COLLINS 32G
TRANSMITTER

8/27/57

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Instruction Book

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MANUFACTURED BY

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA, U.S.A.

PRICE TEN DOLLARS

INSTRUCTIONS

For

COLLINS 32G TRANSMITTER

Serial No. ________________

Manufactured for ____

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By

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INSTRUCTIONS FOR

COLLINS TYPE 32G TRANSMITTER

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COLLINS TYPE 32G TRANSMITTER

DESCRIPTION

GENERAL. The type 32G Transmitter is a self-contained unit with a nominal power output of 40 watts for either radiotelephone or radiotelegraph use. The frequency range is 1500 to 30,000 kc.

The transmitter is built into a steel cabinet 20 inches long, 10-1/2 inches high, and 16 inches deep. The cabinet is copper plated and has a grey crinkle finish.

There are two intermediate radio frequency stages between the crystal controlled oscillator and the final amplifier. These intermediate stages can be used as frequency multipliers or buffers. The output circuit provides for connection to either a balanced or unbalanced antenna feeder system and permits proper impedance matching with satisfactory attenuation of harmonic radiation.

The two-stage speech amplifier is designed for a low level, high impedance input such as a diaphragm type crystal microphone. The modulation capabilities are 100 per cent.

Two separate direct-current power supplies are included in the transmitter. Other features incorporated are combined meter switch and stage selector, fuses in each power transformer primary, stand-by switch, and a cathode ray modulation indicator.

TUBE COMPLEMENT

R-F System		Audio System	
Oscillator	~~C-100D~~ (1) 6AG7	1st Stage	6J7 (1)
1st Int. Amp.	6L6 (1)	2nd Stage	6C5 (1)
~~2nd Int. Amp.~~	~~6L6 (1)~~	Modulator	6L6 (4)
Final Amp.	6L6 (2)	Rectifier	5Z3 (1)
Rectifier	83 (1)	Oscilloscope	913 (1)

OSCILLATOR. The crystal controlled oscillator utilizes a COLLINS C-100D negative resistance oscillator tube in a circuit which has exceptionally good frequency stability. The crystal operates with a low r-f current.

DESCRIPTION

INTERMEDIATE R-F STAGES. The oscillator is capacitively coupled to the first intermediate stage, a 6L6 tube, which can be used either as a buffer or frequency multiplier. Another 6L6 tube is used as the second intermediate stage which can also be used as a buffer or doubler. Two types of coils are used in the tank circuit of this stage depending upon whether single-ended or push-pull operation of the final amplifier is contemplated.

FINAL AMPLIFIER. Two 6L6 tubes, operating class C are used as the final amplifier. A combination of fixed and grid leak bias is used. The tubes are wired to jacks so that connections can be made for either push-pull or single-ended operation.

R-F OUTPUT CIRCUIT. A pi tank output circuit is normally used in the 32G Transmitter. This output system provides an efficient and flexible means of matching a wide variety of antennas together with adequate harmonic attenuation. The output coils are provided with V groove sliders which permit choice of the number of turns at will. Each stator terminal of the input and output condensers is connected to jacks on the output coil mounting base. By the use of bar jumpers fitted with expansion plugs, the output may be converted from a push-pull connection to a parallel connection at will. The spacing of the jacks is the same as the mounting hole spacing of the type A Sangamo mica condensers. These jacks may be used to provide additional padding capacity for the lower frequencies for either push-pull or single ended output. A more complete description of the output circuit is found in the chapter on adjustments.

SPEECH AMPLIFIER. Grid input is provided to the first audio amplifier, a 6J7 tube, which is resistance coupled to the second stage, a 6C5 tube. The audio gain control adjusts the input level to this second stage. Both stages employ cathode bias.

MODULATOR. Four 6L6 tubes operated in Class AB are used to modulate the Class C amplifier. Bias is obtained from a cathode resistor.

INTERMEDIATE POWER SUPPLY. A type 5Z3 rectifier tube is used with a condenser input filter and a voltage divider to provide plate

Voltage for the audio system, the C-100D oscillator, the intermediate amplifiers, screen voltage for the modulators and fixed bias for the r-f stages and the oscilloscope.

R-F POWER SUPPLY. Two type 83V rectifier tubes are used with a two-section choke-input filter to furnish plate and screen voltage for the final amplifier, plate voltage for the modulators and the accelerating voltage to the cathode ray tube.

KEYING CIRCUIT. The transmitter is keyed by interruption of the cathode circuits of the two buffer amplifiers.

CONTROL CIRCUITS. A three-circuit three-position POWER switch is used for controlling the transmitter during normal operation. Two sections of the switch are used for power switching. In the first or OFF position, all power circuits are open. In the second or ST. BY (stand-by) position, the primary of the transformer supplying all filament power is energized. In the third or ON position, the primaries of all power transformers are energized. Terminals 6, 7, and 8 are in parallel with these sections of the switch so that an external switch or relays can be connected for controlling the filament and plate power in the transmitter. The third section of the power switch is connected to terminals 1, 2, and 3 at the rear of the transmitter. The switch connects terminal 1 to terminal 2 in the ST. BY position, and connects terminal 1 to terminal 3 in the ON position. These circuits can be used to control some external device such as a relay or receiver stand-by or antenna circuit.

A second switch, SELECTOR, provides for application of plate power to successive r-f stages. Provision is made for application of plate voltage to the final amplifier through a dropping resistor to facilitate tuning. It is also possible when operating the final amplifier in push-pull to separately measure the combined plate and screen current of each final amplifier tube. The SELECTOR switch is also used to choose the proper circuit arrangement for either Phone or CW operation.

DESCRIPTION

<u>CAUTION</u>: The power switch must be returned to the ST. BT position when changing the position of the SELECTOR switch.

POWER SOURCE. The transmitter is designed to operate from a 110 volt 50-60 cycle source. The power requirements are for full CW carrier, 305 watts, for one hundred percent modulation under Phone operation, 325 watts, and in the stand-by position 80 watts are required.

ANTENNA TERMINATION. The r-f output circuit is fed to the antenna by means of mica blocking condensers which isolate the plate voltage from the antenna. When the final amplifier is operated single ended for feeding an unbalanced antenna, the connections are made between the antenna terminal toward the panel and ground, terminal 4.

For description of special output circuits for low-frequency low-impedance antennas see SPECIAL APPLICATIONS.

MODULATION INDICATOR. A type 913 cathode ray tube is employed as a modulation indicator. The circuit is wired so that the tube can conveniently be used for other purposes. It should be noted, however, that one side of each pair of deflection plates operates at a positive potential of 400 volts, so that when the tube is used for external measurements, suitable blocking condensers should be employed in series with the leads to the external potentials being observed. Deflection to the full diameter of the screen is obtained with approximately 100 volts peak value on the horizontal deflecting plates, and full deflection is obtained with approximately 65 volts peak value on the vertical deflecting plates.

INSTALLATION

UNCRATING. Remove the transmitter from the crate and inspect it carefully, making certain that no parts have been damaged during shipment. All transmitters are carefully tested and inspected before shipment. In case of damage, file all claims promptly with the transportation company. In this regard, it is desirable to preserve the original packing material for the transportation company's inspection.

FUSES. Be certain that the proper fuses are securely in place, as shown below.

6 Ampere - Line Fuse - Next to AC receptacle.
3 Ampere - Intermediate Pack - Middle fuse position
3 Ampere - R-F Pack - Farthest from AC receptacle.

Never use fuses with ratings greater than specified.

POWER. Be certain that the POWER switch is in the OFF position. Insert the power cord in the receptacle at the rear of the transmitter and connect to a 110 volt 60 cycle source. Turn the POWER switch to the ST. BY position and then to the ON position and note if any of the fuses fail due to short circuits which might have occurred due to damage in transit. Return the switch to the OFF position.

TUBES, CRYSTAL AND COIL. Tubes should be inserted in the proper sockets as shown on Figure 1 of the photograph.

Figure 1 also shows the correct position for each of the plugin coils. If push-pull operation of the final amplifier is to be used for feeding a balanced system, the coil for the second intermediate amplifier should be of the type marked PP, while of single-ended operation is contemplated, a coil marked SE should be used. Push-pull operation of the final amplifier requires the use of two final amplifier coils while only one is required for single-ended operation. Single-ended operation of the final amplifier requires that shorting bars be inserted to connect points A to B, C to D and E to F.

Figure 1 also shows the location of the crystal. If a crystal other than that furnished with the transmitter is to be used, it is recommended that it be used in an airgap holder.

INSTALLATION

For installation of final amplifier coil for transmitters designed for low impedance antennas see SPECIAL APPLICATIONS.

Figure 1 also shows the location of the modulation indicator r-f pickup coil.

ADJUSTMENTS

GENERAL. Care should be exercized when making any internal adjustments with power on the transmitter. It is recommended that whenever possible that the POWER switch be returned to the ST. BY position when making internal adjustments. The POWER switch must never be in the ON position when changing the position of the SELECTOR switch.

Before applying power to the transmitter, the audio gain control, see Figure 1, and the three oscilloscope controls should be turned to the full off position, (counterclockwise). The SELECTOR switch should be set in the oscillator (OS) position.

POWER SWITCH. With the SELECTOR switch in the OS position, turn the POWER switch to the ST. BY position. Filament power will be applied to all of the tubes in this position.

OSCILLATOR. Turn the SELECTOR to position OB and set the FIRST AMPLIFIER dial to 0. Turn the POWER switch to ON and adjust CRYSTAL OSCILLATOR dial to secure maximum EXCITATION PLATE current, which will be from 75 to 100 ma. The FIRST AMPLIFIER should then be promptly tuned to resonance as indicated by minimum EXCITATION PLATE current.

FIRST AMPLIFIER. Adjustment of the FIRST AMPLIFIER dial for resonance will result in an EXCITATION PLATE current of approximately 80 ma. when working on low frequencies and as much as 120 ma. when working the stage as a multiplier. GRID CURRENT of the order of 12 to 15 ma. should be indicated.

