

INSTRUCTION MANUAL

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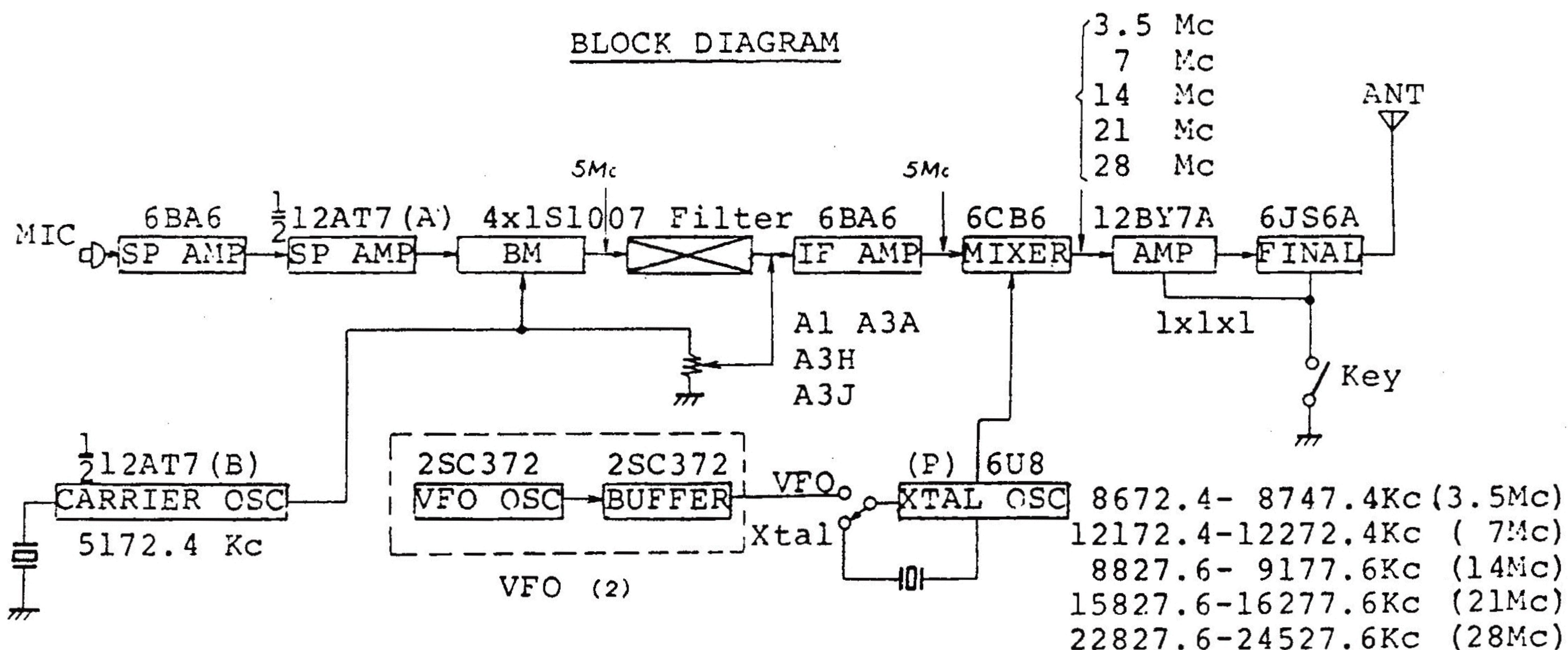
 FL-50B SSB TRANSMITTER

The model FL-50B SSB Transmitter is a compact, high performance desk top amateur transmitter with CW, AM and SSB modes. On all modes, except AM, this transmitter works at an input of 50 watts PEP on all bands from 80 to 10 meters. AM consists of transmitted carrier and one sideband. The SSB signal is generated by a crystal filter.

SPECIFICATIONS

Emission type	SSB (A3J) (A3A) PHONE (A3H) CW (A1)
Input power	50W PEP
Frequency range	3.5-4.0, 7-7.5, 14-14.5, 21-21.5, 28-30 MHz
Antenna impedance	50 - 75 ohms
Carrier suppression	-40 dB
Sideband suppression	-40 dB (1500 CPS)
Spurious radiation	-40 dB
Audio bandwidth	300 - 2700 CPS <u>+3</u> dB
Operation	Manual, P.T.T., Break-in keying
Microphone	High impedance (50K ohms)
Power requirement	220V AC 50/60 CPS 130VA
Dimension	334 m/m Wide, 153 m/m High, 262 m/m Deep
Weight	7 kg

BLOCK DIAGRAM



CIRCUIT DESCRIPTION

Output of carrier oscillator V2, 12AT7 is injected to the balanced modulator, and audio signal from microphone amplifier V1, 6BA6 is applied to the balanced modulator through cathode follower V2, 12AT7. This signal then passes through crystal filter which eliminates lower sideband thus resulting in a USB signal at a carrier frequency of 5172.4 kc.

The 5 Mc signal after passing through the filter is amplified by IF amplifier tube V3, 6BA6, thence to grid of mixer tube V4, 6CB6 together with local oscillator signal. The resultant mixed frequencies appear at plate tuned circuit of the mixer and is the transmitting output signal frequency.

Local signal from V7, $\frac{1}{2}$ 6U8 is subtractively mixed with the USB signal from IF amplifier stage to result in LSB operation on 40 and 80 meters, and the frequencies are additively mixed resulting in output on the opposite sideband on 20, 15 and 10 meters.

Determination of local crystal frequencies:-

For 40 and 80 meters

Transmitting frequency + 5172.4 = Crystal frequency in Kc

For 20, 15 and 10 meters

Transmitting frequency - 5172.4 = Crystal frequency in Kc

Use fundamental crystal for 80 and 20 meters, $\frac{1}{2}$ for 40 and $\frac{1}{3}$ for 15 and 10 meters.

