Operating Instructions

for the

hallicrafters

HT Series Transmitters

Model HT 9

Manufactured By

the hallicrafters *co.*

2611 Indiana Avenue Chicago, U. S. A.

MEMORANDA

-ERRATA-

2. INSTALLATION. (Disregard third par. entirely)

The microphone cable is now connected to a shielded connector located on the left side of the cabinet near the front panel. The method shown in the text no longer applies.

3. COILS AND CRYSTALS. (Disregard first par. entirely)

(a) General
The exciter uses two type 6L6 tubes in a special circuit. When the transmitter is to be operated with crystal control at crystal frequency the second 6L6 is used as a crystal oscillator. When operating on twice crystal frequency the first 6L6 operates as a crystal controlled oscillator and the second 6L6 then operates as a frequency doubler stage. With the coils in their proper positions the band switch automatically takes care of the functions listed above.

(b) An orange dot now replaces the black dot to indicate crystal position.

6. REPRESENTATIVE METER READINGS.

Where ever reference is made to a 6F6 tube the first 6L6 oscillator tube should be substituted in its place. (See schematic)

PARTS LIST - HT-9

Resistors

R1 - 390	ohm	2	watt
R2 - 5,000	"	10	"
R3 - 2,000	"	20	"
R4 - 22,000	"	2	"
R5 - 500	"	10	"
R6 - 20,000	"	10	"
R7 - 20,000	"	10	"
R8 - 2,000	"	20	"
R9 - 10,000	"	10	"
R10 - 30,000	"	75	"
R11 - 2.2 Meg		½	"
R12 - 2,200	ohm	½	"
R13 - 1 Meg		½	"
R14 - 220,000	ohm	1	"
R15 - 47,000	"	½	"
R16 - 0.5 Megohm Control			
R17 - 1,000	ohm	½	watt
R18 - 110	"	10	"
R19 - 47	"	½	"
R20 - 47	"	½	"
R21 - 47	"	½	"
R22 - 47	"	½	"
R23 - 22,000	"	2	"
R24 - 82,000	"	2	"
R25 - 20,000	"	20	"
R26 - 100,000	"	½	"
R27 - 22,000	"	2	"
R28 - 24	"	½	"
R29 - 400	"	½	"

Condensers

C1 - 0.006	mfd.	300	volt	mica
C2 - 0.002	mfd.	500	"	"
C3 - 0.006	mfd.	300	"	"
C4 - 0.002	mfd.	500	"	"
C5 - 0.002	mfd.	500	"	"
C6 - 200	mmfd.	600	"	"
C7 - 0.01	mfd.	600	"	"
C8 - 0.01	mfd.	600	"	"
C9 - 0.002	mfd.	1250	"	"
C10 - 50/150	mmfd.	variable		
C11 - 0.002	mfd.	600	volt	mica
C12 - 8	mfd.	600	"	elect.
C13 - 8	mfd.	600	"	"
C14 - 10	mfd.	25	"	"
C15 - 0.1	mfd.	400	"	paper
C16 - 0.01	mfd.	600	volt	paper
C17 - 4-4	mfd.	475	"	elect.
C18 - 10	mfd.	25	"	"
C19 - 8-8	mfd.	475	"	"
C20 - 25	mfd.	50	"	"
C21 - 8	mfd.	600	"	"
C22 - 4	mfd.	1500	"	oil filled
C23 - 0.002	mfd.	600	"	mica
C24 - 50	mmfd.	600	"	"
C25 - 0.002	mfd.	500	"	"
C26 - 0.002	mfd.	500	"	"
C27 - 0.002	mfd.	500	"	"
C28 - 100	mmfd.	500	"	"
C29 - 100	mmfd.	500	"	"

Transformers

T1	- 7K98	Power Transformer
T2	- 1F83	Choke
T3	- 8K160	Power Transformer
T4	- 1A52	Choke
T5	- 8K153	Plate Transformer
T6	- IN5	Choke
T7	- 2A75	Interstage Transformer
T8	- 3E19	Modulation Transformer

