WIRELESS SET NO. 22, MK. I

FIRST ECHELON WORK

This replaces and cancels Tels. F 283, Issue 1. It has been amended throughout.

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.

MAINTENANCE

General

1. Regular and careful maintenance is essential for keeping the set in good order. The maintenance described here should be carried out by a Signals electrician at least once a fortnight, or more often if possible. Whenever the electrician maintains the set he should fill in the maintenance chart, which is kept by the signal officer for each set under his control. A specimen chart is shown in Fig. 1.

Lubrication and general cleaning

2. Clean slow-motion drives, rims of dials, and "flick" discs (behind panel), using a rag moistened with petrol and wrapped round a sharpened stick, similar to a toothpick. Apply Oildag, or, if none is available, thick oil, to all these. Apply thin oil to all moving parts of flick mechanism. Check tightness of screws securing flick arms and stops. If the stops are loose, fix them so that the dial stops definitely engage on them, but do so without encroaching on the calibrated portions of the dials. Do not alter the setting of the index brackets. Clean interior, including aerial tuning inductor, and inspect for loose or dirty connections; dry out if necessary. All oils and greases must be of the anti-freeze types, for example, W.D. grease No. 9.

Controls

3. Check mechanical action of all controls. Work from left to right. The most important points are:—

(*a*) AERIAL TUNING—should have no endplay and should not foul the locking device at any point. Check operation of clutch.

(*b*) HET. TONE—should turn through 360°, stiffly but smoothly.

(*c*) Switches—clean and positive action.

(*d*) Slow-motion drives—should turn dials smoothly and without slip, especially when turned very slowly. If fine tuning drive is fitted, check for excessive backlash. Check that grooves in slow-motion spindles engage readily on edges of driving discs when flick levers are turned from FLICK to SET. Test this at several positions of dials.

(*e*) NETTING TRIMMER—should turn through 360° and should not foul locking device at any point of its rotation.

(*f*) Netting switch—check self-return action.

(*g*) All knobs—check that grubscrews are tight.

Relays

4. See that contact and pole pieces are clean; inspect the latter, especially for bits of iron rust. Note that the contacts make and break correctly. See that none of the wiring is fouling moving parts of the relays. Check that both the relays operate the instant the pressel switch is depressed. When the switch is released note that the high-speed relay L7A releases instantly and that the slugged relay L6A operates after a delay of approximately 0.25 seconds.

Valves

5. Remove lids of screening cans where used and see that they make good contact with the cans. Check that screening cans are pushed home to bases. See that valves are firmly held in their sockets. If loose, lightly squeeze contacts of sockets. Check that clips fit tightly on top caps of valves, and that the top caps are secure. Inspect grid leads where they pass through screening cans; if worn, replace if possible, or insulate with tape. Also inspect leads where soldered to clips; if wire is frayed, remake joints.

Aerial tuning inductor

6. (*a*) Check operation.

(*b*) Clean with carbon tetrachloride or rectified benzine. Apply cleaning solution to coil with cloth, at same time turning inductor. Make certain groove in wheel is thoroughly clean.

(*c*) Apply graphite oil (Oildag) to rod and moving parts, taking care to keep coil and groove in wheel clean and free from grease and dirt. Oiling to be kept to a minimum.

(*d*) Check calibration. Indicator should read 000 when inductor is ½ turn from bottom end.

Power supply unit

7. (*a*) See that vibrator is making good contact in its holder. Clean pins if necessary.

(*b*) Check operation of on/off switch.

(*c*) Check snatch lead; clean contacts; if noisy or intermittent, replace lead.

(*d*) Check spare vibrator.

(*e*) See that case contains spare fuse wire.

Aerials (vehicle)

8. (*a*) Rods—straighten, clean ends, and apply a little Vaseline to them.

(*b*) Aerial bases—check and clean spring contact and insulator.

(*c*) Pigtails—remove aerial base used in vehicle installation and inspect pigtails and/or connection to aerial base. Replace or repair.

Aerials (34 ft. vertical)

9. (*a*) Base—clean and check for faults.

(*b*) Insulators—check and replace faulty insulators. Look especially for cracks.

(*c*) Guy ropes—replace any which have been standing in wet surroundings for a length of time.

(*d*) Pegs—replace bent or faulty pegs, and make up number (8).

(*e*) Rods—clean, grease threads, and replace bent or damaged rods.

