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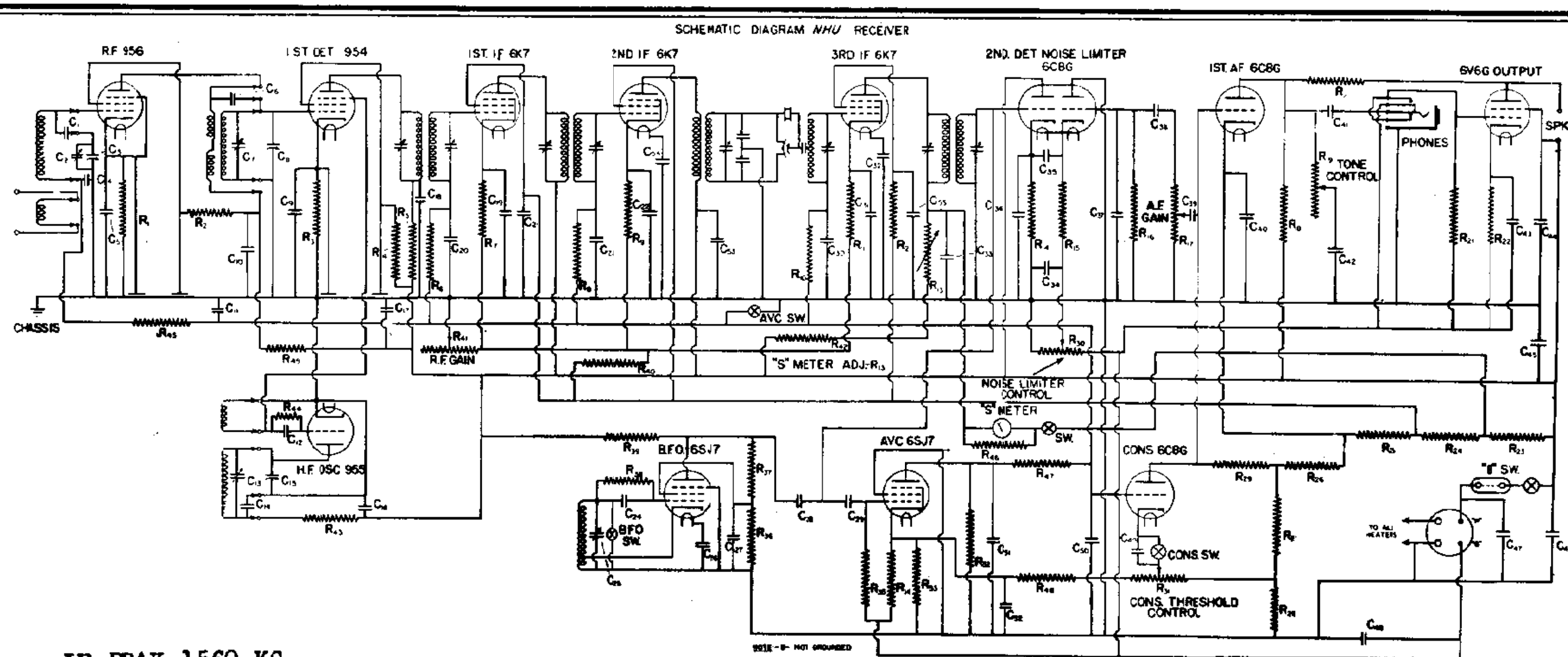

IF PEAK 1560 KC

For the sake of clarity in this schematic diagram, only one set of R.F. coils is shown. The terminals of each R.F. coil assembly are indicated, and it will be understood that condensers C1, C6, C7, C13 and C14 are duplicated in each range.

THE NHU is a communications type receiver designed primarily for operation in the frequency range from 27.5 to 62 megacycles. This spectrum is covered in three bands: 27.5 to 36 Mc., 34 to 46.5 Mc. and 45 to 62 Mc. A superheterodyne circuit is used and all elements necessary for communications service are incorporated

The power supply, Type 5856, employs a type 80 rectifier. The normal B current drain of the receiver is 65 ma. at 200 volts. The heater circuit requires 3 amperes at 6.3 volts.