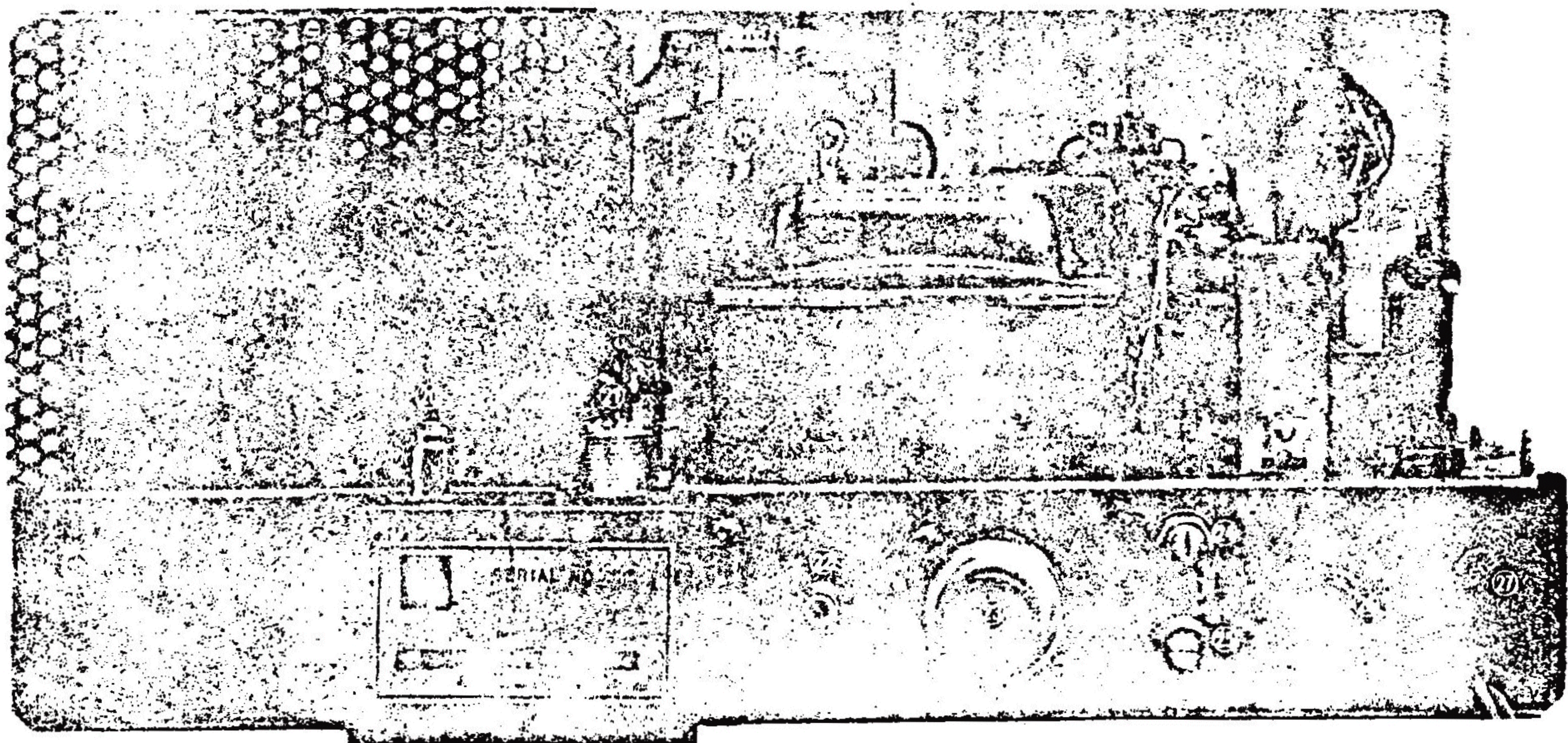
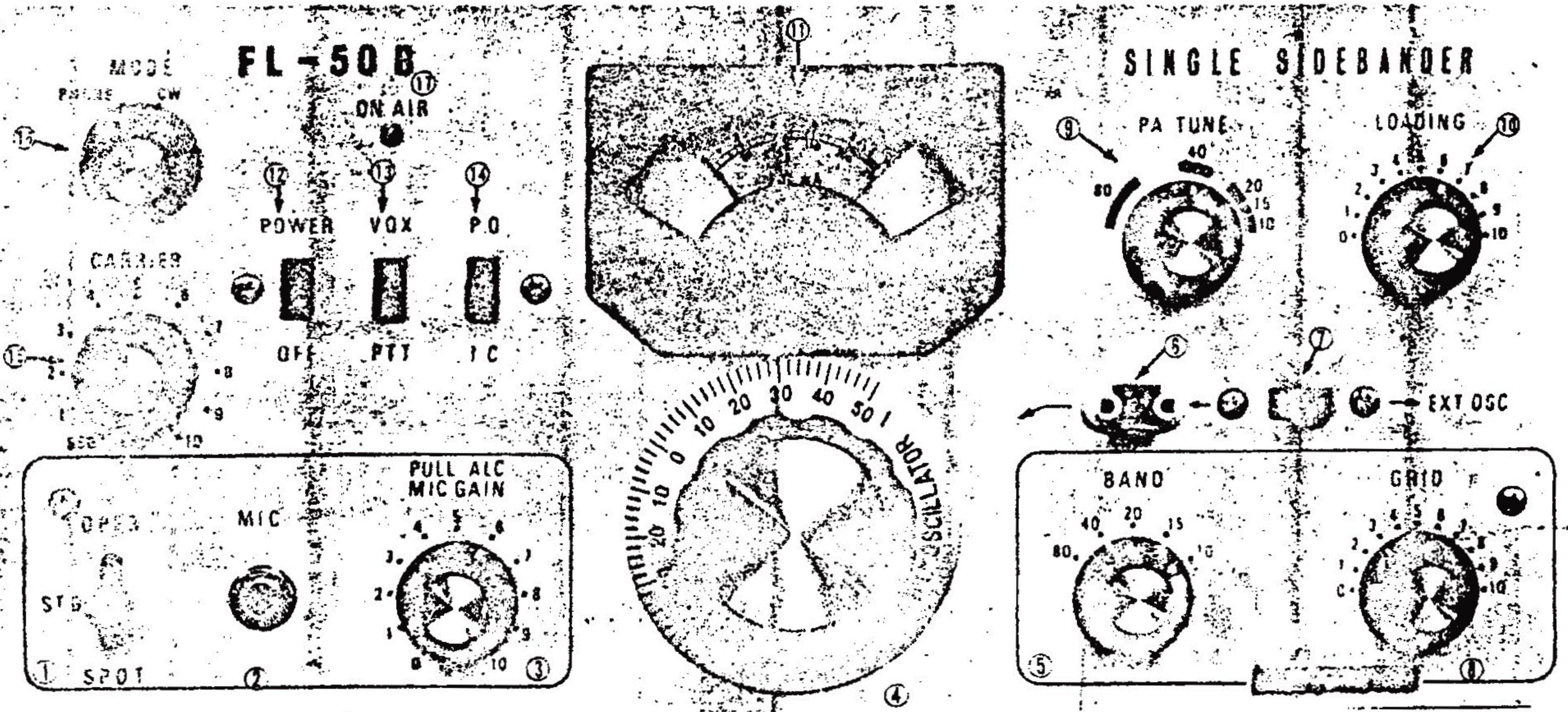
For AM and CW operation, the carrier signal is injected to the grid circuit of the mixer tube through carrier control potentiometer.

