RECEPTION SET R 206, MK. 1

SECOND TO FOURTH ECHELON WORK

Note: This information is provisional and is supplied for guidance pending the issue of more complete instructions. All errors of a technical nature should be notified in accordance with Tels. A 009.

CONTENTS

FIGURES

TABLES

MECHANICAL REPLACEMENTS AND ADJUSTMENTS

Removal of the turret and the range scale

1. Unscrew the four 2 B.A. screws fixing the end bearings of the turret and lift the turret assembly out. Care must be taken to avoid damage to the spring contacts, and also to the rows of contact blocks on the turret. The range scale is removed by unscrewing one 0 B.A. bolt at the side of the R.F. assembly. When replacing it ensure that the figure on the scale is that of the compartment in contact with the R.F. spring contacts.

Removal of a coil compartment from the turret

2. The corners of the coil compartments are screwed to the turret by the 6 B.A. screws bolting down the earthing contacts. Hence, to remove a coil compartment, take out three of the screws of the four earthing contacts at the corners of the compartment, including the one fixing the compartment, and swivel the earth contacts about the fourth screw until the compartment can be removed. With compartments at the end of the turret, the outside ends are fixed by two 6 B.A. screws, which must be removed. The compartment cover is fixed by the two screws at each side of the box. To remove the contact strip unsolder the leads from the inside ends of the fixing screws, avoid getting any solder into the screw threads, and unscrew the 6 B.A. fixing bolt on the inside. This frees the individual contact blocks, all of which must be taken out to remove the moulded boards. When removing a coil, unsolder the leads at the end remote from the coil to prevent damage with the soldering iron to the coil or its protective coating. Care must also be taken when replacing a new coil to see that it is not damaged before or during replacement. If the wax coating is damaged, the coil should be re-impregnated (see para. 71).

Note: When replacing coil compartments, great care must be taken to replace all lock washers and to tighten all screws securely.

Removal of the R.F. chassis

3. (a) Remove the supplies plug from its socket on top of the B.F.O. unit, and the earth lead soldered to the tag on top of the B.F.O. unit. Remove the plug of the coupling lead from the socket on the first I.F.

(b) Remove the aerial leads from the input terminals by unscrewing the nuts at the back of the aerial and earth terminals, noting carefully which wire goes to which terminal. Unsolder the wires connecting the main gang condenser to the spring contacts. Unscrew the four retaining screws from the flange at the base of the R.F. chassis.

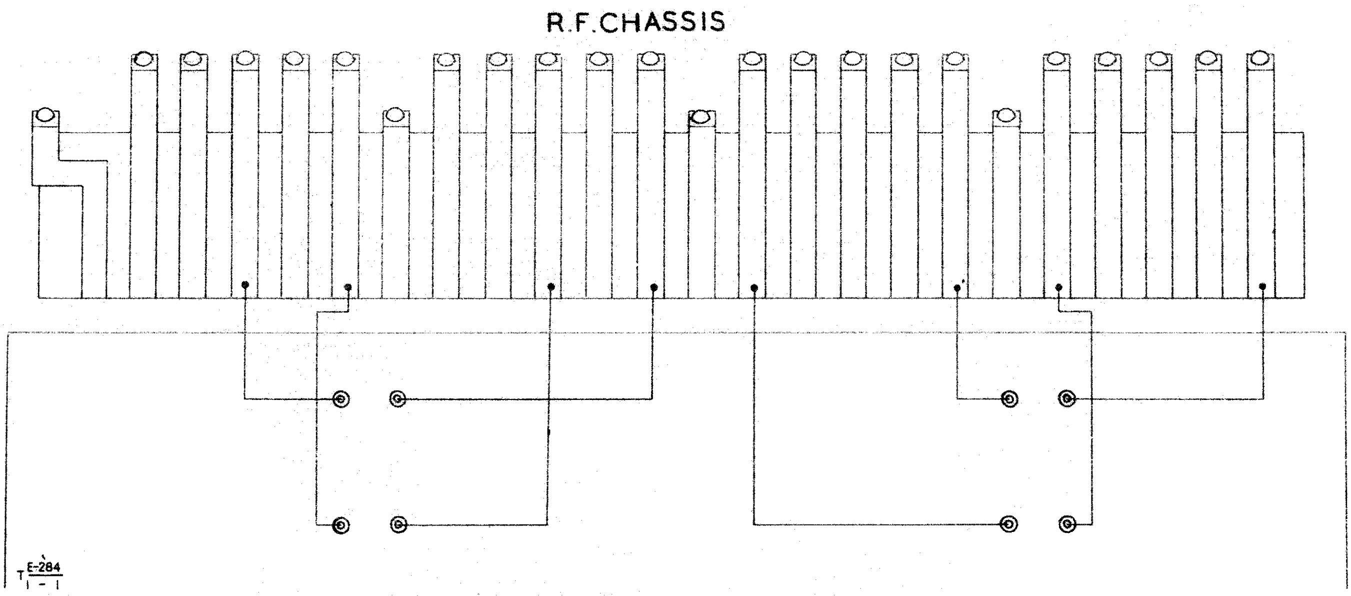

Fig. 1 - Wiring of spring contacts to the gang condenser

4. When removing a valve base from the chassis, at least one of the screens below the chassis will have to be taken out. To do this unsolder all the connecting wires to the components mounted on the screen and remove the four 8 B.A. fixing bolts. The wiring layout must not be altered more than necessary, as this will have serious effects on the alignment. When any operation is performed on the R.F. chassis, the alignment of the set must be checked.

<u>Removal of the R.F. chassis and gang assembly</u>

5. (a) Unscrew the fixing nuts of the aerial input unit and unplug.
(b) Remove the oscillator vernier knob and scale, range handle and both the knobs on the main tuning. Unscrew the locking device of the main tuning. Remove the locking disc by loosening the screw in the clamping collar located between the set front panel and the front of the R.F. assembly and pull the locking disc out. Remove the aerial trimmer knob by screwing the two screws in the spindle union, just behind the front panel. Remove the vernier scale from the bracket on the main drive protruding through the front panel. This is fixed by three screws to the clamping collar on the spindle. Remove the screw just below the indicator mark of the vernier control. This screw locks the slow-motion drive of the latter.
(c) Remove the supply plug, plug to 1st. I.F. transformer, and the aerial connections as described in para. 3, and unsolder the leads to the dial scale lamp.
(d) Unscrew the two 4 B.A. bolts screwed into the metal bracket on the left of the drum scale when viewed from the rear.
(e) Remove the eight 4 B.A. bolts fixing the front panel to the R.F. assembly. Seven of these are cheese-headed and the eighth countersunk. This goes beneath the range handle.
(f) Remove the split pin from the long coin-slotted bolt situated in the centre of the lower edge of the front panel. The split pin is located just behind the panel. Remove the coin-slotted screw.
(g) Remove the 0 B.A. bolt fixing the inner trunnion of the turret assembly to the I.F. chassis. The assembly may now be lifted out.

6. When replacing the locking disc of the main drive, ensure that the top plate of the locking device is over the flange of the disc, and that the vernier is reading zero when one of the red figures of the drum scale is directly covered by the cursor.