SECOND AMPLIFIER. Turn the POWER switch to ST. BY and move the SELECTOR switch to position OBB. In this position the EXCITATION PLATE meter indicates the sum of the plate and screen currents for both the first and second intermediate amplifiers and crystal oscillator.

ADJUSTMENTS

Reapply power and adjust the SECOND AMPLIFIER dial for resonance as indicated by minimum EXCITATION PLATE current, which may be from 100 to 175 ma. depending on the frequency being used. The GRID CURRENT should be 15 to 20 ma. Adjustment MUST be made for minimum EXCITATION PLATE and NOT maximum GRID CURRENT. Return the POWER switch to the ST. BY position. After the SECOND AMPLIFIER has been adjusted, return to the CRYSTAL OSCILLATOR control and adjust for 15 ma. total grid current. This setting will provide optimum results with lowest crystal current. A special coil assembly is provided for frequencies above 20 mc. The second buffer tank is tuned from the top of the coil assembly instead of from the front panel. Adjust this stage to resonance in the same manner as indicated for the single-ended coil assembly by tuning to minimum excitation plate current. The SECOND AMPLIFIER tuning control is used for tuning the grid circuit of the final amplifier when the high frequency coils are used. Adjust the SECOND AMPLIFIER tuning control for maximum grid current to the final amplifier stage.

FINAL AMPLIFIER. It is suggested that a preliminary test of the final amplifier be made by use of a 60 watt - 110 volt lamp for a dummy load. Such a lamp has a resistance of 175 ohms when dissipating 40 watts. (See SPECIAL APPLICATIONS for adjustment of final amplifier circuit designed for low frequency operation into low impedance antenna.) Reference to the GENERAL TRANSMITTER TEST RECORD will show dial readings and tube currents when using a lamp load of the specified type. Note that the test data shows the current for each stage while the EXCITATION PLATE meter indicates the total current for both the first and second intermediate amplifiers.

If push-pull operation is contemplated, the lamp should be connected between the two antenna terminals at the end of the cabinet. No shorting bars should be used for push-pull operation.

If single-ended operation is contemplated, remove the output coil L_2 (nearest the rear of the cabinet) and place shorting bars between jacks A and B, C and D, and E and F. In this case the lamp should be connected between the terminal nearest the front of the panel and ground, terminal 4 on the rear terminal strip.

ADJUSTMENTS

After having properly arranged the output circuit and connected the lamp load for the type of operation contemplated, the following procedure should be followed.

1. Advance the SELECTOR switch to the TN position. In this position plate power is applied to both final amplifier tubes through a 2000 ohm current limiting resistor and the FINAL AMP. PLATE meter.

2. Turn the POWER switch to the ON position.

3. Adjust the FINAL AMP. TUNING condenser for resonance as indicated by minimum FINAL AMP. PLATE current. Adjustment for resonance as indicated by minimum plate current is the proper adjustment of the system for maximum efficiency of the final amplifier for that degree of power input.

4. If the plate current is greater than 80 to 100 ma., increase the capacity of the ANTENNA TUNING condenser and restore resonance with the FINAL AMP. TUNING condenser.

5. If the plate current is less than 80 to 100 ma., decrease the capacity of the ANTENNA TUNING condenser and restore resonance with the FINAL AMP. TUNING condenser.

6. The EXCITATION PLATE meter should indicate 100-175 ma., and the GRID CURRENT meter 12 to 18 ma.

7. Return the POWER switch to ST. BY and advance the SELECTOR switch to CW position. In this position full plate voltage is applied to both final amplifier tubes through the FINAL AMP. PLATE meter.

8. Turn the POWER switch to ON and adjust the loading (Final amplifier plate current at resonance) to 180 ma. by the same method as noted under items 4 and 5 above.

When operating the final amplifier in push-pull, the individual plate currents should be checked by placing the SELECTOR switch first in position FA, for tube A, and second in position FB for tube B. The SELECTOR switch MUST not be moved while the POWER switch is in the ON position. If the individual plate currents differ by more than 10 ma., the tuning of the SECOND AMPLIFIER should be checked. Improper tuning of the second amplifier will produce unequal excitation of the final amplifier tubes when operating in push-pull.

AUDIO GAIN AND MODULATION INDICATOR. Insert the microphone plug in the jack provided, and advance the audio gain control (see Figure 1) to the full on, clockwise position. Place the SELECTOR switch in position PH and turn the POWER switch to ON. Advance the INTENSITY and FOCUS controls of the oscilloscope to produce a sharp image on the screen. In order to insure maximum life of the tube, the image used should be as faint as possible for easy viewing.

The radio frequency pickup coil is an anti-resonant tuned circuit and has a small trimming condenser connected in parallel. The trimmer adjustment is available through a hole in the coil mounting plate. This condenser should be adjusted to give a vertical deflection of about one-third the diameter of the screen. The adjusting screw of this condenser has plate voltage on it, so care must be exercised if adjustment is made with plate voltage on.

Next advance the SWEEP control so as to secure a horizontal deflection as the transmitter is modulated. Modulation will produce a trapezoidal pattern, which when 100 percent modulation is reached will result in a triangle. The SWEEP should be adjusted with 100 percent modulation to provide a horizontal sweep about one-half inch long. Whistling into the microphone will produce a smoother pattern and a more steady degree of modulation to facilitate adjustment of the SWEEP control.

The audio gain control should now be reduced to the correct position so as to secure nearly one hundred percent modulation when speaking into the microphone in a normal voice. Overmodulation is indicated by a blunt bright peak at the triangle apex.

OUTPUT CIRCUIT ADJUSTMENTS

GENERAL. In the 32G Transmitter the output circuit is so arranged that the final amplifier tubes may either be operated in push pull for a balanced load such as a two-wire feeder or in parallel for an unbalanced output such as a Marconi antenna. For normal operation a load impedance of 1800 ohms, as presented to the plate circuit of each amplifier tube, is required. To assist in the adjustment of the pi tank network used in the 32G Transmitter, several curves have been prepared for the two modes of operation.

REFERENCE CURVES OF NETWORK ELEMENTS. Drawing 4558X-1 shows the reactance of (a) the inductor, (b) the input condenser (Final Amp. Tuning) and (c) the output condenser (Ant. Tuning) required for various antenna resistances, when the final amplifier is operated in parallel for a single-wire feeder, a Marconi antenna, an end-fed half-wave antenna or similar antenna systems. Two sets of curves for each reactive element are shown. For operation on frequencies below 2000 kc. the upper curves should be used. Both sets of curves for each element coincide for antenna resistances up to 150 ohms. In order to minimize the sizes of the padding condensers required at the lower frequencies, the inductive reactance range is extended to 600 ohms. The curves extending as branches should be used except at frequencies below 2000 kc.

Drawing 4559X-1 shows the reactance of the three elements required for various antenna resistances when the final amplifier is operated in push pull for balanced system such as a Multiband Antenna, twisted pair feeders, current and voltage fed Zepp antennas, Y matched doublet, Q antenna or similar antenna systems. Two sets of curves for each element are also included on this curve sheet.

Curve III shows the variation of inductance with turns used in the output coils. The coil assemblies used in the 32G Transmitter incorporate indicators s owing the number of turns in the circuit for the different slider positions. Adjustments can best be effected by first removing the coil assembly from the jack plate and then setting the slider position.

Curve IV gives the capacity of the condensers (1) for parallel operation and (2) for push-pull operation. It should be observed that the capacity is given per section in the case of push-pull output. The capacitqtive reactance shown in Drawing 4559X-1 is the reactance of one section of the condenser corresponding with the date recorded in Curve IV.

OUTPUT CIRCUIT ADJUSTMENTS

RESISTIVE CHARACTERISTICS OF COMMON TYPE OF AMATEUR ANTENNAS. In order to obtain greatest benefit from the data included in this chapter it is desirable to have some knowledge of the characteristics of the antenna system to be used with the transmitter. An antenna is a special case of an open-circuited line having distributed constants of inductance, capacitance and resistance. So many factors influence the reactance and resistance of an antenna that calculations become laborious and in many cases do not yield sufficiently accurate results for precise work. In every case, however, an estimation of the antenna resistance and reactance will be most useful.

A table of common antennas in use, particularly by amateur operators, is appended as a guide in estimating antenna characteristics. These approximate characteristics will serve to acquaint the operator with the conditions which must be effected for satisfactory adjustment of the transmitter for operation in the amateur bands.

In addition to the common types listed in the table given on page 12 is the shunt fed vertical used on the ultra high frequency bands. The impedance of such an antenna for 10 and 5 meter operation is approximately 70 + j400 ohms.

In the table on page 12 it is assumed that the antenna systems are cut to frequency and have negligible reactance at the transmitter terminals. If the length of the antenna to be used differs from the proper length for the operating frequency, a check should be made to determine the magnitude of the reactive component of the antenna impedance.