This signal is amplified by V5, 12BY7 tuned driver and finally to power amplifier tube V6, 6JS6A, and antenna. Power amplifier tube operates in class AB2 for maximum power output.

The AC audio component of PA grid current, when overdriven by signal peaks, is rectified by diodes D5/D6 to provide an ALC (automatic level control) voltage into the IF amplifier stage thus reducing its gain and maintaining low distortion.

The PA PI network plate circuit provides attenuation to the higher order harmonics and enables easy, flexible adjustment of impedance matching to antenna feedline.

On CW, manual or break-in keying methods are available. On phone, Push-To-Talk control is available. VOX control can be installed as illustrated in this manual.



OPERATION

Function of Operating Controls

1. OPEP Selects functions of calibration, receiving and transmitting operation.
2. MIC Microphone jack. 3 contact T.R.S. type.
3. PULL ALC MIC GAIN Potentiometer controls microphone gain and switch selects meter to ALC indication.
4. VXO Knob shifts crystal frequency few kilocycle.
5. BAND Band switch.
6. CRYSTAL SOCKET ... For crystal control, use HC-6U type crystal and frequency calculation is given on page 2.
7. EXT. OSC Selects crystal or external VFO control.
8. GRID Tunes driver, mixer and local oscillator plate circuit.
9. PA TUNE P.A. plate tuning.
10. LOADING P.A. plate loading.
11. METER
12. POWER AC power switch
13. VOX-PTT Selects push-to-talk or break-in CW keying. VOX is optional.
14. PO-IC Switches meter function.
15. CARRIER Carrier level control for CW and AM.
16. MODE Selects operation modes.
17. ON AIR Indicates transmission.
18. GND Earth terminal.
19. RF OUT 3V RF output.
20. REC Connector for receiver.
21. ANT Antenna terminal.
22. EXT. OSC Terminal for external VFO

- 23. REMOTE Accessory socket.
- 24. BIAS Adjusts Bias on PA tube.
- 25. ALC Adjusts ALC meter zero setting.
- 26. KEY Key jack for CW operation.
- 27. FUSE 2A.

Initial Adjustment

Set controls as shown below:-

POWER	:	OFF
OPER	:	STBY
MIC GAIN	:	Fully counter-clockwise and push down
BAND	:	Desired band
GRID	:	12 o'clock position
PA TUNE	:	Desired band
LOADING	:	Minimum loading
METER SWITCH	:	IC
PTT-VOX	:	PTT
CARRIER	:	SSB
MODE	:	PHONE

Insert crystal given from the formula into the crystal socket and place crystal switch toward the crystal socket. When external VFO or receiver VFO is used instead of crystal, the crystal switch should be placed toward EXT.OSC.

Accessory plug must be in its socket to supply heater voltage to final tube.

Connect dummy load to antenna terminal on the rear apron of the chassis.

- 1) Turn on power switch and wait for warm-up.
- 2) Set OPER switch OPER position. Meter shows approximately 60mA. If not, adjust BIAS control at rear.
- 3) Advance CARRIER control to obtain small increase in meter reading.
- 4) Tune GRID for maximum IC reading.

- 5) Adjust PLATE for minimum dip in IC. Switch meter to P.O. and adjust PLATE and LOAD controls in turn for maximum RF output. IC should dip to about 70 - 80% of the off-tune current for best loading condition. At maximum input the IC is about 160 mA, but refrain from using this high current for longer than few seconds, therefore make all adjustments quickly. During tune-up, switch OPFR-STBY switch off periodically to reduce the time transmitter is on with high IC. Meter can be left in IC position for constant monitoring of PA current. Any abnormal rise in IC can then be noted and quickly corrected.