(*f*) General—check list of parts and replace any missing or damaged.

Harness and associated parts

10. (*a*) Snatch leads—examine for kinking and external fraying. Inspect contacts in all snatch leads. Check that all snatch plugs and sockets are securely fixed to the lead and have not become loose. For further details see Tels. F 287, Modification Instruction No. 3.

(*d*) Headsets—inspect leads for fraying and snatch plugs for cracks. Clean out microphone, checking terminals and tapsule contacts. Check action of pressel switch, adjusting contacts if necessary. Inspect connections and anchorage of leads to headphones.

(*c*) Key—clean. Check leads for fraying.

(*d*) Remote control units—clean all leads, etc., replacing or repairing if necessary. Clean and check action of unit.

Operation

11. (*a*) Meter—switch on supply unit and check freedom of movement of meter in the A.V.C. position. Switch off and set zero of meter. Note: Set must be in normal working position when adjusting zero of meter.

(*b*) Set test—carry out tests for daily maintenance, checking operation of each control.

Valve tests

12. *Warning.* Switch off set before removing any valves. By noting at regular intervals the performance of certain valve stages, the electrician can detect when any one of these stages begins to lose efficiency, and can thereby keep the general performance of the set at high level. The value of the test figures depends on their being taken under the same conditions on each occasion. The conditions are:—

(*a*) System switch set to R/T.

(*b*) R.F. GAIN at maximum.

(*c*) 60pF and 10Ω dummy aerial (basically equivalent to 12 ft. vertical aerial mounted in ground spike). Condenser, variable, air-spaced, set to 60pF. Resistor to be at least 1W rating.

(*d*) Set tuned to about 3.5Mc/s, except where otherwise stated. The set must not be tuned to an incoming signal.

(*e*) Battery in good condition and fully charged. Connector No. 78 to be used for connecting the battery to the power unit.

(*f*) The same voltmeter must be used on every occasion. The figures given in Tables 1, 2 and 1001 were taken with a model 7 Avometer. A model 40 can be used, but the readings may be slightly lower. If no high-resistance voltmeter is available, the meter in the set may be disconnected and used. A length of wire with a prod must be connected to the negative terminal, and two lengths, each with a prod, to the positive. These latter two lengths should have high-quality series resistances in them of 1.2MΩ and 200kΩ respectively. Tables 1, 2 and 19 show readings which may be expected. Those measured with the set meter are only a very rough indication. Loss of emission is indicated by a rise in the test readings of all valves.

Note. Great care should be taken not to disturb the relative positions of any wiring or components, as this will affect the performance and calibration of the set.

13. Initial valve tests may be made with the aid of the panel meter and the change-over switch, S4A incorporated inside the set. First set S4A to 12V; then set meter switch to A.V.C. and finally vary R.F. gain control R15A from maximum to minimum. At maximum (with no incoming signal) the meter should read not less than 0.5V; and with the R.F. gain control at minimum not greater than 1.5V. If these readings are unduly high, the emission of V1E is low. In addition, if the meter goes hard over to maximum, regardless of the position of the R.F. gain control, the following may be at fault:—

(*a*) V1E filament open-circuited.

(*b*) V3E filament open-circuited.

(*c*) V5A heater open-circuited.

If V5A is open-circuited, no reading will be shown on the panel meter when the meter switch is set to L.T. and S4A to TEST. If, however, V3A has an open-circuited filament, the meter will read the same (12V approximately) whatever the position of S4A. If the filament of V1E is open-circuit, assuming the filaments of V1A and V1D are intact, it will cause the voltage to read over 6V but under 12V, usually round 7–8V. The next test which may be made is to note if the A.V.C. is low. If so, either V1A or V1D is open-circuited, the effect being to increase the filament voltage on V1E, thus increasing the emission. A point that should be noted is that whenever V3A is replaced due to its filament becoming open-circuit, V1C should also be replaced (*after* replacing V3A). It is usually found that the filament of this valve will be open-circuit due to excess voltage being applied when V3A fails. Also, it can usually be assumed that either V3A is faulty or there is a break in the filament feed line if H.T.R. reads over 200V.

