PHILCO

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Service Bulletin — No. 201

Model 200

Philco Model 200 is a superheterodyne radio receiver designed especially to deliver high fidelity reproduction of broadcasts. The audio response of this model extends from 30 to 7500 cycles. This is made possible partly by the design of the R. F. and I. F. circuits, which are so arranged that by means of a set of variable resistances in the I. F. circuits the tuning can either be broadened to take in the high fidelity transmissions which cover more than a single channel, where conditions permit; or sharpened when necessary and when full high fidelity cannot be used to advantage. The design of the audio circuit, speaker and cabinet and the use of a special "Sound-Diffuser' consisting of a scientifically arranged group of sound-radiating vanes, also contribute greatly to the high fidelity result.

The Selectivity-Fidelity Control is the most important adjustment in this receiver. To operate this control properly requires a thorough understanding of its functions and its relationship to the performance of the set. Broad tuning in the R. F. and I. F. circuits is required for the passage of a broadcast signal without any tendency to lose the higher audio frequencies contained in the side bands. This condition is obtained when the selectivity-fidelity control is turned to the extreme right hand position. In this position, maximum fidelity and minimum selectivity will be obtained. This setting will enable the audio amplifier and speaker to reproduce the widest possible range of audio frequencies, but should only be used when no broadcasting station within the range of the receiver is operating on a channel within ten kilocycles of the station being received. As the control is turned toward the left, the selectivity is gradually increased with an attendant gradual decrease in response to the higher frequencies. With this control in the left hand position, the tuning will be extremely sharp.

Model 200 uses the following tubes: Type 78 R. F., type 6A7 detector-oscillator, two type 78 I. F., type 37 Shadowmeter control tube, type 75 2d detector—1st audio, type 42 driver, two type 42 output tubes used as triodes and a type 5Z3 rectifier. The intermediate frequency (I. F.) is 175 kilocycles and the power consumption is 130 watts. The Model 200 will receive broadcasts from 540 to 1720 kilocycles, which includes all standard broadcasts and some of the police broadcast frequencies. This model is for use on alternating current (A. C.) only.

Tube Socket Voltages

Circuit	R.F.	Det. Osc.	1st I.F.	2d I.F.	Shadow-meter Control	A.F.	Dri-ver	Out-put	Rect.
Type Tube / Test Points	78	6A7	78	78	37	75	42	42 42	5Z3
F to F.....	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	5.0
P to K.....	225	210	210	220	63	110	225	335	350*
SG to K.....	80	(G3&5-K) 73	73	76	...	...	225	335 335	...
K to Gnd	3	8	8	4	0	0	0	0 0	...
CG to K.....	0.2	0	0.2	4	0	...	0.2	35 35	...
6A7—G¹ to K..	22.0								
6A7—G² to K..	90.0								

Power Transformer Data

Terminals	A.C. Volts	Circuit	Color of Leads
1–2	120	Primary	White
3–5	780	Plates of 5Z3	Yellow
6–7	5.0	Filament of 5Z3	Blue
8–10	6.3	Filaments	Black
4	...	Center Tap of 3–5	Yellow—Green Tracer
9	...	Center Tap of 8–10	Black—Yellow Tracer

Use Fig. 1 when testing voltages as per table above.
The above voltages were obtained using a high resistance D. C. voltmeter for plate, grid and cathode tests, and an A. C. voltmeter for filaments. Line voltage 115 dial at 55, volume control at maximum, fidelity control at middle position. *P to ground.
Philco Model 025 Circuit Tester is recommended for making these tests.