SSB (A3J)

After initial adjustment, insert microphone plug of PTT microphone. If microphone does not have a PTT switch, then short out PTT terminals on plug as illustrated and control transmitter with OPER panel switch. Set CARRIER control to SSB position. Advance MIC GAIN for correct IC meter "kick-up" for normal speaking. Indicated IC will be about half the tuning IC, i.e. about 80 mA. Pull ALC switch on MIC GAIN control. Meter will indicate full scale for no modulation. If not, adjust ALC control on rear. Check that needle does not kick down below limit of green section of scale on speech peaks.

AM (A3H)

At first adjust the transmitter in SSB mode. Then increase CARRIER control until IC shows 80 mA. Adjust MIC GAIN control until meter kicks up about 5 mA, i.e. 85 mA on speech peaks.

CW (A1)

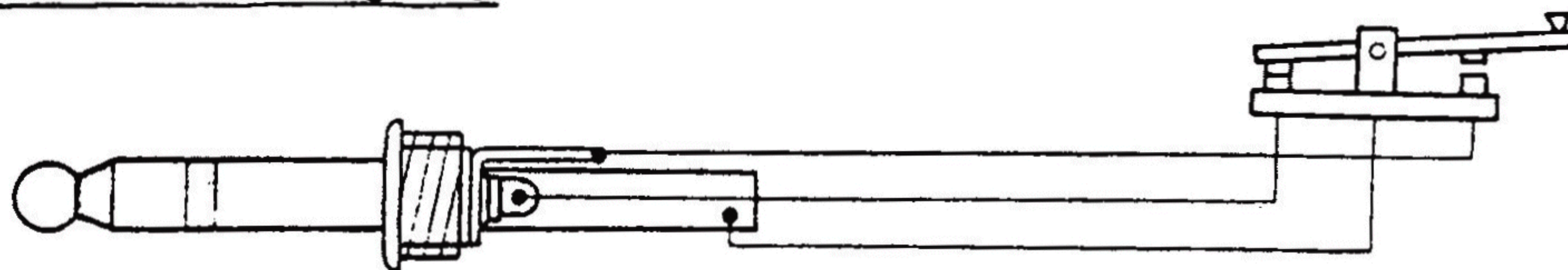
After initial adjustment, set MODE switch to CW position. Insert key plug. Set OPER switch to OPER position and key down. Advance CARRIER control until IC saturates. Do not increase CARRIER control from this point.

For break-in keying, wire the key plug as illustrated and place PTT-VOX switch VOX position.

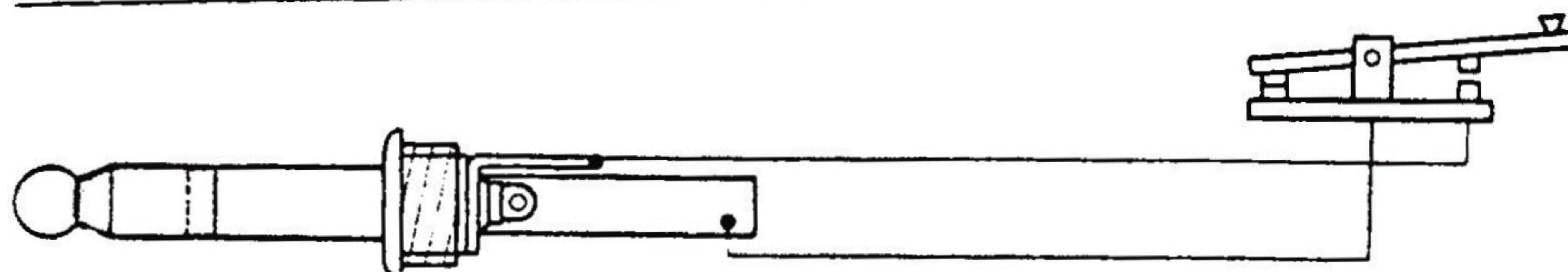
To calibrate transmitter to the receiving signal, switch OPER switch down SPOT position, and increase until zero beat is heard. At SPOT position, weak signal is transmitted for calibration.