TABLE I

TYPE OF ANTENNA	APPROXIMATE ANTENNA RESISTANCE IN OHMS						REMARKS
	160 METERS	80 METERS	40 METERS	20 METERS	10 METERS	5 METERS	
A. Marconi	15 to 30						Unbalanced
B. Doublet with twisted pair feeders	25 to 200	50 to 100	50 to 100	70 to 80	70 to 80	70 to 80	Balanced
C. Single wire matched feeder	600	600	600				Unbalanced
D. End fed half wave	3000	2000 to 3000					Unbalanced
E. Zepp current fed		100 to 200	100 to 200	150	150	150	Approx. Balanced
F. Zepp Voltage Fed		2000 to 3000	2000 to 3000	2000	2000		" "
G. Y matched doublet		300 to 1000	400 to 900	600	600	600	Balanced
H. Q type		400	400	400	400	400	Balanced
I. Multibands							
Model A		1200	1200	1200			Balanced
" B		75		75			"
" C	1200	1200	75	1200			"
" D	1200	1200					"
" E			75	1200	1200		"
" F			1200	1200	1200		"
" G		1200	1200	1200			"
J. Concentric line fed vertical					75	75	Unbalanced

OUTPUT CIRCUIT ADJUSTMENTS

METHOD OF DETERMINING REACTANCE OF LOW IMPEDANCE ANTENNAS. A simple method of checking the antenna reactance consists in connecting a one or two turn inductor in series with the 60 watt lamp load, loosely coupling a condenser-coil combination to this link and tuning the condenser to resonance. The variable condenser should have a capacity of 200 to 500 mmf. and should be of the straight line capacity or semicircular plate type. Note the setting of the condenser for resonance. Resonance may be indicated by a change in the final amplifier plate current or a change in brilliancy of the lamp. (Disconnect one end of the terminals, connecting one terminal to the coil and the other to the condenser.) Now retune the condenser to resonance and again note the setting of the condenser necessary to restore resonance. Calculate the capacity of the condenser at the two settings by using the percentage of the total capacity of the condenser and find the reactance of the condenser from the formula X_c, the absolute value of the capacitative reactance $= \frac{159,000}{Cf}$ where C is the capacity in micro-microfarads and f is the frequency in megacycles. The difference in these two reactances is the reactance of the antenna system. If more capacity is needed to restore resonance after the antenna is inserted in the circuit than before, the antenna reactance is capacitative while if less capacity is required the antenna reactance is inductive by the amount given by the difference of the two reactances calculated.

An examination of the characteristics of a pi network will show that an antenna having capacitative reactance will require a reduction in the capacity of the output condenser. Thus on low frequencies where the antenna resistance is low and a large capacity is required across the output terminals, an antenna having a capacitative reactance is of some benefit. Likewise, on the higher frequencies where the antenna resistance is high and a small capacity is required across the output terminals, an antenna having an inductive reactance may be beneficial.

EFFECT OF HEIGHT OF MARCONI ANTENNA ON RADIATION RESISTANCE. In order to show the manner in which the antenna resistance varies with the height above ground, Curve V is attached for the reader's information. It will be observed that the resistance lowers rapidly as the horizontal portion of the antenna approaches ground. Surrounding objects, such as buildings, have a similar effect.

OUTPUT CIRCUIT ADJUSTMENTS

After having gained some knowledge of the characteristics of the antenna system to be used, the operator should have little or no difficulty in effecting proper adjustment of the network.

EXPLANATION OF THE FUNCTION OF A PI SECTION RADIO FREQUENCY NETWORK. A pi tank circuit network such as used in the 32G Transmitter is electrically equivalent to a low pass filter configuration plus an ideal transformer with a continuously variable transformation ratio. The action of the transformation may best be explained by the theory of resonant circuits. It is a well-known fact that a resistance R, small compared to the required load impedance of the amplifier, inserted in series with the inductive arm of a parallel resonant tank circuit, may be matched to the amplifier by adjustment of the magnitude of the reactances of the two branches. In fact the resistance as measured across the condenser, when the circuit is at resonance, is equal to the square of the capacitative reactance divided by the resistance R. Let us examine a pi network with this fact in mind.

$R_p = \frac{1}{\omega^2 C^2 R_s} = \frac{X_c^2}{R_s}$

In figure (a) below we see the simple parallel resonant circuit so adjusted that at resonance the impedance across the condenser is a pure resistance and equal to the required load impedance of the amplifier

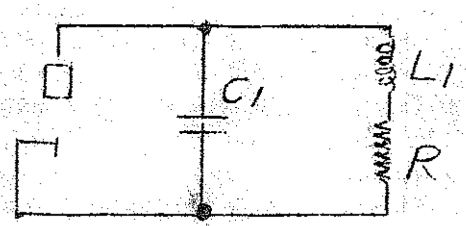


Fig. a

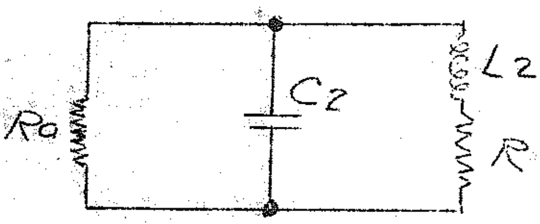


Fig. b

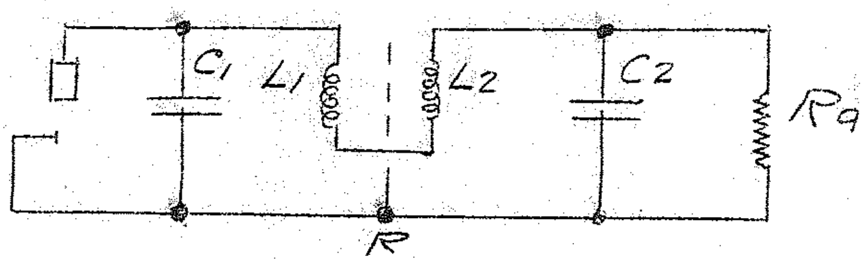


Fig. C

OUTPUT CIRCUIT ADJUSTMENTS

With a similar circuit, figure (b), the resistance R may be matched to the larger antenna resistance Ra by adjusting the reactance of the two elements C_2 and L_2. Since both the amplifier and the antenna are matched to the same resistance, the two may be connected together as shown in figure (c) forming a pi section radio frequency network. In practice both operations are performed without separation of the circuits. When Ra is less than the required load impedance of the amplifier tube by adjusting C_2, the resistance value of R is changed. This requires that C_1 now be adjusted to restore resonance and to match the new value of R to the amplifier. When C_2 is changed and L_2 unchanged, the output branch of the network is no longer at resonance and C_1 must be readjusted in order to restore resonance to the circuit. Thus any adjustment of either condenser of the network will require an adjustment of the other condenser to restore resonance. When Ra is less than the load impedance of the tube, C_2 is adjusted to change the load on the amplifier and C_1 is adjusted to restore resonance.

A physical picture of the operation of the network may be useful toward understanding the adjustments. Let us take a specific case of matching a 100 ohm antenna system, having negligible reactance to the final amplifier operated in parallel. The required load impedance for the parallel output tubes is 900 ohms. From Curve I we see the reactance of the inductive branch is 240 ohms. Also the reactance of the condenser C_1 is 200 ohms and of the condenser C_2 is 86 ohms. It will be observed that the capacity of C_2 is much larger than the capacity of C_1. Suppose C_2 is set at its maximum capacity such that its reactance is less than 86 ohms. In the output branch of the network, the inductance of L_2 (figure (b)) must be small in order that resonance may be effected in this branch. In the input branch, the capacity of C_1 is much smaller and the inductance of L_1 must therefore be larger than the inductance of L_2. Now if the capacity of C_2 is decreased, the reactance of the output condenser is increased. Since Ra remains constant, the resistance value of R must increase when resonance has been restored. Since the capacity of C_2 has decreased, it will be necessary to add sufficient capacity by means of C_1 to restore resonance. At the same time R has been made larger, the capacitative reactance of C_1 has been made smaller and the load impedance presented to the final amplifier tubes has been decreased. With a smaller load impedance, the amplifier tubes draw more plate current or in other words are "loaded" more heavily.

OUTPUT CIRCUIT ADJUSTMENTS

The increased input power is accompanied by an increase in output power from the amplifier which is transferred to the antenna with high efficiency.

Assume that the value of R in the figures is 42 ohms. It can be shown also that the inductance reactance of L_1 is 180 ohms when the load impedance of 900 ohms is matched to the 42 ohm resistance. Similarly with the antenna resistance of 100 ohms matched to the 42 ohm R the reactance of the coil L_2 is 60 ohms and the reactance of the condenser C_2 is 86 ohms.

When the antenna resistance is greater than the load impedance of the final amplifier tubes, the capacity of C_1 required is larger than the capacity of C_2. Here the change in the loading is effected by adjusting C_1 and resonance is restored by adjusting C_2. In other words the control which effects the load should be the larger of the two capacities, while the smaller of the two should be used to restore resonance.

USE OF THE CURVES FOR SIMPLIFYING THE NETWORK ADJUSTMENTS. With the curves of Drawings 4558X-1 and 4559X-1, the magnitude of the reactance of each element may be determined for any antenna system presenting a resistance at the transmitter terminals of 20 to 3000 ohms. The charts showing the approximate range of antenna resistance for common types of amateur antennas provide means of determining the conditions which must be established for proper adjustment. In practice the procedure followed in adjusting the network for any given antenna system is straightforward.

1. For the type of antenna contemplated, i.e. balanced or unbalanced structure, determine the range of the resistance in which the system is most likely to fall.

2. From the curves of Drawing 4558X-1 or Drawing 4559X-1, determine the inductive reactance, X_L, required. From this value calculate the inductance from the formula L, the inductance in microhenries $= \frac{0.159X_L}{f}$ where X_L is the inductive reactance in ohms and f is the frequency in megacycles.

3. Likewise determine the input capacitative reactance X_{c1} and the output capacitative reactance X_{c2} and calculate

the input capacity C_1 and the output capacity C_2 from the formula $C = \frac{159{,}000}{X_c f}$ where X_c is the capacitative reactance in ohms, f is the frequency in megacycles and C is the capacity in micro-microfarads.

4. If the values of capacity found exceed those of the variable condensers used in the 32G transmitter, add sufficient fixed capacity, in the form of a mica condenser having a rating of 2500 volts or better, across the variable tuning condenser.

   In the case of single-ended output, the padding capacity for the input condenser should be connected across terminals B and D on the output coil mounting base and a flexible wire jumper used between A and B. The padding capacity for the output condenser should be connected across terminals C and E on the mounting base and a flexible jumper connected between E and F. For parallel operation a jumper must always be connected between C and D. If no pads are required the bar jumpers supplied with each transmitter are connected A to B, C to D, and E to F.