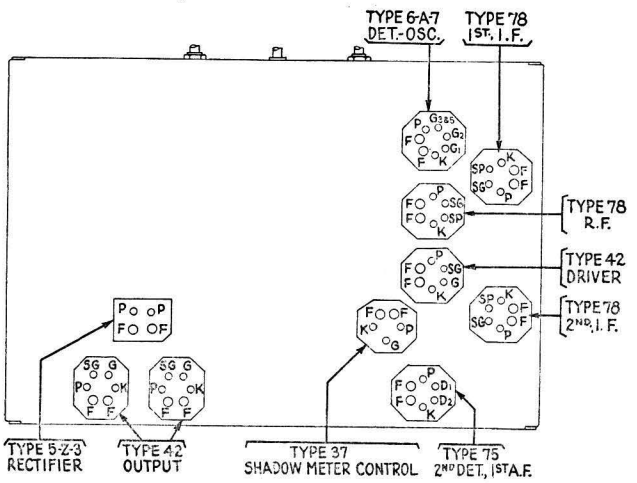


Fig. 1—Tube Sockets (Viewed from Underneath)

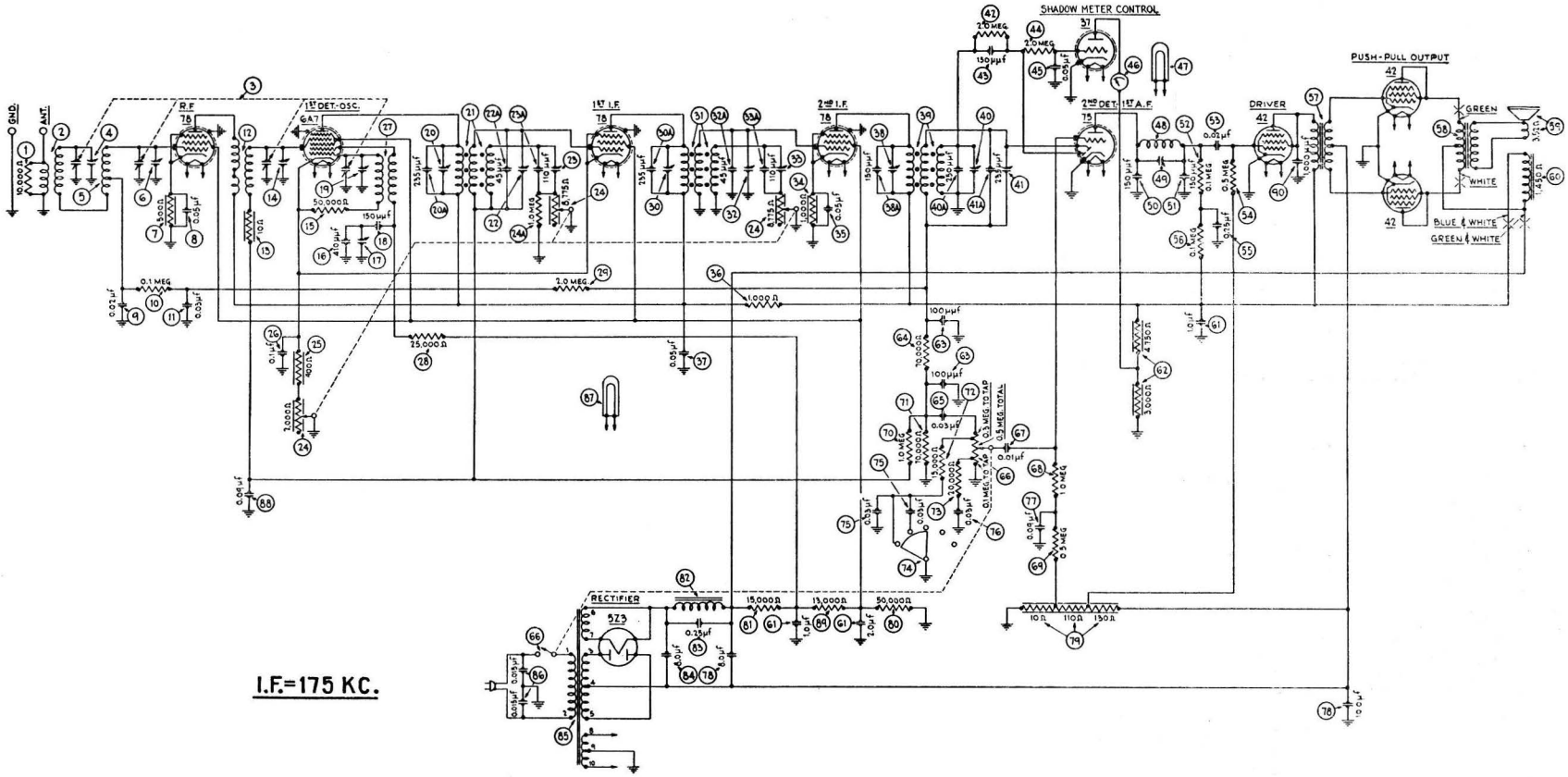


Fig. 2. Schematic Wiring Diagram.