Plug Connection

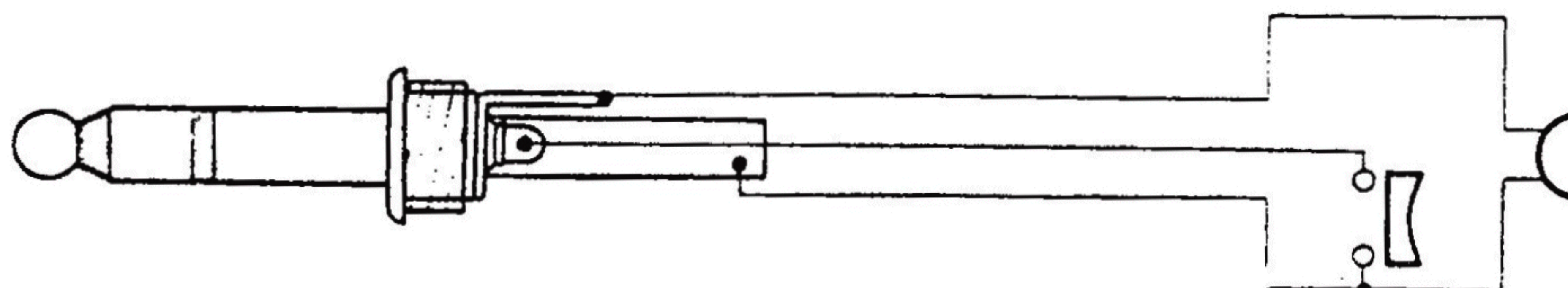
1. Break-in keying



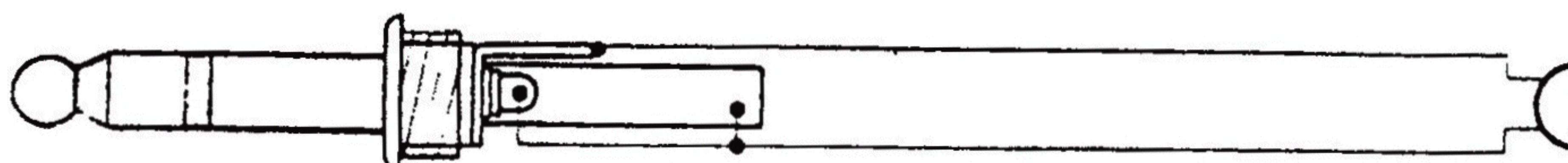
2. Operation switch control