Calibration and netting check

14. Set a wavemeter to 2,100kc/s and tune the receiver to it. Net to the signal, using the correct drill. It should be possible to obtain zero beat within the range of the netting trimmer. Record the setting of the frequency dial and the netting trimmer. Repeat at 2,150, 2,500, 3,000, 3,500, 4,000, 5,000, 6,000, 7,000 and 7,900kc/s. In the last case, if using a Wavemeter, class C, set it to 3,950kc/s and tune the set to the 2nd. harmonic (i.e., 7,900kc/s).

Vehicle suppression and screening

15. Finally, if the station is installed in a vehicle, switch on all electrical gear (e.g., fans, etc.) and start the engine. If bad crackling is heard, the suppression and screening system of the engine and charging equipment, etc. are faulty.

Maintenance chart

16. A specimen maintenance chart is shown in Fig. 1. The electrician, after carrying out each item of his maintenance, inserts a tick in the corresponding square on the chart. If he carries out any minor repairs himself, he puts an "R" in the square, and writes the details in the "Remarks" column. If he finds that a major repair, which he cannot carry out himself, is needed, he puts an "X" in the square and reports the set as unserviceable. He also notes in the "Remarks" column the details of any work done since the set was last maintained; the chart thus gives a complete history of the set.

that a 3V battery (two Cells, dry, X, Mk. II) is fitted in the bracket at the back and is properly connected to the two eyelet tags with correct polarity (red is positive, black negative). Generally inspect the interior and if all appears correct, replace the chassis and secure in the case with the screw at the back. Connect the drop lead to the set, plug in a Microphone, hand, No. 8 and one or two pairs of D.L.R. headphones, then unclamp the morse key, adjust to a suitable working position and reclamp. The unit is now ready for operation of the set. For operation from a telephone exchange connect the exchange line to the EXCH LINE terminals; note that one is earthed.

Unit No. 2

18. For remote operation of the Wireless set No. 22, unit No. 2 is connected to unit No. 1 via a twin cable between the CONTR LINE terminals on both units. The E terminals on the unit must be connected to the same wire of the cable. Unit No. 2 is set up in the same way as the

MAINTENANCE LOG—WIRELESS SET No 22

NOTES 1. THIS LOG IS TO BE COMPLETED FORTNIGHTLY BY ELECTRICIAN AND FORWARDED THROUGH DETACHMENT OR SECTION H.Q. TO SECTION OFFICER.
2. IF TIME IS SHORT, ONLY TESTS MARKED X.

UNIT: 80 DIV SIGNALS
COY: 2 COY.
SEC: H

VEHICLE No: T 15732
SET No: 67204
SUPPLY UNIT No: 67204

MECHANICAL OVERHAUL

SET: LUBRICATION, CONTROLS, RELAYS, VALVES, METER
SUPPLY UNIT: VIBRATOR, SWITCH, LEADS
HARNESS: SNATCH LEADS, HEADSETS, KEY, LEADS, CONTROLS, PERFORMANCE
MOUNTS: 6 AERIAL: TERMINAL LEADS, HOODS, BASE, PEGBOARD, BASES, INSULATIONS, CUPS, PEGS, RODS
34' AERIAL: SECTIONS

VALVE TESTS (USING SET METER WITH SERIES RESISTANCE SHOWN)

DATE	RECEIVER							SENDER						
	V1A	V1B	V1C	V1D	V1E	V2B	V3A	V1E	V2A	V3A	V4A	V5A	V5	V6C
	PIN 4	PIN 4	PIN 4	PIN 4	PIN 4	PIN 3	PIN 3	PIN 4	PIN 3	PIN 3	PIN 4	PIN 4	PIN 4	PIN 4
	200KΩ	200KΩ	200KΩ	200KΩ	200KΩ	200KΩ	200KΩ	200KΩ	2MΩ	200KΩ	2MΩ	12MΩ	4MΩ	4MΩ
3 MAR 44	410	480	490	410	435	260	520	290	130	520	150	250	230	230

R = TO BE REPAIRED BY E/S
X = WORKSHOP REPAIR

CONDITIONS: SYSTEM SWITCH AT R/T; RF GAIN MAXIMUM; FREQ 3-5 MCS (NO INCOMING SIGNAL); LT VOLTS (ON METER) 11; AERIAL 12' IN GROUND SPIKE OR EQUIVALENT DUMMY

CALIBRATION AND NETTING

1. TUNE RECEIVER TO WAVEMETER AT GIVEN FREQUENCY AND RECORD DIAL READING
2. SWITCH TO SEND ADJUST TRIMMER (ONLY) TO TUNE SENDER. RECORD TRIMMER POSITION

2100	3100	3000X	3300	4000X	5000	6000X	7000X	7900
3 MAR 44	2100 3	3100 3	3000X 4	3310 3	4010 3	5000 3	6000 3	7000 3	7900 3
17 MAR 44									

REMARKS

DETAILS OF ALL REPAIR WORK DONE DURING MAINTENANCE AND DURING PERIOD SINCE LAST MAINTENANCE.

