JOHNSON 250-21 TVI SUPPRESSION KIT

FOR 240-101 VIKING I TRANSMITTER

INSTALLATION INSTRUCTIONS

The 250-21 kit contains all the necessary material for completely shielding the Viking I transmitter. Also included are capacitors and chokes for filtering each of the leads emerging from the cabinet with the exception of the RF output connector. For this purpose the JOHNSON 250-20 four section low-pass filter is available as a separate accessory.

In general, the modifications are similar to those outlined in the June 1952 issure of QST *. The 250-21 kit provides additional shielding and filtering designed to make the TVI suppression more effective. Included are a meter shield, dial aperture shield, capacitor and choke filters for VFO leads, meter leads etc. Application of these TVI suppression measures will not adversely affect the performance of the Viking I.

Tools required are the usual screwdriver, long nose pliers and diagonal cutters. Also required are a hand or electric drill, center punch, rule and the following drill bits: #34, 1/8" or #30, 5/32" or #28, 7/32" or #3, and 9/32". A scribe and small square are not absolutely necessary but will prove most useful.

These step-by-step instructions present each step in the correct order and if followed implicitly, will result in a neat and effective job.

*TVI-proofing the Viking I, Philip S. Rand

INSTALLATION, 250-21 TVI SUPPRESSION KIT

PART A, MECHANICAL

1. Remove the transmitter from its cabinet.

2. Check to see that none of the transformers or the choke L1 extend past the edges of the chassis. If they do, loosen the mounting bolts and relocate the transformers. Retighten the transformer mounting bolts.

3. Remove the leads from the meter M1 and unsolder the leads from the microphone connector J1. Remove J1.

4. Remove the front panel.

5. Remove the meter, the dial window escutcheon and indicator plate and the pilot light jewels from the front panel. Also remove the bearing for the final amplifier tuning shaft.

6. Lay the panel on the workbench, face up. Trim the panel template to the outside edge of the panel outline drawing. Using cellulose tape, fasten the template to the panel, top of the template toward the top of the panel. Center punch the panel as indicated on the template.

7. Recheck with the template to be sure that the new panel holes will be accurately located. Drill 12 holes in the panel, clearance size for #6 screws. (#28 or 5/32" drill)

8. Using #6 thread cutting screws, attach the perforated top piece of the shielding to the 1"x 1 3/4"x16" aluminum angle. Use the holes already punched in the angle.

9. Attach the shielding side panels to the rear shield panel using #6 thread cutting screws.

10. Temporarily attach the top of the shield to the side and rear shield panels using about 8 #6 thread cutting screws.

11. Replace the transmitter front panel temporarily. Secure it with three or four of the mounting nuts.

12. Set the shield assembly down over the transmitter chassis and against the back of the front panel.

13. Hold the left side of the shield assembly in position tight against the front panel and two inches from the bottom edge of the chassis. Mark the locations of two of the holes and center punch the chassis. Set the shield assembly aside for the moment. Look for the center punch marks just made, inside the chassis. If all is clear, drill two holes tap size for #6 screws (#34 drill .111"). Replace shield assembly and secure the left end with two #6 thread cutting screws.

14. Follow the same procedure on the right side checking to make sure that the drill will not hit any wires or component parts inside the chassis.

15. Now with the shield assembly snug up against the panel and supported by the four screws installed, center punch and drill holes for the balance of the 28 #6 thread cutting screws used to secure the shield assembly to the chassis. Be careful not to run your drill thru any cables. There should be no components in the way. Do not bother to install the rest of the screws around the bottom of the shield as yet.

16. Using the same #34 drill, thru the six holes on the ends of the front panel, drill the mounting holes for securing the side panels of the shield assembly to the transmitter front panel.

17. Mark the locations for the six mounting holes to be used to secure the 1" x 1 3/4" x 16" aluminum angle to the front panel using either a pencil or scribe. (Attempting to drill these holes thru the front panel will probably result in the angle shifting and a gap in the shielding at the ends of the angle.)

18. Remove the shield assembly, remove the angle from the shield assembly, center punch and drill six holes in the angle using the #34 drill.

19. Check your work to be certain all the holes line up. You should have by now all the necessary holes for mounting the shield assembly.

20. Once again remove the front panel from the transmitter. Remove the tuning dial from the shaft of C29.

21. From the transmitter proper, remove the two 10-32 screws used to secure BKT1 (dial drive assembly) to BKT3 (mounting bracket for the final tuning condensers).

22. Replace the 10-32 screws and lockwashers using them to mount the 17.806 adapter plate of the TVI kit. The adapter plate extends upward effectively lengthening BKT1. (The adapter plate mounts on the outside of the end of BKT3. The left edge of the adapter plate is to be secured by means of a 7/16" 8-32 screw, the 13.49-25 spacer, lock washer and nut.)

23. Check to make sure that the left edge of the 17.806 adapter plate is parallel with the left edge of BKT1. Tighten the 10-32 screws.

24. Remove the 10-32 nut and lockwasher from the front of BKT1.

25. Remove the gear secured by this nut. This will entail loosening the set screws of the gear above the sliding it back toward C29.

26. Using the hole in the left side of the 17.806 adapter plate as a guide, drill a #19 (clearance for a #8 screw) hole in BKT1.

27. Install the 13.49 spacer between the adapter plate and BKT1 and secure with the 7/16" 8-32 screw, lockwasher and nut.

28. Slide the final window shield 23.1003 over the shaft of C29 with the short end up, the top contact fingers pointing toward the rear. Using 1 1/16" 6-32 studs (11.516-1 1/16) and 6-32 nuts mount the window shield temporarily in place using the pair of holes at the top of the adapter plate and the pair of holes in the top of the window shield. Nuts will be required on each side of the adapter plate and each side of the window shield. Adjust the nuts so that the window shield is in a vertical plane

and as close as possible to BKT1. Using a pencil or scribe with the two bottom holes in the window shield serving as a template, mark BKT1 for drilling. Remove the window shield, center punch and drill two holes clearance for #6 screws (#28 drill) in BKT1.

29. Using the following method, it will probably be unnecessary to do any adjusting of the window shield to insure solid contact between the phosphor bronze contact fingers and the front panel of the transmitter. Adjust the top pair of 1 1/16" studs in the 17.806 adapter plate so that exactly 1/4" of the stud protrudes from the rear nut. (Measure from the rear face of the nut). Install the bottom pair of 1 1/16" studs in the holes drilled in operation 28, adjusting them so that two threads protrude from the rear nut.

