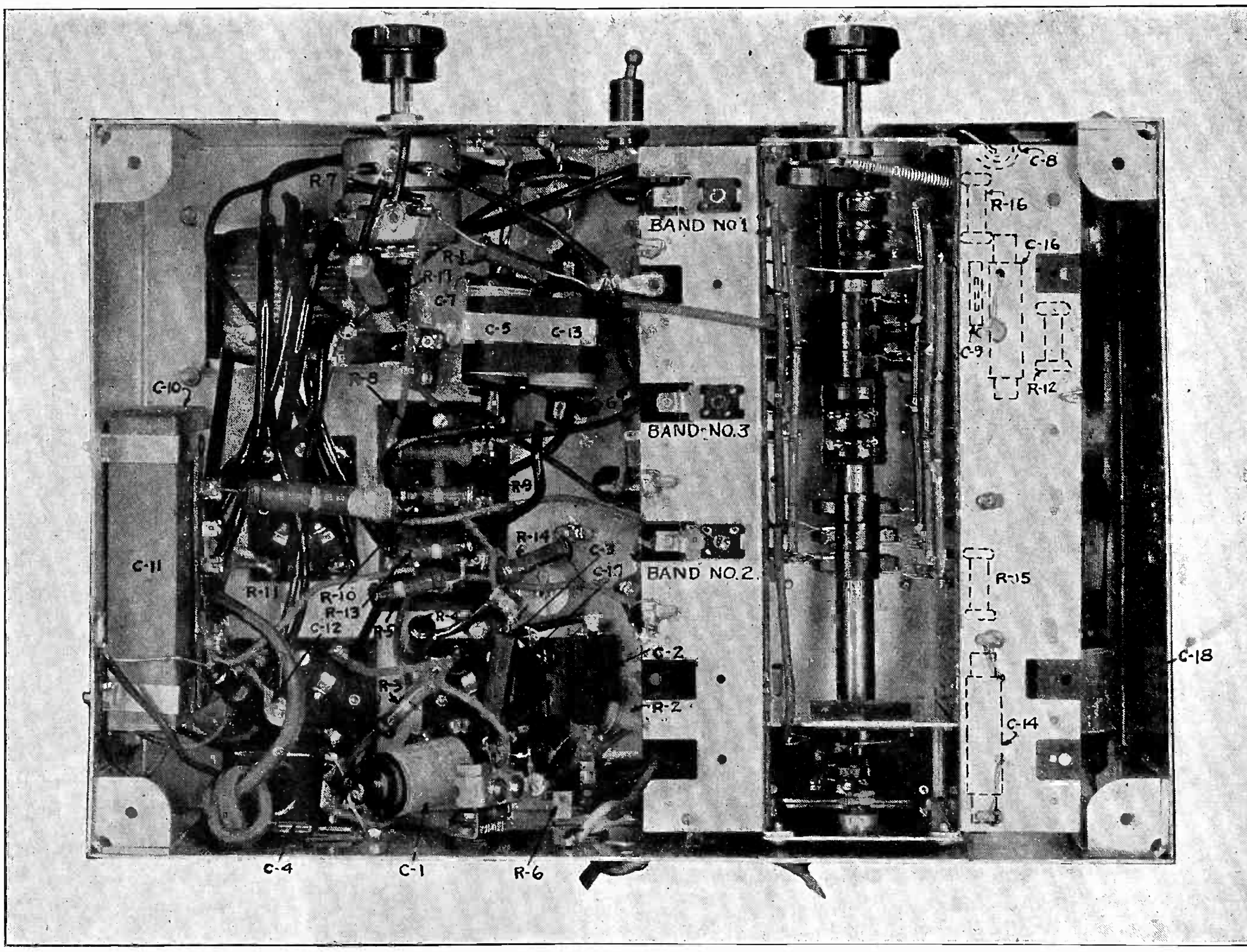


FIG. 2
Under side of the A-C Dragon chassis with the bottom plate removed. Fig. 1 is on front cover.

SERVICE Manual No. 4 of the Pilot A. C. Dragon receiver covers table and console sets bearing the following chassis model numbers:

Chassis No. 10	110-115 volts	50-60 cycles
Chassis No. 10-F	125 volts	50-60 cycles
Chassis No. 10-A	220 volts	50-60 cycles
Chassis No. 10-B	240 volts	50-60 cycles
Chassis No. 10-J	110-115 volts	25 cycles
Chassis No. 10-JF	125 volts	25 cycles

This manual applies to Dragon chasses numbered 410,000, and above.

The Pilot Dragon is a seven-tube superheterodyne receiver which, by means of a special coil switching system, can be used to receive standard broadcast stations or any of the short-wave stations between 18 and 200 meters.

When the band selector switch is turned to the "BC" position the set operates as a standard broadcast receiver. When the band switch is turned to position "3' short-wave stations between 80 and 200 meters are received; in position "2" the set operates from 30 to 80 meters and in position "1" from 18 to 30 meters. For convenience in logging short-wave stations, the lower part of the dial scale is calibrated in equal divisions from 0 to 100, while the upper part of the scale is calibrated in kilocycles from 1500 to 550 kc.

Tubes Explained

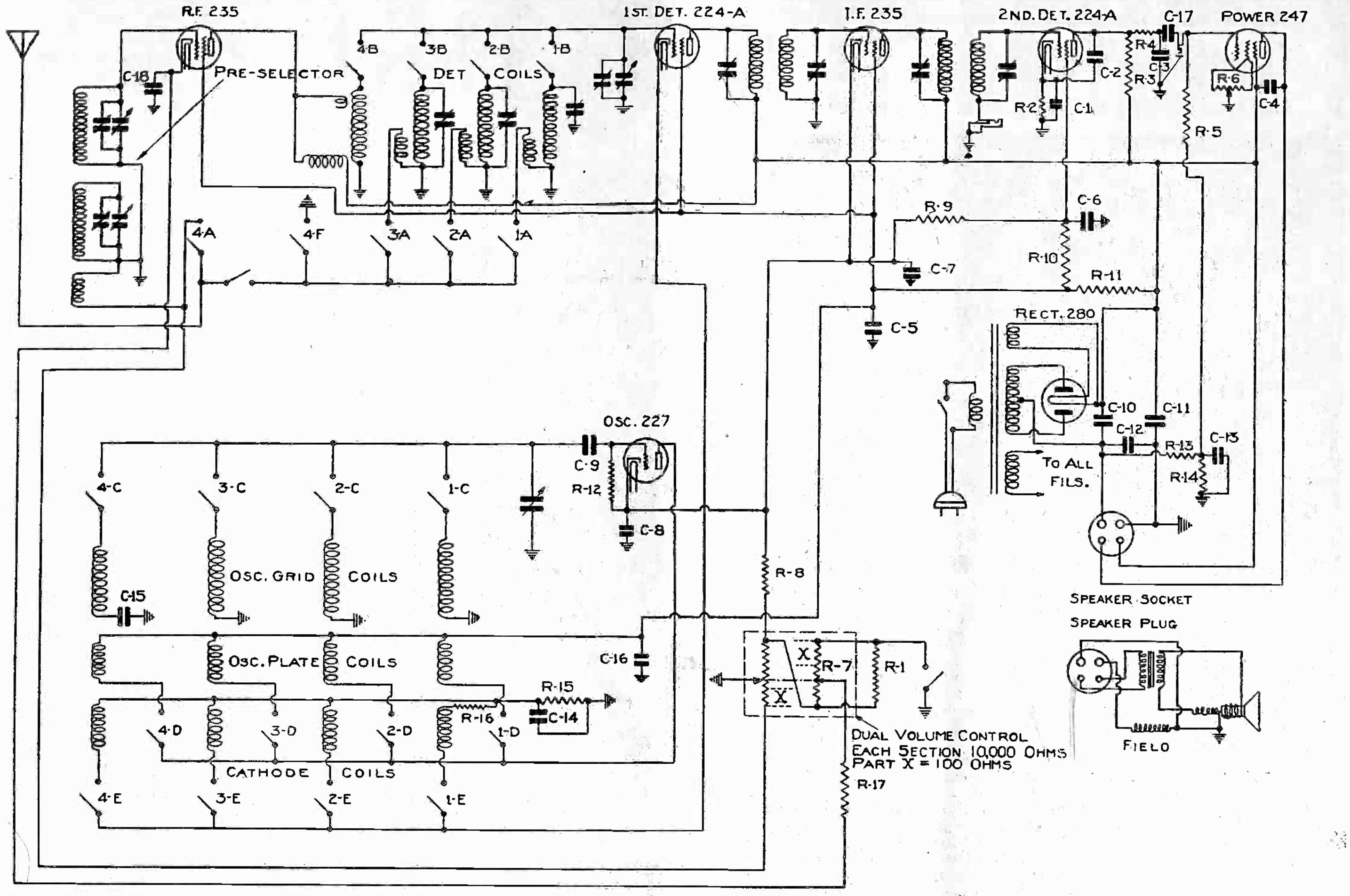
The Dragon is not a combination short-wave converter and broadcast receiver in a single chassis. In each of the three short-wave positions, and in the broadcast position, the set operates as a six-tube super-heterodyne receiver with a single oscillator tube. The complete circuit diagram is given in Fig. 3. An examination of this diagram shows that the circuit consists of a 235 r-f stage, a 224 first detector, a 227 oscillator, a 235 i-f stage, a 224 second detector, a 247 output stage and 280 rectifier.

The method of switching bands is clearly illustrated in this diagram. There are four sets of detector and oscillator coils. The band switch selects any desired pair of coils and connects them to the detector and oscillator tubes and to the tuning condensers associated with these tubes. For instance, when the band selector switch is turned to position 1, the switches indicated in the diagram as 1A, 1B, 1D and 1E are closed. In position 2 of the band selector, switches 2A, 2B, 2C, 2D and 2E are closed. Similarly, the third and fourth sets of switches are closed in positions 3 and 4 respectively. Position 4 is the broadcast band and is marked "BC" on the band selector switch.

On the short-wave bands the receiver operates as a superheterodyne with the antenna coupled directly to the detector coil. Switches 1A, 2A, and 3A connect the three short-wave coils to the antenna and are controlled by the band switch knob. Simultaneously the corresponding grid coil is connected to the grid of the detector tube by switches 1B, 2B and 3B.

Signal Path

The oscillator grid and plate coils as well as the pickup coil which couples the oscillator to the first detector cathode are switched by the switches marked, C, D, and E. Incoming signals, picked up on the antenna, are induced into the first detector grid circuit which is tuned to resonance by one section of the gang



CONDENSERS		RESISTORS	
C1 — .25 mfd.	C9 —.0001	R1— 10000 ohms-½W.	R9— 10000 ohms ½W
C2 —.0005	C10—8	R2— 40000 " "	R10— 10000 " "
C3 —.0005	C11—8	R3—250000 " "	R11— 14000 " 3W
C4 — .01	C12—.035	R4— 50000 " "	R12— 40000 " ½W
C5 — .25	C13—.25	R5—500000 " "	R13—500000 " "
C6 — .25	C14—.1	R6—Center Tap Resistor	R14—120000 " "
C7 — .25	C15—.001480	R7— 10000 ohms-V.C.	R15— 10000 " "
C8 — .1	C16—.1	R8— 250 " ½W.	R16— 500 " "
	C17—.01		R17— 300 " "
	C18—.1		

SCHEMATIC DIAGRAM
DRAGON MODEL 10 SUPER HET

FIG. 3

Schematic diagram of the A-C Dragon for 18 to 555 meters. This is a seven-tube superheterodyne (Model 10).

condenser. The combination of the incoming signal and the locally generated oscillation produce a beat frequency of 115 kc, which is amplified by the i-f amplifier. A trimmer condenser, connected across the grid coil of the first detector is adjusted at the factory to track the detector and oscillator circuit.

When the band selector switch is turned to the broadcast position, switches 4A, 4B, 4C, 4D and 4E are closed and complete the same circuits as the corresponding switches in the short wave bands. As before, the gang condenser tunes the oscillator grid circuit and the grid circuit of the first detector. Unlike the short wave bands, however, the antenna is not coupled directly to the grid circuit of the first detector. As shown in Fig. 3, incoming signals on the broadcast band first pass through the pre-selector and the r-f stage before reaching the first detector. This arrangement of pre-selector and tuned r-f stage eliminates image interference on the broadcast band and provides extreme sensitivity.

Antenna Switching System

To make sure that broadcast signals pass through the pre-selector and r-f stage before reaching the first detector, it is necessary to eliminate any capacity between the antenna and the first detector grid circuit. To eliminate this capacity, the antenna is brought into a shielded compartment in which the broadcast antenna switch 4A and a special short wave antenna switch are enclosed. The latter connects the antenna to the short wave band switches 1A, 2A and 3A when the band selector is in any of the three short wave positions. In the broadcast position the short wave antenna switch is open and switch 4F is closed. The latter grounds contacts 1A, 2A and 3A, together with the wire connecting these contacts together. All undesired capacity in the wiring of the switch is thus eliminated.

The i-f amplifier is tuned to 115 kc, with a total of four tuned circuits. The two trimmers in each i-f transformer are adjusted through holes in the top of the can.

The second detector operates as a self-biased power detector and is resistance-coupled to the pentode output stage. The 50,000 ohm resistor, between the plate of the 224 and the coupling condenser, prevents r-f signals from reaching the grid of the pentode, the r-f component being by-passed by two fixed condensers.

Power Supply and Volume Control

The plate voltages of all tubes, except the oscillator, are supplied directly from the positive side of the line. The plate of the oscillator, together with the screen grids of the first detector and i-f tubes, are supplied from the 90 volt tap on the bleeder across the power supply. The screen grid of the second detector is connected to the 45 volt tap.

Volume is controlled by varying the grid bias of the 235 i-f amplifying tube. On the broadcast band, the volume control also varies the r-f tube bias and the resistance from antenna to ground, this additional control being necessary to reduce strong local stations to complete inaudibility.

At the rear of the chassis, a phonograph pick-up jack is provided. When the pick-up is plugged in, it connects between the low side of the i-f transformer and ground. A high impedance pick-up should be used. The radio volume control should be turned to its minimum position.

A jack is also provided for those who wish to tune in stations with headphones. The phones connect across the output of the second detector. No direct current flows through the phones and there is no danger of shock. High impedance headphones should be used.