Switches

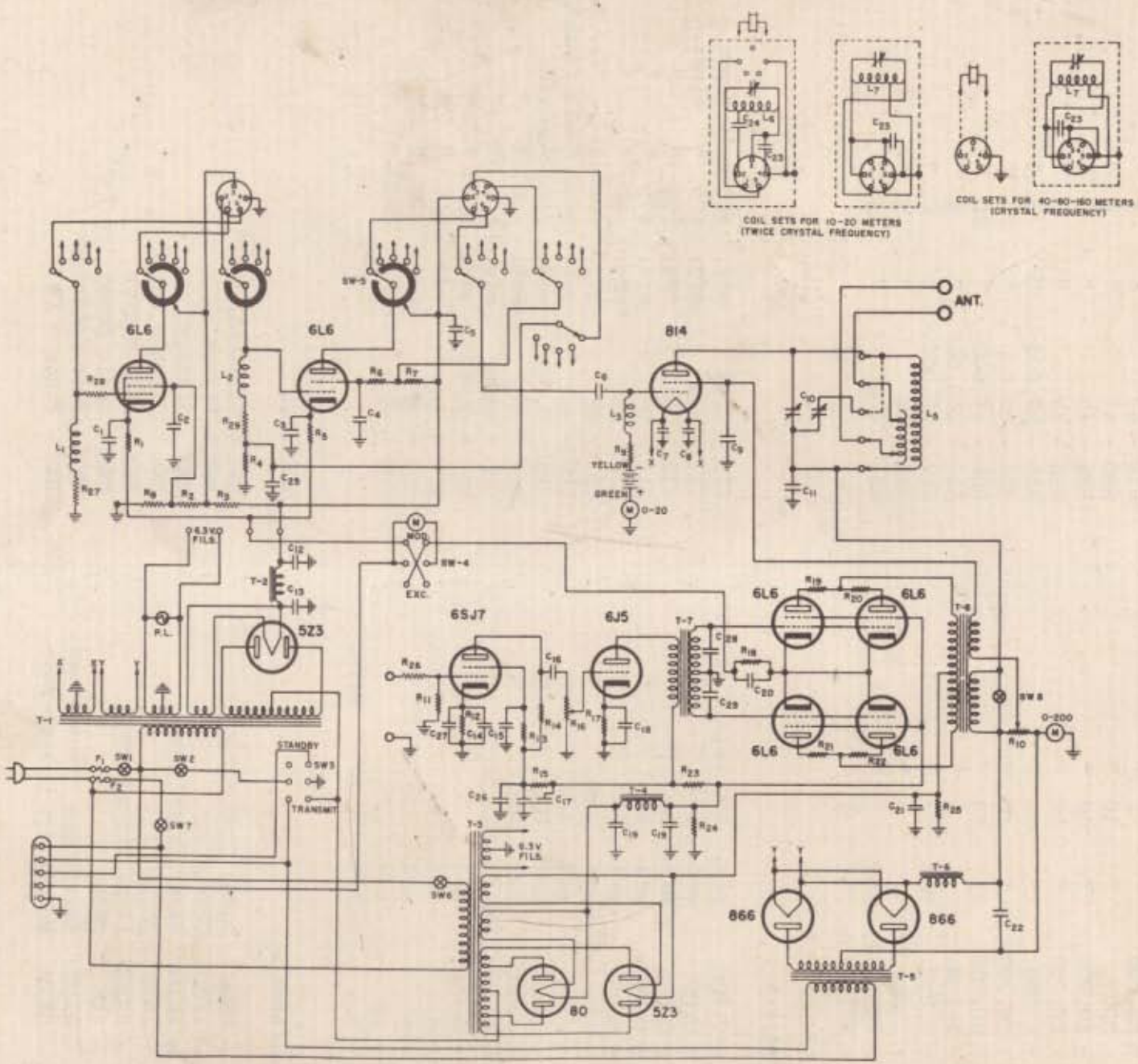
SW1 - Filaments
SW2 - Plates
SW3 - Standby
SW4 - Cathode meter
SW5 - Band switch
SW6 - Audio power (on R16)
SW7 - Door interlock
SW8 - Phone - CW