Removal of the main gang

7. (a) Remove the R.F. chassis and the gang assembly as described in para. 5 and then remove the turret as described in para. 1.
(b) Remove the vertical driving shaft to the drum scale by loosening the bearing screw in the upper block.
(c) Remove the slow-motion drive from the OSC-VERNIER shaft.
(d) Remove the inside trunnion of the turret assembly by unscrewing the 2 B.A. bolts from beneath the chassis.
(e) The main gang assembly is fastened by six 4 B.A. bolts to the front of the R.F. assembly and five 4 B.A. bolts beneath the chassis. Remove these, lift the assembly upwards until clear of the bar at the rear (the control spindles move in slotted holes) and move back and out.
(f) Remove the R.F. chassis from the main gang case as described in para. 3 and unsolder the lead to the spring contacts. The oscillator vernier and aerial trimmers may now be removed if desired.
(g) To remove the main gang from its case unscrew the four fixing screws on the top of the case. Unsolder the wires to the oscillator vernier and aerial trimmers, noting the connections, and withdraw the main gang. IF IT IS NECESSARY TO WITHDRAW IT SO FAR THAT THE CONNECTING LEADS COME RIGHT OUT OF THE HOLES, THE POSITIONS OF THESE LEADS MUST BE NOTED FOR REPLACEMENT.

Notes for replacing main gang

8. (a) When the assembly has been replaced, the bearing screw at the upper block bearing of the vertical driving shaft to the drum scale must be adjusted to give free movement with no backlash.
(b) To line up the scale with the main gang, rotate the drive until the zero of the red figure scale is opposite the cursor. The lower and bearing housing of the vertical shaft is bolted to the main bracket by a horizontal bolt. Remove the locknut and slacken off the fixing nut until the lower helical gears are out of mesh, so that the condenser may be rotated independently of the drum. Rotate the condenser until the stop is reached with the condenser fully in. This is to coincide with the 0 mark on the 0 - 10 reference scale. Remesh the corner helical gears and adjust the lower end bearing housing to give freedom of movement with no more backlash between main tuning drive and scalle drum than specified below (it may be noted that this adjustable end bearing provides a means for taking up backlash between the main tuning drive and the frequency drum, should any exist). Check that with the gang at the fully open stop, the figure 10 of the reference scale is directly under the cursor.
(c) The backlash between the main tuning drive and the frequency drum should not exceed two divisions and between the main tuning drive and the condenser should not exceed one-fifth of one division, both measurements being made on the 100 division interpolating scale.
(d) If backlash is believed to be present, remove the cover plate over the gearbox at X (see Fig. 2). Rotate the spindle D and observe the movement, if any, of the worm wheel E. Proceed then as follows:-

(i) If D can be rotated with no corresponding movement of E (over about 15° angular movement,) remove the worm. This is accomplished by unscrewing the six screws holding the front plate (not shown in drawing), removing the front plate and feeding out the worm. Check, as the worm comes out of mesh, that the worm wheel is spring-loaded. Replace the worm, spring-loading the worm wheel (E) by two teeth.
Note: There are three springs, and if one or two are broken, and replacements are not available, remove the broken pieces and load worm wheel four or six teeth, as the case may be. Replacement of springs is difficult but can be done in situ by careful manipulation; otherwise the whole gang must be stripped.

(ii) If the ball-headed screw B is suspected of being loose, tighten it up until $\frac{1}{4}$ in. projects beyond the locknut. The position is not very critical, and will cause backlash only if the screw has run right out.

(iii) If, when D is rotated, E moves but the vanes do not, tighten the grubscrews A. A satisfactory method of checking for movement, or lack of it, in the rotor assembly, is to mesh the vanes completely (i.e., condenser at maximum capacity) and then place the tips of the fingers lightly over the rotor and stator assembly. If D is now rotated, very small movements of the rotor can be detected.

(iv) The end bearings C may cause backlash in two ways:-

(a) by being too tight, and thus causing greater friction than that for which the spring loading can compensate. This can be checked by forcing the half of the worm wheel which is fixed to the rotor shaft away from the worm in the direction shown by the double-headed arrow (Fig. 2), and then releasing it, observing if the worm wheel returns to its former position. If it does not, slowly slacken the end screws C until it does.

(b) By being slack, and thus allowing axial movement of the whole rotor assembly. This type of backlash is shown, in addition to the usual lost motion by the gang being thrown out of track, i.e., when the receiver is being tuned to an R/T or M.C.W. signal, greater output is obtained in one direction of rotation than the other, or the output reaches a peak midway between the extremes of the lost motion. To remedy this, slacken the locknut, and tighten the two end screws, keeping the rotor vanes central in the stator vanes until the screws are dead tight; then slacken them until conditions described in (a) are met; then tighten the locknut.

A combination of the above adjustments may be necessary to allow the specification conditions for backlash to be met.

Removal of the I.F. assembly

9. (a) Remove the following control knob. H.F. GAIN, I.F. GAIN, B.F.O., BANDWIDTH, and A.V.C.

(b) Remove the supplies plug and earth lead from the B.F.O. unit, the plug from the first I.F. transformer and the drum scale lamp leads from the pins of the LAMP socket.

(c) Remove the 0 B.A. bolt at the rear of the chassis fixing it to the inner trunnion of the turret assembly, and unscrew the six cheese-headed 4 B.A. fixing bolts on the front panel. The I.F. assembly may now be removed.

(d) Each side panel of the I.F. assembly may be removed, if so desired, by removing the six 4 B.A. cheese-headed bolts at the side.

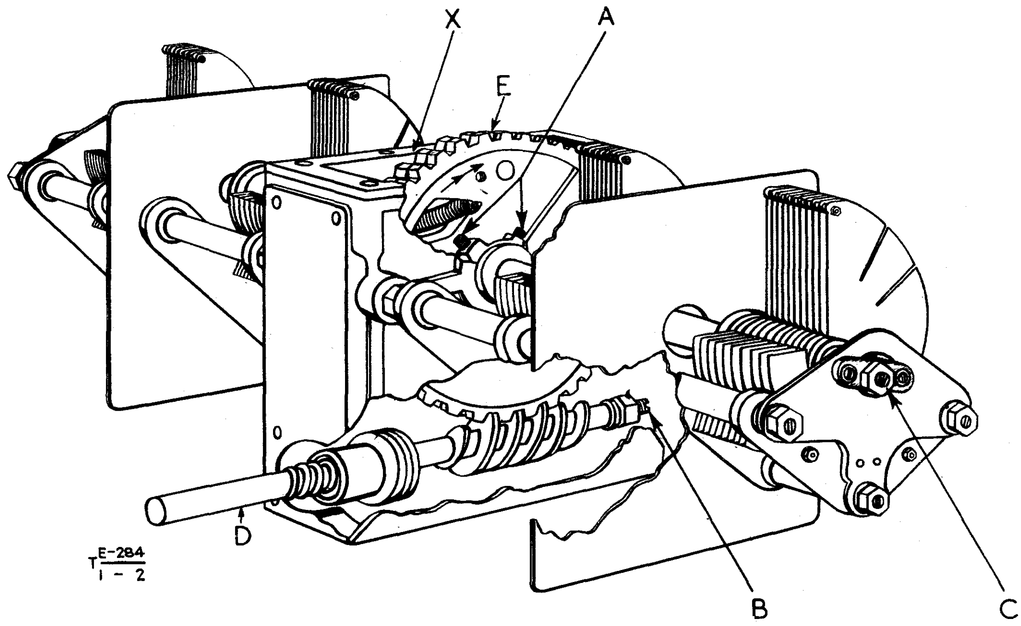

Fig. 2 - Tuning condenser - points at which backlash may occur

Removal of a wafer of the band-width switch

10. (a) Remove the I.F. assembly as detailed in para. 9.
(b) Slacken the grubscrews in the union collar joining the spindles at the click plate and slide the collar back.
(c) Remove the 6 B.A. nuts holding the click plate to the switch assembly and withdraw the click plate and switch spindle.
(d) If one of the front wafers is to be removed, withdraw the two 6 B.A. supporting rods as far as the wafer in question, noting the positions of the spacers. If one of the rear wafers is to be removed, unscrew the 6 B.A. nuts at the rear of the spindles and withdraw the rods towards the front.