NOTE: An 8000 ohm resistor, 33-3016 (Gray-Black-Red) is added across the 2000 ohm section of (21)

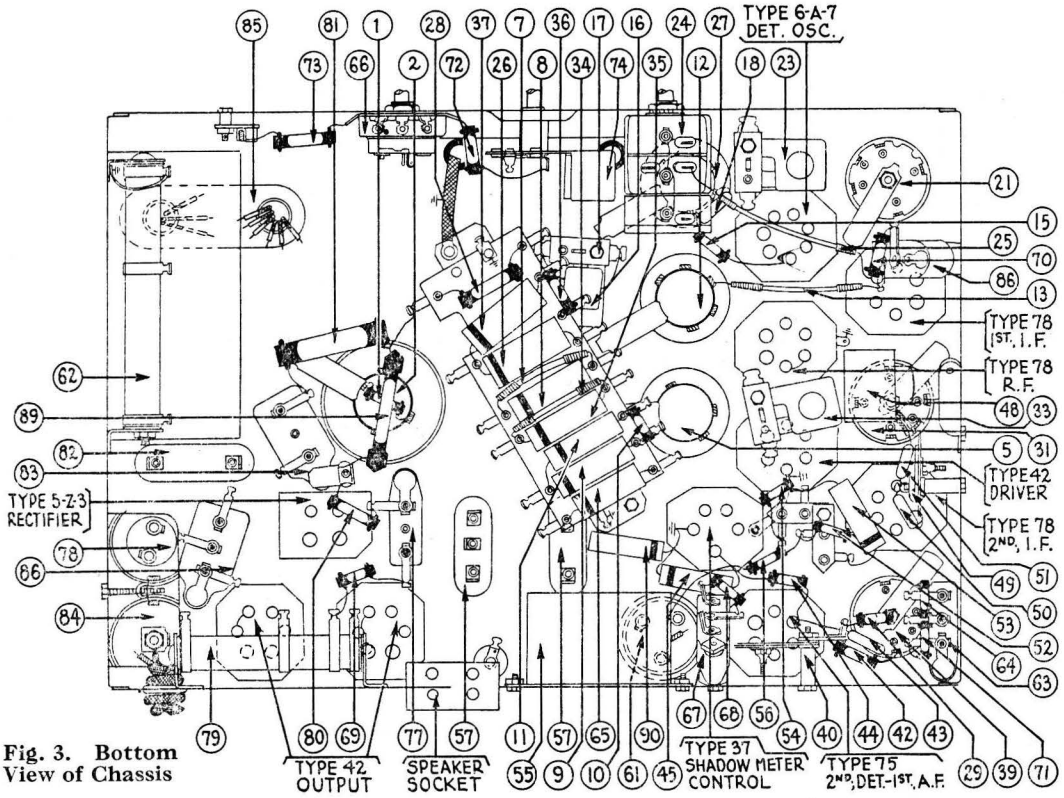


Fig. 3. Bottom View of Chassis

No. on Diagram	Description	Part No.	List Price
(1)	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000	$0.20
(2)	Antenna Transformer	32-1420	.60
(3)	Tuning Condenser Assembly	31-1217	8.25
(4)	Compensating Condenser (Ant.)	Part of (3)	....
(5)	R. F. Transformer	32-1421	.45
(6)	Compensating Condenser (R. F.)	Part of (3)	....
(7)	Resistor (500 ohms) (Flexible; Green-Black-Brown)	6977	.20
(8)	Condenser (.05 Mfd. Tubular)	30-4020	.35
(9)	Condenser (.02 Mfd. Tubular)	30-4113	.30
(10)	Resistor (100,000 ohms) (White-White-Orange)	6099	.20
(11)	Condenser (.03 Mfd. Tubular)	30-4025	.30
(12)	Detector Transformer	32-1422	.90
(13)	Resistor (10 ohms Flexible Wire-Wound)	33-3139	.20
(14)	Compensating Condenser (Det.)	Part of (3)	....
(15)	Resistor (50,000 ohms) (Green-Brown-Orange)	5868	.20
(16)	Condenser (.00041 Mfd. Mica)	30-1000	.35
(17)	Compensating Condenser (Osc. L. F.)	04000R	.45
(18)	Condenser (.00015 Mfd. Mica)	30-1033	.35
(19)	Compensating Condenser (Osc. H. F.)	Part of (3)	....
(20)	Compensating Condenser (1st I. F. Pri.)	Part of (21)	....
(20)A	Condenser (.000235 Mfd. Mica)	30-1037	.35
(21)	First I. F. transformer	32-1403	1.25
(22)	Compensating Condenser (1st I. F. Sec.)	Part of (21)	....
(22)A	Condenser (.000045 Mfd. Mica)	30-1034	.35
(23)	Compensating Condenser (1st I. F. Tertiary)	04000A	.15
(23)A	Condenser (.00011 Mfd. Mica)	30-1035	.35
(24)	Fidelity-Selectivity Control (Wire-Wound Resistors) (2000, 8775, 8775 ohm)	33-5070	2.50
(24)A	Resistor (1 Meg.) (Brown-Black-Green)	33-1096	.20
(25)	Resistor (400 ohms Flexible Wire-Wound)	33-3016	.20
(26)	Condenser (.1 Mfd. Tubular)	30-4122	.35
(27)	Oscillator Transformer	32-1423	.45
(28)	Resistor (25,000 ohms) (Red-Green-Orange)	4516	.20
(29)	Resistor (2 Megs.) (Red-Black-Green)	33-1025	.20
(30)	Compensating Condenser (2d I. F. Primary)	Part of (31)	....