Inductors

L1, L2, L3 - 2.5 mh. r. f. choke
L5 - Output tank
L6 - crystal osc. coil (10 or 20)
L7 - osc. or doubler coil (10, 20, 40, 80, 160)

Fuses

F1 - 10 amp
F2 - 3 amp



SCHEMATIC DIAGRAM – MODEL HT-9 TELEGRAPH-TELEPHONE TRANSMITTER

OPERATING INSTRUCTIONS
MODEL HT-9 TRANSMITTER

1. UNCRATING.

Remove the transmitter and accessories from the crate and carefully inspect for possible damage during shipping. If any damage is found, file a claim immediately with the transportation company at your local office. It is recommended that the original packing material be preserved.

2. INSTALLATION.

The HT-9 transmitter may be installed on a table convenient to the operating position, and being a self-contained unit, requires only the attachment of power, antenna and accessories.

Open the lid of the cabinet and plug the tubes into their respective sockets as marked. (The 814 socket is not marked but its position can be seen from the photograph.) Attach the two clips to the 866 plate caps.

The microphone cable is brought thru the left side of the cabinet and connected directly into the cover of the audio input shield. The outside braided conductor (shield) connects to the ground screw terminal, and the inner conductor to the screw terminal at the small R.F. choke. In replacing the cover on the shield can, carefully attach the grid clip to the 6J7 grid to insure good contact.

The key is connected to terminals #1 and #2 on the five terminal strip on the rear of the cabinet, #1 being the ground side. It is recommended that #1 be also connected to a good ground.

The terminals #1 and #3 on the same terminal strip are shorted automatically by the standby switch in the standby position, (#1 is a ground) and may be connected to the receiver to turn it off during transmission periods.

Terminals #4 and #5 may be connected to an external 110 V.A.C. relay for transferring the antenna from receiver to transmitter. Power for the relay is provided in the transmit position, with the plate supply on.

For voltages of 150, 210, 220 or 250 at 50 or 60 cycles, a special auto transformer is available as an accessory. Where the only power supply available is 110 volts DC or 110 Volts 25 cycle AC, a rotary converter or motor generator set with a rating of about 500 volt amperes and having good regulation is recommended. In order to avoid interference to the receiver, the machine should be equipped with a filter.

Antenna connections are made at the rear of the transmitter to the two terminals mounted on a mycalex plate. For antenna recommendations see Section 5.

3. COILS AND CRYSTALS.

(a) General

The exciter uses a type 6F6 and a type 6L6 tube in a special circuit. When the transmitter is to be operated on crystal frequency, the 6L6 is used as an oscillator. When operation is to be on twice crystal frequency the 6F6 is used as the oscillator and the 6L6 as a doubler. The switching and socket connections automatically take care of the different set of coils, crystals, raising the bias on the 6L6 for doubling and adjusting the screen voltage to the 6L6 for correct excitation.

The exciter has five channels and any set of coils may be installed in any channel. The band switch control knob is numbered to correspond with the positions of the coil and crystal sockets on the chassis.

The tank coil with its associated pick-up coil is plugged into the jack bar on the right hand side of the chassis and must be changed when changing to different bands. The tank coil connections automatically insert the proper sections of the tuning condenser to maintain correct LC ratio. The end of the tank coil marked in red should correspond to the end of the jack bar similarly marked.

(b) Crystal Frequency Operation.
When operating on crystal frequency (for example in the 160-80-40 meter amateur bands), the crystal is plugged into one of the sockets marked "A". The crystal prongs should be placed in the socket terminals marked with dots with the grounded side of the crystal opposite the black dot. The oscillator coil is plugged into the corresponding socket marked "B".

(c) Operation on Twice Crystal Frequency.
For operation on twice crystal frequency (for example in the 20 or 10 meter bands), the coil marked OSC, is plugged into an A socket and the coil marked DOUB in the corresponding B socket. The crystal is plugged into the top of the oscillator coil shield.

Note: For best results use only the best crystals. Recommended are Bliley LD2 for 160 or 80 meter amateur operation, B5 40 meter crystals for 40 and 20 meter operation and HF2 20 meter crystals for 10 meter operation.