(c) Lift out the wafer as far as is possible without straining the leads and unsolder them, noting to which tags they were connected. In the case of the rear wafers it is simpler to remove the leads and tags from the crystal filter sockets.

Removal of the system switch

11. Unscrew the two countersunk screws holding the system switch assembly to the front of the I.F. assembly.

Removal of I.F. cans and A.F. filter

12. These may be removed by tacking out the two holding bolts beneath the chassis and unsoldering the leads to the tags. Access to the cans can, however, be obtained by unscrewing four 6 B.A. bolts at the side of the can and removing the side plate.

Removal of I.F. coils

13. Coil formers are held to the can by means of spring-retaining Spire type nuts on the outside of the can which grip the end of the former protruding through the can. To remove a coil unsolder the leads and twist the Spire nut loose. When replacing the spring Spire nut, it should be pushed up tight against the can with a 2 B.A. box spanner.
Note: In view of the extreme difficulty of carrying out this operation, it should be done only in an emergency.

Removal of cylindrical tagboards

14. These are supported by tapped brass pillars. To remove, unscrew the two 4 B.A. bolts on the upper side of the chassis. In one case the pillars are bolted with the screws retaining a valve base.

Removal of the B.F.O. unit

15. Access may be obtained to the unit by unscrewing the three 6 B.A. bolts at the top of the unit and removing the cover. To remove the unit unsolder the leads to the two tags, noting which lead goes to which tag, and unscrew the four 4 B.A. bolts beneath the chassis.

TEST AND ALIGNMENT PROCEDURE

16. The test equipment required consists of:-

Signal generator, No. 1
" " No. 2, Mk. 1**
Calibrator, crystal, No. 7 or wavemeter SCR 211
Meter, output power, No.3
Voltmeter, valve, 150V, No. 1
Oscillator, B.F.
Oscillator, alignment, crystal filter, No. 1

Setting up

17. It is essential that the I.F. stages are aligned at the peak frequency of the narrow-band crystal filter (approx. 465 kc/s). The procedure for tuning the signal generator is given in para. 20. The standard modulation for testing on this set

is 400c/s at 30% depth, and this will be used unless otherwise stated (140c/s is used for I.F. alignment and testing). Before I.F. alignment is carried out, the crystal filters should be checked to specification and, if necessary, realigned (see paras. 58-68).

18. The normal switch positions of the set are as follows:-

A.V.C. switch to R.T. OFF.
BANDWIDTH KC/S to 0.7
LIMITER and FILTER switches to OUT
H.F. GAIN at 10 (i.e., maximum)
L.F. GAIN at maximum

Any variations from these positions are detailed in the appropriate part of the text.

19. Connect a B.F.O. to the external modulation terminals of the signal generator and set to 140c/s with 30% depth. (140c/s is used to avoid beating with the third harmonic of the 50c/s mains supply. During alignment care must be taken to see that this does not occur). Connect the generator directly to the grid (top cap) of the mixer valve V3A after removing the grid lead. Plug an output meter into the 600Ω LINE output jack and switch to the 10mW range.

20. Tune the receiver to 0.6Mc/s and allow it to warm up. Then carefully tune the signal generator to about 465kc/s for maximum audio output. It is now set to the peak frequency of the narrow-band crystal filter which is the reference frequency, and DURING SUBSEQUENT TESTING IT SHOULD BE FREQUENTLY CHECKED.

21. Switch off the generator modulation and put A.V.C. switch to C.W. OFF. Set the B.F.O. control to its mid-position and adjust C31A for zero beat.

I.F. alignment

22. Dampers are required when trimming some of the I.F. transformers to prevent pulling by other closely coupled circuits. A damper consists of a 0.1μF condenser in series with a 20KΩ resistor.

3rd. I.F. transformer

23. Connect the signal generator directly to the grid (top cap) of V3A and connect a damper from the anode of V2C to earth below the chassis. Care must be taken not to bring any earthy components near to the hot lead of the diode of V4A. With the generator modulated at 140c/s and set to give a suitable audio output, adjust C5L for maximum response.

24. Remove the damper from the anode of V2C and replace on the diode (pin 4 or 5) of V4A. Connect a similar damper to the grid of V2C, taking care not to short-circuit the grid to earth. Adjust C5K.

25. Remove both dampers and check the adjustment by connecting the generator to the grid of V2C. Vary the frequency and observe that the two peaks are within 0.25db. Reconnect the generator to V3A grid and retune as detailed in para. 20.

2nd. I.F. transformer

26. Adjust C5J for maximum output without the use of dampers. Then connect a damper from earth to the grid of V2B beneath its top cap and adjust C5I for maximum.

27. Remove the damper and check the adjustment by connecting the generator direct to the grid of V2B. Switch BANDWIDTH KC/S to 8.0. This overcouples the 2nd. I.F. transformer and there will be two peaks of slightly unequal height, the higher being on the low-frequency side. The trough should be about 3db. below the higher peak and the difference between the peaks not greater than 1.5db. If the asymmetry obtained is outside the limits, the following alternative method of alignment should be tried.

28. Connect the signal generator to the grid of V3A and set to the reference frequency as detailed in para. 20. Switch BANDWIDTH KC/S to 8.0 and connect dampers to the grids of V2B and V2C. Adjust C5I for maximum. Remove the damper from V2C and put it on the anode of V2B. Then adjust C5J. Remove the dampers and check as detailed in para. 27. The choice of the two methods depends upon which gives the least asymmetry.

1st. I.F. transformer

29. Without using dampers and with the generator on the grid of V3A and set to the reference frequency, adjust C5H and C5G for maximum output.

Crystal filter adjustment

30. With connections as detailed in para. 29 and BANDWIDTH KC/S switch to 0.7, adjust the narrow-band crystal filter trimmers C36A and B for maximum output. Switch BANDWIDTH KC/S to 2.5 and adjust C36C and D on the medium filter. DO NOT TOUCH C37A (narrow filter) or C37B (medium filter).

Adjacent channel selectivity

31. With the switch position as detailed in para. 18 and the signal generator connected to the grid of V3A, set the receiver tuning to 1.0Mc/s on range 6. Adjust the generator output to 100μV, modulated at 140c/s with 30% depth, and accurately tune it to the reference frequency.

32. Switch off the generator modulation and put the A.V.C. switch to C.W. OFF and check that the adjustment of C31A carried out as detailed in para. 21 gives zero beat. Return the A.V.C. switch to R.T. OFF and switch on the signal generator modulation. Adjust the L.F. GAIN for an output of 10mW.

33. Detune the signal generator by reducing its frequency by about 20kc/s and increase its output by 200μV. Slowly increase the frequency until an output of 10mW is again obtained. Put the A.V.C. switch to C.W. OFF and increase the frequency of the generator external modulation until it beats with the receiver B.F.O. note and then finally adjust the modulation frequency for zero beat. Note this modulation frequency. Reset the modulation to 140c/s and repeat on the high side of the reference frequency.

34. The sum of the two modulation frequencies thus obtained gives the band-width at 6db. down. Repeat with a generator output of 1mV and 100mV (i.e., at 20db. and 60db. down). The band-width obtained should conform to the figures given in Table 1.