(30)A	Condenser (.000235 Mfd. Mica)	30-1037	.35
(31)	2d I. F. Transformer	32-1403	1.25
(32)	Compensating Condenser (2d I. F. Sec.)	Part of (31)	....
(32)A	Condenser (.000045 Mfd. Mica)	30-1034	.35
(33)	Compensating Condenser (2d I. F. Tertiary)	04000A	.15
(33)A	Condenser (.00011 Mfd. Mica)	30-1035	.35
(34)	Resistor (1,000 ohms) (Flexible Wire-Wound)	33-3017	.20
(35)	Condenser (.05 Mfd. Tubular)	30-4020	.35
(36)	Resistor (1,000 ohms) (Brown-Black-Red)	5837	.20
(37)	Condenser (.05 Mfd. Tubular)	30-4123	.35
(38)	Compensating Condenser (3d I. F. Primary)	Part of (39)	....
(38)A	Condenser (.00015 Mfd. Mica)	30-1041	.35
(39)	Third I. F. Transformer	32-1404	1.25
(40)	Compensating Condenser (3d I. F. Tertiary)	04000X	.20
(40)A	Condenser (.00025 Mfd. Mica)	30-1038	.35
(41)	Compensating Condenser (3d I. F. Secondary)	Part of (39)	....
(41)A	Condenser (.000235 Mfd. Mica)	30-1037	.35
(42)	Resistor (2 Megs.) (Red-Black-Green)	33-1025	.20
(43)	Condenser (.00015 Mfd. Mica)	30-1033	.35
(44)	Resistor (2 Megs.) (Red-Black-Green)	33-1025	.20
(45)	Condenser (.05 Mfd. Tubular)	30-4020	.35
(46)	Shadowmeter	45-2028	2.50
(47)	Pilot Lamp (Shadowmeter)	Part of (46)	....
(48)	Filter Coil (10 K. C.)	32-7261	$0.85
(49)	Compensating Condenser (10 K.C. Audio Filter Trap Circuit)	04000B	.25
(50)	Condenser (.00015 Mfd. Mica)	30-1033	.35
(51)	Condenser (.00015 Mfd. Mica)	30-1033	.35
(62)	Resistor (100,000 ohms) (White-White-Orange)	6099	.20
(53)	Condenser (.02 Mfd. Tubular)	30-4113	.30
(54)	Resistor (.5 Meg.) (Yellow-White-Yellow)	6097	.20
(55)	Condenser (.25 Mfd. Metal Case)	4264	.60
(56)	Resistor (100,000 ohms) (White-White-Orange)	6099	.20
(57)	Audio Transformer	32-7057	2.75
(58)	Output Transformer (On Speaker)	32-7247	2.10
(59)	Voice Coil and Cone Assembly (U-7 Speaker)	36-3321	1.75
(60)	Field Coil and Pot Assembly (U-7 Speaker)	36-3088	8.00
(61)	Condenser (Electrolytic—1, 1, 2 Mfd.)	30-2080	1.85
(62)	B. C. Resistor (Wire-Wound—4750 ohms, 3000 ohms)	33-3138	.45