4. TUNING PROCEDURE.

Assume that the coils and crystals for the desired channels have been plugged into the chassis, the tank coil for the desired frequency plugged in and the bandswitch set to the proper channel. The phone CW switch should be put in the CW position and the key terminals closed.

(a) Exciter tuning (plate switch off.)
1. Turn on filaments and allow a few moments for warming up.
2. Place the cathode current switch in the EXC position.
3. Turn on standby switch.
4. Rotate the knob on the oscillator tuning unit until a rise in cathode current is obtained. If operating on crystal frequency this will be accompanied by a rise in grid current.
5. Adjust knob on doubler tuning unit if operating on twice crystal frequency until maximum grid current is obtained.
6. Readjust oscillator control for maximum grid current and back off slightly on the stable side of resonance. (It will be noticed when tuning the oscillator that the grid current drops off sharply on one side of resonance and more slowly than the other side, the latter being referred to as the stable side of resonance.

(b) Plate Tuning.
1. With antenna disconnected, turn on plate switch and adjust the plate tuning control for minimum reading on the PA plate meter. The reading at resonance should be about 40 MA on the lower frequencies and about 55 MA on the highest frequency. This reading includes both plate and screen current.

Caution: IN ORDER TO APPLY PLATE POWER THE LID OF THE CABINET MUST BE CLOSED SO AS TO CLOSE THE PROTECTIVE INTERLOCK SWITCH. SINCE THE CONSTRUCTION OF THE TRANSMITTER INVOLVES VOLTAGES DANGEROUS TO HUMAN LIFE, THE INTERLOCK SWITCH IS PROVIDED FOR YOUR PROTECTION.

2. Connect the antenna and with the taps set near the cold end of the tank coil and one or two turns apart, turn on the plate switch and retune to resonance. The taps on the tank coil are gradually moved to include more of the pickup coil until the resonant plate current is about 125 MA for phone operation and 150 MA for CW operation.

Notice the scale reading on the tuning dial. If this is varied by more than five or at the most ten divisions, it indicates that the antenna system is of improper dimensions. This should be corrected by proper dimensioning of the antenna or the use of an external antenna tuning unit or the result will be severe harmonic radiation or low output. See section on antennas. In adjusting the taps on the pickup coil, one lead should be kept at or near the cold end of the coil. (Away from the end marked in red)

(c) Other Bands.
Repeat this procedure for each band that is set up in the exciter after which it is only necessary in changing frequency to set the band switch correctly, plug in the final tank coil and adjust the plate tuning.

(d) CW Operating.
Place the phone CW switch in the CW position and turn on filaments. After the tubes have become sufficiently warmed up, the plate supply may be turned on after which transmission may be carried on. Keying is done in the oscillator circuit so that break-in operation is possible. If complete break-in is desired, a separate receiving antenna is recommended as very few antenna relays will handle high speed keying. A keying relay may be used preferably of the low current DC type which has an extra contact for disabling the receiver when the key is pressed. For methods of handling break-in see amateur handbook.

(e) Phone Operation.
Set the phone CW switch in the phone position and set the cathode current switch in the MOD position. Turn on the transmitter which has been set to the proper frequency and then turn on the audio system by rotating the audio gain control in a clockwise direction. The gain control is turned up until the cathode current meter rises about 25 MA above the normal reading of 220 MA on voice peaks.

5. ANTENNA RECOMMENDATIONS.

General.

For antenna connection a separate pickup coil is provided on each plate coil. Connections to the pickup coils are made by means of flexible leads which may be clipped to the tinned winding so as to include any desired number or fractional number of turns. Hence, when the output coils are adjusted for the particular antenna used with the transmitter no further adjustment is necessary when changing bands.

Since the portion of the pickup coil in use is quite closely coupled to the plate coil at all times and the L/C ratio of the plate is never so great as to

require an excessively high impedance to be reflected into the plate coil to obtain the proper plate loading, satisfactory coupling may be obtained into resistive loads varying from low resistance Marconi or doublet antennas to high resistance loads presented by matched-impedance single-wire fed antennas. No provision is made in the transmitter to tune antennas which are not of the proper dimensions for the frequency used and therefore present a reactive load. If the antenna used requires inductive or capacitive loading to tune to the operating frequency, this must be done with an external coil or condenser. The winding of the pickup coil, because of its close coupling to the tank coil, cannot be used as an inductive loading coil, but only as a coupling coil, in accordance with the best practice for obtaining stable loading and maximum harmonic attenuation.