Re-Alignment

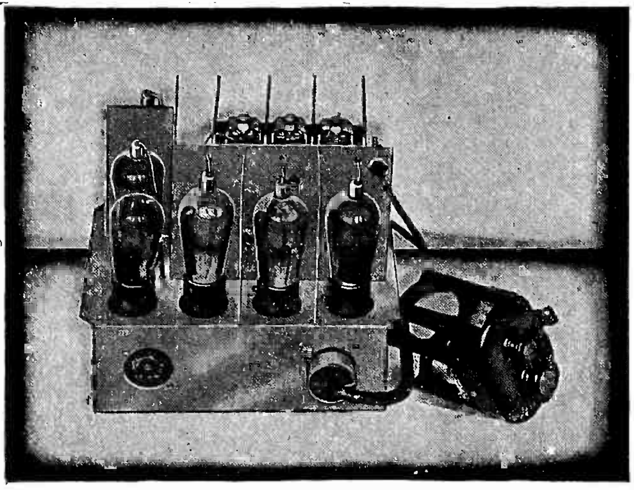
The sensitivity and selectivity of the Pilot Dragon largely depend upon the proper adjustment of the various trimmer condensers. Before sets leave the factory, these trimmers are carefully tuned and every precaution is taken to insure the permanence of the adjustments.

If a set appears to be insensitive, it is possible that rough handling in transit has changed the position of some of the trimmers. In this case, the sensitivity can be restored by re-aligning the set. It is understood, of course, that the tubes have been checked and other tests made, as suggested in the foregoing sections, to make sure that the insensitivity is not due to other causes.

The best method of adjusting the i-f trimmers is by means of a signal generator (or modulated oscillator) tuned to 115 kc. The output of the oscillator is connected across the grid circuit of the first detector and the two i-f transformers are lined up to resonance with the 115 kc signal. Many service stations, however, may not be equipped with a 115 kc oscillator, in which case the i-f transformers can be adjusted at the same time as the broad-

(*Continued on page* 14)

Anderson's New Auto Set



Roland's new 8-tube superheterodyne with automatic volume control and the new 89 output tube.

FULL advantage has been taken of the latest tube developments to produce an outstanding automobile receiver, one that combines the necessary high sensitivity with finest tone quality. Harshness and tinniness of sound, due to negative feedback and mismatched impedances, are completely absent from the Roland Auto Receiver, designed by J. E. Anderson, technical editor of RADIO WORLD.

The circuit is a superheterodyne, embodying the latest circuit refinements, and including original uses devised by this distinguished engineer. For instance, the output tube is an 89, and the circuit carefully designed so that local stations will load up this remarkable tube. The circuit is equipped with distinctive automatic volume control, an 85 tube that serves solely as such control, and performs no additional function. Therefore no delayed a-v-c action affects the true detecting function, since the detection takes place in another tube. This segregation of time constant effect from the receiver circuit proper is an important feature, exclusive in Roland's automobile superheterodyne.

So sensitive is the circuit that in many instances it is desirable to place the receiver underneath the car chassis, somewhere near the differential housing, and to enable this location a 10-foot remote control cable and extra long battery supply cable are furnished. Copper screen, as used on windows, makes a suitable aerial, and should be at least 1 foot below the car chassis, insulated therefrom, about 5 feet square. B voltage required, 135 volts. No C battery needed. Car chassis serves as ground. The complete parts for this receiver, including set chassis and set shield, battery box, remote control, battery cable, all condensers, resistors and coils, speaker with shielded cable; and a kit of RCA tubes (two 239, two 236, two 237, one 89, and one 85) are supplied less aerial. The is Cat. 898-K @.................... $34.60

Wired model, licensed by RCA, with complete equipment, less aerial, but including RCA tubes. Cat. 898-W $37.40

Eveready-Raytheon Tubes

The famous four-pillar Eveready Ratheon tubes are offered at prices that command attention. Each tube is guaranteed to be in excellent condition. When ordering tubes be sure to include as additional remittance postage at 5c per tube. The net prices follow:

46	$ .78	59	$1.25	BR	$1.40
49	1.40	82	.65	LA	1.40
52	1.40	83	.80	112A	.80
55	1.30	85	.80	120	1.50
56	.65	89	.90	171A	.50
57	.90	BA	3.75	V199	1.40
58	.90	BH	2.40	X199	1.30
				200A	2.00

Note: No tubes shipped C.O.D.

Testing Equipment

TEST OSCILLATOR, dial calibrated in 10 kc divisions for the broadcast band, with intermediate frequencies registered directly on the dial also, as follows (including all the commercially used intermediate frequencies): 115, 130, 172.5, 175, 177.5, 260, 400 and 450 kc. Since the broadcast band calibration is for 10 kc subdivisions, the intermediate frequencies used with converters may be tested directly, the popular ones being 550, 650, 1000, 1050, 1075 and 1100 kc. The wired model, modulated type, 105-120-v., 50-60 cycles, 6.5x5x3-inch cabinet. 6-to-1 vernier dial and 56 oscillator tube included in price. Cat. 561 @ $7.85

SAME AS ABOVE, except for battery operation, 22.5 volts of B battery, 3 volts of dry cell A battery required, for 230 tube furnished with oscillator. Wired model, modulated type. Cat. 2301 @..$7.15

ANALYZER PLUG—For the construction of tube and receiver testing devices, the simplest method of access for current, voltage or resistance is to use a 7-pin analyzer plug that goes into the receiver socket. Adapters enable putting in the plug when plug itself does not coincide with receiver socket. The plug is equipped with a 7-lead cable. Cat NA-977 @..........................$1.25

ADAPTERS for NA-977—The three principal adapters required are for serving sockets with UX, UY and six-pin connections, and these adapters are Cat. NA-977-AD @..................$2.19

Write us your requirements for analyzer plugs or adapters for any purpose, including standard set analyzers, as we can furnish virtually any type adapter or plug that is manufactured.

Remit 10% with all C.O.D. Orders

The New Roland "

Unexcelled Performance; I

All our circuits have been expertly designed and fu the world. They have proved themselves of lasting value circuits with which the radio business is afflicted. Our cla understatement, rather than on the fanfare of exaggera

5-TUBE JUNIORS, T-R-F or SUPER

ATWELL cabinet, 16 x 12.7 x 9.75 inches. The five-tube junior model receivers, t-r-f and super, are housed in this cabinet.

SUPER

MUCH effort was devoted to devising and perfectin a superheterodyne circuit that uses only fi tubes, and finally a special autodyne hooku enabled the use of the 57 first detector as oscillator als and to such fine advantage that with one stage of in termediate frequency amplification (175 kc) feeding th second detector, there was enough rectified output load up the new 59 heater type power tube on distan stations. So revealing was this autodyne hookup tha it has become standard in our home-use superhetero dynes. The tubes in the 5-tube junior model super ar two 57, one 58, one 280 and one 59. Note that the new est output tube, 59, the one that eradicates hum becaus the cathode is independent of the heater, is use For 105-120 volts, 50-60 cycles a-c. Equipped wi volume control and tone control. The complete kit, including everything, even unto speaker cabinet and a kit of RCA tubes, is Cat. 595-S @................ $14.7

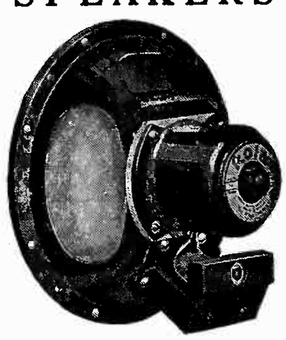
Wired model (licensed by RCA) is Cat. 595-S-V @ ....$16.

T-R-F

The five-tube junior t-r-f set, in the same cabinet, use a stage of untuned r-f, two tuned stages, one of whic feeds the detector, and has a 59 output tube. The com plete kit of parts, including also speaker and cabinet, and a kit of five RCA tubes (two 58, one 57, one 59 and one 280) is Cat. 595-TJ @.................. $12.5

Wired model, complete, with tube kit, Cat. 595-TJ-V @ ....$13.

ROLA
SPEAKERS



The Rola speakers listed herewith are of two series. The cone diameter of the Series F speakers is 8 inches and that of the Series K-7 is 10.5, that of K-9 is 12 inches. All speakers have field coil, output transformer, plug and cable. Besides the speakers listed we can supply models for other purposes, of the same manufacture. Inquire for prices.

8-Inch Diameter

Cat. FP, for '47 or 89 single output; 1800 ohm field coil tapped at 300 ohms......$3.75

Cat. F-P-59, same as above, except for the new 59 tube.......................... 3.85

Cat. F-P-2, for two '47 or 89 tubes in push-pull; 1800 ohm field coil tapped at 125 ohms 3.80

Cat. F-P-2-59, same as above, except it is for new 59 tubes...................... 3.90

Cat. F-45, for single '45 output; 1800 ohm field coil tapped at 800 ohms........... 4.15

Cat. F-45-2, for two '45 tubes in push-pull; 1800 ohm field coil tapped at 500 ohms 4.50

10.5-Inch Diameter

Cat. K-7-P, 1800 ohm field tapped at 300 ohms. For single '47 or 89............ 4.20

Cat. K-7-59, same as above, except for new 59 tube 4.30

Cat. K-7-45, 1800 ohm field, tapped at 800 ohms; for single '45 output...........

Cat. K-7-P-2, 1800 ohm field, tapped at 125 ohms; for push-pull '47 or 89.......... 4.80

Cat. K-7-P-2-59, same as above, except for new 59 tubes.......................... 4.90

Cat. K-7-45-2, for push-pull '45's; 1800 ohm field, tapped at 500 ohms............. 5.10

12-Inch Diameter Cone

Cat. K-9-P, 1800 ohm field, tapped at 300 ohms; for single '47 or 89 output........ 5.25

Cat. K-9-P-59, same as above, except for new 59 output 5.35

Cat. K-9-45, for single '45 output; 1800 ohm field tapped at 800 ohms............... 5.45

Cat. K-9-P-2, for two '47 or 89 tubes in push-pull; 1800 ohm field tapped at 125 ohms 5.75

Cat. K-9-P-2-59, same as above, except for new 59 tubes 5.85

Cat. K-9-45-2, for two 45's in push-pull; 1800 ohm field tapped at 500 ohms...... 5.95

AUTOMOBILE SPEAKER

6 inch cone, 6 volt field for connection to car's storage battery. Shielded cable supplied with each speaker. Cat. RO-AU @.... 4.50

PRECISION PARTS AT

PUSHBACK hookup wire, 1000-ft. rolls, at price nev before equalled. This wire comes in twisted pair ar may be used directly for compact wiring, including a leads, or may be unpaired by purchaser when using i The wire is No. 18, tinned, takes solder readily, and th insulation withstands the normally high voltages modern a-c receivers. Cat. PBW...................$6.

Shielded lead-in wire, 100-foot rolls, for use at aeri installations for minimizing pickup of static disturb ances. Per 100 feet. Cat. SHLW..................

BYPASS condenser, 1 mfd.; withstands 300 volts d- Cat. BPC ....

FARRAND inductor dynamic speakers, for push-pu output; order by output tubes, as follows: '47, '45 or 5 The diameter of cone is 12 inches. This speaker r quires no exciting field. It renders exceptionally faith ful reproduction. Cat. FIND (and specify output tube used) @..3.

TWO-GANG 0.00035 mfd. straight frequency line con denser, brass plates, ¼-inch shaft. Cat. DJ-35 @...

THREE-GANG 0.00035 mfd., midline tuning, bra plates, ⅜-inch shaft at both ends. Cat. SCO-35 @ 1.

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

CHASSIS for 5 tubes, fits in Stanton cabinet; chassis 13½ inches wide, 7½ inches front to back; flaps fro and back 3 inches high; drilled for sockets and speak plug and for volume control and switch at front. Ca 5-TCH @ ....

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

CHASSIS for 7 tube set. Cat. 7-TCH @...........

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

MIDGET POWER TRANSFORMER, for five-tube se to handle three heater tubes, one 247 and one 280. Ca MPT-5 @ .... 1.

MIDGET POWER TRANSFORMER for six-tube se to handle four heater tubes, one 247 and one 280. Ca MPT-6 @ ....1.

8 MFD. WET ELECTROLYTIC condenser, for inverte mounting; washer and extra lug provides insulation fro chassis for circuits with B choke in negative leg. Ca LCT-8 @ ....

ROLAND

35-W Hooper Street TELEPHONE:

How to get there: From Brooklyn Bridge (Manhat From Brooklyn, take Franklin Avenue surface car Street "L" and to Franklin Avenue station of B.M

ower Plus" Circuits

ces Lower Than Ever Before

sted not only in our laboratories but also in the markets of are by no means to be confused with experimental or giddy r performance are modest, and we rely on the strength of Roland is a name that stands for reliability.

4-TUBE T-R-F RECEIVER

THE accomplishment of real results, including not only the enjoyable reception of local stations but considerable distance reception as well, under fav- able conditions, is possible with the Roland 594-T ceiver. The tuned r-f stage has a 58 tube, the detec- r a 57, the rectifier is a 280, while the output tube is e new 59. This receiver is stable in operation, pro- uces good tone, and has a sensitivity far in excess of hat would normally be expected of a 4-tube t-r-f ceiver. Every precaution has been taken to safeguard gainst radio frequency losses, so that the fullest ssible sensitivity and selectivity would result. There no room for losses in so modest a set, and we have iminated them very successfully. The result is a tube t-r-f receiver that has been acclaimed the leader its class. Moreover, the price is at such a reduced vel that no one can say he can't afford a good ceiver. This is indeed a good one and we recommend highly, despite its few tubes and low cost.

This receiver is sold in wired form only, and is censed by RCA. Moreover, despite the very low price, comes complete in all respects, including also the t of four RCA tubes (one 58, one 57, one 280 and one). Speaker of course is included. or 105-120 volts, 50-60 cycles a-c. quipped with volume control and tone ontrol. Cat. 594-T @.................. **$11.95**

his four-tube set is, in our opinion, the best four-tube t made to sell in the $25 to $37 price range of com- titors.

BOSWORTH cabinet, 14 x 11.5 x 9.5 inches, housing the 4-tube t-r-f set.

RIKINGLY LOW PRICES

(Coil shields, 2-inch diam., 2.5 inches high.)