Battery model NHU receivers may be operated with 180 volts of B supply, with a current drain of 60 ma.

The input impedance of the receiver averages about 500 ohms and an open wire transposed line, constructed to have this impedance, will probably give best performance. Such a line may consist of two No. 10 wires spaced 1½ inches apart; two No. 14 wires spaced 2 inches apart may be used as an alternative.

The maximum undistorted audio output of the NHU is about 2 watts. Speaker terminals are provided at the rear of the receiver. The speaker is connected directly in the plate circuit of the 6V6G output tube and the speaker coupling transformer should, therefore, be designed to have an impedance of 5000 ohms. It should also be capable of carrying the 45 milliampere plate current of the output tube.

MODEL NHU

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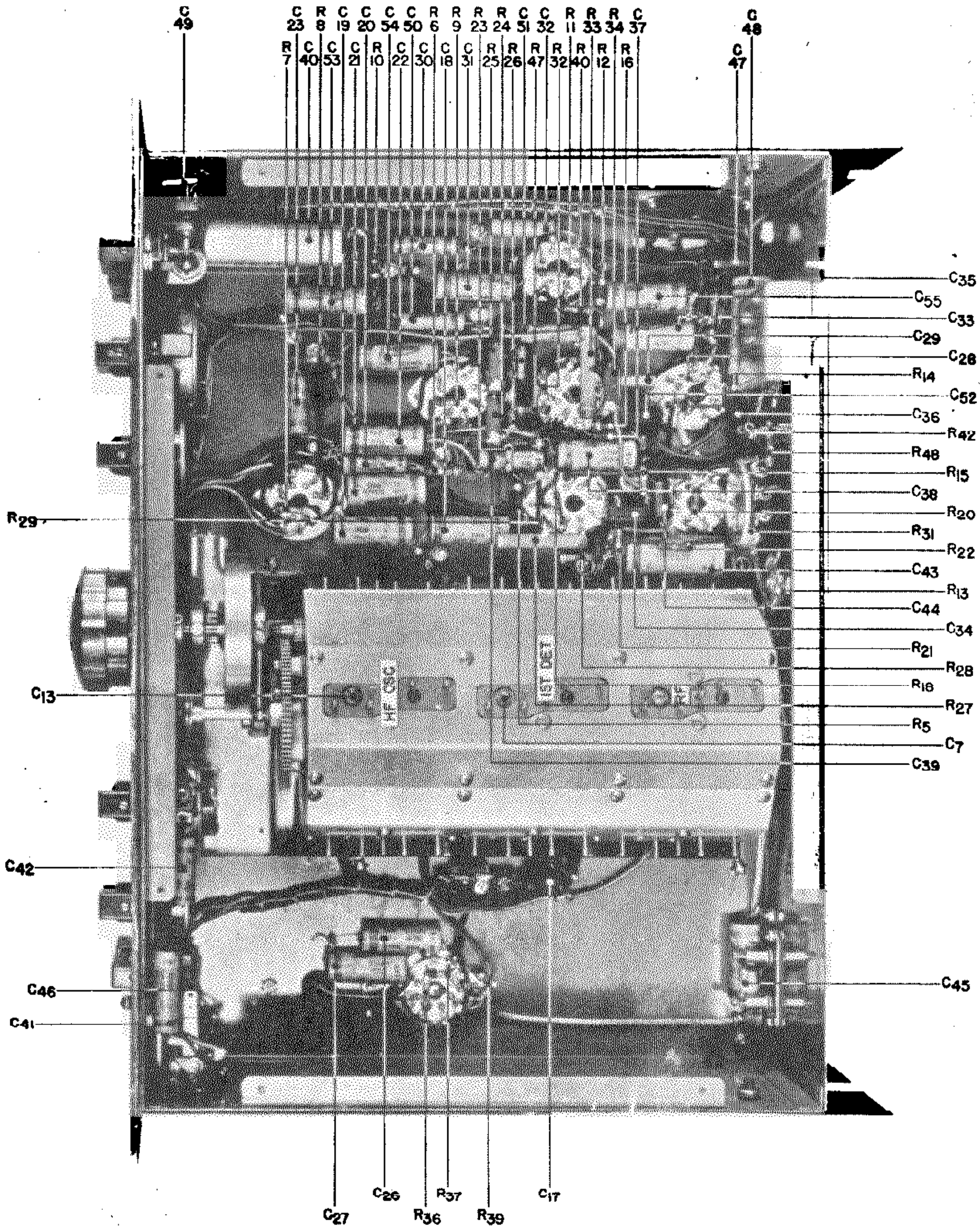