The problem of providing a suitable antenna installation must, of course, be solved by the operator with due consideration to the space and facilities available, and the frequency bands to be used. For those not acquainted with this subject, a study of the chapter on antenna in the "Radio Amateur's Handbook" published by the American Radio Relay League, Inc., West Hartford, Conn., is highly recommended. Of the many types of antenna available, those most desirable from a standpoint of efficiency of power transfer, minimum radiation from feeders, and simplicity of coupling arrangements are the Johnson "Q", two-wire fed matched-impedance "Y" type, matched-impedance single wire fed, and twisted-pair doublet. The efficiency of twisted-pair feeders is rather low at frequencies higher than that of the 40 meter amateur band.

All of the antennas listed above have the disadvantage of being designed for operation at only a single frequency, except that the single-wire fed antenna operates fairly satisfactorily at multiples of its fundamental frequency. Any of these antennas, may, of course, be used as a simple Marconi operated against ground at the lower frequencies.

Matched-Impedance Antennas

These include the two-wire matched-impedance antannas such as the Johnson "Q", "Y" and twisted-pair fed doublet, and the single-wire fed matched impedance antennas. The antenna coupling procedure for these antennas is: first, connect the two antenna feeders to the antenna terminals on the insulator at the rear of the cabinet. In the case of the single-wire fed antenna, connect one antenna terminal to a good ground connection. Second, connect the flexible leads to the pickup coil so as to include approximately the number of turns between connections given in the table below:

Amateur Band	No. of Turns
160 meters	10
80 "	8
40 "	6
20 "	4
10 "	2

Third, turn on the plate voltage and tune the plate tuning condenser for minimum plate current. If the antenna is cut to the proper length for the frequency and particular local condition surrounding the antenna, and if the degree of coupling is correct, this minimum plate current will be 125 MA, and the plate condenser setting will be very nearly the same as that noted previously when tuning the plate circuit to resonance without the antenna connected. If the plate current is too low, increase the number of turns in the pickup coil:

If the number of turns in the pickup coil is too great, the plate current will rise to some value in excess of 150 MA, and no resonant indication will be noticed. If the amplifier tuning dial reading at resonance with the antenna coupled differs from the noted without the antenna coupled by more than approximately ten degrees of rotation the antenna is not of the proper dimensions for the frequency used and is presenting a reactive load to the transmitter. Operating under this condition will be at somewhat reduced efficiency.

Marconi Antennas

A single wire, approximately one quarter wave long from transmitter to far end, or one of the antenna described above, designed for operation at a higher frequency but used as a simple "T" antenna, may be used as a Marconi antenna. Such an antenna should be connected in series with an external loading coil and variable condenser to one antenna terminal. The other should be connected to a good ground connection such as a clamp or cold water pipe main, near the spot at which the main enters the basement of the house. If the antenna is approximately one quarter wave long, the loading coil may be about the same dimensions as the plate coil but with somewhat fewer turns. The antenna tuning condenser should have a capacity of about 200 mmfd., but may be of the ordinary receiving type. If the antenna is shorter than one quarter wave length, the number of turns in the loading coil must be increased to obtain resonance in the antenna circuit. The number of turns required in the pickup coil for use with a Marconi antenna will be less than that given in the table above. Starting with comparatively few turns in the pickup coil, the plate tuning condenser is first set at the no-load resonance setting previously noted. The antenna tuning condenser and, if necessary, the inductance of the external loading coil are then varied until resonance is obtained in the antenna circuit as evidenced by an increase in plate current at the resonant setting. The number of turns in the pickup coil is then adjusted and the antenna retuned until the proper plate loading is obtained. As a final check the plate condenser is then retuned for a minimum plate current. If the setting so found is different from the no-load resonance setting, the antenna circuit is not in tune and the number of turns on the pickup coil is too great.

