resistors R21, R22, and R23 or through i-f coil T2. The bridge circuit is necessary to balance out the capacity of the filter crystal holder plates to prevent the signal from by-passing the crystal. If the point of attachment of the rotor of C71 and the output plate of the crystal was returned directly to ground, the Q of the crystal would be at its highest point and the selectivity would be so great as to be almost unusable, therefore, resistors R21, R22, and R23 are placed in series with the crystal circuit to vary the Q. When the SELECTIVITY switch S11 is in the "0" position, the crystal is short circuited and the selectivity is determined by the receiver circuits only. When the SELECTIVITY control is in position "1", the crystal Q is at its lowest point because of the return circuit through T2 (a parallel tuned circuit having high impedance). When the SELECTIVITY control is at "2", the Q of the crystal circuit is improved because of the lower value of series resistance and so on through position 3 and 4 until at position 4 the series resistance is at the lowest usable value and the crystal Q is highest with a resultant high degree of selectivity.

Because the phasing capacity is across T2, detuning of T2 would normally occur when changing the setting of the phasing condenser. To neutralize this effect an additional set of stator plates has been placed on the phasing capacitor which compensates for this detuning effect.

2-10. NOISE LIMITER. - Refer to figure 2-2. One half of V-8, a type 6H6 tube, is used as a noise limiter. The circuit employed here is a new circuit developed for military use. In this circuit the negative half of the audio wave is automatically clipped at approximately 35% modulation by virtue of the heavy value of AC load impedance in the detector circuit. This eliminates the noise peaks from the negative half of the audio wave. However the noise peaks still appear on the positive half of the audio wave so the automatic noise limiter is inserted in the circuit to remove these. This limiter is a series type limiter in that it is placed between the detector and the first audio stage. In operation, the plate of the noise limiter tube has a voltage, taken from the detector load resistor, placed upon it. Since this voltage is positive with respect to the limiter tube cathode, current flows through this portion of the tube. This current is modulated at the cathode by audio from the detector through capacitor C78, thus the audio appears at the plate of the limiter tube from where it is fed to the grid of the audio amplifier tubes. Since the positive audio peaks appear as positive impulses across the detector diode load, the audio impulses through C78 are positive or in opposition to the negative potential on the cathode of the noise limiter tube. Whenever these positive audio impulses get high enough in amplitude to cancel this negative cathode potential, the tube ceases drawing plate current and the audio is interrupted. The value of plate voltage applied to the limiter plate can be set by varying the sizes of the circuit components therefore the cut-off point can be set at any degree of modulation desired. In the

75A receiver this is set at approx. 35% modulation. As a result, any degree of modulation above approx. 35% is clipped on both the positive and negative halves of the audio; therefore, any noise impulses which are greater than 35% modulation are also clipped off. Since the operating voltage for the limiter is taken from the detector load resistor, the clipping level is always at approx. 35% regardless of how weak or how strong the signal becomes. In-as-much as regular speech frequencies do not suffer in intelligibility to any great extent under such circumstances, this system makes an efficient noise limiter.

A filter composed of R39, C80B, and R40 is inserted in the noise limiter plate return to prevent any of the audio from the diode load resistor reaching the noise limiter output directly rather than through the noise limiter tube. A switch, S14, has been placed in the circuit to by-pass the noise limiter where operating conditions do not require its use.

2-11. AUTOMATIC VOLUME CONTROL. - In order that the receiver may operate at peak efficiency on weak signals, a system of delayed AVC is employed. Refer to figure 2-3. Notice that the cathode of V9 is connected to ground through a voltage divider consisting of R43 and R44. B+ voltage is introduced to the cathode of V9 through R43. This places the delay voltage on the cathode of V9. The plate of V9 is coupled to the i-f amplifier through C74 and therefore, as soon as the received signal becomes strong enough to overcome the positive bias on the cathode of V9, rectification of the signal takes place and AVC control voltage appears across the load resistor R36. At the same time, rectification of the i-f signal is taking place in the detector circuit, and since the grid of the AVC tube, V9, is connected to the positive side of the detector load resistor, the delay voltage is being cancelled by the positive detector voltage. Therefore, the delay voltage is cancelled out allowing the full AVC voltage to be realized, and at the same time an accelerating effect is produced allowing the S-meter to begin functioning sooner than in other delay circuits.