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Alignment and Service Data

TUBES

Individual tubes of the same type will vary slightly in their characteristics and it is well to remember this fact when replacements become necessary. Even though the circuit is designed to reduce the effect of such variations to a minimum, the high frequency oscillator and I.F. tubes should be selected with some care. A replacement high frequency oscillator should be checked in the receiver to make sure that the inter-electrode capacities are the same as those of the tube originally employed. This is easily determined by noting any change in calibration at the high frequency end of any coil range. The change should not exceed four or five dial divisions on the vernier scale.

Substitution of new tubes in the I.F. amplifier may possibly alter overall gain and selectivity characteristics. Instructions for realignment are given in detail in the following pages.

Two other points should be checked when trying the new high frequency oscillator; a fairly strong steady signal should be tuned in, preferably on some frequency above 50 mc.; the C.W. oscillator should be turned off; jarring the receiver or lightly tapping the tube, should not show any evidence of noise in the output. Next turn on the C.W. oscillator to make sure that the tube does not introduce "modulation hum" on the carrier. The tube should again be lightly tapped to see whether or not its characteristics change.

R.F. AND H.F. OSCILLATOR ALIGNMENT

All circuits are carefully and accurately aligned before shipment, using precision crystal oscillators which insure close conformation to the dial calibration. No readjustments will be required, therefore, unless the receiver is subjected to extremely rough handling. Do not attempt to make any adjustments without first determining the exact function of each trimmer condenser and the effect that it will have upon performance.

The coil group which is plugged into the circuit at any time is the one directly underneath the contact strips of the R.F. sub-assembly. The coil nearest the front of the receiver is the H.F. oscillator, the middle coil is the first detector and the coil nearest the antenna terminal strip is the R.F. preselector. Complete alignment for any one coil range is apt to be rather complicated and it is recommended that the operator make no adjustments on the coils themselves. Even the conventional trimmer adjustments require considerable care and should not be attempted by anyone who has not had a great deal of practical experience with high frequency equipment. It should be kept in mind that the capacities and inductances employed in these high frequency circuits are extremely small. Leads to the contact terminals, variable condensers and tubes should not be moved or bent indiscriminately. Furthermore, hand capacity effects are very noticeable when making the trimmer adjustments and it will usually be found necessary to turn any given trimmer condenser to a slightly higher capacity than that which appears to give maximum response because the total circuit capacity will decrease appreciably when the screw driver is released from the trimmer shaft.