(63)	Condenser (.0001 Mfd. Twin—Bakelite Block)	8035-P	.25
(64)	Resistor (70,000 ohms) (Violet-Black-Orange)	33-1115	.20
(65)	Condenser (.03 Mfd. Tubular)	30-4025	.30
(66)	Volume Control (500,000 ohms Tapped at 100,000) and On-Off Switch	33-5071	1.50
(67)	Condenser (.01 Mfd. Bakelite Block)	3903-G	.25
(68)	Resistor (1 Meg.) (Brown-Black-Green)	33-1096	.20
(69)	Resistor (500,000 ohms) (Yellow-White-Yellow)	6097	.20
(70)	Resistor (1 Meg.) (Brown-Black-Green)	33-1096	.20
(71)	Resistor (70,000 ohms) (Violet-Black-Orange)	33-1115	.20
(72)	Resistor (15,000 ohms) (Brown-Green-Orange)	6208	.20
(73)	Resistor (20,000 ohms) (Red-Black-Orange)	6650	.20
(74)	Bass Compensator	30-4196	.75
(75)	Condensers (In Bass Compensator)	Part of (74)	....
(76)	Condenser (.03 Mfd. Tubular)	30-4025	.30
(77)	Condenser (.09 Mfd. Bakelite Block)	4989AR	.35
(78)	Condenser (Electrolytic—8 10 Mfd.)	30-2046	1.85
(79)	B. C. Resistor (10, 110, 130 ohms)	33-3137	.30
(80)	Resistor (51,000 ohms) (Green-Brown-Orange)	4518	.20
(81)	Resistor (15,000 ohms) (Brown-Green-Orange)	5718	.35
(82)	Filter Choke	32-7056	2.20
(83)	Condenser (.25 Mfd. Bakelite Block)	6287-S	.40
(84)	Condenser (Electrolytic—8 Mfd.)	30-2011	1.40
(85)	Power Transformer, 115 volts 60 cycles	32-7258	7.25
	" " 115 volts 25 cycles	32-7259	11.25
(86)	Condenser (.015 Mfd. Twin Bakelite Block)	3793-K	.40
(87)	Pilot Lamp (Station Selector)	6608	.09
(88)	Condenser (.09 Mfd. Bakelite Block)	4989N	.35
(89)	Resistor (13,000 ohms) (Brown-Orange-Orange)	3766	.20
(90)	Condenser (.001 Mfd. Tubular)	30-4201	.25
	Four Prong Socket	7544	.10
	Five Prong Socket	7546C	.11
	Six Prong Socket	6417C	.11
	Seven Prong Socket	27-6005	.11
	Speaker Socket	4957	.10
	Dial Assembly	31-1255	.60
	Dial Scale	27-5049	.25
	Knob (Large)	27-4051	.10
	Knob (Small)	27-4052	.10
	Chassis Mtg. Screw	W1388A	.40C
	Chassis Mtg. Foot (Rubber)	27-4116	.05
	Chassis Mtg. Foot (Steel)	29-1983	.03
	Chassis Mtg. Foot Plate	27-7497	.35C
	Tube Shield	28-1107	.10
	A. C. Cord and Plug Assembly	L-943A	.60