AVC voltage developed across load resistor R36 is fed to the controlled stages through filter resistor R35. Filter resistor R35 and filter capacitor C80A remove AC components from the AVC line. The r-f amplifier, variable i-f, and the first and second fixed i-f stages have AVC voltage applied to them.

SECTION III

INSTALLATION AND INITIAL ADJUSTMENTS

3-1. INSTALLATION.

3-2. UNPACKING. - Refer to figure 1-1. The Model 75A Receiving Equipment is packed in a number of heavy cartons. Refer to the packing slip for a list of all equipment supplied. Open packing cartons carefully to avoid damage to the units within. Remove the packing material and carefully lift the units out of the cartons. Search all of the packing material for small packages. Two extra pilot lamp bulbs and one extra fuse are included with each equipment. Inspect each unit for loose screws and bolts. Be certain all controls such as switches, dials, etc., work properly. All claims for damage should be filed promptly with the transportation company. If a claim is to be filed, the original packing case and material must be preserved.

3-3. INSTALLATION PROCEDURE.

3-4. GENERAL. - The receiver is intended primarily for table mounting. Before attempting to relay rack mount the receiver, make certain the rack has a large enough opening. The receiver and speaker cabinets are both equipped with rubber feet and may be mounted on any table.

When choosing a location for the receiver, consideration should be given to convenience of power, antenna and ground connections, placement of cables and to maintenance.

3-5. CONNECTIONS.

3-6. ANTENNA AND GROUND. - Viewing the receiver from the rear, the antenna and ground connections are at the extreme right hand side of the chassis. Terminals number 1 and 2 should be used for antenna connections if a balanced antenna is employed. If an unbalanced antenna is used for general coverage, connect the antenna to terminal #1 and jumper terminal #2 to ground (G). Connect a good external ground to the G terminal regardless of what kind of an antenna is used. It is recommended that a balanced antenna of good construction and well in the clear be employed. An antenna cut to the operating frequency employing 300 ohm feeders will have optimum sign signal to noise ration but will have directional characteristics and be most efficient on the one band.

3-7. SPEAKER. - Viewing the receiver from the rear, the speaker connections are at the left hand side of the chassis. Two output impedances are available, 500 ohms and 4 ohms. Terminal C is the common terminal while the second terminal from the left is the 4 ohm connection and the third terminal from the left is the 500 ohm connection. The model 270G-1 speaker should be connected to the 4 ohm terminals.

INSTALLATION AND INITIAL ADJUSTMENTS

3-8. AUXILIARY.

a. STANDBY. - A pair of terminals located at the rear of the chassis marked "STD BY RELAY" is provided for connecting a relay or other similar device for automatically disabling the receiver for break-in operation. These terminals break the cathode circuits of certain tubes and are in parallel with contacts on the OFF-FIL ON-B+ switch. If these connections are used, they will be operable when the OFF-FIL ON-B+ switch is in the FIL ON position and shorted when this switch is in the B+ position.

b. CW BREAK-IN. - Terminals at the rear of the chassis marked "G" and "B" are provided for CW break-in. The receiver can be muted during CW operation by applying a +20 volt potential to the terminal marked "B". This potential can be obtained from the cathode of a keyed stage (providing it is biased to cut-off) or from a "B" battery connected through the keying relay to the receiver muting terminal. Also, if the transmitter is cathode keyed, a resistor can be inserted in series with the key and ground and the muting voltage taken from across this resistor. Terminal "G" must be connected to the transmitter ground if receiver muting is employed.

Note that this muting system does not provide protection to the input of the receiver. Protection of the input circuits of the receiver is a separate problem. It is recommended that a small neon bulb be connected between antenna and ground terminals of the receiver for this purpose. In the event a high powered transmitter is used, it is recommended that an antenna-ground shorting relay be used in addition to the neon bulb.

3-9. POWER. - Power connections to the receiver are made by means of a 5-1/2 foot permanently attached power cord. The end of the cord is equipped with a standard AC plug. The equipment consumes 80 watts of 115 volts 50/60 cps power.