If it is found necessary to readjust any coil range of the NHU, the following procedure is recommended: Set the tuning dial near the high frequency end of the range and check the frequency reading by means of an accurate test oscillator or signal generator. Readjustment should be made if the dial is in error by more than about 1%. Correction of calibration is made by adjusting the high frequency oscillator trimmer, which is located underneath the contact terminal strip nearest the front of the receiver. It may be reached from the top of the chassis by means of a 6" or 8" metal screw driver, preferably having a shaft diameter of about 3/16". A screw driver with a metal shaft must be used since the trimmer condenser turns with difficulty but the shaft must not touch any of the metal parts of the receiver when making the adjustment. If the dial reading is found to be too low, more trimmer capacity is needed and vice versa. In adjusting the first detector trimmer in the middle compartment, no signal is necessary, correct alignment being indicated by maximum background noise. This background noise should be fairly loud when the R.F. and audio gain controls are fully advanced, the crystal filter being adjusted for minimum selectivity. Furthermore, the background noise will be approximately the same on all ranges. After the first detector trimmer is adjusted, the R.F. trimmer panel control should be checked to see that the R.F circuits resonate properly, resonance being indicated by an increase in background noise. It may be advisable to use a test signal at this point since the correct R.F. trimmer adjustment is sharper than the peak in background noise would indicate. There are no internal trimmers on the R.F. coils which require adjustment.

With the receiver correctly aligned at the high frequency end of the range, the dial should be rotated towards the low numbers. The background noise may vary slightly over the range but should not change by more than 2 to 1 when progressing across the major portion of the dial. Ganging is checked by pressing one of the outside rotor plates of the gang condenser sideways towards the stator but not enough to make the plates touch. Any change in the position of the rotor plates on either the oscillator or detector condenser section should make background noise definitely weaker. The ganging of the R.F. stage can be checked by noting any change in the position of the R.F. trimmer control. Such a change at this point is relatively unimportant and does not indicate the need for realignment.

In making the initial adjustments on the high frequency oscillator and detector circuits, care must be taken to avoid the image frequencies. The oscillator normally works on the high frequency side of the signal circuits and the test signal will, therefore, appear as an image at a lower dial reading (where the oscillator moves to the low frequency side). The image will show up approximately 3.1 Mcs. lower since the intermediate frequency of the NHU is 1560 kc. It was previously stated that the alignment of the receiver should be correct to about 1% at the high frequency end of any range. The error may be somewhat greater at the center or low frequency dial readings since the receiver is adjusted at the factory for accurate ganging and best performance rather than for exact conformation to the dial scale.

I.F. AND CRYSTAL ALIGNMENT

The frequency to which the I.F. amplifier is tuned is determined by a quartz crystal built into the crystal filter unit. It is extremely important, therefore, that I.F. transformers be tuned exactly to the crystal frequency since the latter is not adjustable. The alignment process differs slightly from that ordinarily employed since the test oscillator or signal generator must first be tuned to the fundamental frequency of the crystal. This frequency is normally 1560 kc. in the NHU but may vary a few kilocycles in either direction.

With a test oscillator connected to the grid of the first detector tube and with the crystal filter adjusted for maximum selectivity, the phasing control being set at 5, the frequency of the test oscillator should be adjusted to give maximum output, as indicated on an output meter connected to the speaker terminals. The A.V.C. switch should be off and the R.F. and A.F. gain controls fairly well advanced. Any coil range may be connected and the setting of the tuning condenser is unimportant.

When using a modulated test signal, the high selectivity of the filter circuits will, under certain conditions, give a triple response since it is possible to separate the carrier frequency from the two side band frequencies. It is usually preferable, therefore, to employ an unmodulated signal, obtaining the necessary audio output by using the beat frequency oscillator. After the crystal peak has been found by carefully tuning the test oscillator in the neighborhood of 1560 kc. the seven I.F. adjustments should be made to give maximum sensitivity. The order in which the adjustments are made is not important. The locations of these adjustments are indicated in the top view photograph and are numbered from one to seven.

Since the I.F. transformers are tuned with air-dielectric condensers, the adjustments are permanent and need only be checked when new tubes are installed, provided, of course, the receiver is not subjected to severe mechanical shocks or vibration.

THE C.W. OSCILLATOR

With the I.F. amplifier correctly aligned to the crystal the C.W. oscillator panel control should be turned to zero. This adjustment should give zero beat with the test signal but if it does not it is only necessary to readjust either No. 8 or No. 9 trimmer.