35. Retune to the reference frequency (see para. 20) and repeat the operations detailed in paras. 31 - 33 with the BAND-WIDTH KC/S switch at 2.5. If the figures obtained for either position of the switch are outside the limits, it may indicate that one or other of the crystal filters is out of alignment. The procedure for realignment is given in paras. 58 - 68. This should be carried out only if it is quite certain that a filter is at fault.

36. Reset the signal generator to the reference frequency. Put BAND-WIDTH KC/S switch to 8.0 and measure the band-width at 6, 20 and 60db. down. Use the double beat method as detailed in paras. 31 - 35 for the 6 and 20db. measurements, but for the 60db. measurement the second harmonic of an external B.F.O. must be used.

Input in µV	Increase in db.	Band-width kc/s		
		0.7	2.5	8.0
200 1,000 100,000	0 20 60	0.65-.9 2.3 max. 6.3 max.	2.0-2.5 4.0 max. 8.0 max.	7.0-9.0 13 max. 27 max.
Cut-off slope between 20 and 60db. in db.kc/s		20 min.	20 min.	5.5 min.

Table 1 - I.F. band-widths

A.F. response

37. Connect the signal generator directly to the grid of V2C with the grid lead removed. Put the A.V.C. switch to R.T. ON, BAND-WIDTH KC/S to 8.0, LIMITER and FILTER switches to OUT and LOUDSPEAKER switch to OFF. Modulate the signal generator at 500c/s with 30% depth with an output of 1V. Tune the generator to about 465kc/s for maximum audio output. Set the L.F. GAIN to give an output of 200mW. Maintain the modulation depth at 30%, and vary the frequency between 300c/s and 3,000c/s. The variation in receiver audio output should be within the limits of +3db. and -12db. with respect to the level at 500c/s. There should be no signs of instability.

A.F. filter performance

38. With the same set-up as detailed in para. 37, put the FILTER switch to IN and swing the modulation frequency about 900c/s until the maximum audio output is obtained. This is the centre of the passband and should be 900c/s ± 80c/s. Set the modulation frequency to this peak and adjust the I.F. GAIN for an output of 100mW.

39. Set the FILTER switch to OUT. The audio output now observed should not be greater than 230mW, i.e., the filter insertion loss should not be more than 4db.

40. Set the FILTER switch to IN. Adjust the modulation frequency to points above and below the peak so that the output falls to 25mW (i.e., a reduction of audio output of 6db.). The difference between these two frequencies gives the band-width at 6db. down which should be between 180c/s and 300c/s.

41. Repeat at frequencies to give an output of 2.5mW (i.e., 16db. down). From the band-widths obtained at 6db. and 16db. down determine the filter cut-off slope. On the lower frequency side it should not be less than 8db./100c/s and on the higher frequency side not less than 4db./100c/s.

R.F. alignment

42. The signal generator is connected to the aerial terminals of the receiver as follows. A non-inductive 100Ω resistor is connected in series with the output terminal of the generator and the left-hand (viewed from the front) dipole feeder terminal. The right-hand dipole feeder terminal is earthed.

Ranges 6-3

43. The R.F. circuits are lined up independently of the rest of the set as follows. Remove the grid lead of V3A (earthing the grid to prevent damage to the valve) and connect a valve voltmeter, set to its lowest range, between the grid lead and earth. Connect the signal generator to the aerial terminals of the set as above. Stop the local oscillator from working by inserting a sheet of Paxolin between the turret studs and contact springs. Set H.F. GAIN to maximum and A.V.C. to R.T. OFF.

44. Set the receiver tuning to 1.05Mc/s on range 6 and the signal generator also to 1.05Mc/s with an output, unmodulated, of 100mV. Put the AE TRIMMER to approximately its mid-position and adjust C5D and E, and C4N for maximum output. Reset the generator and receiver to 0.6Mc/s and adjust L24A, L22A and L23A. It will be necessary to repeat this procedure as the capacity and inductance trimmers have an effect on each other. Reduce the generator output as the circuits are aligned, keeping it as low as possible.

45. Carry out a similar procedure on range 5 (at 2.0 and 1.2Mc/s) range 4 (4.5 and 2.5Mc/s) and range 3 (9.5 and 5.1Mc/s), adjusting the condenser trimmers at the upper frequency and the inductance cores at the lower frequency.

46. When the trimming is completed, the tracking is carried out as follows: Set the local oscillator working by removing the Paxolin strip and replace the lead on the mixer grid. Plug an output meter into the 600Ω output jack and externally modulate the signal generator at 140c/s and 30% depth, connected to the aerial terminals as before. Put the receiver switches to the positions as detailed in para. 18.

47. With the signal generator accurately set to the frequencies used for trimming by means of a wavemeter and the receiver dial set also to these points, adjust the condenser trimmers and inductance cores at the upper and lower frequencies of each range. After adjusting the condenser and inductance it will be necessary to repeat, due to the effects of the trimmers on each other, until the calibration is correct. The tolerance is $\pm \frac{1}{2}\%$.

48. When the tracking is satisfactory adjust the mixer grid circuit trimmers (i.e., C5F and L25A for range 6) to compensate for the difference in capacity of the valve voltmeter and mixer grid input. The other trimmers may also be touched to ensure perfect lining-up, using receiver noise, the signal generator having previously been disconnected.

Ranges 1-2

49. As pulling of the local oscillator by the R.F. circuits becomes predominant on these ranges, particularly on range 1, a slightly different procedure must be adopted. The R.F. circuits should be lined up as detailed in paras. 42 - 45, and it is very important that the oscillator is stopped from working. If it is left running, there is a danger of the mixer grid circuit being lined up to the oscillator frequency.

50. When the lining-up is satisfactory, connect the signal generator directly to the mixer grid and, using an input of 1000µV, track the oscillator in the normal way. Calibration accuracy should be within $\pm \frac{1}{2}$%.

51. The final lining-up of these circuits is done, using the signal generator with a very small coupling. Connect the earth side of the generator lead to the earth on the set and hang the live side near the aerial terminal and use only sufficient output to hear the modulation note, trimming of the R.F. and oscillator circuits being done by ear. The final trimming of the upper frequency end of the range should be done, using the receiver noise only.
Note: On range 1 the local oscillator is tracked at 475kc/s below the signal frequency.

<u>Signal-to-noise ratio</u>

52. Put the controls to the positions as detailed in para. 18 except BAND-WIDTH KC/S which should be at 2.5. At each frequency of Table 2 in turn, set the signal generator output, modulated, to a value not greater than that shown. Carefully tune the receiver, including the aerial trimmer, for maximum audio output. Adjust the L.F. GAIN control for an output of 25mW. Switch off the modulation. The residual noise read on the output meter should not exceed 250µW at any frequency (i.e., 20db. signal-to-noise ratio). These figures will be obtained only under ideal conditions and normally (using mains-operated instruments) an increase in input of 50% can be tolerated.

Range	Frequency in Mc/s	S.G. Output in µV
1	29 25 21	2.0 2.0 2.5
2	19 15 11	2.0 2.0 3.0
3	9.5 7.2 5.1	2.0 2.0 2.0
4	4.5 3.5 2.5	2.5 2.5 2.5
5	2.15 1.5 1.2	2.5 2.5 2.5
6	1.05 0.8 0.6	2.5 2.5 2.5

Table 2 - Signal-to-noise ratios

Second channel ratio

53. Put the controls to the positions as detailed in para. 18 except BAND-WIDTH KC/S which should be 8.0. Set the signal generator to the frequencies of Table 3 with a modulated output of 10μV. Tune the receiver and adjust the L.F. GAIN for 10mW output. Now tune the signal generator approximately to the second channel frequency and increase its output so that it can be accurately tuned to the second channel frequency. Now adjust the generator output for an audio output of 10mW. This must require a figure not less than that given in Table 3. If these figures are not obtained, and overloading is suspected, reduce the H.F. GAIN and repeat the test.