Other Antennas

Other antennas, such as the Zeppelin, tuned doublet, etc., may be coupled and tuned somewhat as described above for the Marconi antenna by using two antenna tuning condensers, two external loading coils and series or parallel tuning, as required. However, a much more convenient arrangement consists of two variable condensers, a tapped coil, and a switch for connecting the condensers in series or parallel with the coil as required. The coil is then link coupled to the amplifier plate coil, using one or two turns of the pickup coil as the coupling link at the transmitter. A "pi" network may also be used as a variable antenna coupling device by connecting the input terminals of the network to the antenna terminals of the transmitter and using all of the turns in the pickup coil.

The "multi-band" antenna is a variation of the tuned doublet, in which the transmission line impedance is about the mean of the terminating impedance, resulting in a minimum mis-match and loss. If properly cut to length, it may be used on several harmonic frequencies by coupling directly to the pickup coil. Dimensions and details are given in the Radio Amateur's Handbook. Where the copper tuning feeders prove unwieldy, very nearly as good results may be obtained by replacing them with feeders consisting of two #10 wires spaced 1-1/2" to 2", giving a transmission line impedance of about 400 ohms.

In any antenna, tuning system, especially where no external tuning is used, a careful check should be made by the amateur to see that harmonic radiation is at a minimum. Harmonic radiation is apt to be serious when the antenna, not carefully cut to length, causes considerable detuning of the tank condenser.

6. REPRESENTATIVE METER READINGS.

Cathode current (crystal frequency operation)	43 MA
Cathode current (twice crystal frequency operation)	77 MA
Grid current (plate on-full load)	8 to 11 MA
Grid current (plate off)	13 to 17 MA
Plate & Screen current (Phone)	125 MA
Plate & Screen current (CW-Max)	150 MA
Mod. cathode current (normal)	225 MA
(swings up 25 on voice peaks)	

Voltage readings for service checks - (DC voltages measured with 1000 ohms per volt meter at socket terminals unless otherwise specified.)

Line voltage	- 117 V	- 50/60 cycles AC
Fil. 6F6 & 6L6	- 6.3 V AC	
Fil. 814	-10.0 V AC	
Fil. 866	- 2.5 V AC	
Fil. 5Z3 (RF)	- 5.0 V AC	
Fil. 5Z3 (Mod)	- 5.0 V AC	
Fil. 6L6G	- 6.3 V AC	
Fil. 6J7	- 6.3 V AC	
Fil. 6J5	- 6.3 V AC	
Fil. 80	- 5.0 V AC	

Exciter plate supply (measured to ground at red lead to R.F. unit) 420 V DC
Grid Bias 814
Not oscillating 45 V DC
10 MA grid current - 145 V DC

Screen 814 - phone transmission loaded - 300 V DC.

Plate 814 - phone - 1000 V DC (Measured at frame of tank condenser to ground)

6L6G - plate to cathode - 400 V.DC	6L6 - plate to cathode - 375 V.DC
6L6G - screen to cathode- 290 V.DC	6L6 - screen to cathode- 300 V.DC
6L6G - grid bias - 23 V.DC	6L6 - cathode to ground- 22 V.DC
6J5 - plate to cathode - 225 V.DC	6F6 - plate to cathode - 200 V.DC
6J5 - cathode to ground- 8 V.DC	6F6 - screen to cathode- 65 V.DC
6J7 - plate to cathode - 30 V.DC	6F6 - cathode to ground- 10 V.DC
6J7 - screen to cathode- 40 V.DC	6J7 - cathode to ground- 1 V.DC

CAUTION: Do not switch bands with the plate power on. Do not attempt to key the transmitter when the phone CW switch in the phone position as high transient voltages are produced across the modulation transformer which might damage the equipment. Always allow filaments about 30 seconds to warm up before turning on the plate power in order to avoid damage to the mercury vapor rectifier tubes. When installing new rectifier tubes that have been shipped, it is wise to allow them to run with only filaments on for about 15 minutes in order that the mercury will vaporize from the tube elements.