30. Secure the window shield on the four studs just installed. Nuts will be required in front of and behind the window shield. Adjust the position of the nuts so that the front ends of the studs are flush with the front nuts when tightened. The window shield should now be in a vertical plane approximately even with the front edge of the oscillator/buffer shield next to C29.

31. Replace the gear previously removed from the final tuning assembly in operation 25. With C29 meshed, the roller contact on L9 must be against the front stop.

32. Slide the 29.387 spring washer over the shaft of C29. Replace the final tuning dial on the shaft of C29. Push it tight against the washer and tighten the set screws being certain that a line running thru zero and 100 on the dial is in a vertical plane with zero at the bottom with C29 fully meshed.

33. Re-install the meter M1 in the front panel.

34. Install two 9/16" grommets (22.113-1) in the meter shield assembly 23.1004. Mount a 22.740-3 terminal board on the outside of the meter shield using 4-40 screws, lockwashers and nuts, the washers and nuts on the outside of the shield. Remove all the hardware from the studs of the meter except the nuts used to hold the meter movement in the case. Slip the meter shield over the meter studs, the terminal strip toward the top. Push the shield hard against the panel so that the phosphor bronze fingers will mark the panel. Remove the shield.

35. Replace the panel on the transmitter temporarily, pushing the panel against the phosphor bronze fingers of the dial window shield assembly so that the panel is marked.

36. Remove the panel, scrape the paint off the panel where marked by the bonding fingers of the shields. A knife will do the job satisfactorily. Only about a 1/4" of paint, outlining the bonding fingers, need be removed.

37. Mount the meter shield permanently with the terminal strip up. Use one brass washer and nut furnished with the meter on each stud. Draw the nuts down tight with approximately 1/8" of the studs extending past the nuts. This would be an opportune time to wax the panel if it has been fingermarked.

38. Remount the dial escutcheon and indicator, both the pilot light jewels on the front panel. Set the panel aside temporarily.

39. Stand the transmitter chassis on its right end. Unbolt the low voltage filter choke L2, lay out, center punch and drill the holes shown of the sketch of the chassis rear, left end.

40. Remount L2 in the new 7/32" holes just provided.

41. The legs used in the original assembly of the kit would be very useful for this operation. Turn the chassis over on its back. Lay the bottom plate over the bottom of the chassis and use it as a template to mark the holes for mounting it. Drill 32 holes for #6 screws (#34 drill).

PART B

INSTRUCTIONS, INSTALLATION 250-21 TVI SUPPRESSION KIT

ELECTRICAL CHANGES

All the .005 mica RF by-pass capacitors are to be removed and replaced with .005 ceramic disc capacitors furnished with the suppression kit. New capacitors should be installed with the shortest possible leads. To save time, simply clip the leads of the capacitors to be removed. In removing solder and bits of old leads from the tube socket terminals, be careful not to overheat the insulation of wiring harness leads.

Operations 2, 3, 4 and 5 (following) all involve changes at the 6AQ5 buffer socket X5.

1. Remove the shaft used to drive the crystal selector switch SW8.

2. Remove capacitors, C26 connected between filament (pin 4) and ground, C27 between cathode (pin 2) and ground and C21 between screen grid (pin 6) and ground. Remove SH5 (2.2ohms 1/2 watt) which is usually connected across the leads of C27.

3. Connect a .005 mfd. ceramic disc capacitor and resistor SH5 between cathode (pin 2) and the ground terminal adjacent to pin 3.

4. Connect a .005 ceramic disc capacitor between filament (pin 4) and the ground terminal beside pin 3.

5. Connect a .005 ceramic disc capacitor between screen grid (pin 6) and the center shield of the socket. Solder at pins 2, 4, 6, the socket center shield and the ground terminal.

Operations 6, 7, and 8 involve changes at the 6AU6 crystal oscillator socket X6.

6. Remove capacitor C16 connected between filament (pin 4) and ground; also remove capacitor C15 connected between cathode (pin 7) and ground.

7. Connect .005 mfd. ceramic disc capacitor between filament (pin 4) and the adjacent ground terminal, pin 3.

8. Connect .005 mfd. ceramic disc capacitor between cathode (pin 7) and the center shield of the socket. Solder at pins 3, 4, 7 and the socket center shield.

9. Remove capacitor C19 connected between switch SW4B and the rotor terminal of the buffer tuning capacitor C22. Leave a lead of approximately 1/4" length from SW4B protruding thru the grommet to the underside of the chassis. Cut the lead of the 100 ohm resistor R26 at the same time.

10. Remove capacitors C17 connected between one of the center terminals of X20 and ground, C24 connected between the second terminal from the

front of the chassis on X20 and ground, remove R26, 100 ohm resistor connected to one of the center terminals of X20. (End connected to SW4B cut in operation before.)

11. Connect .005 ceramic disc capacitor between the second terminal of X20 from the front of the chassis and the ground at the mounting foot of X20 nearest the front of the chassis. Remove the ground lead from the terminal of X20 nearest the front of the chassis. Solder .005 capacitor at both terminals.

12. Connect a 4.7 microhenry choke between the third terminal from the front of the chassis on X20 and the stubs of leads left on SW4B when C19 and R26 were removed. Solder at both points.

13. Connect a .005 mfd. ceramic disc capacitor between the fourth terminal from the front of the chassis on X20 and the rearmost terminal of X20. (The rear terminal should have been grounded in the original assembly of the transmitter.) Solder at both terminals.

14. Connect a .005 ceramic disc capacitor between the end of R20 (100 ohms) which connects to the bottom terminal of SW4A, and ground. Simply push the spaghetti away from the body of the resistor in order to connect the capacitor. Connect the other end of the capacitor to ground using a #6 flat solder terminal under the nearest nut. Solder at both points.

15. Remove capacitor C39 connected between ground and the terminal of X21 nearest the front of the chassis. (In most transmitters, this capacitor is connected between the front terminal of X21 and the #7 terminal of the 4D32 socket X7.)

16. Connect a .005 mfd. ceramic disc capaictor between the front terminal of X21 and the ground terminal adjacent. Solder at both terminals.