   When the push-pull connection is used, the padding capacity for the input condenser is plugged into jacks A and B and the pad for the output condenser is plugged into jacks E and F. No jumper is used between C and D for push-pull operation. The capacities of the variable condensers have a maximum capacity of 260 micro-microfarads per section. The capacity calculated from the curves is given in terms of the capacity per section. Thus, if the calculations reveal a capacity of, say, 500 mmf. for C_2, this means that a padding capacity of 500 mmf. must be used between E and F since only one-half of this capacity is effective across each section of the variable output condenser.

5. Having found the approximate values of inductance and capacity required for the three elements, refer to Curve III to find the number of turns required on the coil. The twenty-six turn forms use indicators showing the position of the slider for a given number of turns in use. If twenty turns are required, from Curve III set the slider at 20 on the indicator strip.

6. Now insert the pads, if required, and attach the antenna leads to the output terminals.

OUTPUT CIRCUIT ADJUSTMENTS

7. Set the ANTENNA TUNING variable condenser at 100 on the dial.

8. Turn on the transmitter and with the SELECTOR switch set in position TN, place the POWER switch in the ON position.

9. Rotate the FINAL AMP. TUNING dial until minimum plate current obtains on the FINAL AMP. PLATE meter.

10. If resonance cannot be obtained over the range of the FINAL AMP. TUNING dial, return the POWER switch to the ST. BY position and move the slider on the inductors one or two turns in one direction. (Note: The same number of turns should always be used in each coil when the push-pull output is used.) After resetting the inductance, repeat the process until resonance is reached. It should not be necessary to move the taps more than one or two turns if the proper values have been predetermined.

11. After resonance has been established, place the SELECTOR switch in the CW position and turn the POWER switch to the ON position. If the minimum plate current is less than 180 ma., decrease the capacity of the output condenser a slight amount (move the dial toward zero), and readjust the FINAL AMP. TUNING dial until minimum plate current again obtains. Repeat this procedure until the FINAL AMP. PLATE current meter reads 180 ma. when at resonance.

    If the minimum plate current is greater than 180 ma. it will be necessary to either add more capacity to the output condenser or increase the number of turns in the inductance The inductance can only be increased a small amount, however, or such maladjustment may prevent operation altogether.

TYPICAL VALUES OF INDUCTANCE AND CAPACITANCE REQUIRED FOR COMMON AMATEUR ANTENNAS AT 160-80-40-20 METERS. Table II has been prepared to show typical values of input capacitance, output capacitance, and inductance required for the unbalanced antenna systems in common use by the amateur operators for 160-80 and 40 meters as referred to in Table I.

Table III shows typical values of input capacitance (per section), output capacitance (per section) and inductance required for balanced antenna systems in common use for the 160-80-40 and 20 meter bands.

OUTPUT CIRCUIT ADJUSTMENTS

For example, suppose the station antenna equipment is comprised of a Model C Multiband Antenna. This particular model has a resistive impedance between 1000 and 1500 ohms on the 160 meter band, 1200 ohms on the 80 meter band, 75 ohms on the 40 meter band and 1200 ohms on the 20 meter band. Assume also, for simplicity, that the operating frequencies are 1850 - 3750 - 7150 and 14150 kc. corresponding to approximate mid-frequency in each band.

On 160 meters (1850), for 1200 ohms impedance, C_1 will have a capacity of 210 mmf. corresponding to a dial setting of approximately 75 degrees. C_2 will have a capacity of 347 mmf. It will be observed that additional capacity will be required unless the inductance of the coil is increased. Assume that the coil is unchanged. A 200 mmf. mica condenser will add 100 mmf. effective capacity to C_2 so that 247 mmf. will be required by the variable condenser. The dial setting will be approximately 85 degrees.

The inductance required is 51.4 microhenries. This value corresponds to approximately 48 turns on the 56 turn form normally supplied for 160 meter operation.

On 80 meters (3750 kc.) for 1200 ohms, C_1 will have a capacity of 220 mmf. corresponding to a dial setting of approximately 80 degrees. C_2 will have a capacity of 376 mmf. which requires a pad of at least 250 mmf. With this pad the setting for the ANTENNA TUNING dial will be approximately 90 degrees. The inductance required is 12.75 mh. corresponding to approximately 24 turns on a 26 turn form supplied for 80-40 and 20 meters.

On 40 meters (7150 kc.) for 75 ohms, C_1 will have a capacity of 117 mmf. corresponding to a dial setting of approximately 40 degrees. C_2 will have a capacity of 555 mmf. which requires a pad of about 500 mmf. (.0005 mf.). With this pad the dial setting will be approximately 65 degrees. The inductance required is 4.63 mh. corresponding to approximately 11 turns.

On 20 meters (14150 kc.) for 1200 ohms, C_1 will have a capacity of 58 mmf. corresponding to a dial setting of approximately 12 degrees. C_2 will have a capacity of 99 mmf. corresponding to a dial setting of approximately 30 degrees. The inductance required is 3.36 mh. corresponding to approximately 8 turns.

OUTPUT CIRCUIT ADJUSTMENTS

BRIEF SYNOPSIS OF NETWORK ADJUSTMENT. Assuming the required values of capacitance and of inductance are within the limits provided in the transmitter, the tuning procedure and adjustment of the pi tank network in the 32G Transmitter is as follows:

1. Set the SELECTOR switch in position TN.

2. Set the ANTENNA TUNING dial at 100.

3. Set the 26-turn inductance at approximately 25 for 3000-4000 kc., 12 for 6000-8000 kc., 8 for 13000-15000 kc. and 3 for 25-30 megacycles.

4. Arrange the output circuit for balanced or unbalanced load as desired.

5. Attach the load to the proper antenna terminals.

6. Turn the POWER switch from the ST. BY to the ON position and rotate the FINAL AMP. TUNING dial until minimum plate current obtains on the FINAL AMP. PLATE meter.

7. Return the POWER switch to the ST.BY position.

8. Set the SELECTOR switch in the CW position.

9. Turn the POWER switch to the ON position and note the plate current to the final amplifier.

10. If the plate current is less than 180 ma., decrease the setting of the ANTENNA TUNING dial slightly and readjust the FINAL AMP. TUNING dial for minimum plate current at once.

11. Repeat the procedure until proper loading is obtained.

12. If the plate current at resonance is greater than 180 ma., either add more capacity across the ANTENNA TUNING condenser or increase the number of turns in the coil. If the inductance is increased too much, greater than critical coupling obtains resulting in maladjustment. The reactance of the FINAL AMP. TUNING condenser should always lie between the limits of 100 and 400 ohms at the operating frequency.

OPERATION OF EQUIPMENT

CW OPERATION. Proper adjustment of the transmitter and proper coupling to the antenna system having been made, radiotelegraph operation of the transmitter should be as follows:

1. Insert key plug in the jacks at the right of the panel.

2. Place the SELECTOR switch in the CW position.

3. Turn the POWER switch from the OFF to ST.BY position, and allow 30 seconds for the tube filaments to warm up.

4. Turn the POWER switch ON.

5. The transmitter is now ready for keying.

6. When receiving turn the POWER switch to ST. BY.

CAUTION: Do NOT key the transmitter when the SELECTOR switch is in the PH position.

PHONE OPERATION. Proper adjustment of the transmitter and proper coupling to the antenna having been made, radiotelephone operation of the transmitter should be as follows:

1. Be certain that the microphone connection to the transmitter is secure.

2. Place the SELECTOR switch in PH position.

3. Turn the POWER switch from OFF to ST. BY, and allow 30 seconds for the tube filaments to warm up.

4. Turn the POWER switch to the ON position.

5. Talk into the microphone and note the pattern on the oscilloscope. The degree of modulation is indicated by the pattern. One hundred per cent modulation is obtained when the pattern reaches a triangle. Over-modulation causes interference on adjacent channels and at the same time reduces the intelligibility of your own signal. Therefore, it is necessary to keep the average level of speech low enough to prevent overmodulation on "peaks".

TABLE II

Antenna Resistance	160 Meter Band 1850 Kc.			80 Meter Band 3750 Kc.			40 Meter Band 7150 Kc.			20 Meter Band 14150 Kc.			Remarks
	C1	C2	L	C1	C2	L	C1	C2	L	C1	C2	L	
A. 15	1010	5230	8.0										Parallel Operation Unbalanced Output
B. 20	875	4050	9.23										
C. 25	800	3300	10.35										
D. 30	730	2820	11.3										
E. 35	685	2460	12.25										
F. 300	279	280	35.8										
G. 600	218	258	51.4	250	300	12.75	130	158	6.7				
H. 1500	292	238	51.4	318	246	12.75							
I. 2000	336	230	51.4	348	234	12.75							
J. 2500	362	222	51.4	370	226	12.75							
K. 3000	386	218	51.4	397	219	12.75							

TABLE III

Antenna Resistance	160 Meter Band 1850 Kc.			80 Meter Band 3750 Kc.			40 Meter Band 7150 Kc.			20 Meter Band 14150 Kc.			Remarks
	C1	C2	L	C1	C2	L	C1	C2	L	C1	C2	L	
A. 25	764	5950	10.35										Push-pull Operation Balanced Output
B. 30	695	4930	11.3										
C. 40	605	3820	13.0										
D. 50	550	3100	14.65	271	1530	7.23	142	800	3.79				
E. 60	502	2630	15.9	247	1300	7.88	129	680	4.12				
F. 70	466	2270	17.25	230	1120	8.5	120	585	4.45	60.5	294	2.24	
G. 75	455	2150	17.9	224	1060	8.85	117	555	4.63	59	278	2.33	
H. 80	438	2020	18.5	216	1000	9.15	113	521	4.80	57	262	2.41	
I. 90	415	1820	19.6	204	896	9.66	107	470	5.05				
J. 100	396	1650	20.7	195	815	10.2	102	427	5.35				
K. 125	356	1350	23.1	176	665	11.4	98	336	5.97	46	175	3.0	
L. 150	328	1160	25.4	162	570	12.55	845	300	6.58	42.5	150	3.3	
M. 175	307	1025	27.4	163	545	12.75	85	286	6.7	42.7	144	3.36	
N. 200	289	900	29.3	172	575	12.75	86.6	296	6.7				
O. 300	241	636	35.8	175	544	12.75	92	284	6.7				
P. 400	216	500	41.5	183.5	510	12.75	96	268	6.7	48	134	3.36	
Q. 500	198	420	46.0	191	483	12.75	100	253	6.7				
R. 600	185	366	50.5	195	458	12.75	102	240	6.7	51.5	121	3.36	
S. 700	184	360	51.4	202	440	12.75	106	230	6.7				
T. 800	192	360	51.4	206	425	12.75	108	223	6.7				
U. 900	196	360	51.4	210	411	12.75	110	215	6.7				
V. 1000	200	356	51.4	213	397	12.75	111.5	208	6.7				
W. 1200	210	347	51.4	220	376	12.75	116	197.5	6.7	58	99	3.36	
X. 2000	240	314	51.4	246	327	12.75	128.5	171	6.7	71	77	3.36	
Y. 2500	254	303	51.4	258	304	12.75	135	159	6.7				
Z. 3000	265	290	51.4	270	296	12.75	142	155	6.7				

OPERATION OF EQUIPMENT

TYPICAL METER READINGS. The meter readings shown in the table below cover the range of normal readings to be expected. The maximum values will be obtained when operating on high frequencies and the minimum values obtained when operating on the lower frequencies.