S-METER ADJUSTMENT

With the R.F. gain control set at any position below 9, the S-meter is disconnected and should read zero. If it does not, it will be necessary to reset the zero adjustment on the meter itself. Advancing the R.F. gain control from 9 to 10 (with A.V.C. off) switches the meter into the circuit and in the absence of any signal or noise the meter should still read zero. If such is not the case readjust control R_{11}, as indicated in the photographs. Line voltage variations of 10 or 15 volts will cause the meter pointer to shift from zero about one division, and compensation may be effected if desired by readjustment of the same control. Similarly, substitution of any tubes in the I.F. amplifier, particularly in the third I.F. stage, will change the zero reading of the meter and compensation is made in the same manner.

C.O.N.S. ADJUSTMENT

Before using the NHU with C.O.N.S. it is necessary to adjust the threshold signal level to which the squelch circuits respond. To do this the receiver must be set up in its normal operating position with the receiver antenna connected. The R.F. gain control

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MODEL NHU

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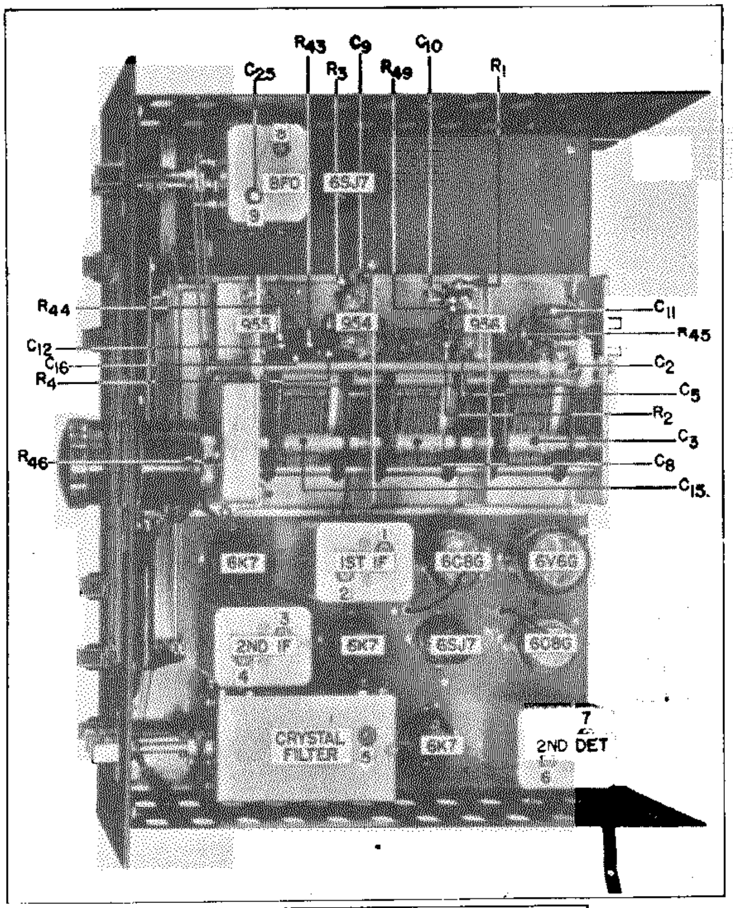