17. Remove the gray lead only from terminal 2.

18. Connect a 4.7 microhenry choke between terminals 2 and 3 of X7.

19. Connect the gray lead removed from terminal 2 of X7 to terminal 3 of X7.

20. Connect a .001 mfd. ceramic capacitor between terminals 3 and 4 of X7, solder at both terminals.

21. Remove the three green leads from terminal 1 of X7 and the green lead from terminal 7. Leave the ground bus as it is.

22. Under the nut securing the rear of the variable inductor L9, install a two terminal tie-point.

23. Install the filament choke (single, open wound heavy current choke) between the insulated terminal of the tie-point just installed and terminal #1 of X7.

24. Connect a .005 ceramic disc capacitor between terminals 1 and 7 of X7 and solder at both points.

25. Connect the heavy green transformer lead and the pair of green wiring harness leads removed from terminal 1 of X7 to the insulated terminal of the tie-point.

26. Connect a .005 ceramic disc capacitor between the insulated tie-point and the ground terminal. Solder at both the tie-point and ground terminal.

The following steps, in addition to being necessary for TVI suppression, will provide additional reserve 10 meter drive. They provide the shortest possible leads in the 6AQ5 buffer tank circuit.

27. Install a large, flat solder terminal under the nut used to secure the bracket for the exciter bandswitch SW4.

28. Remove the rotor contact of the buffer tuning capacitor C22. By exerting steady pull and working it back and forth slightly, it can be easily removed.

29. The next step is to re-install the rotor contact so that it points toward the top of the chassis and connect it by means of a #14 or #16 bus to the ground terminal just installed in the previous step. It will undoubtedly save time to solder the bus to the contact, form it to the necessary shape, then remove C22 so as to be able to easily re-install the rotor contact in its new position. As C22 is being replaced, guide the end of the bus thru the ground contact. After C22 is re-connected, trim the bus to length but do not yet solder.

30. Make up a replacement for C23, previously removed, by connecting two .005 ceramic disc capacitors in parallel. Twist their leads tightly together.

31. Connect this parallel capacitor between the bottom terminal of SW4B (to the stub leads where they emerge thru to the bottom of the chassis) and the ground terminal underneath the mounting bracket of SW4. Solder at both points being careful not to dislodge the 4.7 microhenry choke previously installed.

Next are the changes required at the VFO power socket, X12.

32. Remove the red wires from terminal 3, the two green and the single black lead from terminal 7 and the brown lead from terminal 8. Remove the socket if necessary to simplify this operation.

33. Install two #6 solder terminals under the socket mounting nut between terminals 1 and 8. Ground terminals 1 and 2 to one of the solder terminals just installed.

34. Connect a .005 ceramic disc capacitor between terminals 2 and 3.

35. Connect a .005 ceramic disc capacitor between terminal 8 of X12 and the nearest ground terminal.

36. Connect a .005 ceramic disc capacitor between terminals 7 of X12 and the same ground terminal. Solder at the ground terminal only.

37. Using 3/16" 4-40 screws, lockwashers and nuts, mount the three terminal strip furnished with the kit, inside the chassis in the corner near X12.

38. Connect a 4.7 microhenry choke between terminal 7 of X12 and the terminal (of the strip just installed) nearest the top of the chassis. Solder at terminal 7 of X12 only.

39. Connect the green leads and the black lead previously removed from #7 of X12 to the same terminal as above, on the new strip, solder.

40. Between terminal 8 of X12 and the center terminal of the new strip, connect a 4.7 microhenry choke. Connect the brown lead to the center terminal of the strip. Solder at X12 and the terminal strip.

41. To the terminal of the new strip nearest the bottom edge of the chassis, connect the red wires removed from #3 of X12 and a 4.7 microhenry choke.

42. Connect the other end of the choke to terminal 3 of X12. Solder at the terminal strip and at X12.

Filtering of the key leads.

43. The terminal of X20 nearest the front of the chassis should be empty.

44. Remove the blue lead from the key jack J2 and connect it, together with one lead of a 4.7 microhenry choke to the terminal of X20 mentioned above. Solder.

45. Connect the other end of the choke and a .005 ceramic disc capacitor to the terminal of the keying jack J2 from which the blue lead was removed. Solder.

46. Solder the other end of the .005 capacitor to the heavy ground lug of J2. Re-install the shaft for the crystal selector switch.

Line filter assembly and wiring.

47. Unsolder both wires of the line cord, pull the ends a couple of feet thru the grommet in the chassis.

48. Lay the line filter assembly, consisting of three open wound chokes, down on the bench with the edge of the mounting bracket up, the bracket toward you.

49. Connect a 3" length of W2 wire to the top left hand terminal. Solder the lead to the terminal on the back side of the assembly.

50. Connect a 5" lead of W2 wire to the top, rear terminal of the center choke, solder.

51. Solder a 9" lead of W2 wire to the rear, top, right hand terminal of the assembly.

52. Solder the line cord leads to the bottom left and center terminals of the filter assembly. By soldering to the terminals on the underside of the filter assembly, the line cord leads need only be approximately 1" long measuring from the knot in the cord.

53. Solder leads to the antenna relay socket furnished with the kit.

One lead should be 2 7/8" long with 3/8" of the insulation stripped off, the other lead should be 2 3/8" long with 3/8" of the insulation stripped off.

54. Mount the antenna relay socket in the holes drilled earlier beneath the choke L2, using a 4-40 screw, lockwasher and nut. Mount the socket so the shortest lead is toward the RG8/U RF output cable.

55. Mount the line filter assembly between terminal strip X17 and choke L2 using 3/16" 4-40 screws, lockwashers and nuts. At the same time install three flat #6 solder terminals under these nuts parallel to the rear edge of the chassis, a single terminal pointing toward X17 under the nut nearest X17 and a pair of terminals, one pointing each direction, under the nut nearest L2.

56. Trim to length and solder the 3" lead from the top of the line filter assembly to the center terminal of X17.

57. Trim the 5" lead from the top, center terminal of the filter assembly to the body terminal of the fuse post F1, the terminal from which the line cord was previously removed.

58. Run the 9" lead from the top of the filter assembly, under the choke L2, and over to the terminal on X22 to which the red/gray wire is connected. Connect and solder.