SELECTOR SWITCH	EXCITATION PLATE	AMPLIFIER GRID	AMPLIFIER PLATE
OS	70-80	0-2	0
OB	90-120	0-2	0
OBB	110-180	10-15	0
TN	110-180	10-12	80-100
FA	110-180	10-12	90*
FB	110-180	10-12	90*
CW	110-180	10-12	180
PH	110-180	10-12	180

*Individual plate currents register only when using push-pull connections. Otherwise positions FA, FB, CW and PH will show the total amplifier plate current.

SERVICE DATA

GENERAL. The service data included herein is intended to assist an experienced operator in maintenance of the transmitter. If trouble of a nature such that the cause is not evident, is encountered, it is suggested that a complete description of the symptoms be forwarded to the manufacturer for analysis.

TEST DATA. Each transmitter is given a thorough inspection and test at the factory. A copy of the Engineer's test sheet is furnished with each transmitter. These data show normal power consumption; frequency response, tube voltages, and dial settings for specified frequencies.

TERMINAL BOARD CONNECTIONS. Refer to Figure 2 and note the bakelite terminal board underneath the chassis. Wires which terminate on the terminals are shown in the tabulation below. The schematic diagram also designates corresponding points in the circuit with similar numerals.

TERMINAL NO.	WIRE CODE		CONNECTS TO
1	Yel-Blue Tracer	T3	Center Tap of 5Z3 filament winding
	Black	C30	4.5 mfd. condenser
	Black	L8	841C Choke
2	Red	L8	841C Choke
	Green	R24	4000 ohm Bleeder res.
	Black	C29	4.5 mfd. condenser
	Black	R18	100,000 ohm Audio Plate resistor
3	Black	L9	3357 Choke
	Black	L10	808C Choke
	Black	C33	4.5 mfd. condenser
	Red		To selector switch
4	Green	L10	808C Choke
	Black	C34	4.5 mfd. condenser
	Red	R27	40,000 ohm Bleeder resistor
	Yellow	T2	Secondary modulation Trans.
	Black		Jumper to 7
5	Red		Modulator screen
	Red	C28	6.0 mfd. condenser
	Brown	R25	20,000 ohm Bleeder resistor

SERVICE DATA

TERMINAL NO.	WIRE CODE		CONNECTS TO
6	Red	C25	6 mfd. condenser
	Blue	R21	50,000 ohm plate resistor
7	Red	S2	Selector switch
	Black	C33	4.5 mfd. condenser
	Black		Jumper to No. 4
8	YEL-Red Tracer	T3	Center tap of 5Z3 plate winding
	Black	C29	4.5 mfd. condenser
	Black	C30	4.5 mfd. condenser
	Black	R26	750 ohm fixed bias divider
9	Yel-Red Tracer	T5	Center tap 83 plate winding
	Black	C33	4.5 mfd. condenser
	Black	C34	4.5 mfd. condenser
	Bare		Jumper to No. 10
10	Bare		Jumper to No. 9
	Black	C33	4.5 mfd. condenser
	Red	C22	6.0 mfd. condenser
	Red	C25	6.0 mfd. condenser
	Red	C28	6.0 mfd. condenser
	Black		Ground
11	Brown	R18	100,000 ohm resistor
	Red	C22	6.0 mfd. condenser
12	Blue	T2	1800 ohm tap on secondary modulation transformer
	Green		Oscilloscope terminal P2
13	Yel-Green Tracer	T3	Center tap of 83 filament winding
	Red	L9	3357C choke
14	Red	T2	Secondary modulation transformer
	Red	S2	Selector switch

SERVICE DATA

ELECTRICAL COMPONENTS. The electrical components in the 32G Transmitter are shown in the tabulated form below:

RESISTORS

	Description	Ohms	Wattage	Stock No.
R1	Crystal adj.	5,000	25	173.0162
R2	Voltage Dividing	2,500	10	172.2500BD
R3	Oscillator Grid Voltage Dropping	2,500	25	172.0208
R4	1st Int. Amp. Grid	100,000	1	170.100mF1
R5	1st Int. Amp. Screen Dropping	25,000	10	172.25mBD
R6	2nd Int. Amp. Grid	50,000	2	172.50mF2
R7	2nd Int. Amp. Screen Dropping	10,000	10	172.10mBD
R8	Final Amp. Grid	5,000	10	172.5mBD
R12	Final Amp. Screen Dropping (Tube A)	10,000	10	172.10mBD
R13	Final Amp. Screen Dropping (Tube B)	10,000	10	172.10mBD
R14	Final Amp. Tuning	2,000	25	172.0207
R15	1st Audio Input	3 meg	1/2	170.3megF½
R16	1st Audio Cathode	2,500	1	170.2500F1
R17	1st Audio Plate Dropping	100,000	2	170.100mF2
R18	1st Audio Plate Filter	100,000	2	170.100mF2
R19	Gain Control Pot.	500,000		173.33
R20	2nd Audio Cathode	2,500	1	170.2500F1
R21	2nd Audio Plate Filter	50,000	2	170.50mF2
R22	Modulator Cathode	150	10	172.150BD
R23	Modulator Grid (1 per tube)	250	1/2	170.250F½
R24	Audio Power Supply Bleeder	4,000	10	172.4mBD
R25	Modulator Screen Divider	20,000	10	172.20mBD
R26	Fixed Bias 200 ohms	200	10	172.200BD
R27	Fixed Bias 300 ohm	300	10	172.300BD
R28	R-F Power Supply Bleeder	40,000	25	172.0222
R29	Cathode Ray Voltage Divider	200,000	1/2	170.200mF½
R30	Cathode Ray Focusing Pot.	50,000		173.49
R31	Cathode Ray Intensity Pot.	20,000		173.48
R32	Cathode Ray Audio Sweep Pot.	500,000		173.50
R33	Cathode Ray Audio Sweep dropping	1 meg	1/2	170.1megF½

SERVICE DATA

CONDENSERS

	Description	Capacity	Volts Test	Stock No.
C3	Oscillator Plate Blocking	.0005	1000	910.0005BE
C4	Oscillator Grid By-pass	.006	1000	910.006BE
C5	Oscillator Coupling	30 mmf.		182.17H
C6	1st Int. Amp. Cathode By-pass	.006	1000	910.006BE
C7	1st Int. Amp. Screen By-pass	.002	1000	910.002BE
C8	1st Int. Amp. Plate Blocking	.0005	1000	910.0005BE
C9	1st Int. Amp. Tuning	100 mmf.		182.24H
C10	2nd Int. Amp Grid Return	.006	1000	910.006BE
C11	2nd Int. Amp. Screen By-pass	.002	1000	910.002BE
C12	2nd Int. Amp. Plate Blocking	.0005	1000	910.0005BE
C13	2nd Int. Amp. Tuning	140 mmf. per sec.		182.25H
C14	Final Amp. Grid Return	.006	1000	910.006BE
C15	2nd Int. Amp. Tuning Condenser By-pass	.006	1000	910.006BE
C16	2nd Int. Amp. Cathode By-pass	.006	1000	910.006BE
C17	Final Amp. Tuning (Dual Section)	260 mmf.		182.28C
C18	Ant. Tuning (Dual Section)	260 mmf.		182.28C
C19	Ant. Ground Return	.002	5000	950.002A
C20	Ant. Blocking (2)	.001	2500	925.001A
C21	1st Audio Cathode By-pass	20.0 mf.	100	183.5
C22	1st Audio Plate Filter	6.0	450	180.47
C23	1st Audio Plate Blocking	.25	600	180.13
C24	2nd Audio Cathode By-pass	20.0	100	183.5
C25	2nd Audio Plate Filter	6.0	450	180.47
C26	Modulator Cathode By-pass	20.0	100	183.5
C27	R-F Bias Filter	4.0	450	183.15
C28	Modulator Screen By-pass	6.0	450	180.47
C29	Exc. Power Supply Filter Output	4.5	500	180.48
C30	Exc. Power Supply Filter Input	4.5	500	180.48
C31	Final Amp. Screen By-pass (Tube A)	.002	1000	910.002BE
C32	Final Amp. Screen By-pass (Tube B)	.002	1000	910.002BE
C33	R-F Power Supply 1st Section	4.5	500	180.48
C34	R-F Power Supply 2nd Section	4.5	500	180.48
C35	Cathode Ray Tube Grid By-pass	.0005	500	909.0005D