5 kc, shielded intermediate coils, primary and second- y tuned by Hammarlund condensers built in, ac- ssible to screwdriver. Flexible leads attached, in- uding grid lead emerging through hole in top. at. INT-175 @ .... **$ .79**

0 kc, same as above, except for difference in fre- uency. Cat. INT-450 (tunable from 390 to 465 kc). **.82**

00 kc, same as above, except for difference in fre- uency. For short-wave supers. Cat. INT-1500.... **.97**

et of three matched, shielded coils for r-f, modulator nd oscillator, where i-f is 175 kc. Oscillator has pickup inding. Padding condenser, 700-1000 mmfd. included. at. SHL-175 .... **1.39**

et, same as above, except for around 450 kc. Padding ondenser, 350-450 mmfd., included. Cat. SHL-450.. **1.39**

et, three shielded t-r-f coils for 0.00035 mfd. T-r-f oils have 80-meter tap (lug inside coil), which need not e used if not desired. Cat. TRF-L............... **1.19**

00 TURN HONEYCOMB coil, total diameter, 1¼ inches; ill tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd. qualizer). Cat. HC-800 @.......................... **.30**

00 TURN HONEYCOMB coil, same style, tunes to 400 c. with 0.0001 mfd. Also may be used without con- enser as antenna input coil, screen and plate choking, r two used inductively coupled for evening the ampli- cation of t-r-f sets, in untuned stage feeding detector. at. HC-300 (each) @................................... **.20**

0 TURN HONEYCOMB coil, ¼ millihenry, for all short ave purposes. Cat. HC-50 @....................... **.15**

WATT PIGTAIL RESISTORS, all resistance values. Iention Cat. PGTR and state resistance in ohms there- fter. Price .... **.07**

OTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ **5c**; 25,000 ohms @ **75c**; 50,000 ohms @ **75c**; 100,000 hms @ **80c**; 500,000 ohms @ **80c.**

OTENTIOMETER with a-c switch attached, 10,000 hms, for variable mu grid bias as volume control. at. POT-10-SW @ .... **.79**

VALNUT FINISH, EITHER DORSET OR STANTON ABINET for midget sets, cut for 7-inch cone. Cat. IDCB @ **4.50**

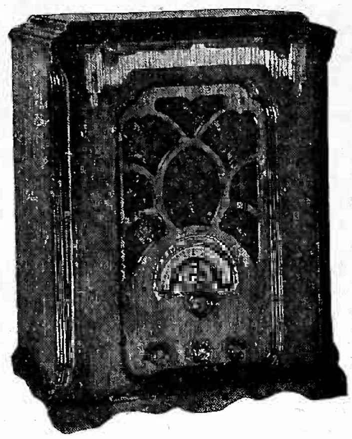
THREE GANG .0005 MFD. Cat. DJA-35 @....... **1.25**

ELFORD 30 henry choke; stands up to 100 ma; in lack shield case. Cat. KEL-30 @........................ **.93**

5 VOLT center-tapped fil. trans., 2 amperes Cat. LT @ .... **.79**

7-Tube Super

THE best chassis that we make, housed in our most luxurious table model Stanton cabinet, is the seven-tube superhetero- dyne. This receiver is noted not only for its most exceptionally ex- quisite tone but also for its extraordinary ability at bringing in far-distant stations, in- cluding stations of ex- tremely low power. Un- der normal conditions the night-time range of this receiver is estimat- ed to be 3000 miles. So DX fans will get their full measure of delight from the 597-S receiver, the most sensitive and most selective of the Roland line of receivers and kits.



THE STANTON cabinet into which are put the 7-tube a-c super or the 6-tube d-c set.

The set is for a-c op- eration, uses the newest and best tubes, with two 59 tubes in the out- put. These new output tubes eradicate hum because the cathode is independent of the a-c heater.

The circuit completely suppresses forms of interference peculiar to superheterodynes, including image reception. This suppression is due to the high selectivity developed, including the selectivity ahead of the intermediate channel. All told there are seven tuned circuits, although only three are con- trolled by the three-gang tuning condenser. The stations are far enough separated on the dial on a frequency basis to make tuning easy despite the high selectivity. Care has been taken to avoid sideband suppression. Tone is one of the first con- siderations in all Roland Receivers and has been most care- fully protected in our seven-tube quintessence of excellence.

The intermediate frequncy is 175 kc, the mixer has a stage of t-r-f ahead of it, modulator and oscillator are tuned, and the sensitivity built up so high that the average is better than 2 microvolts per meter, and at the high frequency end the sensitivity attains levels approximating 0.25 microvolts per meter. For the man or woman who knows his or her radio this is the receiver par excellence.

The Roland autodyne circuit is used, whereby oscillator and modulator are combined in one tube, and in a manner that, far from being less desirable than where two separate tubes are used, is, if anything, more desirable, because of electron coupling. The receiver is available either in kit form or wired.

Complete kit, including cabinet and speaker, and also including a kit of RCA tubes (two 58, two 57, two 280 and two 59), for 105-120 volts, 50-60 cycles a-c. Equipped with volume control and tone control. Cat. 597-S.................. **$22.95**

Wired model, with tubes, including cabinet and speaker. Cat. 9 597-S-W.............................**$26.95**

SIX-TUBE D-C CIRCUIT

For 110-volt d-c locations we have an ex- cellent 6-tube set. Parts include speaker and Stanton cabinet, and kit of RCA tubes (two 239, one 236, one 237 and two 238's in push-pull). Cat. 386-T **$21.75**

Wired model, with cabinet, speaker, tubes. Cat. 386-T-W **23.50**

SHORT WAVES

TWO-TUBE BATTERY MODEL

Our two-tube 15-200-meter circuit for earphone work is excel- lent one and has proved its popularity for many years. The 2-volt tubes (237) are used, in detector and one stage of transformer audio, with Hammarlund tuning condenser of 0.00014 mfd. and a Hammar- lund feedback condenser of 0.0002 mfd. capacity. This hookup is virtually standard with short-wave enthusiasts, especially those keen on European reception.

The complete kit of parts, with picture diagram of the wiring, is obtainable at only $7.95 (Cat. SWBAT-K), and a wired model at only $1 extra (Cat. SWBAT-W). Herewith is the list of parts and prices:

One set of four special plug-in coils $1.25
One Hammarlund 0.00014 mfd. tuning condenser 1.15
One Hammarlund 0.0002 mfd. feed-back condenser 1.25
Three UX sockets.............. .18
One audio transformer......... .50
One 50,000-ohm resistor........ .08
One 300-turn honeycomb choke.. .25
One 0.00025 mfd. grid condenser with clips .... .08
One 6.5 ohm filament resistor.. .12
One 20-ohm rheostat........... .25
One equalizer .... .15
One battery switch.............. .10
Six binding posts .... .24
Binding post strip............. .10
REL vernier dial .... .70
Two knobs .... .10
One 7x10 inch front panel, bake-lite 1.20
One baseboard .... .25
One blueprint ....

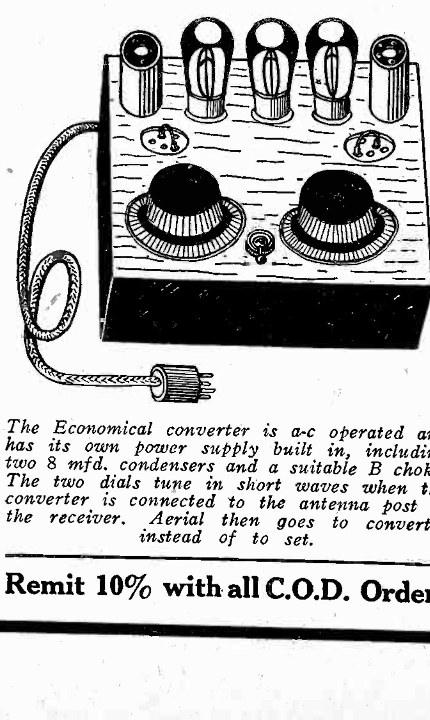
Cat. SWBAT-K (complete kit, less tubes, cabinet) $7.95

Blueprint furnished free with each kit.

Economical Converter

A short-wave converter, 20 to 200 meters, that also may tune somewhat into the broadcast band, depending on what intermediate frequency is used, can be built economically. While the appear- ance is not the best possible to attain, due to economical cost, the converter is nevertheless good on performance, especially as modulator and oscillator are separately tuned. The wave bands are changed by plugging tipped leads into each of the band sockets, at corresponding positions. Many users of this converter, which they themselves built, have expressed their delight at its per- formance. And it works on superheterodynes as well as on t-r-f sets, which is not true of all converters. A plain wooden box, stained, is used for cabinet, and is supplied with the rest of the parts. The tubes used are three 237's. For a-c operation, 105-120 v, 50-60 c. The complete kit of parts, including cabinet, all resistors, condensers and coils, and a kit of three tubes, is Cat. ECONV @ $7.95

Wiring diagram is furnished free with each kit.



The Economical converter is a-c operated and has its own power supply built in, including two 8 mfd. condensers and a suitable B choke. The two dials tune in short waves when the converter is connected to the antenna post of the receiver. Aerial then goes to converter instead of to set.

Short-Wave Parts

HAMMARLUND 0.0002 mfd. junior midline condenser, popular for feedback control in short-wave circuits. Isoltantite base. Cat. H-20 @ $1.25

HAMMARLUND 0.00014 mfd. junior midline tuning condenser, the capacity used for virtually all short-wave tuning. Isolantite base. Cat. H-14 @ 1.15

HAMMARLUND 0.00014 mfd. dual condenser (two sections), Isolantite base. Cat. H-14-DUO @ 2.05

Set of four plug-in-coils, two windings, UX bases; for use of UX tube sockets as coil receptacles. Gripping flange on each, also different color code on each flange for each coil. Cat. SWL-UX @ 1.30

Set of four plug-in coils, three windings, six-pin bases; for use of six-pin tube sockets as coil receptacles. Third winding is for feedback. Useful for single tube set or for regenerative detector where set has stage of t-r-f. Cat. SWL-SXP.............. 1.65

Short-wave r-f choke, inductance ¼ millihenry. Honeycomb type. Cat. HC-50 @ .... .15

Blueprint of two-tube battery-operated short-wave earphone set and of four-tube set, same as two-tube, except for two stages of audio. (Both.) Cat. BP-SW-2-4 @ .... .15

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(*Continued from page* 11)
cast band trimmers, using an oscillator tuned to broadcast frequencies. This method can be used successfully when the i-f transformers are slightly out of adjustment. However, if the factory adjustments have been changed with a screw driver and the i-f amplifier thrown completely out of line, a 115 kc generator must be used to re-adjust the trimmers.

Re-Alignment on Broadcast Band

To re-align the i-f and broadcast band trimmers, the service station must be equipped with a modulated oscillator and an output meter. The oscillator must be able to supply a modulated output at 1400 kc and 600 kc.

To adjust the set with this equipment, the procedure is as follows:

1. Remove the chassis from the cabinet.
2. Connect the output meter across the primary of the loudspeaker input transformer. If the meter is not equipped with a multiplier, connect it across the secondary of the speaker transformer.
3. Plug the loudspeaker into the chassis
4. Connect the output of the oscillator across the grid circuit of the first detector. In other words, clip one output lead to the control grid of the first detector and the other output lead to the chassis
5. Tune the oscillator to 600 kc, switch on the receiver and turn the band selector switch to the BC position. Then tune in the 600 kc signal, turning down the attenuator of the oscillator until a normal output is registered on the output meter. Tune the set carefully to the position which gives the maximum deflection of the output meter. Then adjust the four trimmers of the i-f transformers for maximum output.
6. Connect the output of the oscillator to the antenna and ground connections of the set. Tune the oscillator to 1400 kc and turn the dial of the receiver until the signal is accurately tuned in. Then adjust the broadcast detector trimmer and the r-f and pre-selector trimmers until maximum output is recorded on the meter. Go over the adjustments of these trimmers several times to make sure that the pre-selector, r-f and detector circuits are properly lined up with the oscillator.

Re-Alignment on Short Waves

To re-align the short wave bands, the service station should be equipped with a short wave signal generator or oscillator, supplying a modulated output at 12,000 kc, 9,000 kc and 3,500 kc. The first band is lined up at 12,000 kc, the second band at 9,000 kc and the third band at 3,500 kc. In each case, the detector trimmer is adjusted to give best sensitivity. The method is the same on each band and may be described as follows:

1. Connect the output of the signal generator across the antenna and ground terminals of the set and tune the generator to the required frequency, as specified above. Turn the band selector switch to the proper position and tune in the signal with the tuning control of the receiver. 12,000 kc comes in at a dial setting of about 50 on the first band, 9,000 kc at about 5 on the second band and 3,500 at 10 on the third band. In common with all short wave super-heterodynes and short wave converters, the signal can be tuned in at two positions on the dial. In this case, however, it must be tuned in at the lower reading on the dial scale. For instance, on the second band, 9,000 kc can be tuned in at 5 and 7 on the scale. To line up the set properly this signal must be tuned in at 5 on the dial.

When the signal has been tuned in at the proper setting of the dial, adjust the detector trimmer for maximum output, at the same time re-adjusting the main tuning dial very carefully with the other hand.

Removing Chassis

To remove the chassis from the cabinet, proceed as follows:

1. Pull the knobs off the shafts of the tuning dial, volume control and band switch. There are no set screws on these knobs.
2. Remove the nut from the line switch.
3. Remove the four screws holding the chassis to the bottom of the cabinet.
4. Pull out the loudspeaker plug and slide the chassis out of the cabinet.

[Other Illustration on Front Cover.]

A Thought for the Week

WELL, it's all over—and certainly radio figured as never before in the activities of all political parties. Now that we know who our president is to be, for the coming four-year term, let's put our shoulders to the wheel and fight with and for him, and, whether we be Democrat, Republican or what-not, prove to ourselves and the world that we are Americans first and partisans afterward.

Time marches on—and so does radio!