59. Connect three .005 ceramic disc capacitors, each by-passing the bottom terminal of one of the line chokes to ground. Connect one capacitor between the lower terminal and the ground terminal below each of the line filter assembly individual chokes. Solder at the ground terminals and at the bottom terminal of the choke nearest X17.

60. Connect the longest lead from the antenna relay power socket to the bottom terminal of the center choke of the line filter and solder together with the capacitor lead.

61. Connect the shortest lead from the antenna relay power socket to the bottom terminal of the line choke nearest L2 and solder along with its respective capacitor lead.

Turn the chassis over for the following operations.

62. Mount a 135-500 JOHNSON insulator atop the chassis by removing the mounting screw for the bias filter (C12, C13) and running a 6-32 screw thru C12 C13 mounting bracket and into the 135-500 standoff. Install a #6 flat solder terminal on the insulator.

63. Unsolder the green/white lead from the bottom of choke L7 and connect it to the solder terminal on the stand-off insulator. Between this solder terminal and the bottom terminal of L7, connect a 4.7 microhenry choke. Solder at L7.

64. Under the screw head (of the screw used to mount L7) nearest the 135-500 insulator, install a #6 flat solder terminal. Between this ground terminal and the terminal on the 135-500 insulator, connect a .01 mfd. ceramic disc capacitor. Solder.

65. Remove C19 connected between SW4A and the rotor of the oscillator tuning condenser C18.

66. Install a #6 solder terminal under the nut directly below the oscillator tuning capacitor C18. Turn the rotor terminal of C18 toward the chassis (use the technique described in operation 29) and solder a #14 or #16 lead between rotor and the ground solder terminal.

Correction: Page 12, operation 4:

Secure the panel permanently, reconnect J1. Looking from the rear of the chassis, solder the lead from the top of the meter switch (plus) to the left hand terminal of the meter filter assembly. Solder the meter lead from the bottom of the meter switch to the right hand terminal of the meter filter assembly. Also solder meter terminals,

INSTALLATION, 250-21 TVI SUPPRESSION KIT

FINAL ASSEMBLY

1. Install the filter for the meter leads as follows:

   From the left hand terminal of the terminal strip on the meter shield, to the plus (left hand meter terminal) connect a 4.7 microhenry choke. From the right hand terminal of the terminal strip to the negative (right hand) meter terminal, connect a 4.7 microhenry choke. Between the center terminal and one of the meter studs, connect a .005 mfd. ceramic disc capacitor. Between the center terminal and the other meter stud, connect another .005 ceramic disc capacitor. Using a very short lead, solder a ground from the center terminal to the meter shield. If solder terminals were used for connection to the meter studs, they may now be soldered. Do not yet solder the outside terminals of the meter terminal strip.

2. Install all the hardware on the front panel of the transmitter. Install the 16" aluminum angle of the shield assembly on the top of the front panel using #6 thread cutting screws. Cut off the two center screws flush with the angle. (This is permanent installation.) Be sure the final tuning indicator plate is loose enough to permit adjustment. Install the front panel. (Don't forget the bearing for the final tuning shaft.)

3. Adjust the final tuning indicator from the top of the panel using a piece of wire bent at the end to form a hook. When the indicator is properly located tighten by means of the two screws thru the escutcheon.

4. Secure the panel permanently, reconnect J1.

5. With the top off, mount the main shield assembly using #6 thread cutting screws. You will find a tendency for the holes in the front of the side shield panels to strip out due to being drilled. Install a #6 lockwasher and nut on each of the six screws passing thru the panel and the front edges of the shield panels.

6. Before installing the chassis bottom plate, check the transmitter out thoroughly. (The holes in rear, bottom edge of the chassis, used to secure the rear of the chassis in the cabinet will be covered by the bottom plate. The bottom plate should be drilled to clear the chassis mounting screws.) Install the bottom plate using #6 thread cutting screws. Replace transmitter in cabinet. The screw in the bottom plate under X12 should be cut off, otherwise it will hit the socket and cannot be screwed all the way in.

7. In order to re-install the chassis in the transmitter cabinet, two changes are necessary. Remove the screws used to secure the lid hinges to the cabinet and reverse them so that the heads are underneath and the nuts atop the cabinet. This provides the required clearance for the shield assembly.

8. Remove the original front top rail of the cabinet and discard. The maroon finished angle strip furnished with the TVI kit is installed in its place after the transmitter is in the cabinet. The angle is tapped for the original screws.

OPERATION

In some areas it may prove possible to operate the TVI suppressed Viking I without a low-pass filter between the transmitter and antenna feed system. Operation is this manner does not compromise the flexibility of the pi-network output tuning, and unbalanced loads from 50 to several hundred ohms can be matched. Harmonic suppression of the pi-network is greatest when the load impedance is low and the value of output coupling capacitance used, is high.

When a low-pass filter is used, it must operate into a load, the impedance of which is equal to the characteristic impedance of the filter. The ideal condition is attained when the SWR on the coaxial line from transmitter to load is 1:1 and the line impedance is equal to the characteristic impedance of the filter. Since the effectiveness of an improperly terminated low-pass filter diminishes rapidly as the SWR rises, the SWR should not be allowed to exceed 2:1. Successful operation on several bands with a minimum of antennas will undoubtedly make an antenna coupler necessary.