SERVICE DATA

TRANSFORMERS

	Description	Stock No.
T1	Audio Driver	160.307E
T2	Modulation	160.CD355
T3	Filament Power	161.4269
T4	Exc. Pack, Plate Power	161.4268
T5	R-F Pack, Plate Power	161.4486

INDUCTORS

L1	Antenna Network Inductor (Tube A)	
L2	Antenna Network Inductor (Tube B)	
L3	Plate R-F Choke (Tube A)	240.8
L4	Plate R-F Choke (Tube B)	240.8
L5	Final Amp. Cond. Rotor Drain	240.2
L6	2nd Int. Amp. Plate Choke	240.2
L7	1st Int. Amp. Plate Choke	240.2
L8	1st Int. Amp. Plate Choke	162.841C
L9	R-F Power Filter Input Choke	162.810C
L10	R-F Power Filter Output Choke	162.4485
L11	Osc. Plate R-F Choke	240.2M

METERS

		Range	
M1	Excitation Plate	0-200 ma.	250.4200
M2	Amplifier Grid	0-25 ma.	250.425
M3	Amplifier Plate	0-300 ma.	250.4300

SWITCHES

S1	Power and Stand-by	259.36
S2	Stage Selector	259.37
S3	Key	263.J7

SUPPLEMENTARY INSTRUCTIONS FOR ULTRA HIGH FREQUENCY OPERATION OF 32G TRANSMITTER

For frequencies above 20 mc. the 32G Transmitter is provided with a special 2nd buffer coil. This differs from the standard coil in that the tank circuit is tuned by means of an insulated screw driver from the top of the coil can. The tank circuit is tuned to minimum plate current as previously instructed. The "Second Amplifier Tuning" becomes the grid tank tuning and should be set for maximum grid current.

1. Place small toggle switch found in front of buffer coils in Hi. Frq. position.

2. After the first buffer has been tuned, apply plate voltage to 2nd buffer.

3. Adjust the control at top of second buffer coil with an insulated screw driver for minimum current as indicated by the "Excitation Plate" current meter.

4. Adjust grid tank ("Second Amplifier" tuning condenser) for maximum grid current as indicated by the "Grid Current" meter.

5. Readjust the tank circuit for minimum plate current to make sure it is still in resonance.

The procedure of transmitter tuning other than this stage is carried out in the same manner as instructed.

7-27-37

SPECIAL APPLICATIONS

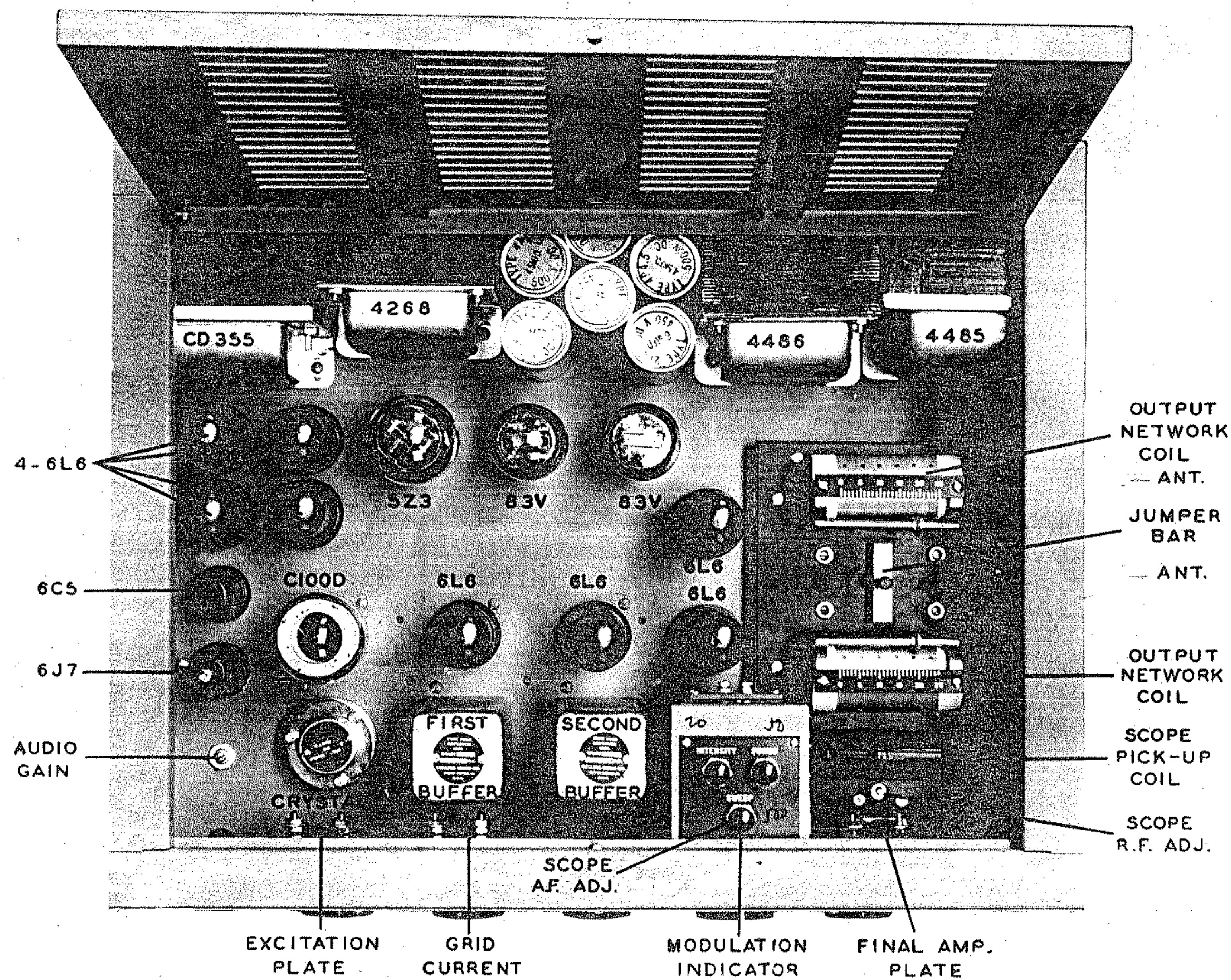
ANTENNA RELAY. Some models of the 32G Transmitter are equipped with an antenna switching relay. This relay is mounted inside the cabinet and operates so as to connect the transmitter output circuit to the antenna terminals during transmitting periods, and to connect the antenna to terminals 4 and 5 during stand-by periods or when the transmitter is not operating. It is then possible to connect a receiver across terminals 4 and 5 and use the transmitting antenna for receiving purposes.

OUTPUT CIRCUIT. Although it is electrically and physically possible to utilize the pi tank output circuit as normally furnished in the 32G Transmitter, a more flexible system is desirable for use with extremely low impedance antennas, especially when operated in the low frequency range of the transmitter.

For antennas which have a resistance of 2 to 15 ohms, the 32G Transmitter is supplied with an output system which consists of series fed tank circuit inductively coupled to antenna by means of a pick-up coil with adjustable coupling. This system provides for efficent transfer of power to a short antenna, which must have external inductance added for tuning purposes.

The adjustments of the transmitter when used with this output circuit are the same as with the standard transmitter except for output circuit adjustment. To adjust the special output circuit, resonance should first be obtained of the final amplifier tuning with no antenna connected. The antenna should then be connected with the antenna coupling coil as loosely coupled as possible (one or two turns). Series resonance should then be obtained in the antenna circuit by adjustment of the antenna tuning condenser and the external loading coil. Series resonance will be indicated by a sharp rise in final amplifier plate current. Coupling should then be increased in small steps (increase number of turns in pick-up coil) until final amplifier plate meter indicates a loading of 180 ma. at resonance of the antenna system.

Care should be exercised so as not to obtain closer coupling than provides the proper loading. If such is done, the final amplifier will be detuned and this latter condition is not desirable.



4268
CD355
4486
4485
5Z3
83V
83V
C100D
6L6
6L6
6L6
6L6
FIRST
BUFFER
SECOND
BUFFER
CRYST.
4-6L6
6C5
6J7
AUDIO GAIN
OUTPUT NETWORK COIL
ANT.
JUMPER BAR
ANT.
OUTPUT NETWORK COIL
SCOPE PICK-UP COIL
SCOPE R.F. ADJ.
SCOPE A.F. ADJ.
EXCITATION PLATE
GRID CURRENT
MODULATION INDICATOR
FINAL AMP. PLATE