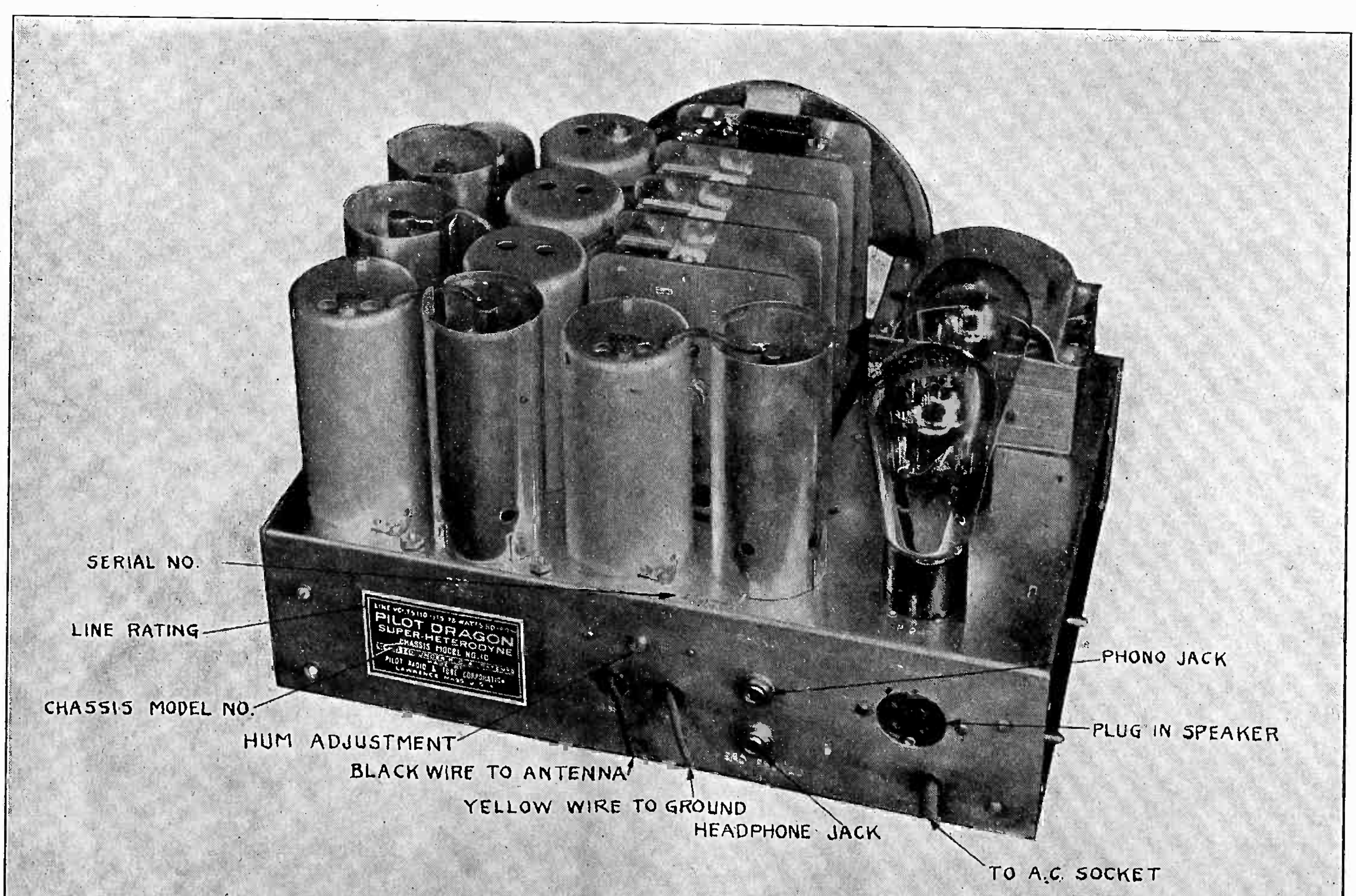
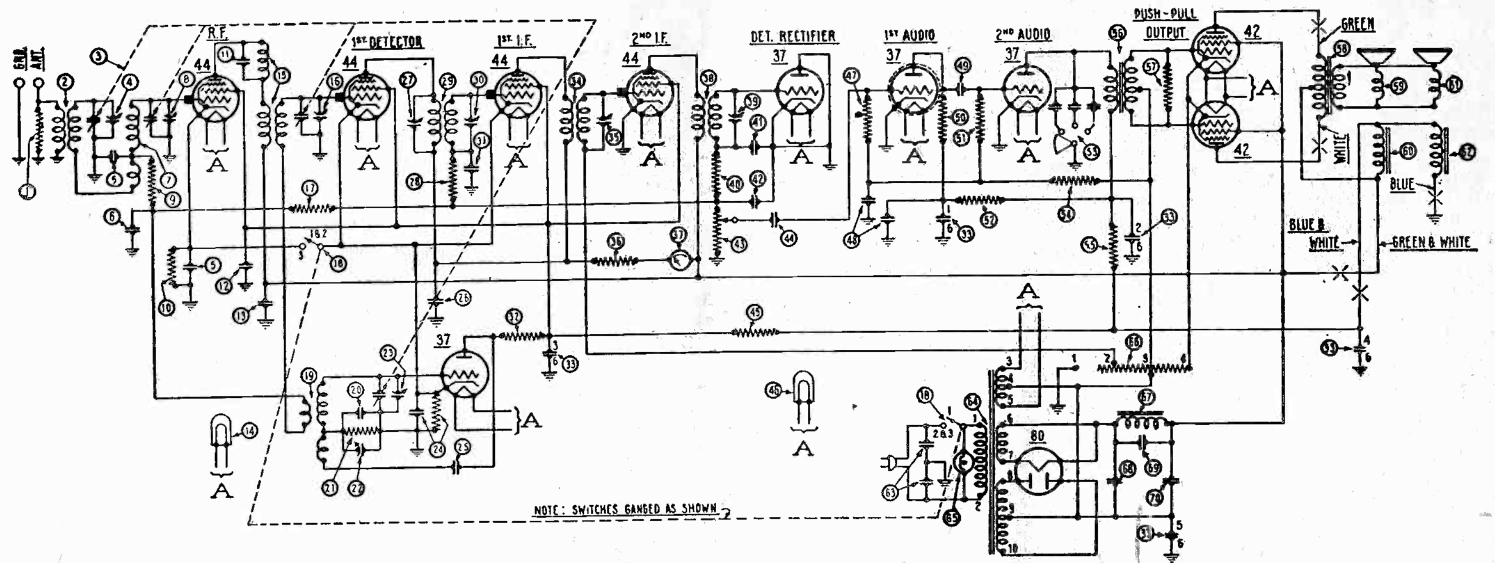


FIG. 4
Rear of the A-C Dragon, chassis removed from the cabinet.

Circuit Analysis of Philco 15

By David Earnshaw

Philco Research Department



[*The general service information on the Model 15 Philco was published in the October 29th issue. All resistance and capacity values were given. Herewith is an analysis of the circuit.*—EDITOR.]

THE Model 15 Receiver is an 11 tube superheterodyne embodying all the best features known in radio set designing.

The analysis of the circuit should be followed on the wiring diagram.

The antenna is connected to Coil No. 2. which is shunted by Resistor No. 1. Coil No. 2 and No. 7 comprise what is actually termed a "Pre-Selector Circuit," that is, the signal which is applied to the first 44 Tube is very carefully selected from unwanted signals by means of two tuned circuits. These two circuits are coupled by means of the small coil at the bottom of No. 7. The signal being applied to the 44 Tube is very carefully selected from unwanted signals by means of two tuned circuits. These two circuits are coupled by means of the small coil at the bottom of No. 7. The signal being applied to the 44 Tube is amplified and the signal in the plate circuit is coupled to the secondary of Coil No. 15 by means of two primaries.

Why Two Primaries Are Used

The top primary in the diagram is tuned by Condenser No. 11. These two primaries are used in order to secure uniform amplification throughout the range of frequencies covered by this set. Also coupled to Transformer No. 15 is the Oscillator Coil No. 19. At this point the signal is heterodyned against the local oscillator in the set to produce the heterodyne frequency which will be amplified by the I. F. system.

In this receiver, the oscillator will always be tuned to 175 kilocycles higher than the incoming signal. This oscillator circuit is rather unique, in that it gives a uniform output over the broadcast frequency band. This is accomplished by the fact that the circuit combines both inductive and capacitive coupling by means of the Plate Coil and Series Condensers Nos. 20 and 22. By using this circuit, no danger of overloading the first detector is encountered by having too strong oscillator voltage at one end of the band. This oscillator is also of the fixed bias type, thereby keeping harmonics generated in the oscillator to a very low order.

The Intermediate Frequency

The resultant frequency, which is generated when the signal and the oscillator beat together, appears in the plate circuit of the first detector and is amplified by the first I.F. amplifier stage. The transformer feeding this first I.F. Tube is a double tuned transformer in order to obtain a very high order of selectivity. It is tuned both primary and secondary so that none other than the desired frequency can be amplified by the first tube.

A pure signal thus being obtained in the I.F. Amplifier, this signal is amplified by the two succeeding stages which are tuned only in their secondary circuit. By tuning only the secondary circuit and properly designing the transformer, an I.F. system can be made which does not cut as many side bands as would be cut by an I. F. system in which both primary and secondary coils are tuned. The question as to whether all transformers must be tuned both primary and secondary, must be answered by the amount of total selectivity required in the set.

Second Detection

The signal has now reached the stage where it must be converted into its audio modulation, that is, demodulated. This is accomplished in the Type 37 Detector Rectifier. This tube, when connected in the manner shown, is a Diode Rectifier, that is, any signal which is impressed upon it is directly proportional to the output. This means that when receiving a given signal and the modulation is increased, the audio output will go up in direct proportion. This is a very important feature which is very difficult to obtain except by using a diode type rectifier.

At the same time that this signal is rectified, two components are developed in Resistors Nos. 40 and 43. One is the D.C. component and the other is the audio frequency envelope which was impressed upon the carrier. This D.C., which is generated, is proportional to the strength of the carrier voltage which is being developed on the diode rectifier. Therefore, if this D.C. voltage is fed back and allowed to control the grids of the R.F. and I.F. Amplifiers, it will tend to make the voltage which is developed across the diode constant for all signal levels impressed between antenna and ground. Of course this voltage, which is generated in the diode, contains a certain amount of the intermediate frequency which must be filtered out before it is applied to these tubes.

This filtering is accomplished by means of Resistor No. 40 and Condensers Nos. 41 and 42, also by Resistor Nos. 28, 17 and 9 with their asociated by-pass condensers.

Audio Amplifier

With the perfection of the exponential tube, the Type 44, it is possible to design a set such as this model which is capable of handling the extremes of all signal strength which may be applied to the antenna.

The audio frequency, which is developed across Resistor No. 43, is now applied to the grid of the first audio amplifier through Condenser No. 44. Resistor No. 43 is the volume control which determines the desired volume level of the signals. This audio frequency is amplified by the first and second audio tubes which are resistance coupled in order to secure good frequency characteristics. It is then applied through the push-pull transformer to the grids of the push-pull 42 Tubes, and thence to the speakers.

The tone control on this set is accomplished by placing various capacity condensers (53) across the plate of the second audio tube.

On this model there is incorporated shadow tuning, that is, an indicator which will show when the set is correctly tuned. This is accomplished by placing the device so that it receives the plate current of the first I.F. and the first detector circuits.

As can be seen from the previous discussion regarding the action of the automatic volume control, a variable voltage is applied to the grids of these tubes in order to accomplish automatic volume control. This causes the variation in gain in these circuits which is accompanied by a variation in plate current. Therefore, as the signal is tuned through when tuning the gang condenser, the voltage developed in the diode circuit reaches a maximum when the signal is correctly tuned. Consequently this means that the plate current in the first detector and I.F. Tubes will reach a minimum for that given signal when the carrier is correctly tuned. This is indicated by the width of the shadow in the shadow tuning box; the smaller the shadow, the lower is the current in these tubes.

Proportional Difference

As can be seen from this explanation, the width of the shadow is dependent

(*Continued on next page*)

WHAT INTERMEDIATE?

Importance of the Frequency Discussed

By Einar Andrews

WHAT intermediate frequency is best in a superheterodyne? The best frequency is one that is higher than the highest modulation frequency and lower than the lowest signal frequency that is to be received with the superheterodyne. For broadcast reception this leaves a choice of almost any frequency between 30 and 500 kc.

There are certain principles that must be kept in mind in selecting the frequency. First, it must not be too low, or the circuit is likely to be so selective that only low audio frequencies can be received without tone correction in the audio amplifier. Second, it must not be so low as to make it impossible to eliminate image interference. Third, it must not be so high as to make close padding difficult. Fourth, it must not be so high that it lies near the lowest frequency to which the radio tuner is adjustable. Fifth, it must not lie within the radio frequency tuning range, for if it is, there will be a certain band of frequencies that is not receivable because of heterodynes.

It is permissible, however, to select a frequency that is considerably higher than the highest frequency to which the radio frequency tuner reaches. When such a frequency is chosen it is not logical to call it an intermediate frequency, but rather a fixed frequency. The circuit does not cease to be a superheterodyne when the fixed frequency is higher than any of the signal frequencies, because we can still select an oscillator frequency that is higher than the signal frequency by an amount equal to the fixed frequency, although the difference is higher than any of the signal frequencies.

Avoiding Images

At first superheterodynes used relatively low intermediate frequencies, beginning at 30 kc, then going up to 45 kc, and finally to a value around 90 kc. All superheterodynes using these low frequencies suffered from one common defect, image interference. There are two ways of minimizing such interference. One is to increase the selectivity of the radio frequency tuner, and the other is to increase the intermediate frequency. Both have the same effect, namely, the reduction of the undesired frequencies in comparison with the signal frequency desired. Increasing the selectivity of the radio tuner increases the suppression of the frequencies that might cause image interference and at the same time increases the strength of the desired frequency. Increasing the intermediate frequency removes those frequencies that might cause image interference so far from the desired frequency that the radio tuner can suppress them adequately with the selectivity that it has.

Futility of Odd Endings

At this time the most popular intermediate frequency is 175 kc, but other frequencies are used quite extensively. The tendency is to use higher frequencies, and 465 kc is coming into wide use. Possibly the best range of intermediate frequencies for broadcast reception is that between 175 and 465 kc, although these limits are by no means fixed. There is no strong argument in favor of using any particular frequency within this range, or outside it either, for that matter.

Frequencies ending in 2.5, 5 and 7.5 have been favored on the theory that because they are not multiples of the channel separation, namely, 10 kc, they will not give rise to as much heterodyne interference as frequencies that are exact multiples of 10 kc. The theory does not seem to work out in practice. The intermediate frequency itself cannot beat with either the signal or the oscillator frequencies to cause audible heterodynes, but it is possible that some harmonic of the intermediate frequency will beat with either of these high frequencies, provided that the order of the harmonic is high enough. If the intermediate frequency ends in 5, the even harmonics will be exact multiples of 10 kc and these harmonics will coincide with signal frequencies. Hence audible heterodyning is possible. The odd harmonics will fall half way between channel frequencies and the heterodyne will be 5,000 cycles, which is certainly audible. Therefore the odd harmonics may also cause interference.