PARTS LIST - HT-9

Resistors

R1	- 400	ohm	2	watt
R2	- 25,000	"	2	"
R3	- 20,000	"	10	"
R4	- 20,000	"	2	"
R5	- 500	"	10	"
R6	- 20,000	"	10	"
R7	- 20,000	"	10	"
R8	- 20,000	"	20	"
R9	- 10,000	"	10	"
R10	- 30,000	"	75	"
R11	- 3 meg	"	½	"
R12	- 1000	"	½	"
R13	- 1 meg	"	½	"
R14	- 250,000	ohm	1	watt
R15	- 50,000	"	1	"
R16	- 1 Meg Control			
R17	- 1000	ohm	½	"
R18	- 110	"	10	"
R19	- 50	"	½	"
R20	- 50	"	½	"
R21	- 50	"	½	"
R22	- 50	"	½	"
R23	- 20,000	"	2	"
R24	- 75,000	"	2	"
R25	- 20,000	"	20	"

Condensers

C1	- .006	mf.	900	volt	mica
C2	- .002	mf	600	"	"
C3	- .006	mf.	900	"	"
C4	- .002	mf.	600	"	"
C5	- .002	mf.	600	"	"
C6	- .0002	mf.	1000	"	"
C7	- .01	mf.	1000	"	"
C8	- .01	mf.	1000	"	"
C9	- .002	mf.	1000	"	"
C10	- 50/150	mmf.	variable		
C11	- .002	mf.	2500	volt	"
C12	- 8	mf.	600	"	"
C13	- 8	mf.	600	"	"
C14	- 10	mf.	25	volt	
C15	- .25	mf.	400	"	
C16	- .01	mf.	400	"	
C17	- 4-4	mfd.	475	"	
C18	- 10	mf.	25	"	
C19	- 8-8	mf.	475	"	
C20	- 20	mf.	50	"	
C21	- 8	mf.	500	"	
C22	- 4	mf.	1500	"	
C23	- .002	mf.	600	"	
C24	- .00005	mf.	600	"	

Transformers

T1	- 7K98	Power Transformer
T2	- 1F83	Choke
T3	- 8K160	Power Transformer
T4	- 1A52	Choke
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T6	- IN5	Choke
T7	- 2A75	Interstage Transformer
T8	- 3E19	Modulation Transformer

Switches

Sw1 - Filaments
Sw2 - Plates
Sw3 - Standby
Sw4 - Cathode meter
Sw5 - Band switch
Sw6 - Audio power (on R16)
Sw7 - Door interlock
Sw8 - Phone - CW

Inductors

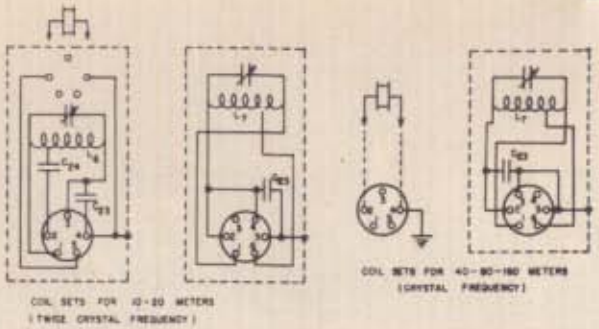
L1, L2, L3, L4 - 2.5 mr. r. f. choke
L5 - Output tank
L6 - 6F6 osc. coil (10 or 20)
L7 - 6L6 osc. coil (10, 20, 40, 80, 160)