FIG. 1

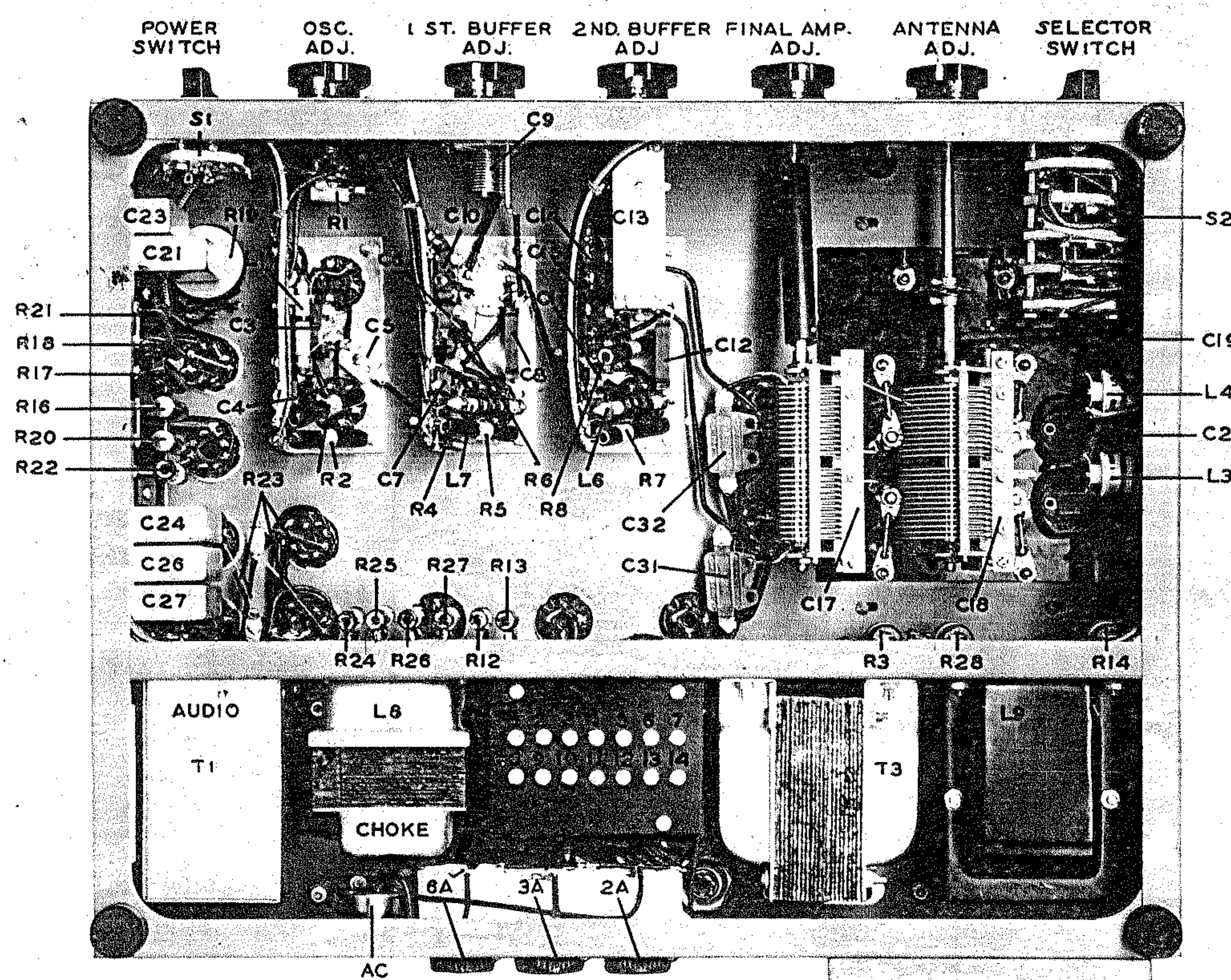
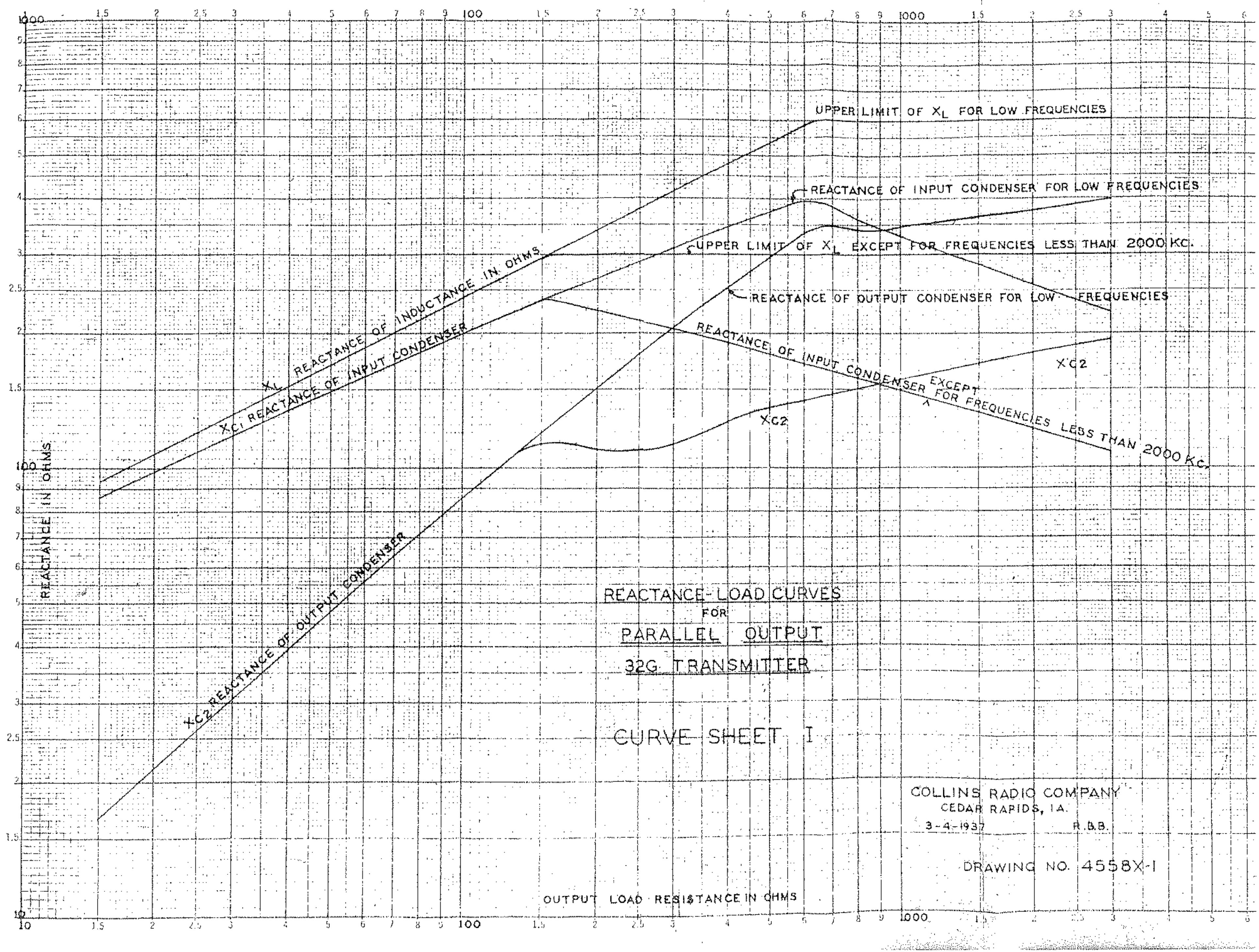
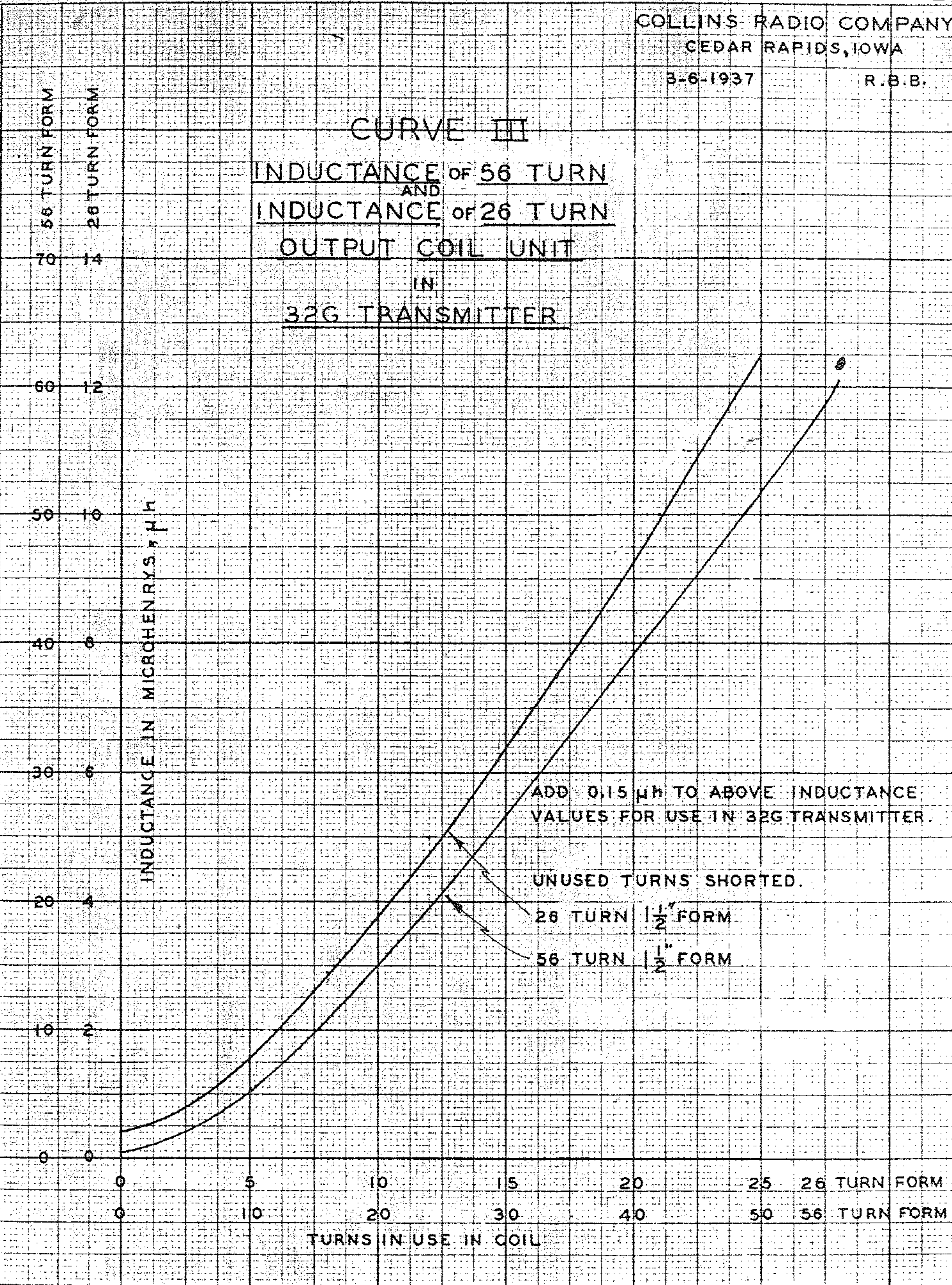
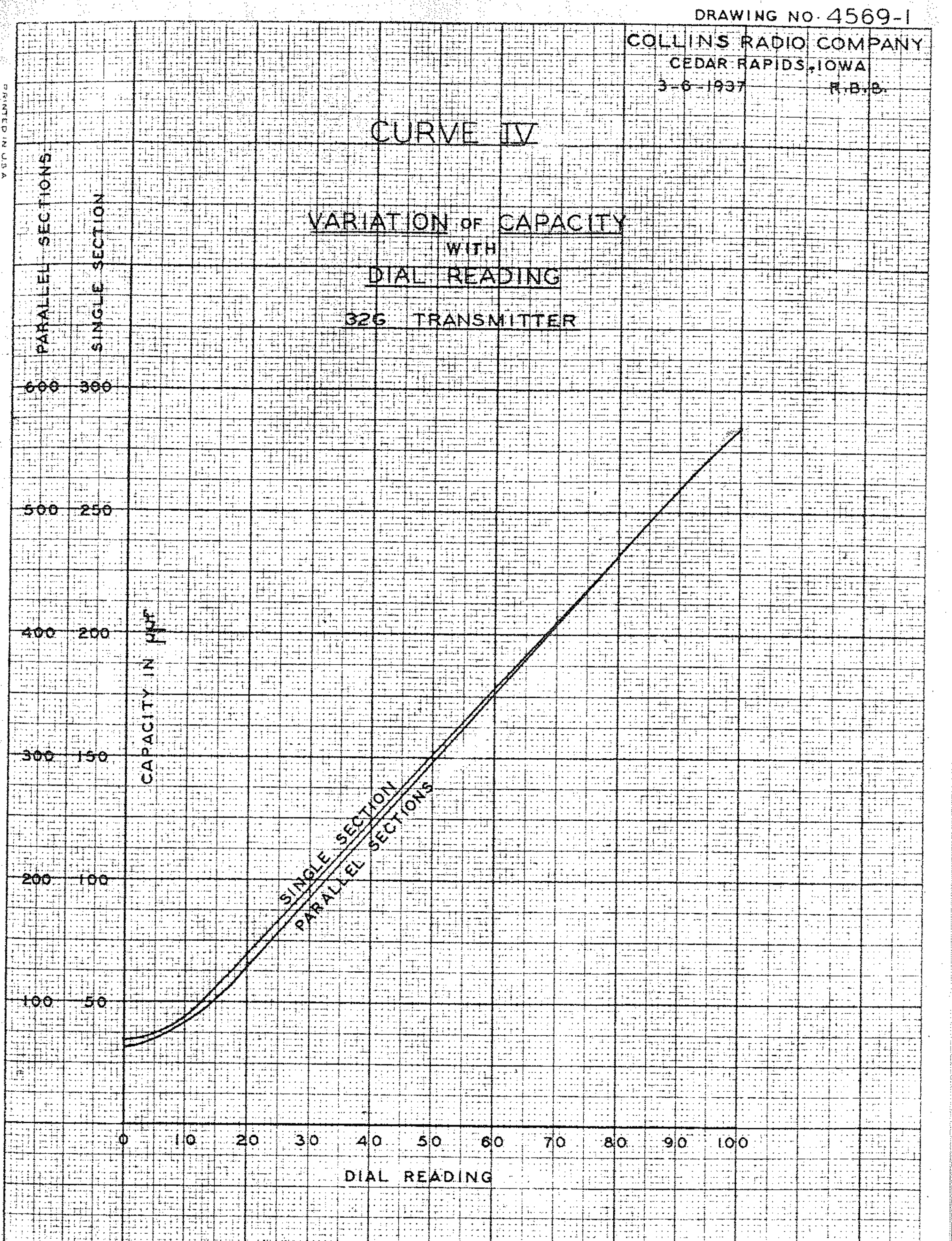