If we use an intermediate frequency ending in 2.5 or 7.5, all harmonics the order of which is divisible by 4 will end in 10 and will therefore coincide with channel frequencies. All the other harmonics will end in 2.5, 5, or 7.5 and therefore will give rise to heterodynes of 2,500, 5,000 or 7,500 cycles, all of which are audible. Therefore the necessary conclusion seems to be that we cannot avoid heterodynes by selecting any particular intermediate frequency. If we are to eliminate such interference it must be done by shielding, filtering and by designing the circuit so that the harmonics of the intermediate frequency are weak.

Heterodyning may occur between harmonics of the intermediate frequency and oscillator frequency. Suppose, for example, that we have a superheterodyne with an intermediate frequency of 400 kc and that we wish to receive a frequency of 800 kc. The oscillator is set at 1,200 kc. In this case the second harmonic of the intermediate is equal to the signal frequency and the third harmonic is equal to the oscillator frequency. We can expect heterodyning with both. But we would not gain anything by making the intermediate frequency 395 or 405 kc., at least not in a practical sense.

Most Favored Case

Let us examine a case of the most favored frequency, namely, 175 kc. This ends in 5 and should be quite free of heterodyning. Let it be required to receive 700 kc. The oscillator is set at 875 kc. Both are harmonics of 175 kc. Hence we must expect heterodyning. There is one point in favor of the low intermediate frequency. In this particular case the harmonics involved are the fourth and the fifth, and since the intensity of the harmonics decreases with increasing order, we can expect the heterodyning to be weak. But this is not because the intermediate frequency ends in 5, but because it is relatively low. This should not be interpreted as an argument for using a low intermediate frequency. There is also an advantage in using a high intermediate frequency in that the higher it is the fewer the chances of heterodyning, for there will be fewer harmonics of the intermediate frequency in the broadcast band and in the tuning range of the oscillator.

I-F for Other Ranges

When the superheterodyne is to receive frequencies other than those in the regular broadcast band it is necessary to select an intermediate frequency to fit the particular circumstances. For example, if it is to receive the long waves employed for broadcasting in Europe, which range from about 150 to 435 kc, the intermediate must not fall within this range, nor must it come very close to either limit. The frequency chosen may be either higher than 435 kc or lower than 150 kc. If in addition the circuit is to receive the regular broadcast band, the fixed frequency must not be higher than about 500 kc. It would be quite feasible to select a frequency of 465 kc, but it is customary to select a frequency less than 150 kc. In fact, most dual range superheterodynes now constructed use 115 kc, which is satisfactory for both ranges.

If the circuit is to be used for receiving signals of higher frequencies than those of the regular broadcast band the intermediate frequency should be much higher, and it may be in the broadcast band provided the amplifier is shielded so that it will not pick up broadcast signals directly. In short wave converters the intermediate frequency lies in the broadcast band because the broadcast band tuner is used as the intermediate selector. The 465 kc frequency has been used in many successful short wave receivers, but this frequency has no particular advantage over other frequencies, except that it is low enough to be used if the receiver is to cover broadcast frequencies as well.

PHILCO SET

(*Continued from preceding page*)

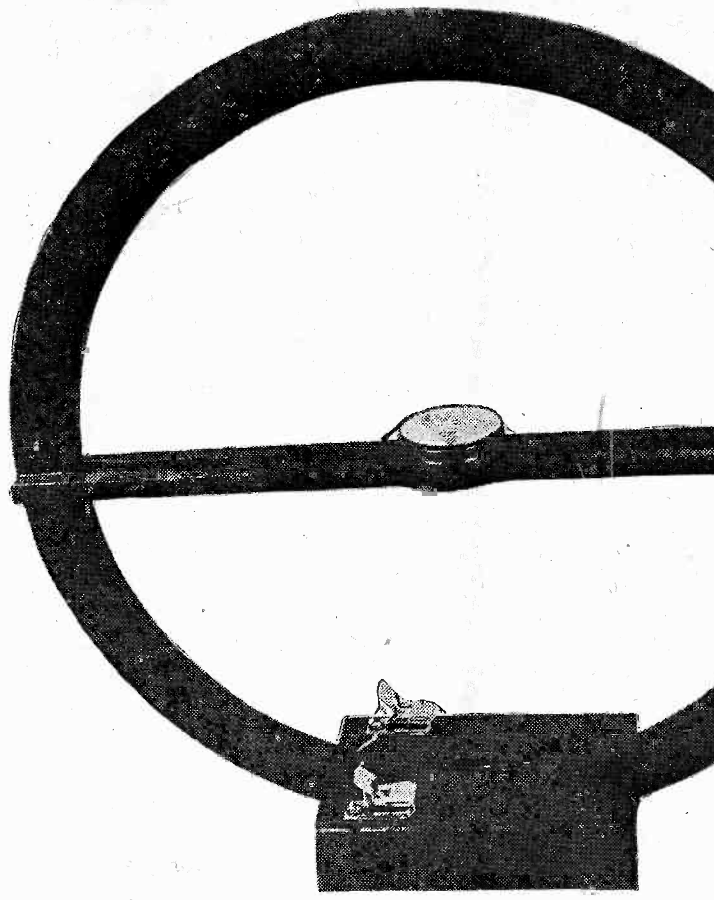
entirely upon the strength of the carrier of the transmitting station. When a distant station is tuned in, the carrier voltage is much lower than when a local station is tuned. Therefore, when the set is correctly tuned for either signal, that is, when it is tuned to a minimum shadow width for that signal, the two widths will be different in proportion to their signal strength.

There is also embodied in this receiver a two position sensitivity control. This is Switch No. 18. The first position in the rotation of this switch closes the line switch but leaves the switch in the cathode of the first detector and first I.F. open. When this switch is open, it allows the voltage on the cathodes of these tubes to remain quite high. This means that the tubes will be operated at a considerably reduced gain. When the switch is turned still further on, this cathode switch closes, the voltage is reduced to rated value, three volts, and the full gain is released from these two stages. This gives a set which has available two ranges of sensitivity. The first, the low sensitivity position, will pick up less static and general noise than the more sensitive position. The high sensitivity position can be used in such locations as those where extremely distant stations are desirable and where there is a low static level.

SIMPLE GALVANOMETER

Tangent Type Measures Small Current

By Paul Erwin



THE TANGENT galvanometer is one of the principal means of measuring electric current in physical laboratories. It is called the tangent galvanometer because the current causing the deflection is proportional to the tangent of the angle of deflection.

While the simple instrument depicted in Fig. 1 is not exactly a tangent galvanometer its construction is similar, and it can be used for detecting minute direct currents. It is also so simple that any one can make it without trouble and at very little cost. The large circle is of wood with a groove for wires on the outside. Its diameter is one foot. The simplest way of getting such a form is to take an embroidery hoop and remove the felt "tire," leaving a groove just sufficient for the turns.

The coil consists of 30 turns of No. 30 enameled copper wire. The terminals of this coil are brought to the two clips mounted on two wooden cleats glued to the side of the hoop.

Compass as Indicator

The indicator is an ordinary compass which may be obtained for about a dime. This compass is mounted at the exact center of the hoop in a horizontal position on two wooden cross pieces, one on each side of the hoop.

When a current is passed through the coil a magnetic field is set up inside the coil and this field is very nearly uniform near the center of the coil. The magnetic needle will tend to align itself in the direction of the field.

So far there is no way in which current can be measured because there is no restoring force that tends to resist the action of the current. In order to measure current it is necessary to balance the effect of that current against some restoring force. That holds true of all deflection instruments. In the ordinary ammeter or voltmeter the effect of the current is balanced against the restoring force of the spring. With no current the spring holds the needle at the zero position.

In the compass there is no spring and there is no other restoring force provided. However, we have at hand a natural restoring force, that of the earth's magnetic field. When there is no current through the coil the magnetic needle will point north and south. If therefore we turn the loop so that the needle points to north on the compass dial we not only have a zero position for the needle but we also have a restoring force. This force is extremely weak and for that reason the instrument is exceedingly sensitive. If we first orient the loop so that the needle points to north on the dial when no current is flowing and then turn on the current the needle will turn from its original position by an amount depending on the strength of the current. Therefore we have a means of measuring the current. Of course, it is necessary to calibrate the instrument.

Right-Angle Field

In order to get the proper effect, however, it is necessary to set the compass in the proper relation to the form of the coil. The magnetic field due to the current will be at right angles to the plane of the coil. Obviously, therefore, the compass must be set so that the needle lies in the plane of the loop when no current is flowing. That is, the north and south points on the compass must be along the two cross pieces and the plane of the coil itself must point north and south. Thus deflections will be measured from the plane of the coil.

If the compass needle is a magnet of strength M and the field of the earth is Hy the force tending to pull a pole parallel to the loop is MHy. If the field due to the current is Hx the force tending to pull the pole so as to align the needle at right angles to the plane of the loop is MHx. These two magnetic forces will result in a field which is the vector sum of the two forces. The magnitude of the resultant is the square root of the sum of the squares, or $R = M(Hx^2 + Hy^2)^{1/2}$. The needle will assume the direction of the resultant. If the equilibrium position of the needle makes an angle θ with the plane of the loop we have relation $Hx = Hy \tan \theta$.

Accuracy Limited

Hx is proportional to the current flowing in the coil and Hy is the force of the earth's magnetic field. Hy is a constant at any one place for the earth's field does not change much. Therefore we have a relation between the current flowing in the coil and the deflection produced by it. The relation may be written $I = K \tan \theta$, in which I is the current flowing in the coil, K is the galvanometer constant, and θ is the angle of deflection from the plane of the loop.

For small deflections the angle is proportional to the tangent but this proportionality does not hold accurately for greater angles than about 5 degrees.

An instrument of this type is not suitable for routine or accurate current measurement of current but it is valuable as a laboratory instrument for studying the electrical and magnetic principles.

Clockwise? Counter-Clockwise?

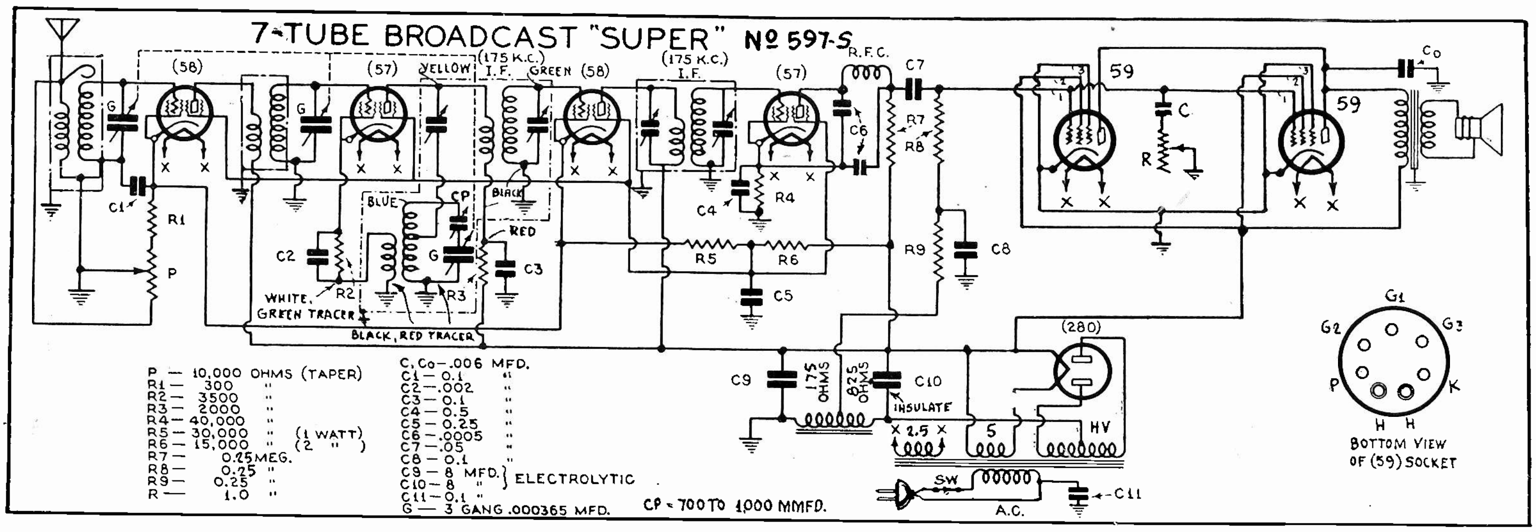
All too often some one who orders a dial or dials gets the type he does not want, although he gets what he ordered. The trouble lies in the confusing description "clockwise" and "counter-clockwise." So bad has the situation become that some dial manufacturers, who deal mostly with set manufacturers, request that the two words be not used in attempting to describe the dial, but that the type of dial be identified by the condenser action. Thus the buyer is asked to state whether the condenser closes to the right or closes to the left.

It is doubtful whether any completely satisfactory and foolproof definition can be given of clockwise and counter-clockwise (or anti-clockwise) as applying to dials. As to the hands of a clock, of course clockwise means the direction in which the hands turn when the clock is going, from left to right at the upper semicircle of descriptive arc, from right to left at the lower.

AN A-C SUPER

and D-C T-R-F Set

By Edwin Stannard
Roland Radio Company



[Herewith is the final instalment of a series of two articles dealing with well-tried circuits specially developed by the author. Last week, issue of November 2nd, he described the 594-T, a four-tube t-r-f set for a-c operation; the 595-TS, a five tube a-c t-r-f set, senior model; and the 595-S, a five-tube a-c superheterodyne, using the 57 as autodyne as in the seven-tube model, the same color-coding applying to both.— EDITOR.]

THOSE who have a strong hankering for DX will find the 7-tube superheterodyne, diagramed herewith, provided a night range of about 3000 miles, and that means coast-to-coast reception, although under some conditions much greater distance will be covered, and under other conditions less distance. The fact remains that the sensitivity is abnormally high, ranging from 0.25 microvolts per meter at the higher radio frequency end, to somewhat less at the low radio frequency end, and averaging about 2 microvolts per meter.