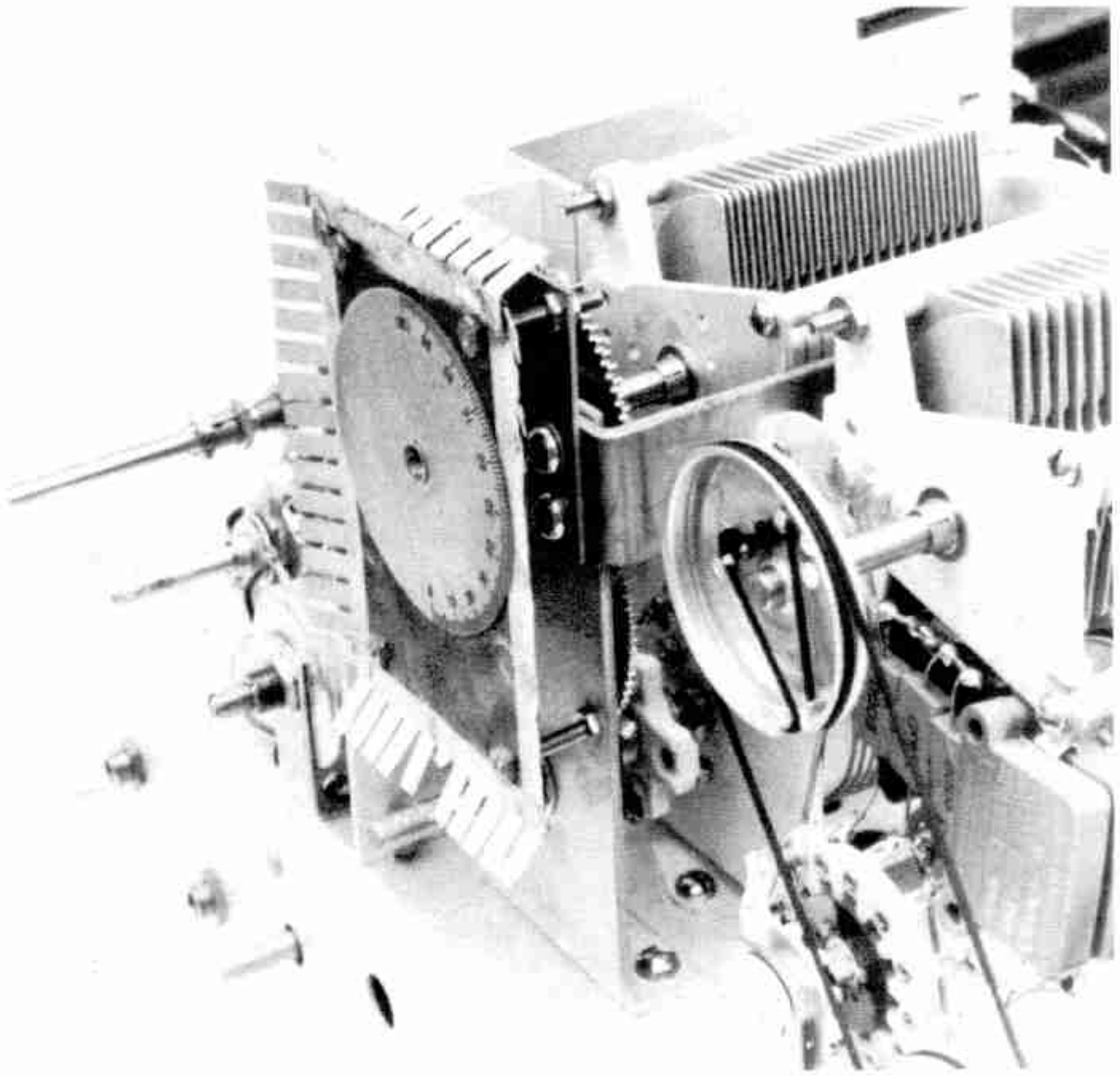
With single ended antenna systems the transmitter ground is a component of the load and appears as the equivalent of an impedance in series with the antenna. It is important to keep the ground impedance low. Any appreciable voltage drop across the ground impedance will cause the case of the transmitter and accessories such as microphone, key and VFO to become hot with RF. Intense local fields will thus be produced. In addition to complicating TVI suppression, this can seriously affect the operation of the transmitter, generating feedback in the audio system. Symptoms of RF feedback (sometimes supersonic and inaudible) are: abnormally high static modulator plate current, poor speech quality and very broad sidebands. This condition is most likely to occur while operating on 10, 15 or 20 meters since an effective ground is often difficult to attain on these bands. An acceptable alternative is to use one or more quarterwave counterpoise, one for each band, experimentally trimmed to length and connected to the transmitter ground terminal.