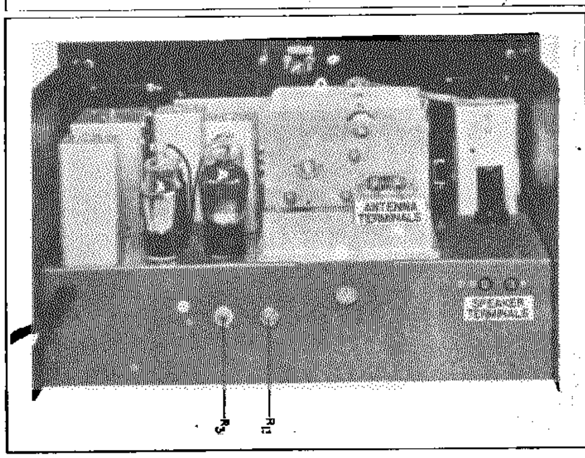

should be advanced to 9 and the receiver tuned to the operating frequency. The R.F. trimmer must be correctly resonated and the selectivity control set between 7 and 8 for maximum band width. The phasing control should be set at its normal operating position; the adjustment of the A.F. gain, tone and limiter controls is unimportant. The A.V.C.-C.O.N.S. switch should now be thrown to the "on" position and the threshold level adjustment, R_{31}, turned counterclockwise until the noise drops out. The control must not be retarded any farther than is necessary for the receiver will not respond to the desired signal. This point should be carefully checked by tuning in the signal with C.O.N.S. off and then turning it on to make sure that the signal is not squelched. The amount of leeway can be easily determined by retarding the R.F. gain control until the signal drops out. Ordinarily, the receiver will be operated with the R.F. gain control advanced to 9.

MISCELLANEOUS

There are a few additional points relating to the operation of the crystal filter which should be mentioned. Inasmuch as the A.V.C. circuits are actuated by the I.F. signal at the 2nd detector, it is essential that the desired station be very carefully and accurately tuned. If this is not done, the action of the selectivity control will appear to be restricted. Suppose, for instance, a signal is being received with the selectivity pointer set at minimum selectivity; readjusting the control to increase selectivity should, of course, reduce the strength of the signal due to side band cutting and should weaken the high audio frequencies. If the signal is tuned slightly off the center of the carrier, changing the selectivity control setting will result in greater audio output, since the fundamental I.F. signal reaching the 2nd detector will be decreased and the A.V.C. circuits will automatically increase the circuit again. Furthermore, the "tone control" effect, noted above, will be absent; in fact the high audio frequencies may be increased in volume. These effects are mentioned because they are apt to be confusing when the receiver is first put in operation. The obvious way of avoiding them is to tune in the signal with the control set near maximum selectivity and then readjust the selectivity knob, as may be required by receiving conditions.

The setting of the phasing condenser will modify the range of selectivity. With the phasing condenser set near either end of its range (as would be required to eliminate an interfering signal close to the desired signal) it will not be possible to obtain knife-edge selectivity. There will still be a very definite single signal effect but modulation side bands will be passed through the filter since the capacity bridge circuit is unbalanced. This is a fundamental consideration and holds true in either phone or C.W. reception with A.V.C. either on or off.