3-10. HEADPHONES. - Headphone connections are made by means of a panel jack and a standard 1/4" dia. plug. 500 ohm headphones should be employed, however, any higher impedance phones will be quite satisfactory.

3-11. TUBES. - Before turning the equipment on for the first time, inspect the tubes and see that they are in the correct positions and firmly seated in their respective sockets. Be sure the tube shields are on the type 6AK5 tubes.

3-12. FUSE. - The fuse is located on top of the chassis near the rear right hand corner. Contained within an extractor type fuse post, the fuse can be removed for inspection by turning the cap of the post to the left and pulling straight back until the cap and fuse comes free.

3-13. INITIAL ADJUSTMENTS.

3-14. GENERAL. - As shipped from the factory, there are no adjustments which will be necessary to place the receiver in immediate operation, however, the S-meter can be adjusted for various antennas if desired. The S-meter has been set to read S-9 with a 100 microvolt signal presented to the antenna terminals from a 300 ohm load. If desired, the S-meter can be allowed to remain as adjusted at the factory, in which case, the receiver is ready to operate. Refer to SECTION IV for FUNCTIONS OF CONTROLS and operating notes.

3-15. S-METER ADJUSTMENT. - In event a beam antenna is used on the receiver, the S-meter can be set back to correspond to the gain of the antenna thus allowing a more accurate reading. To do this it will be necessary to know the approximate gain of the beam. If this is known, a signal can be tuned in and the SENSITIVITY adjustment (see figure 5-2) can be rotated until the S-meter reading is a comparable amount lower. (One S unit equals 6 db on the meter). After adjusting the sensitivity of the meter, short circuit or remove the antenna and adjust the meter for zero reading with the ZERO adjustor.

MUTING COLLINS 75A-1 RECEIVER FOR CW BREAK-IN OPERATION

A method has been worked out wherein the 75A-1 Receiver may be silenced when CW break-in operation is desired. This muting is accomplished by applying a 20 volt positive potential to the cathode (pin #8) of the 6H6 detector limiter tube (V8) when the transmitting key is closed. This 20 volts should drop to zero when the key is up. A one half megohm isolating resistor should be connected to the socket pin #8 of (V7) in series with the lead running out to the plus 20 volts.

One place this muting voltage may be obtained is from the voltage drop across a cathode resistor in the transmitter. The tube in the transmitter whose cathode resistor is used for this purpose should be a tube which is biased to cut off when the transmitter key is open.

It is necessary that a common ground connection be used between receiver chassis and transmitter chassis.

This voltage may also be obtained from a B battery or a low voltage power supply, and its application to pin #8 of (V7) in the receiver may be controlled by a relay which in turn is operated by the transmitter keying circuit.

In the event cathode keying is used in the transmitter, a resistor may be placed between key and ground, and the voltage drop across this resistor may be used to supply the muting voltage.