250-20 JOHNSON Low-Pass Filter — Amateur Net $16.50

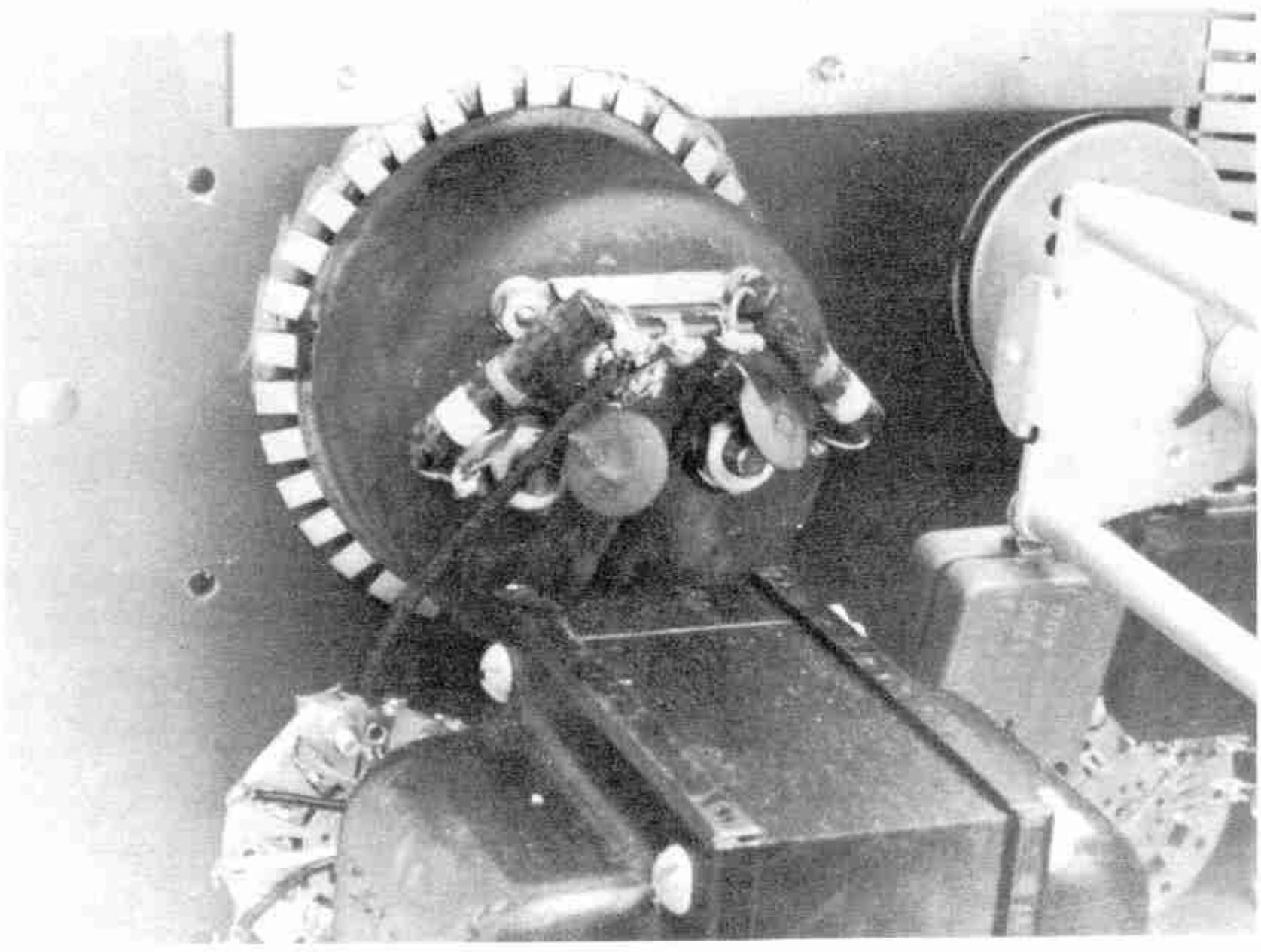
250-21 TVI Modification Kit-Viking I

Parts List

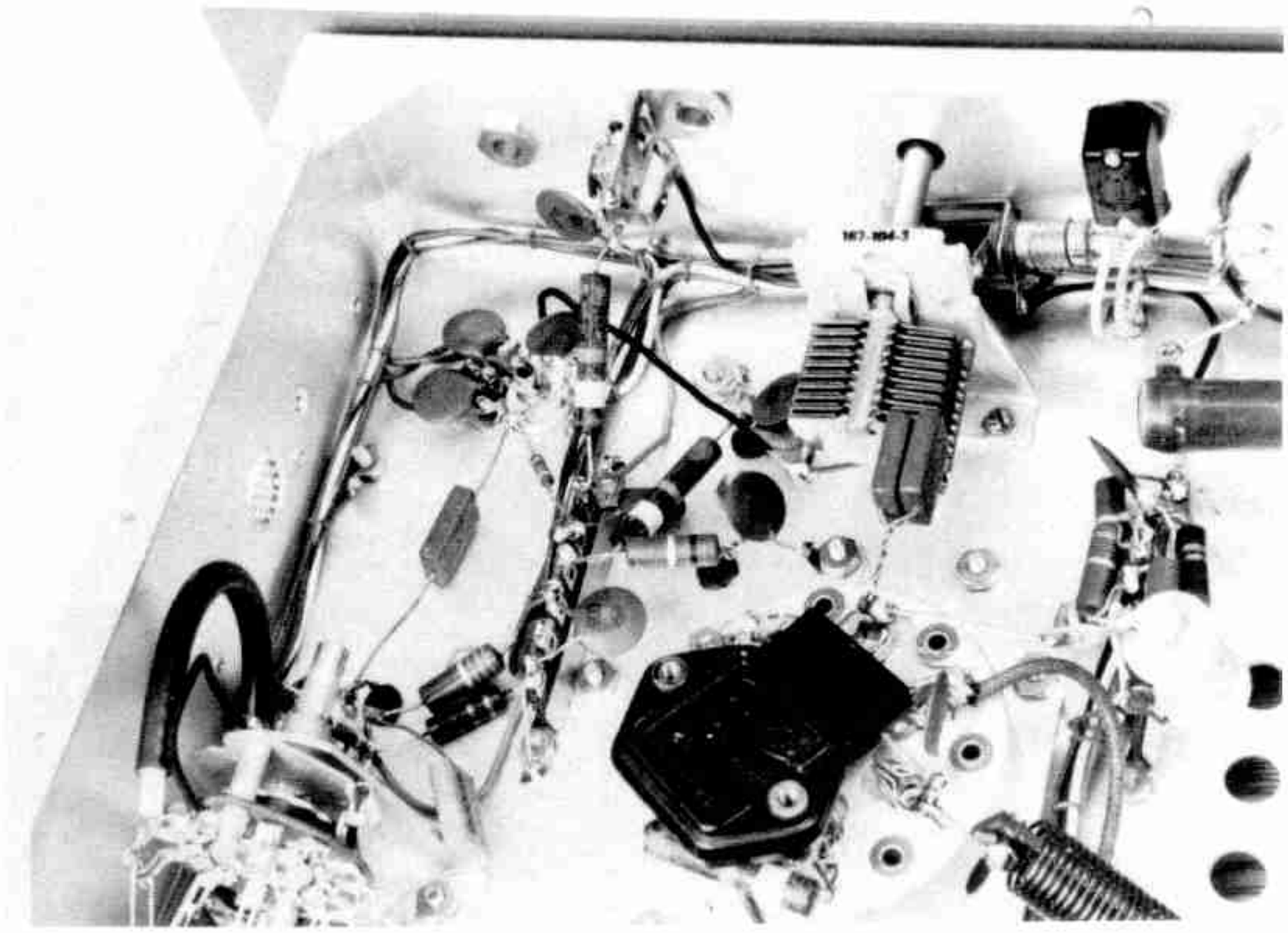
Part No. or Drawing No.	Qty.	Description
17.821	1	Panel bracket
17.822	1	Bottom plate
17.823	1	Top front angle
17.824	1	Back shield
17.825	2	Side shield
17.826	1	Top shield
23.1003-2	1	Final window shield
23.1004	1	Meter shield
17.806	1	Adapter plate
23.1000	9	VHF filter chokes
23.1001	1	Line filter VHF choke assembly
23.1002-1	1	Filament VHF filter choke
22.827	22	.005 mfd. 600wv ceramic disc capacitors
126-105	1	Crystal holder (antenna relay terminals)
11.516-1 1/16	4	1 1/16" 6-32 stud
12.02-1	22	6-32 nut
11.11-3/8	8	3/8" 4-40 NPB RH screw
12.01-1	8	4-40 NPB nut
29.116-3	8	#4 shakeproof washer
22.740-3	2	"2003" Jones terminal strip
11.21-7/16	1	8-32 NPB RH screw 7/16"
22.113-1	2	Rubber grommet 9/16"OD x 5/16"ID x 3/16" thick, 1/16" slot for 7/16" hole
16.104-1	8	#6 solder terminal
11.803-5/16	120	5/16" 6-32 thread cutting C.P.S. Binding Head Screw
11.28-3/8	2	3/8" 10-32 NPB RH screw
13.49-25	1	.120" spacer
29.00-1	1	#8 shakeproof washer
12.05-4	1	8-32 hex nut
22.826	1	.01 mfd. 1500 wv ceramic disc capacitor
22.828	1	.001 mfd. 1500 wv ceramic disc capacitor
22.837	1	Cinch #1510A lug terminal strip
29.387	1	Shakeproof washer, Style 18, No.3512-22, Phosphor bronze
135-500	1	Insulator, stand-off
71.91-100	2 ft.	Black plastic covered #20 hookup wire