Range	Frequency in Mc/s to which receiver is tuned	2nd. channel frequency in Mc/s	Minimum input in μV for 10mW at 2nd. channel frequency	Minimum permissible 2nd. channel ratio in db.
1	29 25 21	28.07 24.07 20.07	100 400 1,000	20 32 40
2	19 11	19.93 11.93	1,000 20,000	40 66
3	9.5 5.1	10.43 6.03	2,000 40,000	46 72
4	4.5	5.43	40,000	72
5	2.15	3.08	500,000	94
6	1.05	1.98	1,000,000	100

Table 3 - 2nd. channel ratios

A.V.C. adjustment and efficiency

54. Put the controls to the positions as detailed in para. 18 except BAND-WIDTH KC/S at 2.5 and A.V.C. to R.T. ON. Set the signal generator to give a modulated output of 5μV at 3.5Mc/s. Tune the receiver and increase the generator output to 10mV and adjust L29A for minimum output.

55. Turn the L.F. GAIN control to give an audio output of 200mW. Now vary the generator output from 10mV to 10μV; the audio output change should not exceed 4db., i.e., the output should not fall below 80mW. No signs of instability should be present.

C.W. heterodyne efficiency

56. Put the controls to the positions as detailed in para. 18 except BAND-WIDTH KC/S to 2.5. Set the signal generator to give a modulated output of 100 V at 465Kc/s. Tune the signal generator and inject the signal direct to the mixer grid of V3A. Adjust the L.F. GAIN control for an audio output of 10mW. Switch off the modulation and put the A.V.C. switch to C.W. OFF. Adjust the beat note to approximately 400c/s and the receiver audio output should not be less than 60mW.

Limiter

57. With the same set-up as detailed at the end of para. 56, decrease the L.F. GAIN so that the output is reduced to 10mW. Switch the LIMITER to IN; the receiver audio output should now be within the limits 3.0 - 6.0mW.

CRYSTAL FILTER ALIGNMENT

58. Remove the crystal filter from the receiver and short together tags 4 and 5 with a stout piece of copper wire. Place the filter in the appropriate jig on the amplifier portion of the Oscillator, alignment, crystal, filter, No.1.

59. Adjust the output of the oscillator to about 200μV and rock its frequency about 465kc/s (within ± 100c/s) until the position giving the maximum meter reading is obtained. This frequency is the mid-band frequency (m.b.f. Fig. 3). During subsequent alignment the output of the oscillator must not exceed 23μV when passing through the m.b.f., otherwise the crystal will be damaged.

60. Adjust the end condensers (i.e., C36A and C36B on the narrow filter) for maximum amplifier meter reading at the m.b.f., using a non-metallic tool and rotating each condenser equal amounts from its maximum capacity position. It will be necessary to adjust each condenser in turn several times until no further increase in meter reading can be obtained.

61. Set the oscillator to F1 (Table 4), the low-frequency rejection point, and increase the output of the oscillator by about 50db. to give a suitable reading on the meter. Adjust the top trimmer (i.e., C37A on the narrow filter) for the minimum reading.

62. Reduce the oscillator output to below 23μV and increase the frequency of F2. Turn up the output again and rock the oscillator slightly to find the high-frequency rejection point. Note the frequency difference from the m.b.f. of each rejection point and adjust C37A to equalize them. This is done by adjusting C37A for half the difference on the high-frequency side and then checking the low-frequency side, re-adjusting, if necessary.

63. Repeat the operation detailed in para. 60 and also adjust C37A for symmetry of the two rejection points. These should be equally displaced from the m.b.f. within the limits of Table 4. Now set the oscillator to the m.b.f. and adjust its output for a suitable meter reading.

64. Tune the oscillator to each rejection point in turn, increasing the output to produce the same meter reading as detailed in para. 63. The difference in oscillator outputs between the m.b.f. and either rejection point must be greater than 55db.; if not, the compensating resistance (i.e., R24A on the narrow filter) should be adjusted as detailed in para. 63, otherwise leave the short-circuit on.

65. Remove the strap between tags 4 and 5 (para. 58) and replace it by a length of resistance wire (two or three strands of 30 S.W.G. Eureka, slightly longer than the distance between the tags is suitable).

66. Repeat the operation as described in para. 64, adjusting the length of the resistance wire (or number of strands) until a reading greater than 55db. is obtained.

67. Retrim the end condensers at the m.b.f. and also the top condenser for symmetry of the rejection points if necessary. The filter should now conform to the specification tests of Table 4.

Filter	W4/505A (narrow)	W4/506A (wide)
m.b.f.	465kc/s ± 200c/s	465kc/s ± 200c/s
f1	m.b.f. - 3.23kc/s	m.b.f. - 4.46kc/s
f2	m.b.f. + 3.26kc/s	m.b.f. + 4.5kc/s
m.b.f. - f1) To be within ± 250 c/s.	3.2 - 3.8kc/s	4.5 - 5.5kc/s
f2 - m.b.f.) To be within ± 250 c/s.	3.2 - 3.8kc/s	4.5 - 5.5kc/s
Band-width -6db.	0.65 - 1.0kc/s	2.4 - 3.0kc/s
Level of f1 and f2	- 55db. ± 5db.	- 50db. ± 5db.
Level of return lobes	- 50db.	- 40db.

Table 4 - Crystal filters W4/505A and W4/506A

68. The dependence of the response curve on individual components and their adjustment, if the response is incorrect, is given as follows (The components refer to filter W4/505A but are applicable to similar components on filter W4/506A):-

(a) Incorrect band-width at -6db. and incorrect adjustment of trimmers C36A and B.
(b) Incorrect level of the return lobes: Low Q of L33A and B, i.e., with a low Q the figure greater than -50db. on filter W4/505A will not be obtained.
(c) Incorrect level of rejection points: Incorrect setting of compensating resistance R24A, or a leakage resistance across the crystal of less than 10MΩ.
(d) Asymmetry of rejection points: Incorrect setting of C37A, the crystal having a spurious activity, or sense of L33A and B reversed.
(e) Displacement of the rejection points from the m.b.f.: Incorrect mutual inductance of L33A and L33B. This is dependent on the spacing of the inductance cores by means of shims. An alteration in shim thickness of 0.001in. alters the displacement of each rejection point by approximately 100c/s.

WINDING DETAILS

69. This information is given for guidance in an emergency only. The coils should either be matched with a manufacturers' sample taken from the spares of a set, or adjusted finally in the set. The figures give a general idea of the coil winding, with the necessary dimensions; they do not depict any particular coil but should be used for guidance with the text. When Litz type wire is used the end should be prepared for soldering by heating in a methylated spirit flame and dipping in methylated spirit while still red hot. The wire should be wiped clean and it is then ready for soldering.