The first tube is a 58, used as a stage of t-r-f, and feeding the autodyne tube, or combination first detector and oscillator. For a long while there were considerable doubts about getting a highly satisfactory circuit that would enable this economy of room and tubes, but it has bene accomplished in a splendid manner.

The antenna and the first detector input coils are in separate shields, but the first intermediate frequency transformer and the oscillation coil, with its pickup winding, are in a high separate shield. The condenser across the primary of the intermediate coil, instead of going directly to both ends of that coil, goes to one terminal and other side to a tap on the tuned oscillation coil. No color code is given for this tap connection because the joint is made at the coil factory, but the other connections are color-coded on the diagram. For instance, the green outlead goes to the grid cap of the first itnermediate tube (58), the end of this winding is represented by a black outlead that goes to ground, the plate connection for the autodyne tube (57) is yellow, the return of this winding (primacy of intermediate) is red and goes to a resistor that leads to B plus, the end of the cathode resistor goes to the white lead with green tracer, while the returns of the pickup winding and the oscillation winding are common and represented by a black lead with a red tracer.

So, while the hookup is quite special in respect to the combination of the two functions in one tube, and the use of two separate transformers in one shield, the correct connections are easily and readily made, and no particular concern need be felt about the authenticity of the connections, so long as the color code is followed. It is infallibly correct and embodies the circuit formation exactly as diagramed.

Seven Tuned Circuits

All told there are seven tuned circuits, three of them represented by the three-gang condenser and being variable, four of them represented by primaries and secondaries of the intermediate coils, and being fixed. Seven tuned circuits give you all the selectivity that it is possible to its utmost desirable value, care has been exercised not to fall into the trap of cutting sidebands and thus reducing greatly the response at the high audio frequencies.

The new output tube, the 59, which is of the heater type, is somewhat along the same lines as the '47, but reduces greatly the hum level, because of the segregation of heater and cathode. This improvement is not so noticeable in circuits that do not make adequate provision in prior stages for minimization of the hum level, and that do not have sufficient filtration, but the present circuit takes care of those needs abundantly. In fact, the seven-tube superheterodyne, with its 59's in parallel output, identified as the 597-S in the diagram, is the best all-around performer of the a-c circuits described in this series.

The D-C 486-T

Here is a six-tube t-r-f receiver for d-c that employs two of the new 48 type power tubes. In addition to these tubes it uses two 239's as radio frequency amplifiers, one 236 as detector, and one 237 as audio frequency amplifier. This is a good line-up of tubes and an economical one in respect to filament power consumption.

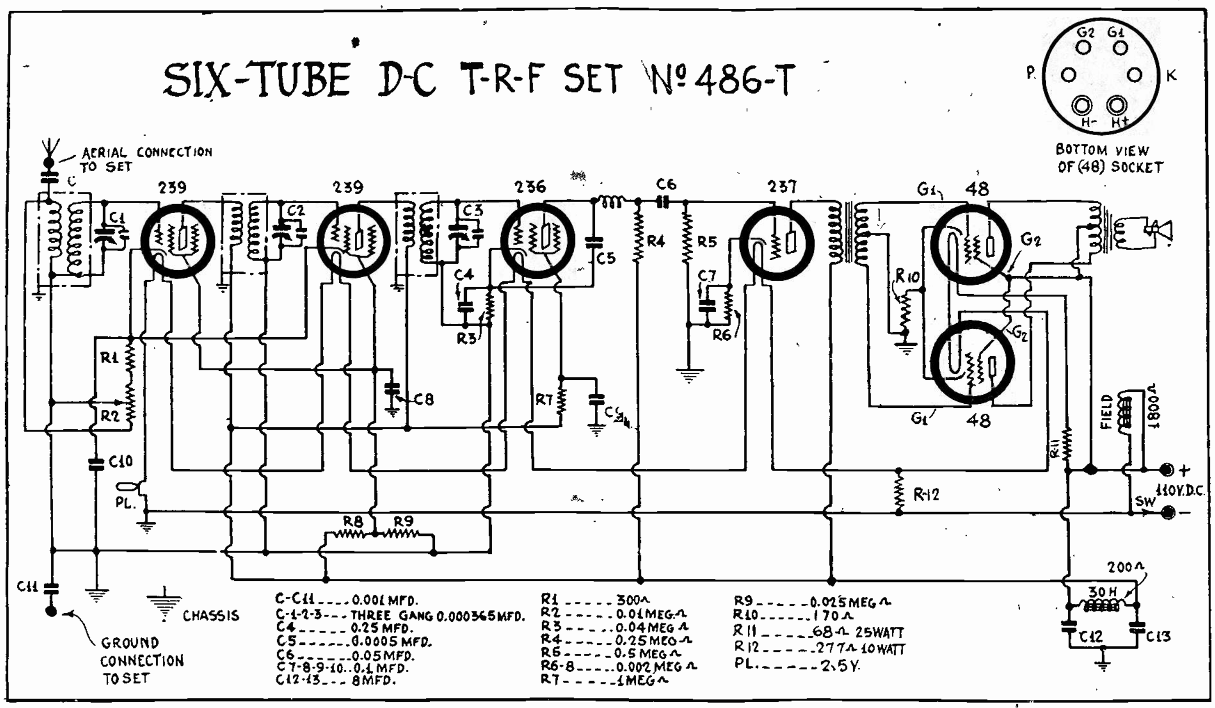
The filament circuit in this receiver differs from the filament circuit in similar sets in that most of the power expended in the circuit is useful. (See diagram 486-T.) That is, a very small portion of it is wasted in the necessary ballast resistor. Each of the 48 tubes requires a voltage of 30 volts and a current of 0.4 ampere. The remaining tubes require a current of 0.3 ampere and a voltage each of 6.3 volts. The pilot light will operate on the same current and it will drop about 2.5 volts, or a little more. We shall assume that it drops 2.5 volts for the purpose computing the required ballast and shunt resistors. Therefore there is a total drop of 27.7 volts in the 0.3 ampere tubes and in the pilot light.

Since the current here will be 0.3 ampere and it will be 0.4 ampere in the power tubes we must put in a shunt, R12, to carry the extra 0.1 ampere. Its resistance we can determine from the voltage drop, 27.7 volts, and the current through it of 0.1 ampere. That is, R12 should be 277 ohms.

A Precaution

The wattage dissipation in R12 will normally be only 2.77 watts but it is not safe to use a resistor of this wattage rating. Suppose a tube of the 0.3 ampere type should be removed from its socket during testing, or suppose that the filament of one of them or the pilot light should burn out during service. Then the entire current will flow through R12 and the wattage dissipation will rise, resulting in probable burn-out of the shunt resistor. This danger is imminent whenever the filament line in shunt with R12 becomes open in any manner. Damage can be prevented by using a heavy shunt resistor. We shall give the necessary wattage rating later.

Let us now turn to the series resistor R11. The total voltage drop in the filaments will be 87.7 volts. Hence if the line voltage is 115 volts there is an excess voltage of 27.3 volts that must be dropped in the ballast resistor R11. The current through this resistor will be 0.4 ampere and therefore the resistance should be



68 ohms. It is so specified in the list of parts. The wattage dissipation will be 10.9 watts. Hence we should use a resistor of about 25 watt rating to have an ample margin of safety.

Now we can return to the shunt resistance. We have the ballast resistance of 68 ohms. The resistance in the filaments of the two 48 tubes will be 150 ohms and the shunt resistance is 277 ohms. Hence we have a total of 495 ohms in series with 115 volts when the 0.3 ampere circuit is open. The current then will be 0.232 ampere. At this rate the power dissipated in R12 will be very close to 15 watts. A ten watt resistor will be safe enough if the open is of short duration but it would be better to use a 15 or 25 watt resistor for R11. In the list of parts it is given as 10 watts.

While we have specified R11 and R12 at 68 and 277 ohms, respectively, neither is extremely critical because the filament current of the tubes is not critical. A few ohms more or less would make no practical difference.

Since all the tubes in the circuit are of the heater type we can use the full voltage of the line on the plates of all the tubes, except for such voltage as is taken for the grid bias. The plates and the screens of the two power tubes are connected directly to the positive side of the line so that no voltage is dropped in the filter choke. This connection is allowable in view of the facts that the line voltage is partly filtered, that the power stage is push-pull, and that a large condenser is connected across the line. The effective voltage on the plates is only about 100 volts, however, because there is a drop of about 17 volts in the bias resistor R10, which has a value of 170 ohms.

While the by-pass condensers C12 and C13 in the B supply circuit are specified at 8 mfd. each, 4 mfd. condenser would be all right. Of course, the larger the capacity the better. It is preferable to use paper dielectric condensers rather than electrolytics because with dry condensers it is not necessary to observe any polarity.

The speaker used in this set should be specially designed for the 48 tubes because the optimum load resistance is lower for these tubes than for any other power tube. It is only 2,000 ohms per tube. Suitable speakers are now available.

The 48 tube requires a six-contact socket and the connections are to be made as shown in the insert at the upper right hand corner of the drawing. It will be noticed that the grid next to the plate on the socket should be connected to the high voltage and the grid next to the cathode is to be connected to the high voltage side of the transformer. That is, G1 is the control grid.

The volume control R2 is a 10,000 ohm potentionmeter and it should be of the tapered type. The slow rate of change end of the resistance should be connected to the antenna. It may be difficult to tell which is the slow-tapered end but it can be discovered experimentally. If the resistance is connected in the wrong way the volume change will be abrupt but if it is right, the change in volume will be gradual. The test should be made on a strong signal.

Fading and Weather Connected

Observation on radio fading promises to aid meteorologists in predicting weather conditions, according to conclusions reached independently by Professor R. C. Colwell, of the Department of Physics of West Virginia University, and Professor Ivo Ranzi, of the University of Camerino, Italy.

Although these observers worked in zones of widely different climatic conditions and made their observations on different waves their conclusions are practically identical. Professor Colwell made his observations on the 309-meter wave of KDKA, Pittsburgh, and Professor Ranzi made his on a 100-meter wave.

Transferred Reflection

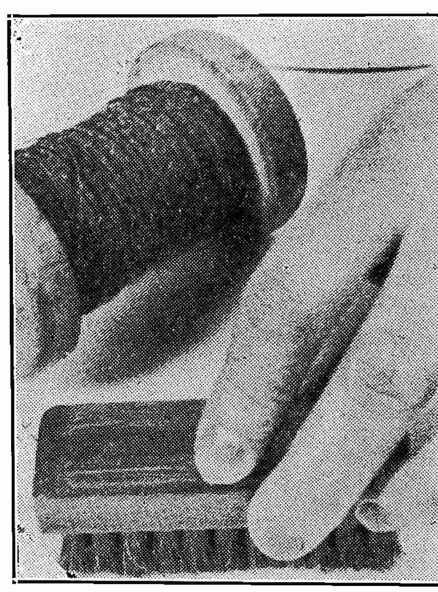
Both observers believe that fading is due to reflection in the E stratum of the Kennelly-Heaviside layer. This is a layer of strongly ionized gas, the ionization being produced by radiation from the sun. When the effect of the sun ceases about sun-down the ionization density decreases and the reflection is transferred to the F stratum of the Kennelly-Heaviside layer, which is higher up.

The two professors have observed that when a cyclone advances from the north the ionic density of the E stratum greatly decreases and that when an anticyclone advances from the north or when a cyclone exists to the south, ionization increases rapidly.

Disturbances at High Altitudes

A cyclone is what is usually known as a general storm. It is characterized by a whirling motion of air over a wide area, with a low barometric pressure in the center. On the front the wind is from the southwest, in the northern hemisphere, and is accompanied by cloudiness or precipitation. An anticyclone is just the reverse. In the center the barometric pressure is high, the winds blow outward, and the weather is clear.

The connection between radio fading and weather seems to indicate that the air disturbances known as cyclones and anticyclones extend to great altitudes.



Amyl acetate on a wire brush removes enamel from radio wire.

Determination of Padding Capacity and Inductance

By J. E. Anderson

[Last week was published the first of a series of articles by J. E. Anderson, technical editor, on the superheterodyne. Padding and oscillator circuits were discussed. This week more data are given on padding. Read these important articles each week.—EDITOR.]

CASE II

IN Case II the condensers are disposed as shown in Fig. 1. C_m is assumed to be across the variable condenser alone. It is assumed further that C is the same in both circuits at all settings. This assumption is not strictly true for several reasons. The capacity C is made up of the capacity of the coil, the capacity of the variable condenser, and the input capacity of the tube. The trimmer capacity across C is supposed to be an integral part of C. In the oscillator circuit neither the tube nor the coil capacity is directly across C because C_s is interposed between. Moreover, the capacity of the oscillator coil will in general be different from the corresponding capacity in radio frequency circuit and the tube capacities will also differ to some extent.

The error introduced by the assumptions is negligible because the difference may choose independently, namely, L, C_s, the frequencies where the minimum counts, C_s has a negligible effect.

Three Conditions

It will be observed that in the oscillator circuit we have three quantities which we may choose independently, namely, L. C_s, and C_m. Therefore, we may impose three independent conditions on the circuit and then determine L, C_s, and C_m so that these conditions are satisfied. Let these conditions be that the difference between the natural freqencies of the radio frequency circuit and the oscillator shall be exactly equal to f, at the three signal frequencies Fo, F_1 and F_2. If we determine the three unknown elements in the oscillator circuit so that these conditions are satisfied, there will be exact tracking at these specified frequencies. For the time being we need not know what the values of these frequencies should be in order to give the best possible tracking on the whole.

Let the values of C corresponding to the three signal frequencies Fo, F_1, and F_2 be Co, C_1, and C_2, respectively. All these values of C are known because we are supposed to know the inductance Lo in the radio frequency circuit and we can assign any values we wish to the frequencies. Hence for any signal frequency we can compute the corresponding capacity.

At F_0 the capacity in the oscillator circuit is $C_s\ (C_0 + C_m) / (C_s + C_0 + C_m)$. At F_1 and F_2 the expressions for the capacity are the same except that C_1 and C_2 are substitute for C_0.