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CONDENSER AND RESISTOR LIST

Symbol	Function	Type	Rating
C_1	R.F. Padding	Fixed Mica	See Note No. 1.
C_2	R.F. Trimmer	Variable Air	15 mmf. max.
C_3	R.F. Tuning	Ganged Section	6-40 mmf.
C_4	R.F. Grid Return	Fixed Mica	008 mfd. 500 Volt
C_5	R.F. Cathode Bypass	Tubular	.01 mfd. 400 Volt
C_6	R.F. Coupling	Fixed Ceramic	See Note No. 1.
C_7	1st Det. Trimmer	Variable Air	See Note No. 1.
C_8	1st Det. Tuning	Ganged Section	6-40 mmf.
C_9	1st Det. Cathode Bypass	Tubular	.01 mfd. 400 Volt
C_{10}	R.F. B+ Bypass	Tubular	.01 mfd. 400 Volt
C_{11}	R.F. AVC Bypass	Fixed Mica	003 mfd. 500 Volt
C_{12}	H.F. Osc. Grid	Fixed Mica	100 mmf. 500 Volt
C_{13}	H.F. Osc. Trimmer	Variable Air	See Note No. 1.
C_{14}	H.F. Osc. Padder	Fixed Ceramic	See Note No. 1.
C_{15}	H.F. Osc. Tuning	Ganged Section	8-40 mmf.
C_{16}	H.F. Osc. Filter	Fixed Mica	250 mmf. 500 Volt
C_{17}	R.F. Filter	Fixed Mica	003 mfd. 500 Volt
C_{18}	1st Det. B+ Bypass	Tubular	.1 mfd. 400 Volt
C_{19}	1st I.F. Cathode Bypass	Tubular	.1 mfd. 400 Volt
C_{20}	1st I.F. Grid Filter	Tubular	.01 mfd. 400 Volt
C_{21}	1st & 2nd I.F. Screen Bypass	Tubular	.1 mfd. 400 Volt
C_{22}	2nd I.F. Cathode Bypass	Tubular	.1 mfd. 400 Volt
C_{23}	2nd I.F. Grid Filter	Tubular	.01 mfd. 400 Volt
C_{24}	BFO Grid	Fixed Mica	100 mmf. 500 Volt
C_{25}	BFO Tuning	Variable Air	4 mmf.
C_{26}	BFO Heater Bypass	Tubular	.1 mfd. 400 Volt
C_{27}	BFO Screen Bypass	Tubular	.1 mfd. 400 Volt
C_{28}	BFO-2nd Det Coupling	Special	2 mmf.
C_{29}	AVC Coupling	Fixed Mica	50 mmf.
C_{30}	3rd I.F. Grid Filter	Tubular	.01 mfd. 400 Volt
C_{31}	3rd I.F. Cathode Bypass	Tubular	.1 mfd. 400 Volt
C_{32}	3rd I.F. Heater Bypass	Tubular	.01 mfd. 400 Volt
C_{33}	3rd I.F. Plate Filter	Tubular	.1 mfd. 400 Volt
C_{34}	Limiter Control Bypass	Fixed Mica	.003 mfd. 500 Volt
C_{35}	2nd Det. Coupling	Metal Cased	1 mfd. 200 Volt
C_{36}	2nd Det. Cathode	Mica	100 mmf. 500 Volt
C_{37}	Limiter Output Bypass	Mica	100 mmf. 500 Volt
C_{38}	Limiter Output Blocking	Tubular	.1 mfd. 400 Volt
C_{39}	1st A.F. Grid Coupling	Tubular	.01 mfd. 400 Volt
C_{40}	1st A.F. Cathode Bypass	Electrolytic	8 mfd. 200 Volt
C_{41}	Audio Coupling	Tubular	.1 mfd. 400 Volt
C_{42}	Tone Control	Tubular	.01 mfd. 400 Volt
C_{43}	2nd A.F. Cathode	Electrolytic	25 mfd. 50 Volt
C_{44}	2nd A.F. Screen	Mica	.003 mfd. 500 Volt
C_{45}	Spkr. B+ Bypass	Tubular	.1 mfd. 400 Volt
C_{46}	B+ Switch Bypass	Mica	.003 mfd. 500 Volt
C_{47}	B+ Cable Bypass	Mica	.003 mfd. 500 Volt
C_{48}	Chassis to B− Bypass	Electrolytic	25 mfd. 50 Volt
C_{49}	CONS Switch Bypass	Mica	100 mmf. 500 Volt
C_{50}	AVC Filter	Tubular	.01 mfd. 400 Volt
C_{51}	AVC Plate Bypass	Tubular	.01 mfd. 400 Volt
C_{52}	AVC Cathode Bypass	Fixed Mica	.003 mfd. 500 Volt