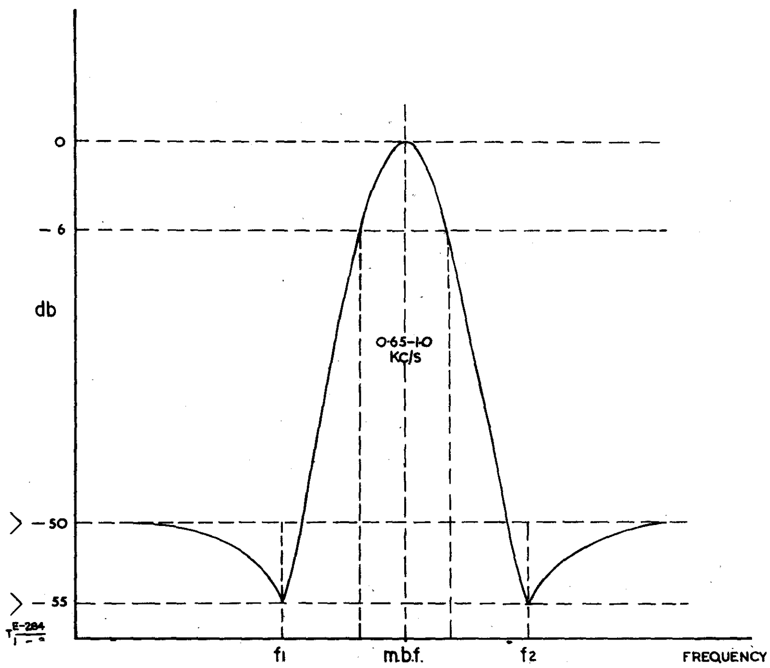

Fig. 3 - Response curve for crystal filter W4/505A

Receiver

70. R.F. coils, except for the aerial coil on range 1, are all wound on the same type of former in roughly four ways as shown in A, B, C and D. The spills have their angular positions with reference to the flat of the base as shown in Fig. 4. Spills, reference numbers, 1, 3 and 5, are fixed in holes drilled in the base, and spills 2, 4, 6, 7 and 8 are in holes drilled through the top of the former at a distance from the base specified by the distance Y quoted separately under each heading. The distance X is the distance along the former from the base of the start of the first winding. In the text windings, which are in all cases clockwise, looking along the former, are assumed to start at the end nearer the base.

71. After winding, the coil should be wax-dipped with tropical grade wax, Claude Campbell, No. L.P.R.M.3, or its equivalent. Dip the coil in wax at a temperature of 105-110°C. until all bubbling ceases (approx. 3 min.). Remove the coil and allow the wax to cool until it just begins to become opaque when it should be flash-dipped and the wax again allowed partially to harden. The coil should be flash-dipped a further four times.

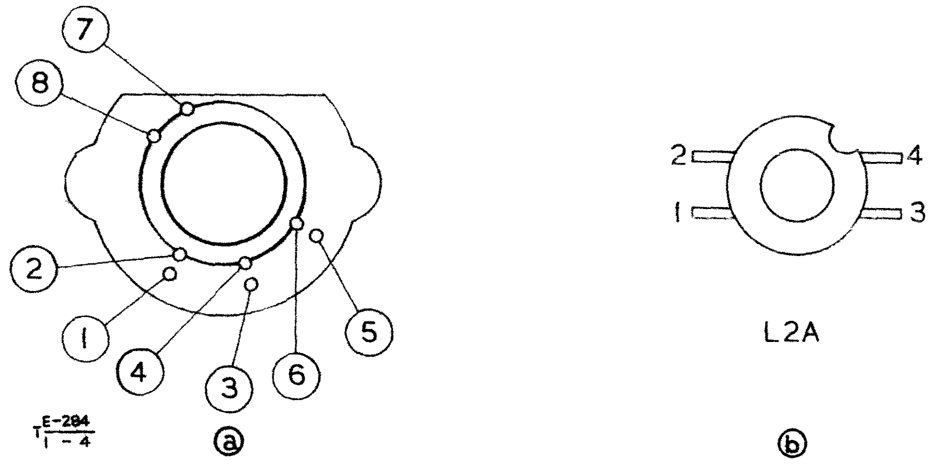

Fig. 4 - R.F. coils - positions of spills

Range 1

72. Aerial coil, L2A consists of $5\frac{1}{4}$ turns No.20 S.W.G. enamelled copper wire, tapped at a $\frac{1}{2}$ turn from the finish. Start - Tag No.1 of the special former (the bas is shown in Fig. 4). Finish - To be securely bound off and the free end left $1\frac{1}{2}$in. long. Tapping is made with No.20 S.W.G. enamelled copper wire and left $1\frac{1}{2}$in. long.

1st. R.F., L3A and B

73. Wound as shown in Fig. 5A. Main winding L3A consists of 4 turns No.18 S.W.G. tinned copper wire, spaced evenly between distance X and Y, starting spill No. 1, finishing spill No. 2. Distance X = 5/16in. distance Y = 1in.

Coupling winding L3B consists of 4 turns No.36 S.W.G. D.S.C. copper wire, wound centrally between the main winding, starting spill No. 5, finishing spill No. 6.

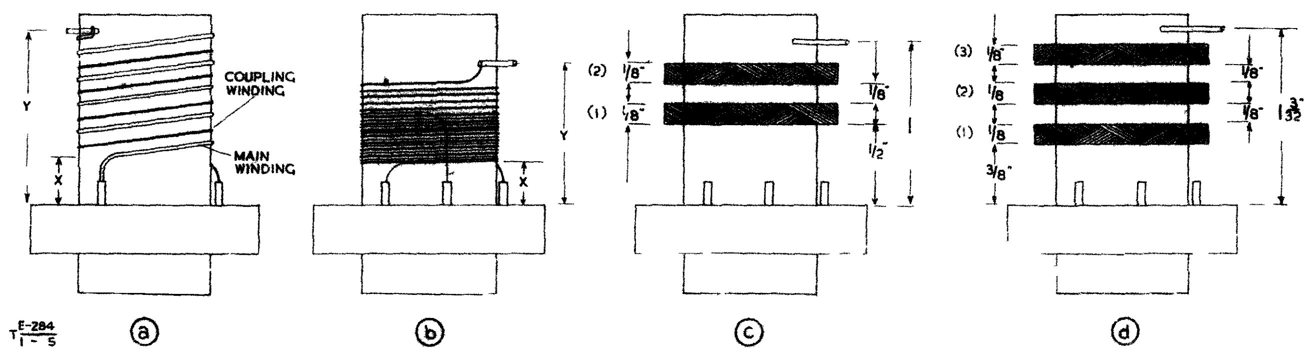

Fig. 5 - R.F. coil windings

2nd. R.F., L4A and B

74. Details as given for 1st. R.F., L3A and B.

75. Oscillator coil L5A. Wound as shown in Fig. 5A and consists of $4\frac{1}{2}$ turns No.18 S.W.G. tinned copper wire, tapped 1 turn from the start with No.20 S.W.G. tinned copper wire, the end being left 1in. long, starting spill No.3, finishing spill No.7. Distance X = 5/16in., distance Y = 1in.

Range 2

76. The coils in the range are wound approximately as shown in Fig. 5A, except the oscillator coil which has no coupling winding.

Aerial coils L6A, L6B

77. Main winding L6A consists of $6\frac{1}{2}$ turns No.18 S.W.G. tinned copper wire, spaced evenly between the distances X and Y, starting spill No.5, finishing spill No.8. Distance X = $\frac{1}{4}$in., distance Y = 7/8in.

Coupling winding consists of 4 turn of No.22 S.W.G. D.S.C. copper wire, wound between the first and second turns of the main winding, the two ends being twisted together for a distance of about 1in. and left free. A small piece of Domolac sheet to be inserted between the main and coupling windings at the cross-over of the ends of the coupling winding.

R.F. coils L7A and L7B

78. Main winding, as for the Ae. main winding L6A.

Coupling winding consists of 3 turns No.36 S.W.G. D.S.C. copper wire, wound between the first turns of the main winding, starting spill No.3, finishing spill No.1.