Adjusting Compensating Condensers in Model 200

The quality performance of this receiver depends to a great extent upon providing a wide channel through the R. F. and I. F. stages to permit the passage of a broadcast signal without cutting of the side bands.

In order to produce this wide tuning band, the set must be carefully and accurately adjusted. These adjustments will be more critical than in the conventional radio, and the procedure will be somewhat more complicated.

In making the adjustments, it is necessary to use an unmodulated signal generator. The PHILCO Model 048 Set Tester or the Model 024 Signal Generator can be readily adapted for this purpose by the installation of a single-pole double-throw switch, and an additional grid leak resistor, as shown in Figure 4. This switch will adapt the signal generator for either a modulated or an unmodulated signal.

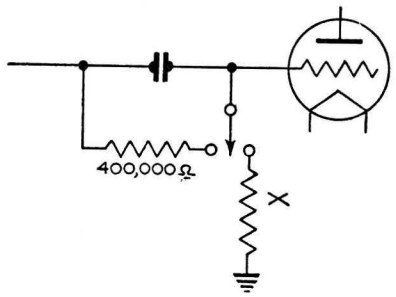
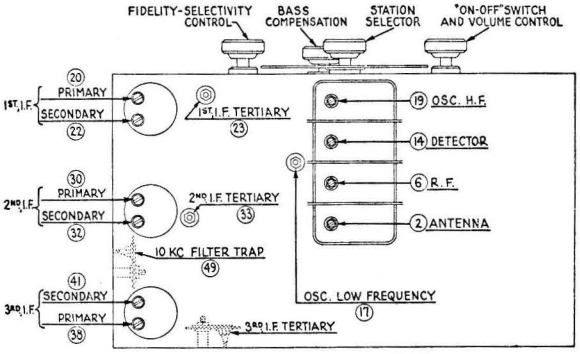


Figure 4 Adaptation of Signal Generator Circuit for Use in Making Adjustments on Model 200.



Locations of Adjusting Condensers.

With an unmodulated signal, it is not possible to obtain an indication of output by means of the usual form of output meter. An indirect indication can be obtained, however, through the automatic volume control system by connecting a high resistance voltmeter having a scale reading of 0-5 or 0-10 volts across the R. F. cathode resistor ⑦, shown in the wiring diagram Fig. 2. This connection can be made conveniently through the use of leads equipped with test clips. With this arrangement, maximum output at the second detector will be indicated by a minimum reading of the meter, and vice versa. In other words, the action will be just the opposite of an output meter used to measure audio frequency voltage at the power output stage. With no signal applied to the receiver, the bias voltage indicated by the voltmeter, will be approximately 3 volts. This voltage will be reduced by the application of a signal to the R. F. or I. F. input circuits.

I. F. ADJUSTMENTS

After preparing the unmodulated signal generator and connecting the voltmeter as directed, proceed as follows:

1. Set the receiver tuning dial at its extreme low frequency position. Remove the grid clip from the cap of the 6-A-7 detector oscillator tube, and connect the signal generator antenna lead in its place. Connect the ground lead from the signal generator to the ground terminal of the chassis. Adjust the signal generator frequency to exactly 175 K. C. Turn the fidelity control of the receiver all the way to the left.
2. Adjust the 6 I. F. padding condensers ⑳, ㉒, ㉚, ㉜, ㊶ and ㊳ (see Fig. 5) in the tops of the 3 I. F. cans, for maximum output (minimum meter reading), starting with the compensator or padder at the front of the chassis, and continuing with the adjustments toward the rear of the set. During these adjustments, the output of the signal generator should be regulated to maintain a voltmeter reading of approximately 2 volts.
3. Connect a 250 Mmf. Condenser from the plate of the 2nd I. F. tube to ground. This will increase the voltmeter reading to approximately 2.5 volts.
4. Readjust the 3d I. F. secondary padder ㊶ for maximum output.
5. Readjust the 3rd I. F. primary padder ㊳ for maximum output. Do not touch the grid padder ㊶ again.
6. Turn the fidelity selectivity control all the way to the right.
7. Adjust the 1st & 2nd I. F. tertiary padders ㉓ and ㉝ for MINIMUM output (maximum voltmeter reading).
8. Leaving the fidelity selectivity control in the right hand position, it will be found, upon varying the frequency of the signal generator, that two definite dips will appear in the voltmeter reading—one at 167 K. C. and another at 182 K. C. These dips in the voltmeter reading indicate peaks in the tuning curve. The amplitude of these peaks should be equal; that is, the same voltmeter reading should be obtained at both 167 K. C. and 182 K. C. Any variations in these two readings can be corrected by a *slight* readjustment of the 3rd I. F. primary padder ㊳. If the peak at 167 K. C. is higher than the one at 182 K. C., the primary padder will have to be turned out. If the reverse is true, the capacity of this padder must be increased. In any case, the voltmeter readings must be made equal by dividing the differences through readjustment.