Symbol	Function	Type	Rating
C_{53}	I.F. B+ Bypass	Tubular	.1 mfd. 400 Volt
C_{54}	Heater Bypass	Tubular	.1 mfd. 400 Volt
R_1	R.F. Bias	Fixed	500 ohms ½ Watt
R_2	R.F. Screen	Fixed	50,000 ohms ½ Watt
R_3	1st Det. Bias	Fixed	5,000 ohms ½ Watt
R_4	1st Det. Screen	Fixed	250,000 ohms ½ Watt
R_5	1st Det. Plate Filter	Fixed	2,000 ohms ½ Watt
R_6	1st I.F. Grid Filter	Fixed	500,000 ohms ½ Watt
R_7	1st I.F. Bias	Fixed	500 ohms ½ Watt
R_8	2nd I.F. Grid Filter	Fixed	500,000 ohms ½ Watt
R_9	2nd I.F. Bias	Fixed	500 ohms ½ Watt
R_{10}	3rd I.F. Grid Filter	Fixed	500,000 ohms ½ Watt
R_{11}	3rd I.F. Bias	Fixed	500 ohms ½ Watt
R_{12}	3rd I.F. Screen Filter	Fixed	2,000 ohms ½ Watt
R_{13}	S-Meter Adjustment	Variable	1,000 ohms 1 Watt
R_{14}	2nd Det. Load	Fixed	20,000 ohms ½ Watt
R_{15}	Limiter Input	Fixed	100,000 ohms ½ Watt
R_{16}	Limiter Output	Fixed	50,000 ohms ½ Watt
R_{17}	Audio Gain Control	Variable	500,000 ohms
R_{18}	1st A.F. Plate	Fixed	100,000 ohms ½ Watt
R_{19}	Tone Control	Variable	500,000 ohms
R_{20}	Degeneration	Fixed	1 meg. ½ Watt
R_{21}	2nd A.F. Grid	Fixed	500,000 ohms ½ Watt
R_{22}	2nd A.F. Bias	Fixed	250 ohms ½ Watt
R_{23}	S-Meter Bridge	Fixed	1,000 ohms ½ Watt
R_{24}	Voltage Divider	Fixed	5,000 ohms 1 Watt
R_{25}	Voltage Divider	Fixed	5,000 ohms 1 Watt
R_{26}	1st A.F. Bias	Fixed	150 ohms ½ Watt
R_{27}	Voltage Divider	Fixed	15,000 ohms 2 Watt
R_{28}	Voltage Divider	Fixed	1,500 ohms ½ Watt
R_{29}	CONS Plate	Fixed	500,000 ohms ½ Watt
R_{30}	Noise Limiter Control	Variable	10,000 ohms
R_{31}	CONS Threshold Control	Variable	10,000 ohms
R_{32}	AVC Plate	Fixed	500,000 ohms ½ Watt
R_{33}	Voltage Divider	Fixed	1,500 ohms 2 Watt
R_{34}	AVC Bias (Voltage Div.)	Fixed	200 ohms 1 Watt
R_{35}	AVC Grid	Fixed	5 meg. ½ Watt
R_{36}	BFO Screen Bleeder	Fixed	100,000 ohms ½ Watt
R_{37}	BFO Screen	Fixed	100,000 ohms ½ Watt
R_{38}	BFO Grid Leak	Fixed	50,000 ohms ½ Watt
R_{39}	BFO Plate	Fixed	250,000 ohms ½ Watt
R_{40}	R.F. Gain Bleeder	Fixed	50,000 ohms ½ Watt
R_{41}	R.F. Gain Control	Variable	10,000 ohms
R_{42}	S-Meter Bridge	Fixed	1,500 ohms ½ Watt
R_{43}	HFO Plate Filter	Fixed	5,000 ohms ½ Watt
R_{44}	HFO Grid Leak	Fixed	20,000 ohms ½ Watt
R_{45}	R.F. Grid Filter	Fixed	500,000 ohms ½ Watt
R_{46}	S-Meter Shunt	Fixed	130 ohms ½ Watt
R_{47}	AVC Filter	Fixed	500,000 ohms ½ Watt
R_{48}	CONS Threshold	Fixed	25,000 ohms ½ Watt
R_{49}	R.F. Plate Filter	Fixed	2,000 ohms ½ Watt

Note No. 1. — Condensers C_1, C_6, C_7, C_{13} and C_{14} are different in each coil range and are individually adjusted as circuit conditions may require. Definite ratings cannot be listed.