2nd. R.F. L8A, L8B

79. Details as given for 1st. R.F. L7A, L7B.

Oscillator L9A

80. Consists of $6\frac{1}{2}$ turns No.18 S.W.G. tinned copper wire, tapped $2\frac{1}{8}$ turns from start. Tapped with 20 S.W.G. tinned copper wire, free end left $\frac{3}{4}$in. long. Winding is evenly spaced between distance X and Y, starting spill No.5, finishing spill No.8. Distance X = $\frac{1}{4}$in., distance Y = 7/8in.

Range 3

81. All coils are wound approximately as shown in Fig. 5B.

Aerial coils L10A, L10B

82. Main winding L10A consists of $14\frac{1}{2}$ turns No.24 S.W.G. D.S.C. copper wire, evenly spaced between the distance X and Y, starting spill No.5, finishing spill No.8. Distance X = $\frac{1}{4}$in., distance Y = 13/16in.

Coupling winding L10B consists of 3 turns No.24, S.W.G. D.S.C. copper wire, close-wound over the first part of the main winding and separated from it by a strip of Domolac sheet, starting spill No.1, finishing spill No.3.

1st. R.F. coils, L11A, L11B

83. Main winding is L11A. Details as for the aerial coil winding, L10A.

Coupling winding L11B, consists of 3 turns No.36 S.W.G. D.S.C. copper wire, wound as for the coupling winding of the aerial coil, starting spill No.1, finishing spill No.3.

2nd. R.F. coils L12A, L12B

84. Main winding consists of 14 turns No.24 S.W.G. D.S.C. copper wire, starting spill No.5, finishing spill No.6. Distance X = ¼in., distance Y = 13/16in.

Coupling winding consists of 7 turns No.36 S.W.G. D.S.C. copper wire, wound as for the aerial coil coupling winding, starting spill No.1, finishing spill No.3.

Oscillator coil L13A

85. Consists of 18 turns of No.24 S.W.G. D.S.C. copper wire, tapped 5 turns from the start by leaving a loop in the winding at the appropriate point, twisting together and securing to spill No.3, starting spill No.1, finishing spill No.6. Distance X = ¼in., distance Y = 13/16in.

Range 4

86. All coils in this range are wound approximately as given in Fig.5B.

Aerial coils L14A, L14B

87. Main winding L14A consists of 31 turns of close-wound 27/47 Litz type wire, starting spill No.5, finishing spill No.6. Distance X = 5/16in., distance Y = 13/16in.

Coupling winding L14B consists of 5 turns No.24 S.W.G. D.S.C. wire, close-wound over the first part of the main winding and separated from it by a strip of Domolac sheet, starting spill No.1, finishing spill No.3.

1st. R.F. coils L15A, L15B

88. Main winding L15A consists of turns of close-wound 27/47 Litz type wire, tapped 10 turns from the start. Tapping is made by leaving a loop in the main winding at the appropriate point, twisting together and leaving free for 2in., starting spill No.5, finishing spill No.6. Distance X = 5/16in., distance Y = 13/16in.

Coupling winding L15B consists of 7 turns of No.36 S.W.G. D.S.C., wound as for the aerial coil coupling winding, starting spill No.1, finishing No.3.

2nd. R.F. coils, L16A, L16B

89. Main winding is L16A. Details as for the main winding of the 1st. R.F. coil L15A.

Coupling winding L16B consists of 4 turns of No.36 S.W.G. D.S.C. copper wire, wound as detailed for aerial coil coupling winding, starting spill No.1, finishing spill No.3.

Oscillator coil L17A

90. Consists of 27 turns close-wound 27/47 Litz type wire, tapped 12 turns from the start. Tapping is made by leaving a loop of wire in the appropriate position, twisting together and securing to spill No.3; starting spill No.5, finishing spill No.6. Distance X = 5/16in., distance Y = 13/16in.

Range 5

91. All coils in this range are wound approximately as given in Fig. 5C and to the dimensions shown there.

Aerial L18A, L18B.

92. Main winding L18A consists of 2 piles of 29 turns, each of 27/47 Litz wire, wave-wound, starting spill No.5, finishing spill No.6.

Coupling winding L18B consists of 8 turns of No.28 S.W.G. D.S.C. copper wire, close-wound, between the first pile and the base of the coil, starting spill No.1, finishing spill No.3.

1st. R.F. L19A, L19B

93. Main windings L19A is wound as the aerial main winding, L18A, but tapped between the two piles. Tapping taken by twisting together the finish of the first pilse and the start of the second, and leaving free for 2in., starting spill No.5, finishing spill No.6.

Coupling winding L19B consists of 6 turns of No.36 S.W.G. D.S.C. copper wire, close-wound between the two piles of the main winding. The ends are brought out over the first pile of the main windings, starting spill No.1, finishing spill No.3.

2nd. R.F. L20A, L20B

94. Main winding L20A is wound as for 1st. R.F. main winding, L19A.

Coupling winding L20B consists of 2 turns No.36 S.W.G. D.S.C. copper wire, close-wound between the first pile of the main winding and the base of the coil as near to the first pile as possible, starting spill No.1, finishing spill No.3.

Oscillator coil L21A

95. Consists of two piles of 24 turns each 27/47 Litz wire, wave-wound, tapped between the piles by twisting the finish of the first pile with the start of the second and bringing out to spill No.5, over the first pile, starting spill No.3, finishing spill No.4.

Range 6

96. All coils in this range are wound approximately as shown in Fig.5D and to the dimension shown there.

Aerial coils L22A, L22B

97. Main winding L22A consists of 3 piles of 44 turns, each wave-wound with 27/47 Litz wire, starting spill No.5, finishing spill No.6.

Coupling winding L22B consists of 9 turns No.28 S.W.G. D.S.C. copper wire, close-wound between the first pile and the base of the coil, starting spill No. 1, finishing spill No.3.

1st. R.F. coils L23A, L23B

98. Main winding L23A is wound as for L22A, but tapped after the first pile by twisting the end of the first pile and the start of the second, and leaving the free end 2in. long.

Coupling winding L23B consists of 4 turns No.36 S.W.G. D.S.C. copper wire, close-wound between the first and second piles of the main winding, the leads brought out over the first pile to the spills, starting spill No.1, finishing spill No.3.

2nd. R.F. coils L24A, L24B

99. Main winding L24A is wound as for the 1st. R.F. main winding, L23A.

Coupling winding L24B consists of 7 turns No.36 S.W.G. D.S.C. copper wire, close-wound between the first pile and the base as near to the first pile as possible, starting spill No.1, finishing spill No.3.

Oscillator coil L25A

100. Consists of three piles of 30 turns each 27/47 Litz, wave-wound, tapped between the first and second piles in the same way as the 1st. and 2nd. R.F. coils, but the tapping is brought back over the first pile to spill No.3, starting spill No.1, finishing spill No.2.

H.F. chokes L1A, L1B

101. Consists of 10 turns of No.30 S.W.G. enamelled copper wire. Connecting wires are 20 S.W.G. tinned copper to be passed through slots in the end of the former and securely located.

I.F. coils, L26A - F

102. Dimensions as given in Fig. 6. Consist of 102 turns 27/47 S.W.G. Litz type wire, close-wave wound, starting tag 1, finishing tag 2. Inductance, 265μH ± 2%, with the core in position.