POWER SWITCH
OSC. ADJ.
1 ST. BUFFER ADJ.
2ND. BUFFER ADJ
FINAL AMP. ADJ.
ANTENNA ADJ.
SELECTOR SWITCH
S1
C9
C23
R19
R1
C10
C13
C21
C12
C3
C5
R21
R18
R17
R16
R20
R22
C4
C8
R2
C7
L7
R4
R5
R6
R8
L6
R7
R23
C32
C31
C17
C18
S2
C19
L4
C20
L3
C24
C26
C27
R25
R27
R13
R24
R26
R12
R3
R28
R14
AUDIO
T1
L8
CHOKE
T3
6A
3A
2A
AC

FIG. 2


UPPER LIMIT OF X_L FOR LOW FREQUENCIES
REACTANCE OF INPUT CONDENSER FOR LOW FREQUENCIES
UPPER LIMIT OF X_L EXCEPT FOR FREQUENCIES LESS THAN 2000 KC.
REACTANCE OF OUTPUT CONDENSER FOR LOW FREQUENCIES
REACTANCE OF INPUT CONDENSER EXCEPT FOR FREQUENCIES LESS THAN 2000 KC.
X_{C2}
X_L REACTANCE OF INDUCTANCE IN OHMS
X_{C1} REACTANCE OF INPUT CONDENSER
X_{C2} REACTANCE OF OUTPUT CONDENSER
REACTANCE IN OHMS
OUTPUT LOAD RESISTANCE IN OHMS
REACTANCE-LOAD CURVES
FOR
PARALLEL OUTPUT
32G TRANSMITTER
CURVE SHEET I
COLLINS RADIO COMPANY
CEDAR RAPIDS, IA.
3-4-1937
R.B.B.
DRAWING NO. 4558X-1

DRAWING NO. 4570-2





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EUGENE DIETZGEN CO. NO. 346 B

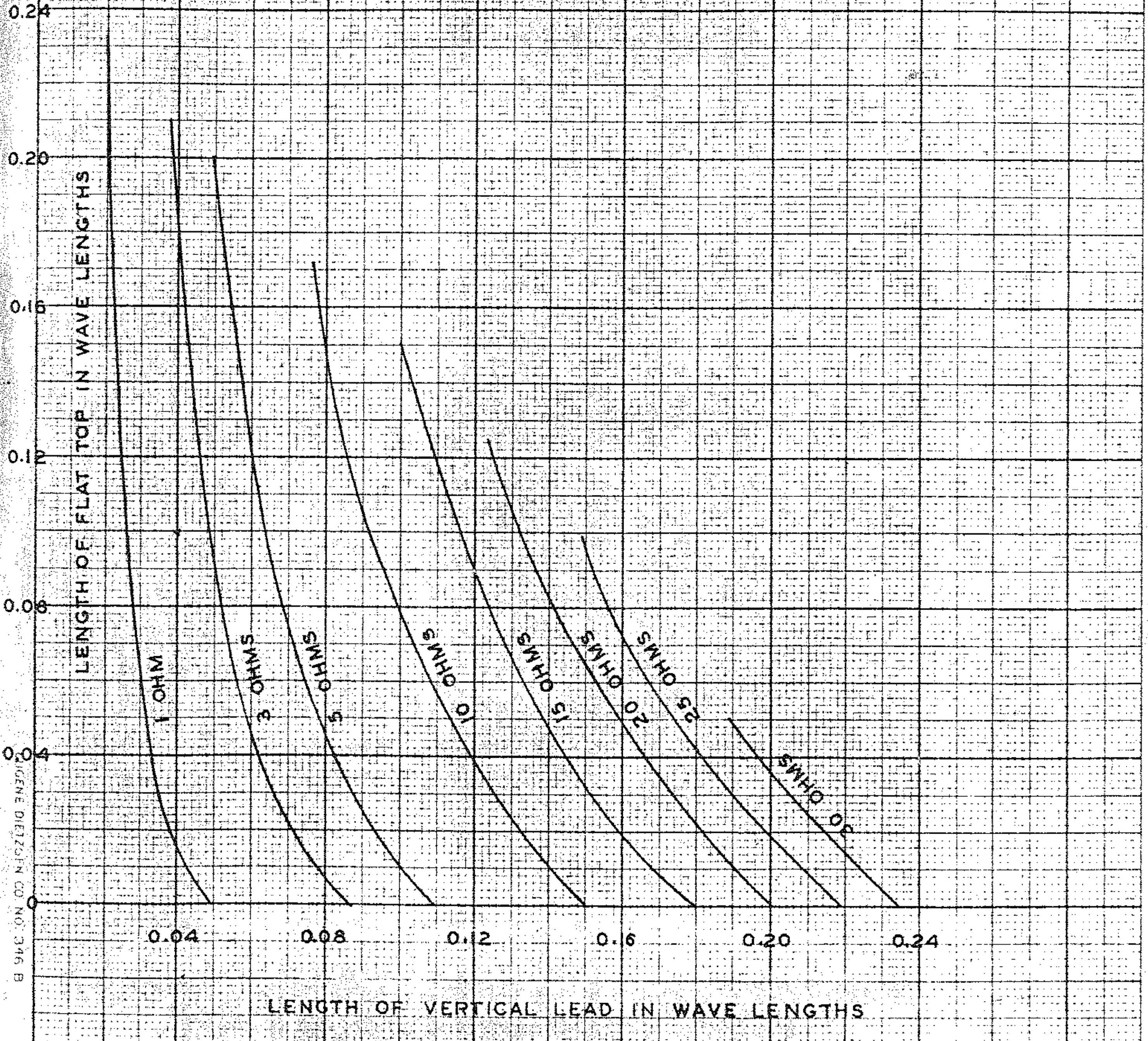
DRAWING NO. 4568-1

COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

3-6-1937 R.B.B.

CURVE V

RADIATION RESISTANCE OF "L" TYPE MARCONI ANTENNAS



Crystal socket plate - 2" square aluminum
Osc. socket plate -
Note:- The above are both mounted on one aluminum bracket
$1\frac{3}{4}$" by $1\frac{1}{2}$" by $4\frac{1}{2}$" long

Substitute 6AG7 for C-100A- vacuum tube crystal oscillator