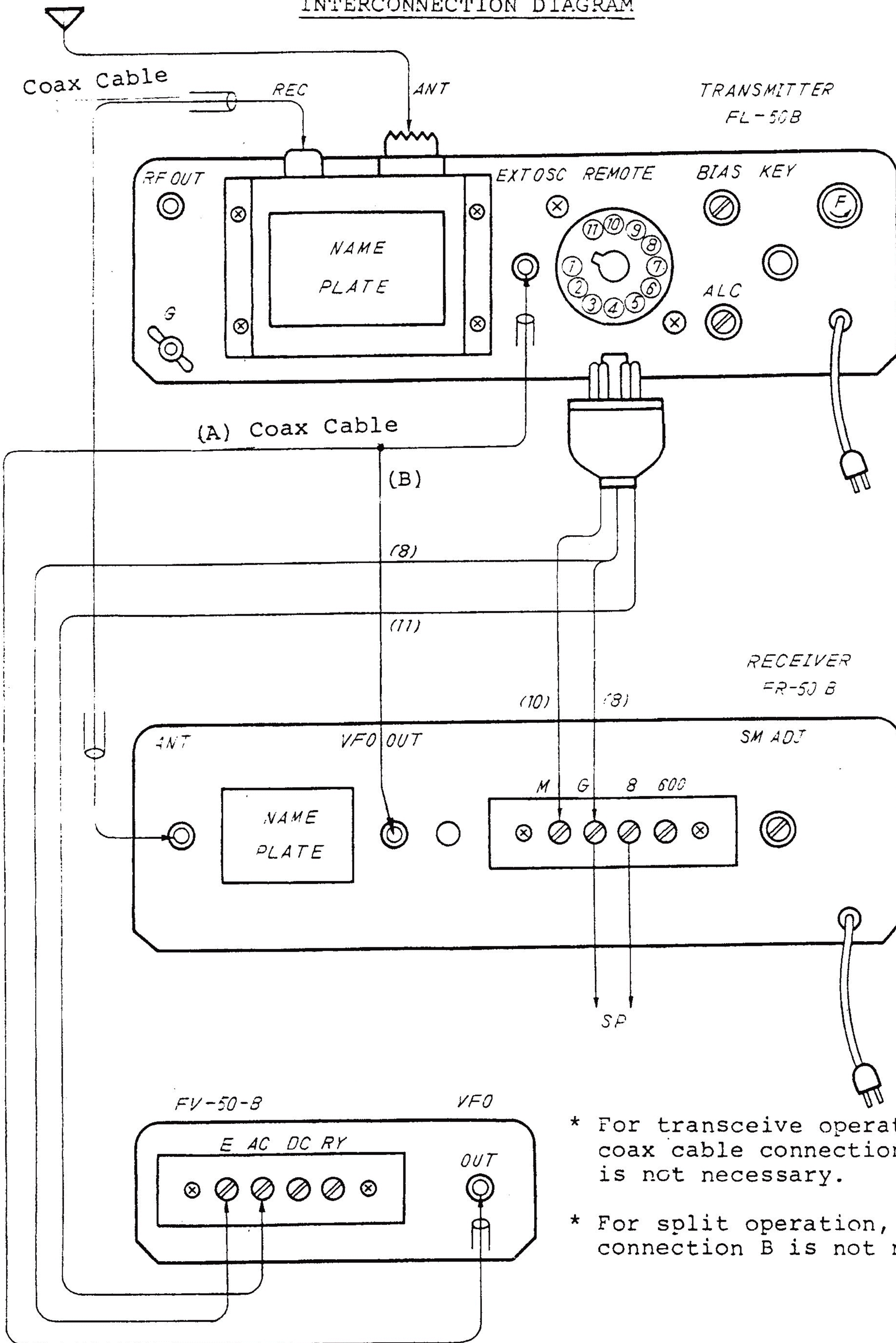
3. Push-to-talk



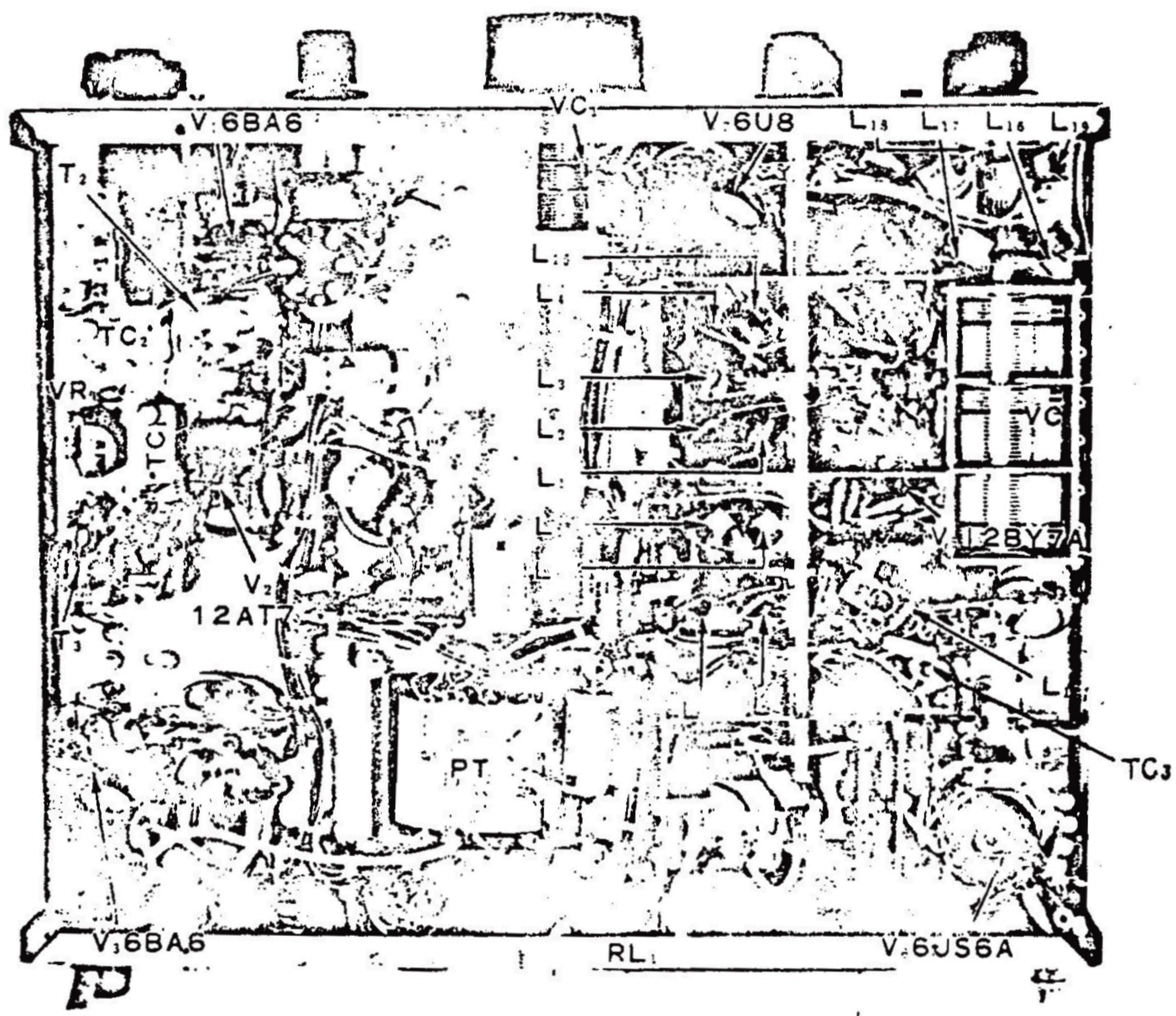
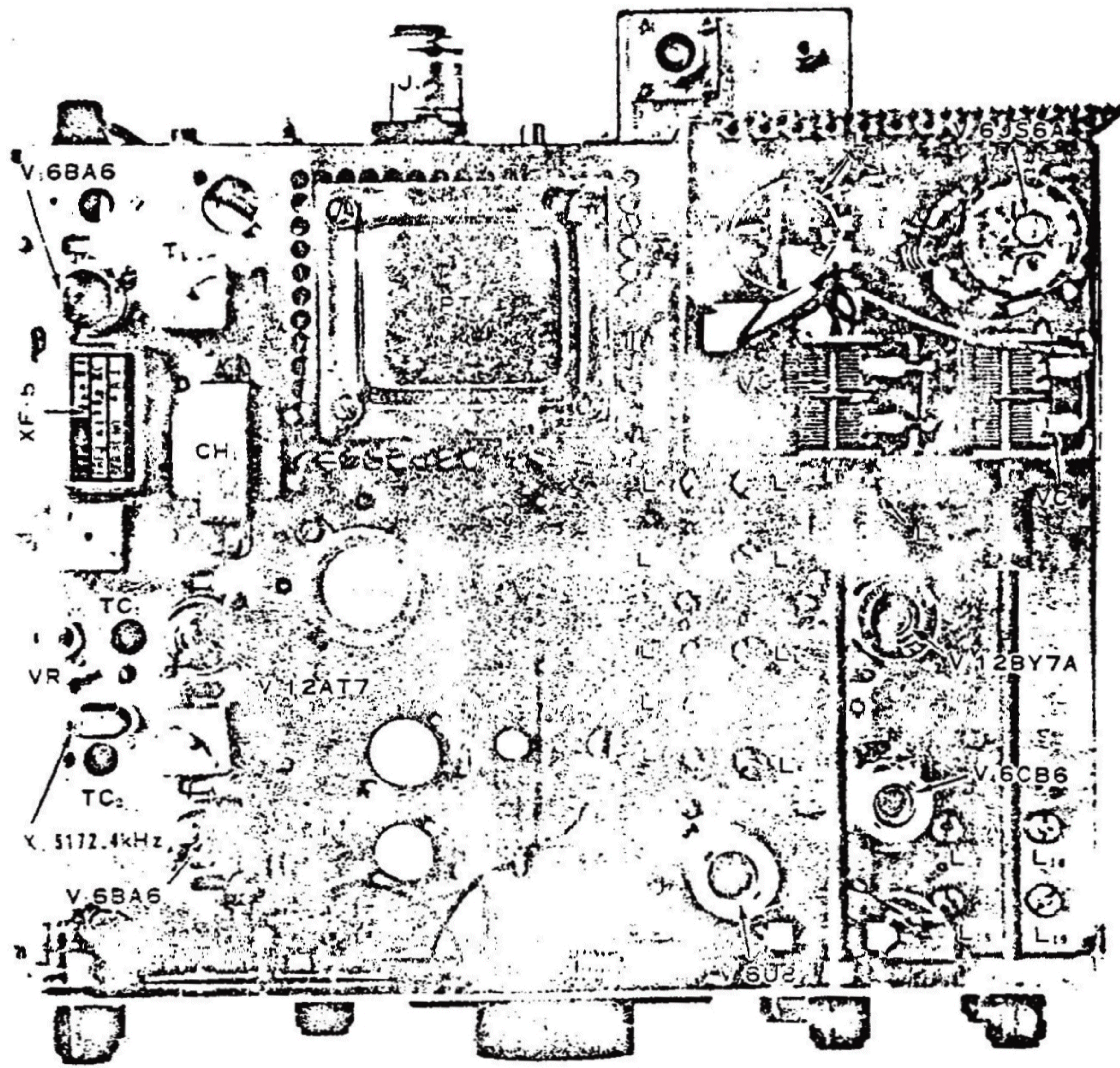
4. Operation switch control