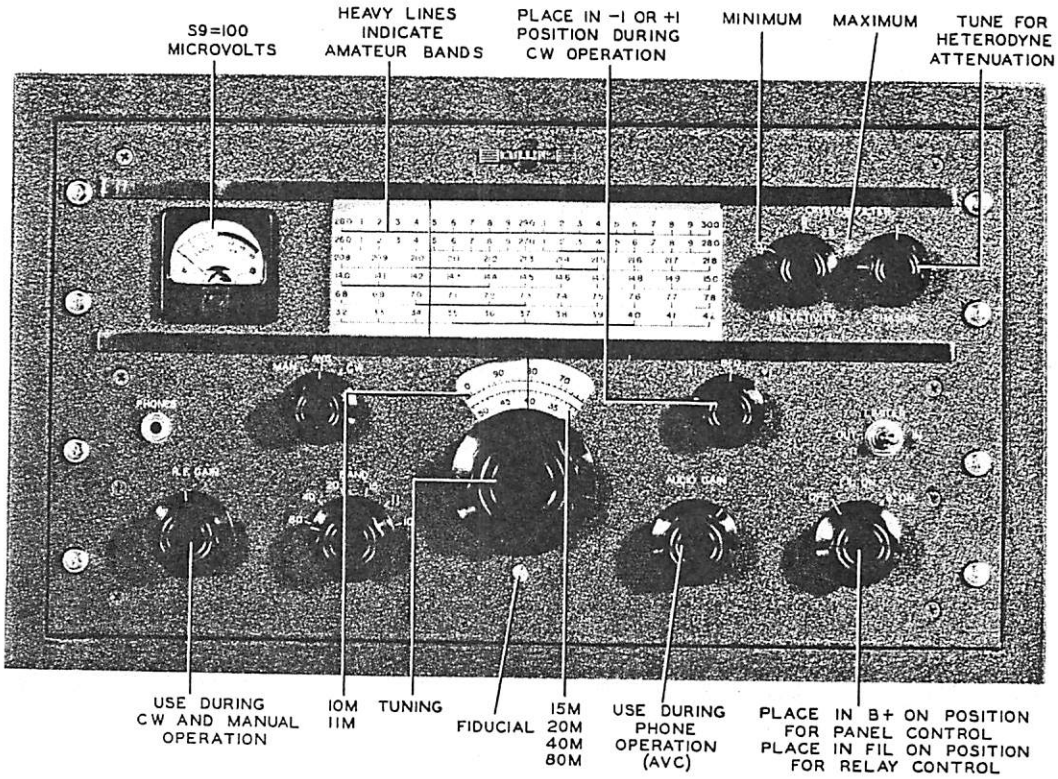

FIGURE 4-1 OPERATING CONTROLS

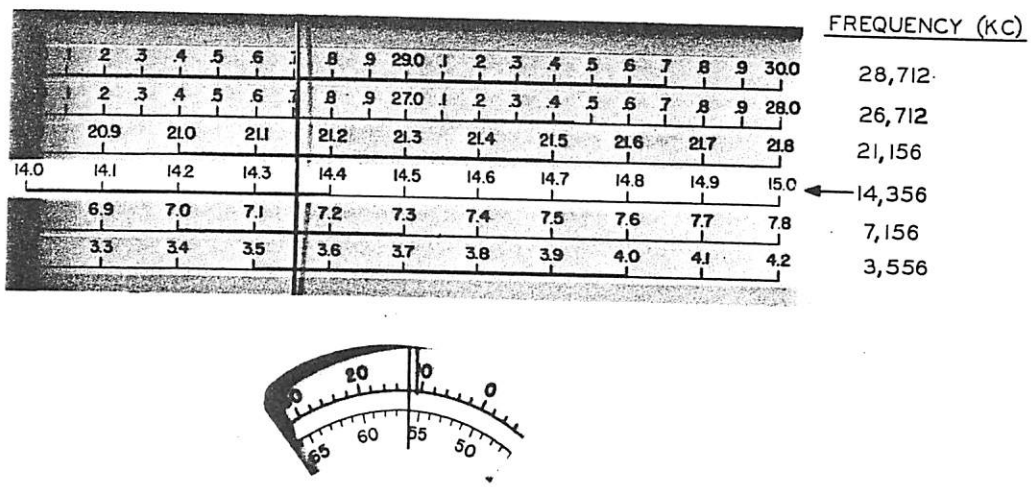

FIGURE 4-2 TYPICAL DIAL READINGS

SECTION IV

OPERATION

4-1. GENERAL.

This section contains only the information necessary for adjusting the 75A receiver during normal operation.

4-2. FUNCTION OF CONTROLS.

4-3. OFF - FIL ON - B+ ON. - See figure 4-1. This knob controls the plate and filament power in the receiver. In the OFF position this control turns the receiver completely OFF. In normal operation the control is turned to the B+ ON position. During stand-by, the control can be turned to the FIL ON position thus disabling the receiver but allowing the tube filaments to remain heated.

4-4. BAND SWITCH. - The BAND switch, located at the left of the TUNING dial, selects the amateur band upon which reception is desired and at the same time illuminates both the correct dial scale in the slide-rule dial, and the correct portion of the vernier dial.

4-5. MAN-AVC-CW. - This control is provided to select either automatic or manual volume control and to turn the beat frequency oscillator on for CW reception.

4-6. TUNING. - The TUNING Control is equipped with a large knob for ease and comfort in operation. Two scales make up the tuning dial. The slide rule dial is calibrated in divisions of 100 kc each while the vernier dial is calibrated in 1 kc divisions on the 80, 40, 20, and 15 meter bands and 2 kc divisions on the 11 and 10 meter bands. The upper scale on the vernier dial is 2 kc per division, the lower scale is 1 kc per division. The proper scales on both dials are illuminated by operation of the BAND switch.