Using these expressions for the capacities in conjunction with the oscillator inductance L in the frequency formula we obtain equations (1).

$$\left.\begin{aligned}(F_0+f)^2 &= \frac{(C_0+C_m+C_s)}{4\pi^2 L\, C_s\, (C_0+C_m)}\\ (F_1+f)^2 &= \frac{C_1+C_m+C_s}{4\pi^2 L\, C_s\, (C_1+C_m)}\\ (F_2+f)^2 &= \frac{C_2+C_m+C_s}{4\pi^2 L\, C_s\, (C_2+C_m)}\end{aligned}\right\}\quad (1)$$

These are the three conditions, stated mathematically, that must be satisfied if the oscillator frequency is to be exactly f kc higher than the signal frequency at the three signal frequencies F_0, F_1 and F_2. The expressions in (1) are three simultaneous equations in L, C_s and C_m and all of these may be obtained from the equations by elimination.

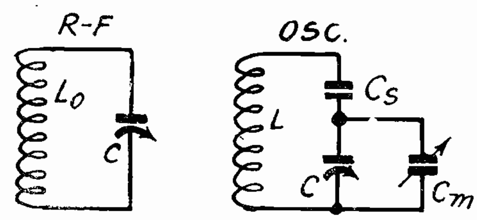


FIG. 1

This shows the arrangement of the condensers in the oscillator when tracking is effected by the method explained under Case II.

L is eliminated very easily by dividing the second and the third equations by the first. Performing this operation we obtain equations (2).

$$\left.\begin{aligned}\left(\frac{F_1+f}{F_0+f}\right)^2 &= \frac{(C_1+C_m+C_s)\ (C_0+C_m)}{(C_0+C_m+C_s)\ (C_1+C_m)}\\ \left(\frac{F_2+f}{F_0+f}\right)^2 &= \frac{(C_2+C_m+C_s)\ (C_0+C_m)}{(C_0+C_m+C_s)\ (C_2+C_m)}\end{aligned}\right\}\quad (2)$$

These equations involve only the unknown C_s and C_m. It is convenient to eliminate C_s and then to solve for C_m. However, before this is done it is still more convenient to introduce frequency ratios instead of frequencies. Let us define the frequency ratios R, r_1, and r_2 as follows: $f = RF_0$, $F_1 = r_1F_0$, and $F_2 = r_2F_0$. These definitions enable us to express all frequencies in terms of one frequency and the various ratios. Moreover, the ratios enable us to express C_1 and C_2 in terms of the ratios C_0. We have $r_1^2C_1 = C_0$ and $r_2^2C_2 = C_0$, for capacities are inversely proportional to the squares of the frequencies.

If we put these relations into formulas (2), eliminate C_s, and solve for C_m we obtain equation (3).

$$C_m = \frac{RC_0}{(1+r_1)\ \ (1+r_2)\left(\dfrac{r_1+r_2}{2}\right) + R(r_1+r_2+r_1r_2)}\qquad (3)$$

Formula (3) enables us to obtain the minimum capacity C_m in terms of the known frequency ratios and the capacity C_0 in the radio frequency circuit corresponding to the tie-down frequency F_0.

When C_m has been found it may be substituted in one of the equations (2), which may then be solved for C_s. Doing this we obtain equation (4).

$$C_s = \frac{(1+r_1+2R)\ \ (C_0+C_m)\ \ (C_0+r_1^2\,C_m)}{RC_0[2r_1+R\ (1+r_1)] - r_1^2\,C_m\ (1+r_1+2R)}\qquad (4)$$

With formula (4) be obtain the value of the series condenser capacity, provided that we have previously found the minimum capacity C_m.

After both C_m and C_s have been obtained we can substitute them in one of the equations (1) and solve for L. Taking the first of the equations we obtain equation (5).

$$L = \frac{L_0\ (C_0 + C_m + C_s)C_0}{(C_0 + C_m)\ C_s\ (1 + R)^2}\qquad (5)$$

Formulas (3), (4), and (5) are general expressions that may be applied to any case of padding in which the condensers are arranged as in Fig. 1. In numerical computation a high degree of accuracy is necessary. This does not apply so much to C_m as it does to C_s and L. C_s in particular requires accuracy because of the fact there is a difference between two nearly equal terms in the denominator of equation (4). A small error in either term will introduce a large error in C_s, and since C_s is contained as a factor in (5), there will also be a large error in L. It has been found that the accuracy required is at least that obtainable with five-place logarithms.

The curves in Fig. 2 have been computed with formulas (3), (4), and (5) at intervals 50 kilocycles from f = 0 to f = 600 kc. L varies from 245 to 122.8 microhenries, C_m varies from zero to 10.1 mmfd., and C_s varies from infinity to 255.5 mmfd. Since C_s varies very rapidly as the intermediate frequency becomes low, the last value given on the curve is that for f = 150 kc. However, the two values at 100 and 50 kc are indicated at the appropriate abscissas.

From the curves we can obtain the values of L, C_m, and C_s for any desired intermediate frequency between zero and 600 kc. For example, at 175 kc the values are, L = 190.5 microhenries, C_m = 4 mmfd., and C_s = 920 mmfd. At 400 kc the values are, L = 147.5 microhenries, C_m = 8 mmfd., and C_s = 410 mmfd.

The curves are based on the tie-down frequencies Fo = 600 kc, F_1 = 1,000 kc, and F_2 = 1,450 kc.

Example of Tracking

As a test of the closeness of the tracking resulting from these computations the difference frequency has been computed over the entire broadcast band when f = 400 kc at 600 kc, 1,000 kc, and at 1,450 kc. The resulting tracking curve is plotted in Fig. 3. The abscissas give the signal frequency and the ordinates give the deviation of the difference frequency from 400 kc. It will be noted that the curve crosses the zero line at 600 kc and again at 1,000 kc. It should also cross at 1,450 kc but due to a slight error in the computation it crosses just a shade over that frequency. The tracking is excellent throughout. At no point within the tuning range is the deviation as much as 4 kc. That is, the tracking is better than one per cent. It is necessary to go down to about 540 kc and up to about 1,530 kc before the deviation exceeds 4 kc.

It is well to state here that the detuning indicated by the divergence from the zero line does not represent detuning in the intermediate frequency amplifier. It is rather the radio frequency tuner that is off resonance by the amount shown, for the maximum is determined by the most selective part of the tuner, and that is the intermediate. When the receiver is tuned for maximum volume the result

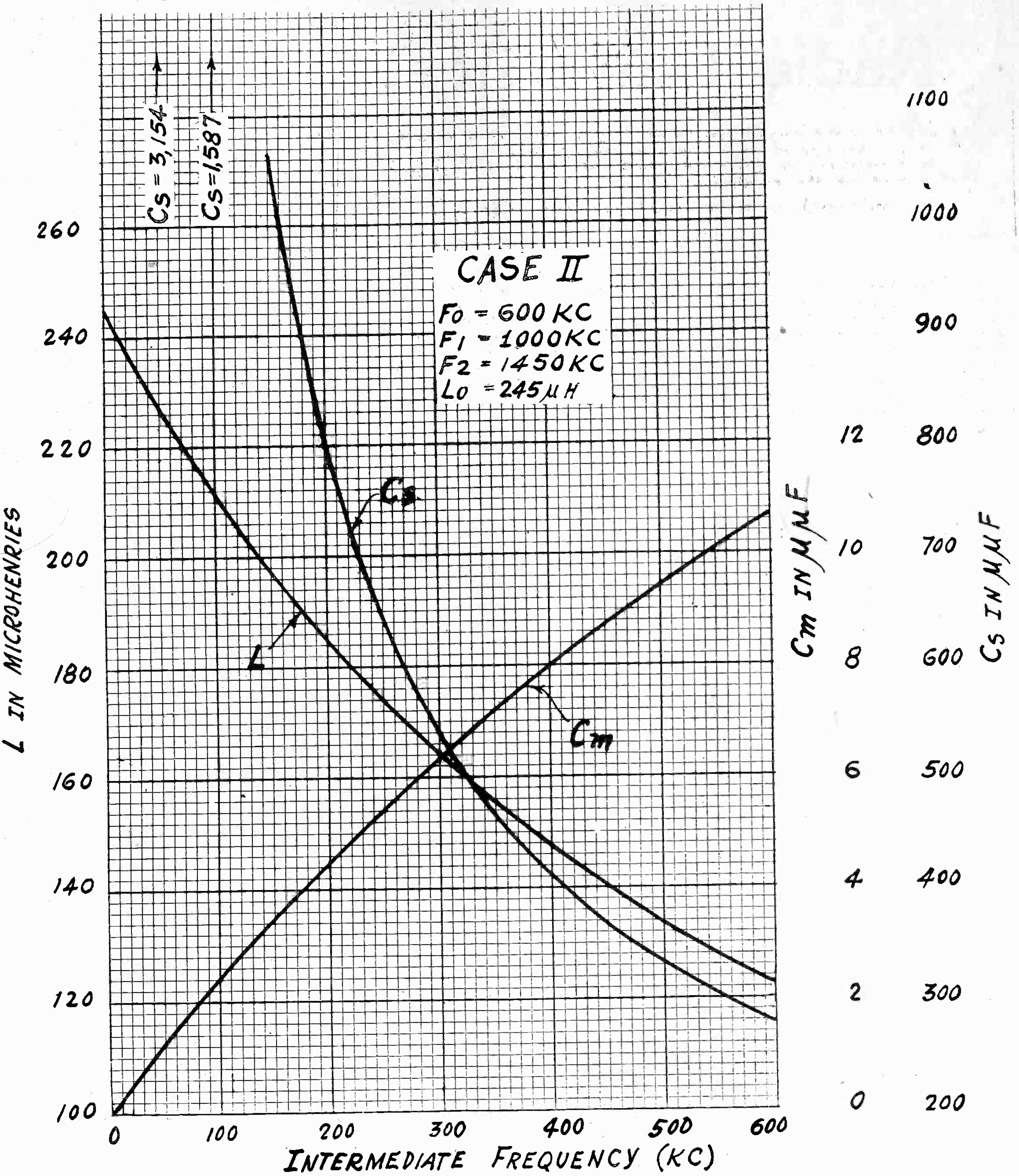


FIG. 2

These curves give the minimum capacity Cm, the series capacity Cs, and the oscillator inductance L for various intermediate frequencies between zero and 600 kc. Values are based on an inductance of 245 microhenries in the radio frequency circuit.

is really a compromise between the two tuners so that actually both are detuned, in opposite directions, but the intermediate has by far the greater influence because it has the greater relative selectivity.

Even if all the detuning should occur in the radio frequency amplifier the percentage of detuning is small. Suppose it amounts to 4 kc as in this case. At 550 kc this would amount to about 0.7 per cent. of the signal frequency and at 1,500 kc it would amount to only about ¼ of one per cent.

It was stated previously that the point of inflection of the tracking curve, that is, the point where the curvature changes direction, should fall below the zero line by a small amount. The encircled point in Fig. 3 is that point, and it falls just a little below the zero line. It will be noted, however, that at 750 kc the deviation is greater than it is at 1,250 kc. A slight improvement, therefore, could have been made in the tracking if F_1 had been chosen slightly below 1,000 kc rather than exactly 1,000 kc. The point of inflection would then have been closer to the zero line and the curve would have been more nearly symmetrical. The difference is so slight, however, that it was not considered worth while to select a lower value for F_1 in view of the simplicity of computation with 1,000 kc.

We mentioned the possibility of finding the frequency at which the point of inflection occurs. The point may be found as soon as C_m and C_s have been found, for the relation determining it is $C = C_m [1 + (4 + 3C_s / C_m)^{1/2}]$. The frequency is obtained from C thus determined and from the inductance Lo in the radio frequency circuit. Sometimes the relation is useful in estimating the closeness of the tracking.

(*Continued next week*)

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.

VARIOUS circuits I have built, requiring an oscillator, have included the modification of the Hartley, as developed by Shiepe, and as first shown in your columns. That it is an excellent and dependable oscillator there is no doubt. Now I am ready to try my hand at a short-wave super, but it musn't consist of more than five tubes. Therefore the modulator is also the oscillator. I have tried various methods of obtaining the signal input, but find that it has to be to the control grid circuit, otherwise next to nothing doing. That leaves me up a tree as to the oscillation combination, and I don't want to give up this excellent oscillator. A few helpful suggestions will be appreciated.—C. J.

The circuit is shown in its entirety herewith, and those experimentally inclined my try their luck with this autodyne. After the autodyne, of course, everything is more or less standard, and no experimentation is necessary. The circuit shows a coil switching system. The grid to the left, in the 57, is the control grid, and into this the signal is put. The oscillation circuit is the suppressor grid, which may be returned to the taps on the coils or to cathode itself, as you prefer. The desire is to have as much signal input as practical, and as low an oscillation voltage as is consistent with adequate mixing. The two circuits —control grid and suppressor grid—are but loosely united, so far as electron flow is concerned, and therefore the two different frequencies are combined in the same tube by electron coupling. There is no reason, so far as we can see, that the oscillator should not work as shown, although this particular feature (of oscillation in the suppressor circuit) is novel and experimental, and we make no claims for it nor any guarantees of any kind. We do say it is well worth trying, as some engineers of standing have obtained results that way. Some other experimenters have failed.

HAVING BUILT the 4-tube a-c 1933 Diamond of the Air, I am suffering the following troubles: (1) Sensitivity is not as high as I expected; (2) there is a tunable hum, in that the hum is greatest at maximum volume position of the volume control, and least at minimum position; (3) the set squeals, and I don't know just what to do to stop it; (4) the pentode plate current is not around 38 milliamperes but around 63. A little help is needed.—L. V. G.

Answering your questions in their order: (1) Low sensitivity may be due to so many causes in any set that it is not possible to locate the exact trouble from the information given, but since you encounter squealing it is obvious that the tuner itself is keenly alive and that there is some defect in subsequent coupling. Whenever a set squeals it is at least a good sign that there's plenty of life. Getting rid of squealing is not difficult. (2) What you refer to as tunable hum is not that at all, for tunable hum has to do with hum heard when tuning in a station, and not heard when no station is tuned in, hence has nothing to do with the volume control. Your trouble evidently is (a) that the detector tube gets no plate current, because cathode return is open, or no B voltage is applied; (b) no voltage on screen; or (c) resistor between cathode of detector and cathode of r-f is too low, so try a resistance of 10,000 ohms. (3) Squealing may be cured by removing turns from primary of interstage coupler, or by putting a resistor across antenna-ground posts, of such value as stops the squealing, but not of any lower value than necessary; or instead a resistor across detector tuned circuit, where around 20,000 ohms may be tried. (4) the high plate current is commonly due to the wrong bias on the power tube, which in turn may result from a defect in the power tube itself. Usually, however, it is because of the wrong value in the bias-apportioning resistors for the pentode tube. Carbon resistors, by the way, do not stay put enough to be serviceable in this position. Put a 0-100 or 0-50 milliammeter in the plate circuit of the output tube and put in higher resistance values between joint of the two biasing resistors and ground until the plate current does not exceed ma in this circuit. You did not mention it, but if the plate current runs that high, then the maximum voltage must be down to about 200 volts. It is quite likely you failed to insulate the first 8 mfd., next to rectifier, and that is the full cause of all your troubles. When you have corrected the defects as stated you will have an extremely delightful little receiver.