INTERCONNECTION DIAGRAM

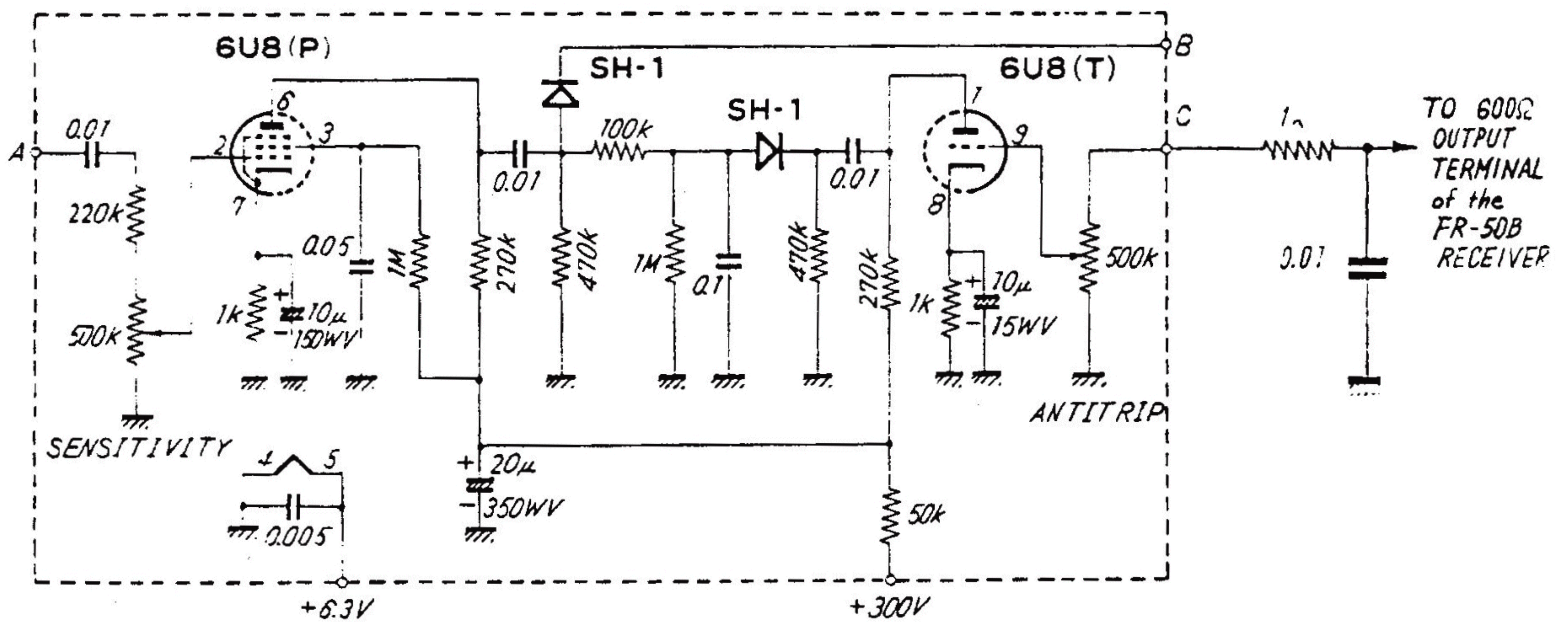


- * For transceive operation, coax cable connection A is not necessary.
- * For split operation, connection B is not necessary.



VOX CIRCUIT

In this transmitter, VOX circuit is not built-in, but can be easily built on the chassis. Recommended circuit diagram is shown below. A, B and C shall be wired to the point marked A, B, C on main circuit diagram.



TROUBLE SHOOTING

Most cases of trouble can be traced to defective tubes. Substitution of new tubes will sometimes clear the obscure case. Intermittent fault in tubes can be discovered by lightly tapping the tube. Occasionally, tube socket terminals will become dirty or corroded causing an intermittent condition.

Table shows typical voltage readings at each tube socket terminal. The value listed are nominal and vary slightly due to the line voltage fluctuation and to normal tolerances in components.

Followings are typical cases of the trouble and trouble shooting guides.

<u>DEFECT</u>	<u>POSSIBLE CAUSE</u>
Fuse blow	Defective transformer, silicon diode or electrolytic capacitor
Relay does not work	Defective relay or V7, 6U8
Insufficient output	Defective tube V5, V7, V3, V4, V2, V6. PA grid improperly tuned. Antenna not resonant at frequency. Defective transmission line. Carrier crystal or local crystal defective.
Insufficient carrier suppression	Carrier balance control improperly adjusted. Carrier frequency improperly set. Defective balanced modulator diodes.
Insufficient sideband suppression	Excessive mic gain, Carrier frequency incorrect. Crystal filter mistuned.