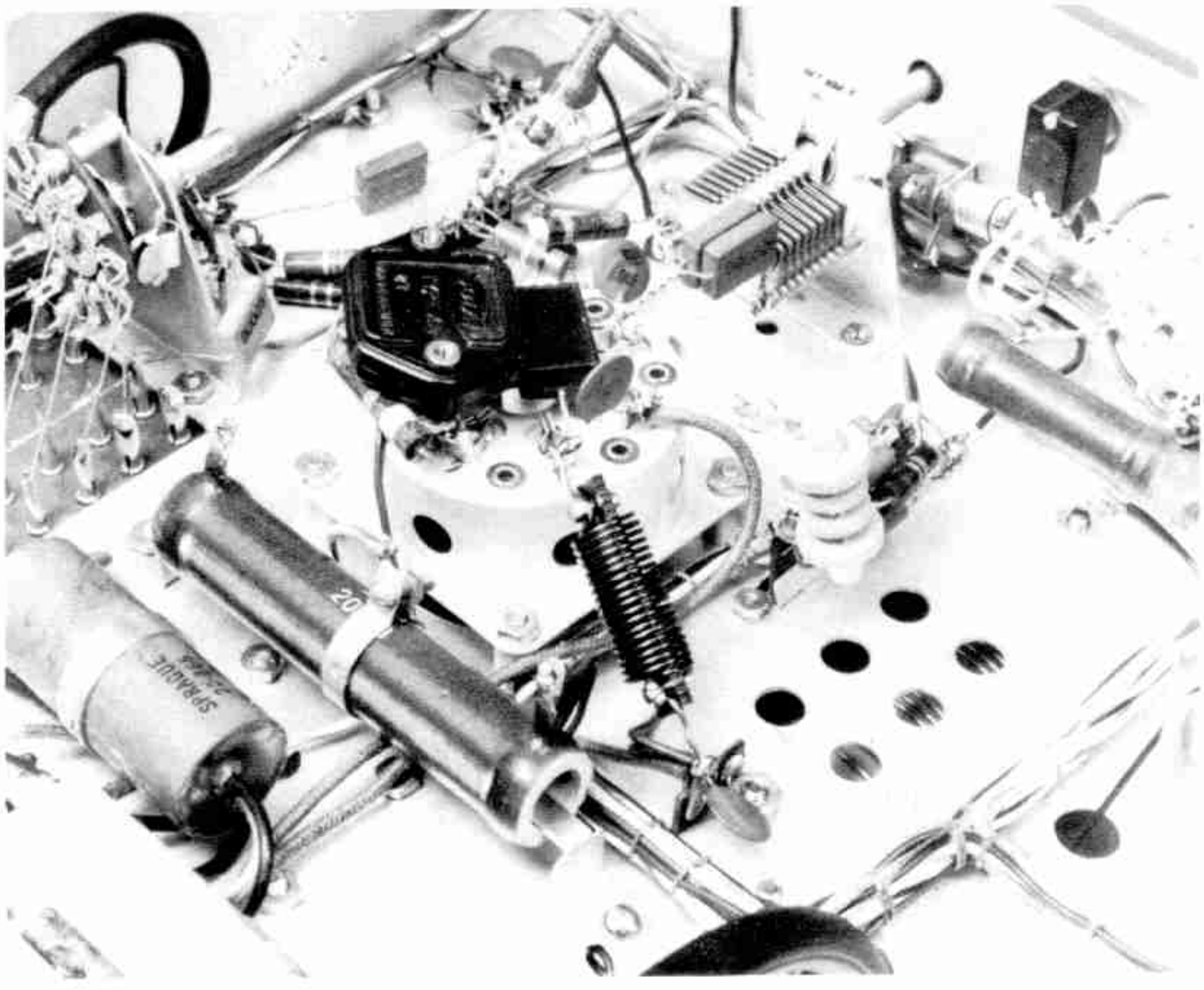
Operations A22 thru A32



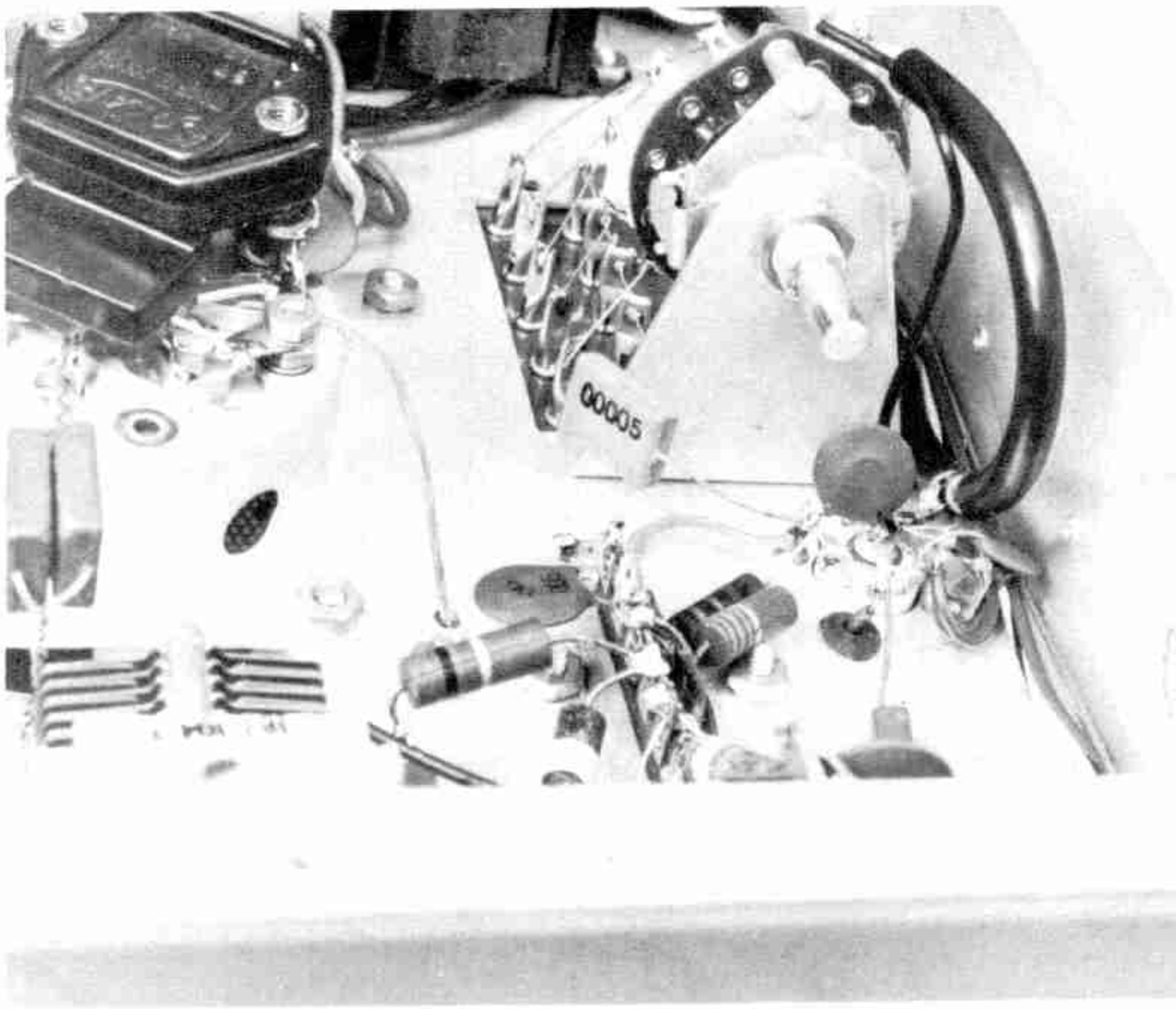
Operations A34 thru A37



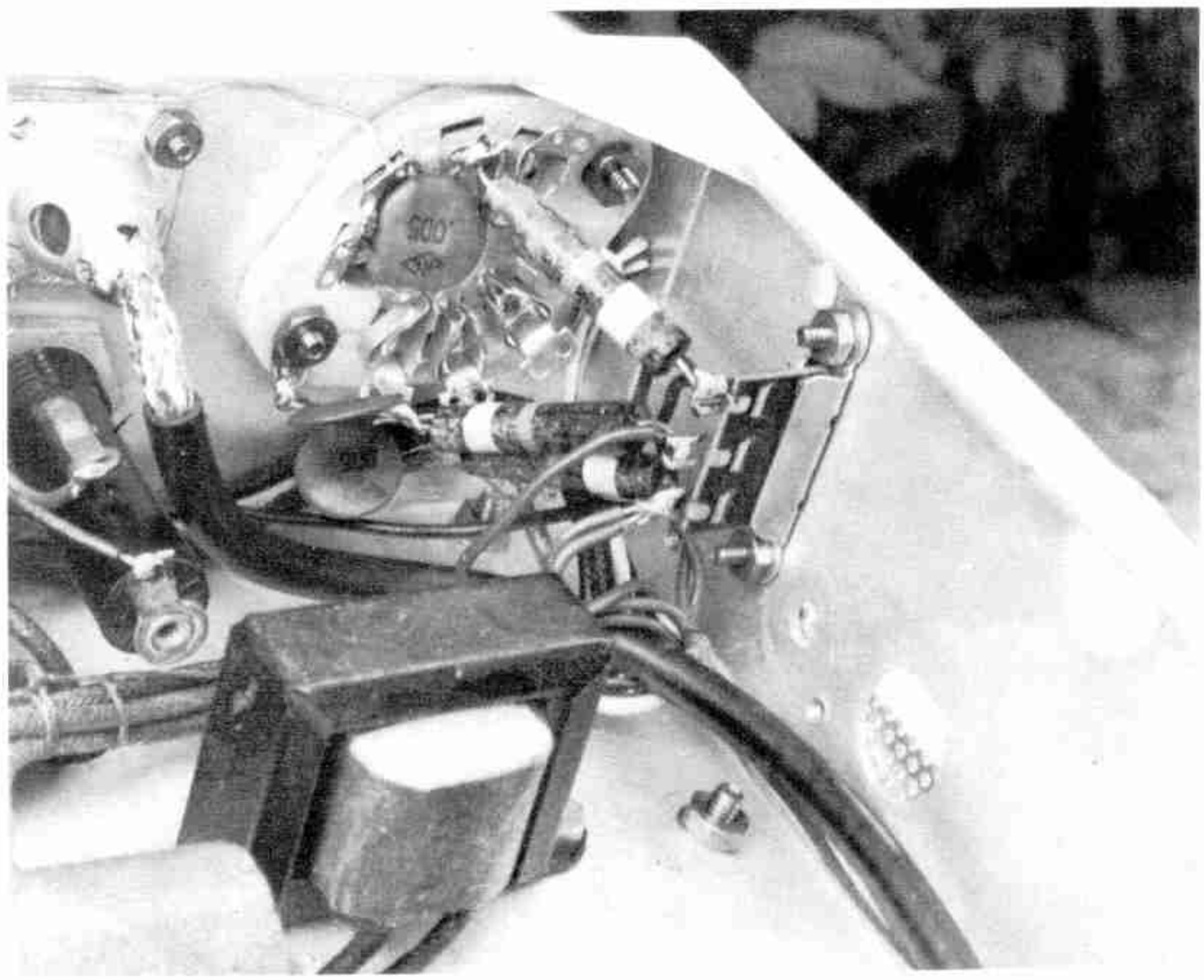
Operations B1 thru B5, B9 thru B16, B43 thru B46



Operations B17 thru B26



Operations B6 thru B8



Operations B32 thru B42

Operations B47 thru B61

Operations B62 thru B66