* * *

SOME TIME this Winter I intend to build a television receiver and would like a few hints on (1) what kind of a tuner to use; (2) what kind of audio; (3) whether the output tube or tubes should be of the heavy or light plate current types. I am prepared to go up to 400 ma if you say the word.—L. E. T.

(1) You do not say how far from the reception points are the stations to be brought in, but if you are not close to them, build a superheterodyne consisting of a simple mixer, two stages of i-f with very tight coupling between plate and grid circuits, using additional condensers from plate to grid if standard coils are used; full-wave 55 second detector, triode unit as a stage of resistance audio, and use an output tube that under normal receiver operating conditions would draw plate current about three times the maximum current recommended for the neon lamp. Don't forget to have the scanning system the best that is obtainable.

* * *

WHAT IS the object of having a low resistance B choke for better regulation when the high-voltage secondary of the power transformer, through which the same current flows, has a high resistance? —E. J. N.

No object consistent with good practice. While in the case stated the total resistance is lower than it would be if the choke were of high resistance, still the purpose is defeated when the power transformer secondary has a high resistance. About the best recommendation to make under the circumstances, supposing the power transformer remains, is to introduce a heavy bleeder.

* * *

WHAT IS a good type of broadcast hookup for single tube mixing?—A. L.

See Edwin Stannard's hookup on page 18.

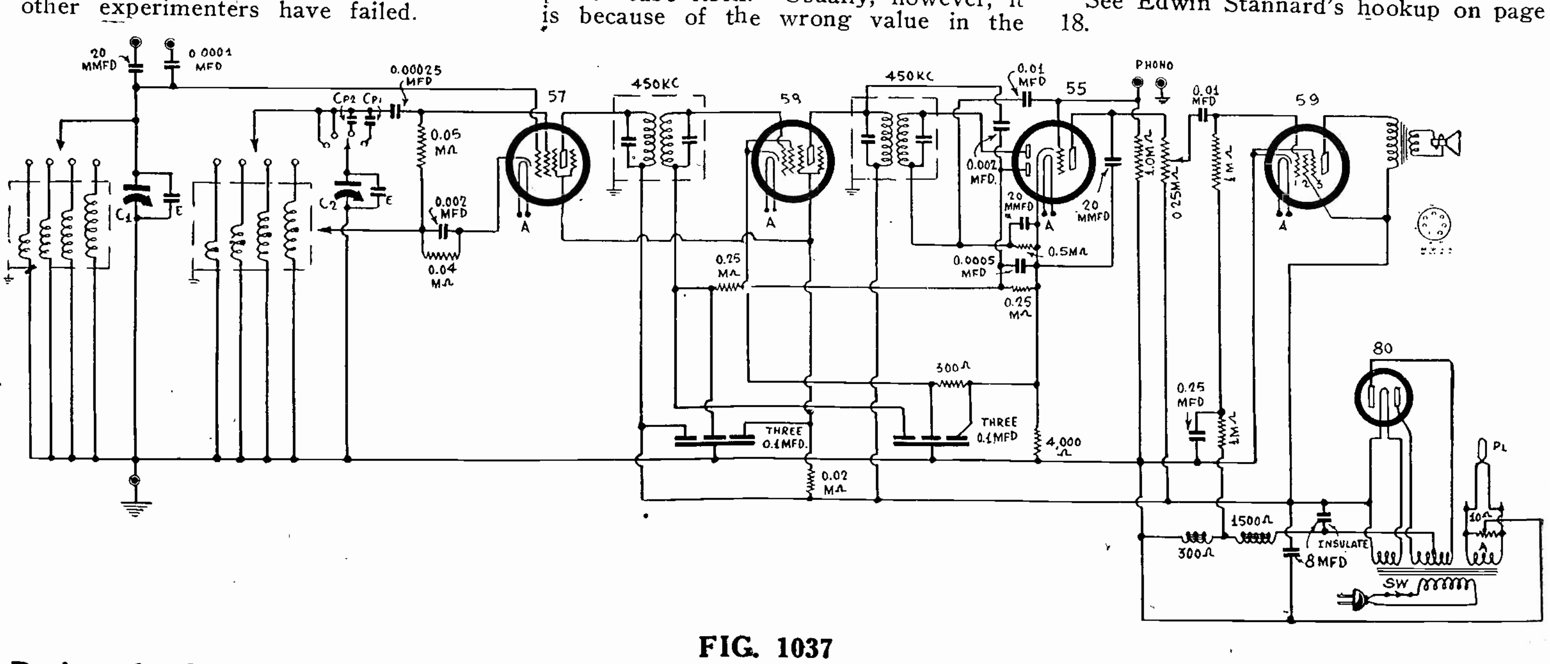


FIG. 1037

Design of a five-tube superheterodyne, wherein the first 57 is used in autodyne fashion, and an experimental method shown for separation of the signal and oscillation inputs.

STATION SPARKS

By Alice Remsen

Wanderlust

For "Savannah Liners"

WJZ Tuesdays, 6:30 p.m.

Roaming the byways of the world,
Healthy, and broke, and free;
Knowing the feel of a heather couch,
Knowing the smell of the sea.
Tramping the cobbles of Amsterdam,
Coaling a ship at Rangoon,
Making love to a brown skinned lass,
Under a tropical moon.

Scrubbing the decks of a P and O,
Mediterranean bound;
Wandering through a thousand ports,
Covering plenty of ground.
Treading the streets of London town,
Drinking beer in a pub;
Knowing the fear of a cornered rat,
First time down in a sub.

Owning a pair of feet that itch
Each time they stop for a while;
Owning a soul which longs for rest,
Away on a lonely isle.
Longing to stop, yet bound to go,
Through storm, or fire, or flood.
What is a sailor-man to do
With wanderlust in his blood!
—A. R.

* * *

AND IF YOU LISTEN IN TO THE SAVANNAH LINERS PROGRAM under the direction of Bob Armbruster, you'll get wanderlust and want to go wandering around the world in ships. Listen in; you'll like it!

* * *

The Radio Rialto

Indian summer is with us, so we shan't mind our rambles today. . . . The old rialto is flooded with sunshine . . . there's a pleasant tang in the air which seems to give zest to what ever we do. . . . In spite of the vague whispering campaign now going the rounds as to what may happen if so-and-so, or so-and-so gets in, the rialto ramblers are in an optimistic mood. . . . We meet Bob Haring, the well-known orchestra leader, at the corner of 47th and Broadway. Bob hasn't had a program for weeks, but he's still grinning, still smoking a cigar, and still optimistic for the future. Great guy, Bob! . . . There's Harold Van Emburgh, the singing saxophonist, carrying a music case weighing thirty-five pounds. Harold was heard on the air plenty last year, with Rolfe's Lucky Strike program and the Club Valspar, but this year he's had no luck; he has just opened at the fashionable night club, the Place Pigalle, where he sings and plays until the wee sma' hours, but he doesn't grumble, for he has a wife and baby to take care of; but Harold is very optimistic today; says he thinks things will pick up after election. Let's hope so.

There's Irving Berlin, a dapper little man; we say "hello" and tell him he's getting fat. We're quite close to his music emporium, so supposing we stop up and see Georgie Joy. . . . Well, well! What on earth has happened to you, Georgie? There the poor lad sits behind his desk, his arm in a sling, and we find out that he thought he would like to join Frank Parker's polo club, and took a ride on a horse; the horse didn't like it, cut up rough, threw him off, and left Georgie with a broken shoulder; but even with that handicap, Georgie, like everyone else we have met today, is smiling. . . . Little Benny Bloom, Irving Berlin's publicity man, is in the same mood, grinning from ear to ear. Gee, what a wonderful world it is today! . . .

WLW, Cincinnati's wonderful station, has sent representatives in to New York to search for radio talent. We had the privilege of meeting their Mr. Nichols, a charming English gentleman, and Mr. Perazz, equally charming and courteous; these gentlemen have listened to hundreds of radio artists and would-be radio artists during their short stay at the Hotel New Yorker; they have not yet decided on the lucky one . . . they are in the market for a girl who can sing torch songs, ballads and rhythm numbers . . . it will be a very pleasant engagement. . . . Ran into Molly Klinger up there, and she was obliging as usual, playing for some of the singers. . . . June Pursell and Billie Dauscha were among those heard. . . .

Well, let's toddle up to Feist's. . . . Johnny White, the professional manager and my very good friend, lost his dear old dad a few days ago and is feeling pretty blue. Buck up Johnny lad! . . . Sitting with Johnny is that clever leader, Joe Furst, who conducts the smooth rhythmic band heard over WABC and emanating from the Village Barn. Joe Furst is a nice fellow and a good musician, tells us that he has a harp in his band, and also invites us down to the Village Barn to give it the once over; we hear it is an unique place, so we'll go one of these fine nights and then perhaps tell you all about it. . . . There's handsome Jim Brennan, who, together with Bill Hansen and Howard Howe, makes up the trio known as the Three Little Sachs; he tells me they are back on the air over WMCA; this is good news, for they were always a snappy and entertaining trio. . . . A little farther up Broadway is the WMCA building in which Howard Lanin has his office; we haven't seen Howard since the Bourjois summer program went off the air, so let us gallivant up to the seventh floor and say "Hello." . . . The office is humming with activity. Jimmy Lanin greets us with a smile and ushers us into the private office of the jovial maestro, Howard. . . . He's pleased to see us; we sit down and chat, and learn that the boys are all excited because a protege of theirs, one Jose Santiago-Font, has become the primo-basso of the Scala Milano. . . . While under the management of the Lanin Brothers, he won the Caruso Memorial prize and established a precedent by winning a renewal of the scholarship for an extra year. During his first year in Italy he changed his voice from a baritone to a basso-profundo. . . . We also learn that Howard Lanin now has a mixed quartette for his family, two boys and two girls; the last little girl was born on October 3rd. . . . Met up with Tommy Weir, of the swell tenor voice; we both worked on the English synchronization of a German film at the Standard Sound Studios; he's none the worse for his ferry trip twice a day to and from Staten Island; in fact, I think it does him good. . . . Ivy Scott lives over there too and likes it. . . . Ivy, by the way, is in the new musical produced by Peggy Fears. . . .

Well, we'll taxi over to WABC and look around. . . . Here we are . . . 22nd floor again. . . . Righ off the reel we learn that a new series of dramatic programs are now being heard daily at 7:15 p.m., with the exception of Saturday and Sunday; called "Buck Rogers in the year 2432." Highly imaginative series; better listen in and find out what may be happening five hundreds years from now. . . . Also, the Fitch Professor has returned to CBS, with the Three Brothers Trio, and Helen Mors, platinum-haired torch singer; Wednesdays at 11:30 a.m. . . . An optimistic tone pervades CBS also. . . . Perhaps there is something in the air. . . . Maybe prosperity is tired of hiding just around the corner and has decided to come right out in the open; certainly sounds like it.

Well, we'll meander over to NBC and see how they feel about it. . . . Come along now, step out smartly, over to Fifth Avenue and don't linger by the way to look at all the pretties in the shops. . . . Yes, I know window-shopping is fascinating, but our time is limited, so eyes front, forward march. . . . Here we are at 711. . . . Let's take a look in some of the studios. . . . Studio A on the 13th floor. . . . There's Hugo Mariani, rehearsing his orchestra; he always sits on a titlted chair on top of a little platform, and while he is directing you always expect to see him fall over, but he's got a wonderful sense of balance. . . . There's Kelvin Keech at the microphone; watch him, he smiles, standing on tiptoe, not because he's so short; just a habit, that's all. . . and there's Robert Simmons, with his eyes glued to the clock; he always watches it while he sings. . . . Not much news around here. . . . Of course, you know that Eddie Cantor is back on the air with Rubinoff for the Chase and Sanborn Sunday programs. . . . Oh, by the way; I nearly forgot a very interesting bit of information; my old pal, Arthur Behim, is on the air now, every morning except Sunday, with Bud Collyer, for Kruschen Salts, 7.45 a.m. WABC. . . . Listen in to this program as you eat your breakfast; it'll put you right for the day. . . . And another thing; I gave an audition myself for Station WLW; came to terms with their affable manager, Mr. Clark, and I leave this week for Cincinnati. . . . Shall let you know time and day of programs and hope you'll listen in to your girl friend. . . . WLW is a big station, 50,000 watts, which will soon be changed to 500,000 watts, so you won't be able to miss me. . . . It's about time to be on my way home to Octavia's roast beef and Yorkshire pudding, and the next time you hear from me I'll probably be on my way to Cincy and a new environment.

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ANSWERS TO CORRSPONDENTS

M. Ivkovich, Powhattan Point, Ohio. . . . Glad you like Stations Sparks; "Myrt and Marge," are mother and daughter. . . . "Myrt" is Myrtle Vail, who married George J. Dameral, the original Prince in The Merry Widow; "Marge" is Donna Dameral, their daughter. . . . Tito Guizar is from Mexico. Studied at the Mexican National University in Mexico City. . . . Studied voice in Italy. Came to New York in 1929 to make records of Spanish and Mexican songs. Signed with CBS in 1930. . . . Arthur Tracy was born in Philadelphia. . . . Played small time vaudeville. . . . Was discovered for big time radio by Eddie Wolfe, who built him up into "The Street Singer" you know today. Tracy had some experience in dramatic stock and opera before tackling radio. . . . Harry Richman spent his boyhood in Cincinnati. Began his career in Chicago, as piano player in a music factory (song publishers). Went into vaudeville with a violinist. Act flopped. Then played piano for Mae West; ditto the Dolly Sisters. Had a lot of bumps until the late Flo Ziegfeld booked him for the Midnight Frolics; this made him and he has never looked back. Has written quite a few best selling popular songs.

A. E. M., Albany, N. Y.—Am sorry; have no data at present on Richard Maxwell, except that he wears a Phi Beta Kappa key. Shall probably get some information about him for you in the near future.