In reading the TUNING dial, it is merely necessary to combine the vernier dial reading with the slide-rule dial reading. Thus the 10 meter dial reading in figure 4-2, would be 28712 kc. The vernier dial supplies the last two figures of the frequency in kilocycles on all bands whereas the slide-rule dial supplies the first two figures of the frequency in kilocycles in the 80 and 40 meter bands and the first three figures in the 20, 15, 11 and 10 meter bands.

4-7. CRYSTAL FILTER.

a. SELECTIVITY. - The selectivity of the receiver is varied with the SELECTIVITY control. The band width is adjustable in 5 steps from 4 kc to 200 cycles at 2 times down (6 db down from the peak of the resonant frequency). Position 0 is broad tuning while position 4 is sharp tuning.

b. PHASING. - The phasing control is used primarily to assist in rejecting interfering heterodynes. The control when positioned on the panel mark (straight up), is properly set for crystal phasing. In the event a high frequency heterodyne is interfering with reception, the control should be moved back and forth in the vicinity of the panel mark until the heterodyne is attenuated. If the heterodyne is low frequency (low pitched whistle) the control should be moved farther out from the panel mark on either side.

4-8. BFO. - The beat frequency oscillator control is located to the right of the vernier tuning dial. This control is used only during CW reception. Because of the high degree of selectivity obtainable with this receiver, it is important that the BFO control be used properly during CW reception. The control should be operated to +1 or -1 on the panel to obtain the beat note, do not allow the BFO control to remain at "0" setting and detune the tuning dial to obtain the beat note, since this would result in a loss of signal strength. If an accurate frequency check of the received signal is wanted tune the signal to zero beat with the TUNING dial then add 1 kc to the dial reading if the BFO control is set at +1 or subtract 1 kc if the control is set at -1.

4-9. RF GAIN. - The RF GAIN control is connected in the cathode circuits of the r-f amplifier, the second mixer, and the second 500 kc i-f stages. It is used when manual volume control is desired. Operating the MAN-AVC-CW switch to MAN or CW connects the control into the circuit and disables the AVC circuit.

4-10. AUDIO GAIN. - The AUDIO GAIN control is used to control the audio amplification of the receiver. This control is used primarily during radio telephone reception when the automatic volume control is functioning.

4-11. PHONES. - The phones jack is located on the front panel of the receiver. Any headphone may be employed, 500 ohm impedance preferred. The speaker is automatically disconnected when the headphones are plugged in.

4-12. LIMITER. - The LIMITER switch controls the use of the automatic noise limiter.

4-13. MOVEABLE FIDUCIAL. - The line on the vernier dial can be set to exact frequency by tuning in a signal from a frequency standard and moving the fiducial to correspond. (WWV can be found at 15 MC on the 20 meter band).

4-14. OPERATION. - While the 75A receiver contains many new and improved principles and circuits, a simplicity of operation found in few other receivers has been obtained. Familiarity with the FUNCTIONS OF CONTROLS, paragraphs 4-2 through 4-11 and reference to figure 4-1 will enable any amateur to operate the receiver. For those not familiar with the amateur bands, the following paragraphs are written.

OPERATION

The postwar amateur bands, upon which standard equipment can be expected to operate, are converted to frequency as follows:

80 meter band = 3500 to 4000 kc
40 meter band = 7000 to 7300 kc
20 meter band = 14000 to 14400 kc
11 meter band = 27195 to 27455 kc
10 meter band = 28000 to 29700 kc

An additional band, the 15 meter band (21000 to 21500 kc) is pending; therefore, it also is included in the 75A receiver.

The BAND switch calibration is in meters.

Each amateur band is indicated with a heavy line on the slide-rule dial; therefore, the band is quickly found during band change.

While the United States amateur is allowed to operate only within the frequency limits of 28000 to 29700 kc on the 10 meter band, some foreign amateurs are allowed to operate to 30,000 kc. This has been taken care of by extending the 10 meter scale to 30,000 kc in the 75A receiver, however, the heavy line only covers the band to 29700 kc.