R. F. ADJUSTMENTS.

The R. F. portion of the receiver is adjusted as follows:

9. Replace the grid clip on the detector-oscillator tube and connect the antenna terminal of the signal generator to the antenna terminal of the chassis. Turn the fidelity selectivity control all the way to the left and set the receiver dial at 1,500 K. C. The same type of output indication is employed as in the I. F. adjustments.
10. Adjust the signal generator for a frequency of 1,500 K. C. Adjust the "oscillator" padding condenser ⑲ and the "detector" padding condenser ⑭ for maximum output and in the order mentioned. Regulate the signal generator output control to maintain a voltmeter reading of 2 volts as before.
11. Turn in padder ⑥ (R. F.) until the voltmeter reads 2.5 volts and then adjust padder ② (ANT.) for maximum output.
12. Readjust padder ⑥ for maximum output. Do not touch padder ② again.
13. Set the receiver dial and the signal generator at 600 K. C. Adjust the "oscillator low frequency" padder ⑰ for maximum output. As the R. F. tuning is rather broad, there will be a considerable range on the dial that will give about the same output when the oscillator L. F. padder is adjusted for maximum. The padder must be adjusted at the middle of this range. This point may be determined with accuracy in the following manner: Starting with the usual voltmeter reading of 2 volts, slowly turn the receiver dial toward the low frequency end and, at the same time, readjust the padder ⑰ for maximum output until a point is reached where the maximum output is indicated by a voltmeter reading of 2.5 volts. Note carefully the exact dial reading at this point. Follow the same procedure while turning the dial in the opposite direction until the output reading decreases to the same value. Set the dial at the exact center of these two points and readjust padder ⑰ for maximum output.
14. Adjust the 3d I. F. tertiary padder ㊵ to give minimum width in the shadow tuning meter in the receiver. This padder is reached from rear of chassis.

ADJUSTMENT OF 10 K. C. FILTER

The 10 K. C. filter in the audio circuit will rarely require readjustment. As the proper adjustment of this padder (㊾ on diagram) requires an accurately calibrated audio oscillator, it should be reset only in the event that it has been tampered with or in cases where it has become necessary to replace one of the elements of this filter. An emergency adjustment of this filter can be made in the following manner:

15. Connect the signal generator to the control grid of the type 6-A-7 tube, leaving the grid clip in place.
16. Disconnect the voltmeter from resistor ⑦ and connect an output meter to the plates of the power output tubes in the usual way.
17. Set the receiver dial at 550 K. C. At this point, the oscillator in the receiver will be tuned to 725 K. C. The adjustment of the signal generator (switch in unmodulated position) to approximately this same frequency will cause an audible beat note to be heard in the speaker. By means of the signal generator tuning control, reduce the frequency of this beat note until zero beat is reached, at which point the output meter reading will decrease to 0. Turning the receiver dial in either direction will gradually increase the frequency of the audible note so that at 540 or 560 K. C. a 10,000 K. C. note will be heard. At either of these points, the padder ㊾ should be adjusted for minimum reading of the output meter.

September, 1934

Printed in U. S. A.