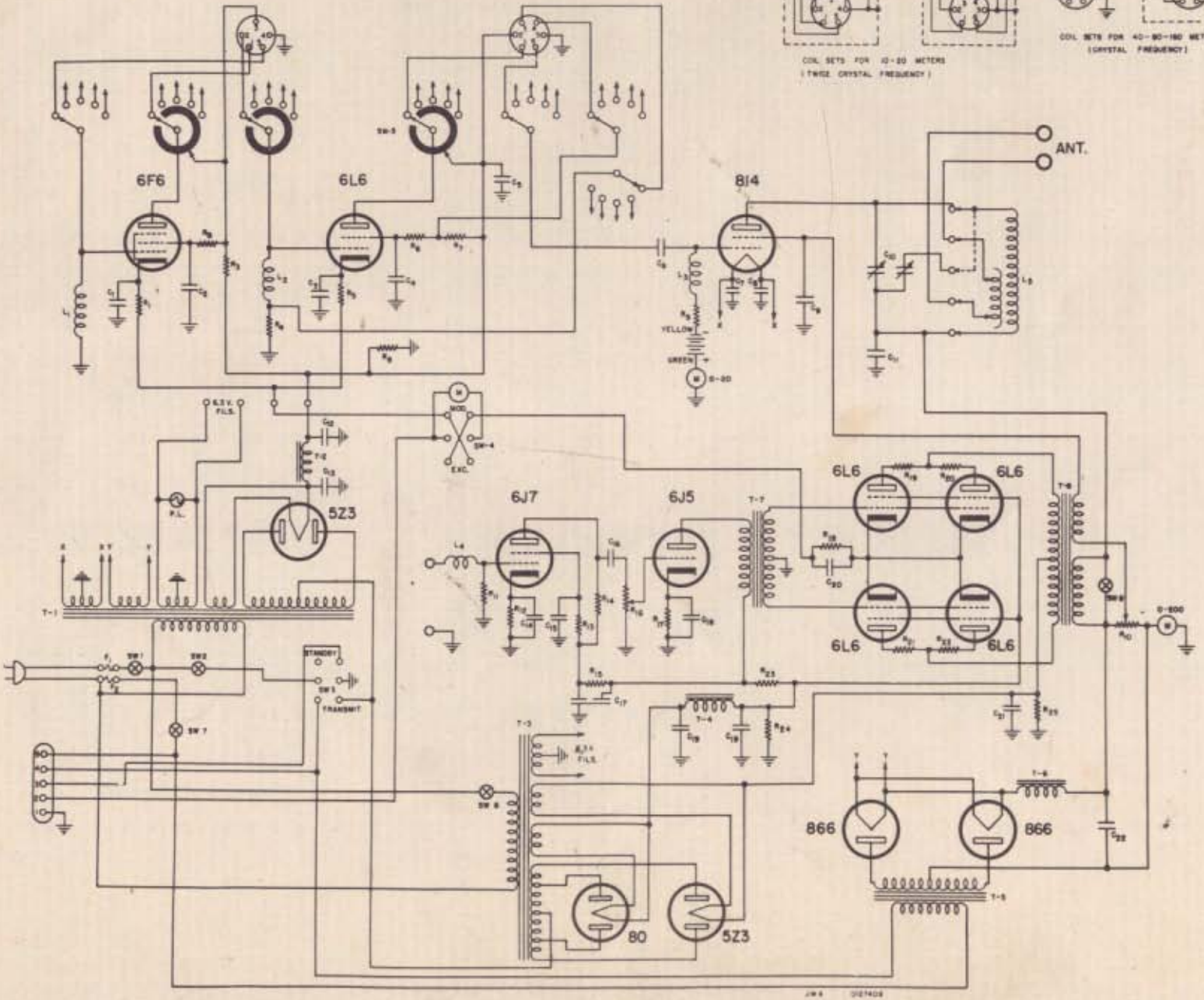
Fuses

F1 - 10 amp
F2 - 3 amp

the hallicrafters *inc.*

SCHEMATIC DIAGRAM — MODEL HT-9 — TELEGRAPH - TELEPHONE TRANSMITTER





G U A R A N T E E

This transmitter is guaranteed to be free from any defect in workmanship and material that may develop with in a period of ninety (90) days from date of purchases, under the terms of standard guarantee, as designated by the Radio Manufacturers Association. Any part or parts that prove defective within this period will be replaced without charge when subjected to examination at our factory, providing such defect, in our opinion, is due to faulty material or workmanship, and not caused by tampering, abuse or normal wear. All such adjustments to be made F.O.B. the factory. Should it be necessary to return any part or parts to the factory, a "Return Material Permit" must be obtained in advance by first writing the Adjustment Department, who will issue due authorization under the terms of the guarantee. The Hallicrafters, Inc., reserve the right to make changes in design or add improvements to instruments manufactured by them without incurring any obligation to install the same in any instrument purchased.

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