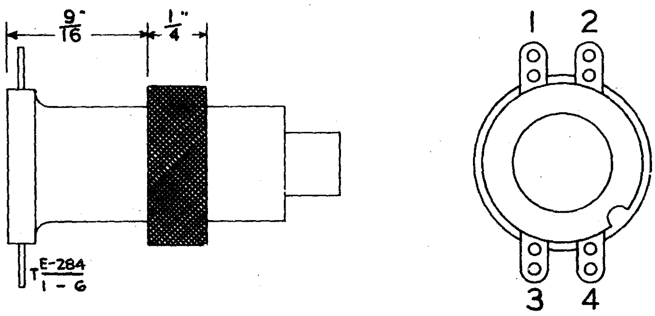

Fig. 6 - I.F. coil assembly

I.F. coupling coil L22A

103. Consists of 2 turns of 28 S.W.G. D.S.C. copper wire, wound on the same former as L26F and as close to the main winding as possible on the side nearest to the tag panel, starting tag 3, finishing tag 4.

A.V.C. coil L29A

104. Winding and dimensions as for I.F. coil as given in Fig.6 and consists of 127 turns 27/47 Litz wire, close-wave wound, starting tag 2, finishing tag 3. Inductance, 232μH ± 2%, without a dust core or can.

Beat oscillator coil L30A

105. Dimensions as given in Fig.7 and consists of 106 turns of 27/47 Litz type wire with tapping 53 turns from the start, close-wave wound, starting tag 1, 53 turns tap tag 4, finishing tag 2.

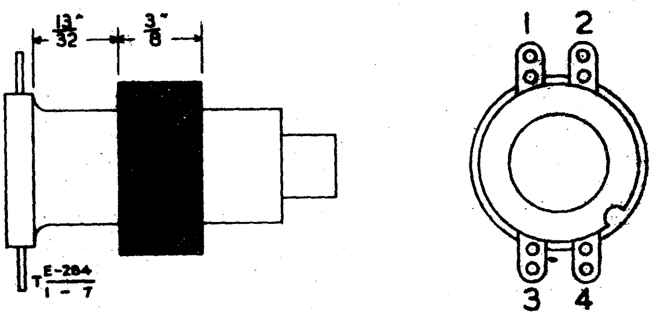

Fig. 7 - B.O. coil assembly

R.F. choke L31A

106. Dimensions as given in Fig. 8 and consists of 1,000 turns of No.40 S.W.G. D.S.C. copper wire, starting tag 3, finishing tag 4. Inductance, 10mH ± 25%.

Audio filter coils L32A, L32B

107. Consist of 800 turns of No.28 S.W.G. enamelled copper wire, bound with tropical tape. The inductance is adjusted by varying the gap between the E and I laminations. Inductance, 0.265H ± 25%. After adjustment, impregnate with tropical wax.

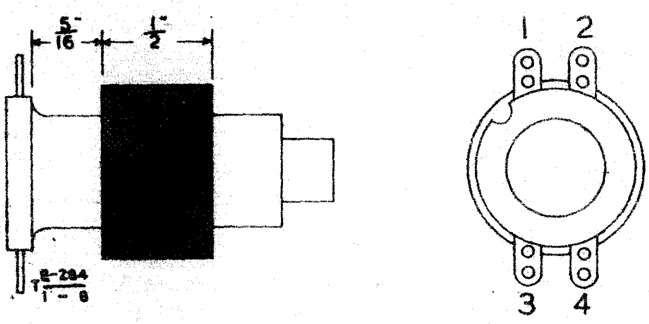

Fig. 8 - R.F. choke coil assembly

Crystal filters

108. Narrow-band coils L33A, L33B consist of 23½ turns of 83/45 straight-laid H.F. cable, R.C.C. The start and finish to be brought out adjacent to the centre flange and tied in position with thread. Dope the coil with solution of polystyrene in benzine. Inductance, 55.2μH ± 2%.

Wide-band coils L34A, L34B

109. Consist of 36½ turns of 83/46 S.W.G. straight-laid H.F. cable, R.C.C., wound and doped as for narrow-band coils. Inductance, 137.9μH ± 2%.

Output transformer T2A

110. The windings and interleaving are put on in the order given.

First half of the secondary 1 consists of 65 turns of No.28 S.W.G. enamelled copper wire. The start is connected to tag 1, the finish is connected to the start of the second half of secondary 1. Cover with three layers of 0.005in. manilla paper.

Secondary 2 consists of 500 turns of No.38 S.W.G. enamelled copper. The start is connected to tag 3 and the finish is connected to tag 4. Cover with five layers of 0.005in. manilla paper.

Primary consists of 4,000 turns of No.40 S.W.G. enamelled copper wire, fully interleaved. The start is connected to tag 6 and the finish is connected to tag 7. Cover with five layers of 0.005in. manilla paper.

Secondary 3 consists of 500 turns of No.38 S.W.G. enamelled copper wire. The start is connected to tag 4 and the finish is connected to tag 5. Cover with three layers of 0.005in. manilla paper.

Second half of secondary 1 consists of 65 turns of No.28 S.W.G. enamelled copper wire. The start is connected to the finish of the first half of secondary 1 and the finish is connected to tag 2. It is bound over all with tropical tape. Vacuum-impregnate with bitumen.

Power supply unit

R.F. chokes L1A - C

111. Consist of 36 turns of No.18 S.W.G. enamelled copper wire, close-wound on a 5/16in. diameter former. One loop of strong black thread to be passed through the choke round one side and tied before impregnation.

Choke L2A

112. Consists of 250 turns of No.28 S.W.G. D.S.C. copper wire, wave-wound ½in. wide. Inductance, 0.6mH, D.C. resistance, 75Ω. Vacuum-impregnated with varnish.

R.F. chokes L3A - B

113. Consist of 20 turns of No.16 S.W.G. enamelled copper wire, close-wound on a ½in. diameter former. Tied and impregnated as detailed for L1A - C.

Choke L4A

114. The inner winding consists of 57½ turns of 18 S.W.G. enamelled copper wire, followed by 5 turns of varnished cambric tape 0.007in. thick.

The outer winding consists of 54½ turns of 18 S.W.G. enamelled copper wire, wound in the same direction as the inner winding. Wrapped with 2 layers of cambric and vacuum-impregnated with varnish. Inductance of each winding, 0.06mH (0mA). D.C. resistance, 0.16Ω.

Choke L5A

115. Consists of 4 piles, each of 187 turns of No.34 S.W.G. D.S.C. copper wire, wave-wound. Each pile is 7/32in. wide and spaced 3/32in. Vacuum-impregnated with varnish or tropical wax. Inductance, 2.2mH.

Choke L6A

116. Consists of 180 turns of No.16 S.W.G. D.S.C. copper wire. Winding is wrapped with 2 turns of varnished cambric tape 0.007in. Completed coil is vacuum-impregnated with tropical varnish. Inductance, 250μH (1,000c/s). D.C. resistance, 0.16Ω.

Choke L7A

117. Consists of 200 turns of No.20 S.W.G. D.S.C. copper wire. Winding is wrapped with 2 turns of 1in. wide cambric and the complete coil vacuum-impregnated with varnish. Inductance, 400μH at 1,000c/s. D.C. resistance, 32Ω.

L.F. choke L8A

118. Consists of 131 turns of No.16 S.W.G. enamelled copper wire, interleaved with 0.002in. manilla paper. Complete winding wrapped with 2 layers of cambric and vacuum-impregnated with tropical varnish.

L.F. choke L9A - B

119. Consists of 4,800 turns of No.32 S.W.G. enamelled copper wire, interleaved with 0.002in. manilla paper. Complete winding wrapped with 2 layers of cambric and vacuum-impregnated with tropical varnish. Inductance, 10H (100mA). D.C. resistance, 220Ω ± 10%