VOLTAGE CHART

* AC voltage

TUBE	SSB	PIN NUMBER								
	MODE	1	2	3	4	5	6	7	8	9
V1 6BA6	OPER	0	0.5	* 6.3	0	60	2	0.5		
	STBY	0	0.5	* 6.3	0	60	2	0.5		
V2 12AT7	OPER	150	0	2.3	0	0	105	0	1	* 6.3
	STBY	160	0	2.5	0	0	115	0	1.2	* 6.3
V3 6BA6	OPER	0	1.3	* 6.3	0	140	80	1.3		
	STBY	0	1.4	* 6.3	0	150	95	1.4		
V4 6CB6	OPER	0	1.8	* 6.3	0	140	110	0		
	STBY	-27	0	* 6.3	0	160	140	0		
V5 12BY7A	OPER	3.4	0	0	* 6.3	* 6.3	0	150	150	0
	STBY	0	-27	0	* 6.3	* 6.3	0	160	160	0
V6 6JS6A	OPER	0	0.05	150	* 0	- 35	0	(10) 0.1	(12)*6.3	(P)300
	STBY	0	0	160	0	-65	0	(10) 0	(12)*6.3	(P)330
V7 6U8	OPER	105	0	70	* 6.3	0	145	0.5	1.5	0
	STBY	330	0	75	* 6.3	0	160	0.5	17	0

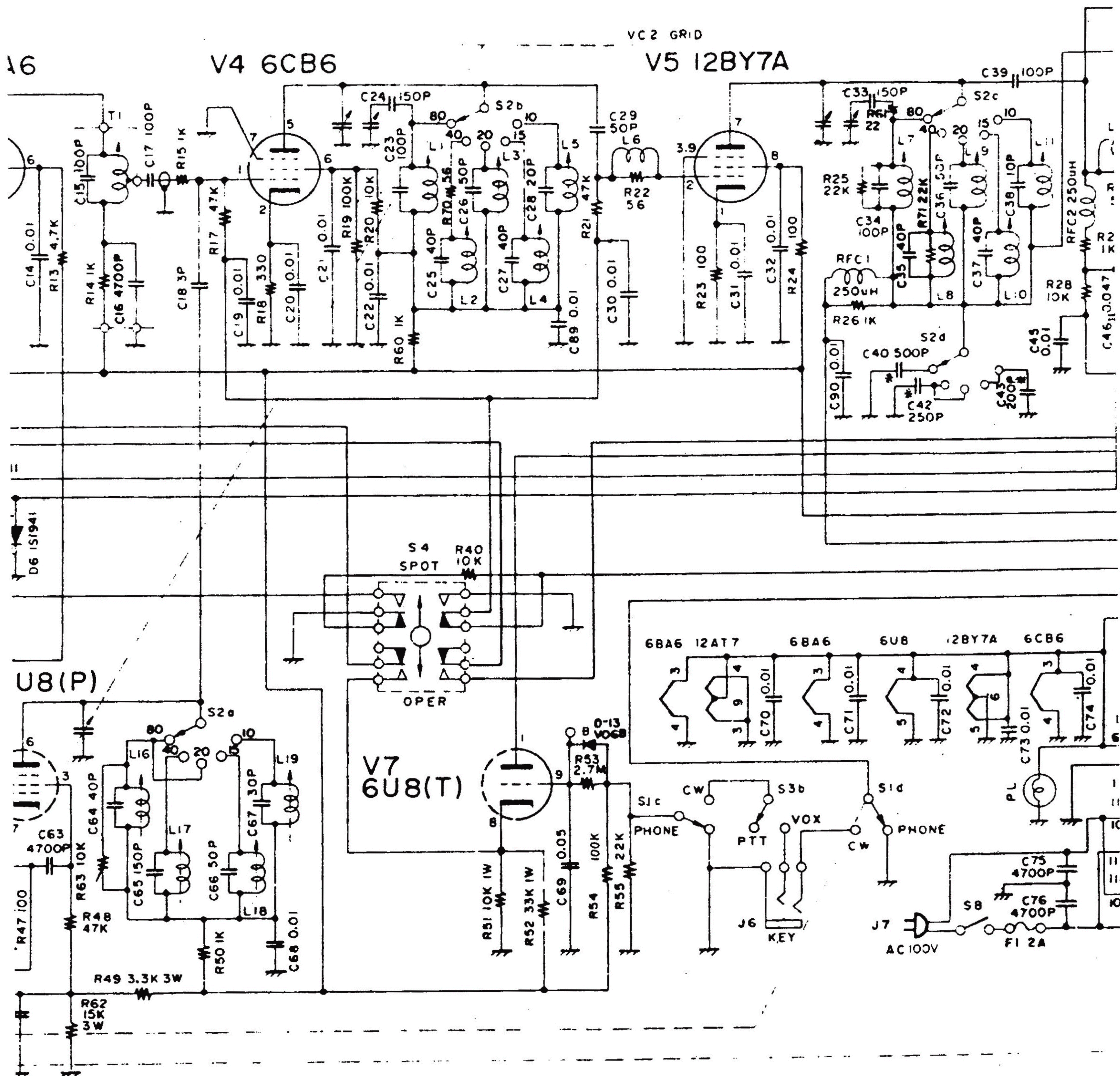
(10) Pin 10, (12) Pin 12, (P) Top cap

16

V4 6CB6

VC2 GRID

V5 12BY7A



U8(P)

V7 6U8(T)

6BA6 12AT7 6BA6 6U8 12BY7A 6CB6

PHONE PTT VOX CW PHONE KEY AC 100V F1 2A