SECTION V

MAINTENANCE

5-1. INSPECTION.

5-2. GENERAL. - This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5-3. ROUTINE INSPECTION. - Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects and deterioration of components.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is, therefore, important that this inspection be made as frequently as possible and it should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

5-4. CLEANING. - The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion itself is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity accumulates in any part of the equipment. It is very important that rotating equipment such as variable condensers and tap switches be kept free from dust to prevent undue wear.

One of the greatest sources of trouble in equipment located in a salt atmosphere is corrosion. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general it will be found that contacts such as tap switches, tube prongs, cable plug connectors and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays etc., should be made more frequently in order to keep the equipment in good condition.

5-5. VACUUM TUBES. - Make a check of emission characteristics of all tubes. After the emission check, examine the prongs on all tubes to make sure that they are free from corrosion. See that all tubes are replaced correctly and firmly seated in their sockets, and a good electrical contact is made between the prong of the tube and the socket. Before a tube is discarded,

make certain that the tube is at fault and the trouble is not a loose or broken connection within the equipment. A complete set of tested tubes of the same type specified should be kept on hand at all times. If faulty operation of the equipment is observed and tube failure suspected, each tube may be checked by replacing it with a tube known to be in good condition. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit.

If tubes have been in use for a period of time equal to or exceeding the manufacturers tube life rating, it is suggested that they be replaced. A marked improvement in the performance of the equipment is usually noticeable after the weak tubes have been replaced.

5-6. TUBE REPLACEMENT PRECAUTIONS.

a. All tubes are removed by pulling straight up on them.

b. Before a tube is inserted, make certain that the type of tube is correct for the socket into which it is being placed.

5-7. TUBE TABLE.

RECEIVER:

Symbol	Type	Function
V1	6AK5	RF amplifier
V2	6SA7	First mixer
V3	6SK7	First i-f amplifier
V4	6L7	Second mixer
V5	6AK5	Crystal h-f oscillator
V6	6SG7	500 kc i-f amplifier
V7	6SG7	500 kc i-f amplifier
V8	6H6	Noise limiter
V9	6SJ7	AVC
V10	6SJ7	BFO
V11	6SJ7	Audio amplifier
V12	6V6	Output tube
V13	6SJ7	Variable frequency oscillator
V14	5Y3 GT	Rectifier

5-8. TROUBLE SHOOTING

MAINTENANCE

5-9. GENERAL. - The most general cause of improper operation of radio equipment is tube failure. Refer to paragraph 5-5 in this section for comments concerning vacuum tube replacement. Defective tubes causing an overload in power circuits may usually be located by inspection. Corrosion resulting from operating the equipment in a salt laden atmosphere may cause failure of the equipment for no apparent reason.

In general, trouble encountered in radio apparatus may be isolated by means of various tests and measurements, and the section of the equipment determined in which the trouble is located. If this is done, the components in the associated circuit may be checked and the trouble located. Refer to the table of resistance and voltage measurements.

5-10. NO ONE BUT AN AUTHORIZED AND COMPETENT SERVICE MAN EQUIPPED WITH PROPER TEST FACILITIES SHOULD BE PERMITTED TO SERVICE THIS EQUIPMENT.

5-11. FUSES.

5-12. GENERAL. - This equipment is supplied with a fuse of the correct rating. Fuse failures should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Always replace the fuse with a fuse of 2 amp rating.

5-13. ALIGNMENT.

5-14. GENERAL. - Should the receiver get out of alignment, it is recommended that it be aligned at once since misalignment would cause unsatisfactory performance.

5-15. EQUIPMENT AND TOOLS USED FOR ALIGNMENT.

a. 500 kc to 30 mc signal generator.

b. Fiber or bakelite adjusting tool, 1/8" diameter with screwdriver type bit.

c. Fiber or bakelite adjusting tool, 5/16" diameter with screwdriver type bit.

d. Small screwdriver.

5-16. 500 KC IF. - The i-f frequency for this receiver is the exact frequency of the filter crystal and will be within one or two kc of 500 kc. Thus the first step in 500 kc i-f alignment is to determine the exact frequency of the crystal. This is done by turning the receiver ON and attaching the