NO METER READING FOR LT WIRING REPAIRED.

INITIALS: E/S, NCO, SECTION OFFICER

WARNING: SINCE VALVES ARE IN SERIES PARALLEL, ALWAYS SWITCH OFF SET BEFORE REMOVING A VALVE, AND REPLACE BEFORE SWITCHING ON.

Fig. 1—Specimen maintence log sheet

REMOTE CONTROL UNITS F, No. 1 and No. 2

SETTING UP

Unit No. 1

17. For operation of the Wireless set No. 22, unit No. 1 is connected to the lower right-hand drop lead of the set, either directly or via extension leads. Place the unit in its proposed working or testing position with the cover to the front and hinges uppermost. Release the catches and open the cover, resting it flat on top of the unit. Operating instructions are given in the working instructions for the Wireless set No. 22 and briefly on a chart fitted in the lid of the unit. Before connecting up, undo the screw at the back of the unit and pull the chassis out of the case. See unit No. 1 except that there is no drop lead connection to unit No. 2 and inside there should be an additional battery of 24V (two Batteries, dry, refill, 8-cell, No. 1, Mk. 1). For test purposes unit No. 2 may be set up alongside unit No. 1.

Maintenance

19. Maintenance of units which form part of Wireless station No. 22 should be carried out at the same times as for the other equipment. Normally for the units held as spares or separate items, monthly maintenance only need be carried out. Batteries should not be left inside units which are to be transported or stored out of use for long periods.

Daily maintenance

20. Wipe off all dust, dirt and moisture from the exterior of each unit. Lift up the instruction card in the front cover and clean behind if necessary. See that the connections are all correctly made and held tightly under terminals or plugged fully home. Examine leads for damage. See that all control knobs are tight and in the correct position of the spindles. See that the spring round the drop lead is securely anchored under the screw and washer on the front panel of unit No. 1. Adjust the morse key if necessary. Check the mechanical action of the switches on each unit and that of the MOD CONTROL on unit No. 1. Do not press the microphone switch or turn the generator handle. Carry out any simple repairs which may be necessary but report any defects, such as a damaged drop lead on unit No. 1, which cannot readily be corrected. Leave the switches in their central positions.

21. Electrical tests to be carried out daily when the units are connected to the Wireless set No. 22 are given in Tables 15 and 16. The tests marked with an asterisk are not to be carried out if under wireless silence. The tests are such as can be carried out by an operator and are for checking the operation of the system, not primarily for fault-finding. Simple defects, such as a broken or disconnected external lead or a faulty headset, may be rectified by the operator by repair or replacement but all faults should be reported. Causes of faults are given in the order in which they should be investigated; action should be taken until the fault is cleared and the fault reported if it persists after all tests. Tests on the unit No. 2 involve co-operation with the operator on unit No. 1 and, since it is unit No. 2 which is under test, direction should come from the remote end at a pre-arranged time.

Weekly maintenance

22. Once a week the daily maintenance of each unit should be supplemented as follows:—

(*a*) Check the carrying sling, front cover, clips and hinge. Correct faults where possible, e.g., lubrication of hinge, if stiff, and report any irreparable damage

(*b*) Release the screw at the rear of case and withdraw the chassis from the case.

(*c*) Measure the voltage of the dry batteries inside the units. If 1.5V cells have dropped below 1.25V or 12V batteries (in unit No. 2) below 10V, replace by similar batteries in good condition or, if no replacement batteries are available, report. Make sure battery connections are correct and tight.

(*d*) Clean the interior of the unit where necessary. Do not interfere with switch contacts or relays, except to check that the top relay cover in unit No. 1 is securely wedged home by adhesive tape.

(*e*) Test the action of the switches and, if there is any roughness, a *little* oil may be applied to the bearings but must be kept well away from the contacts. Turn the ringer very slightly and check that the switch at the rear of the generator changes over. On unit No. 1 check the action of the MOD CONTROL. Report any apparent deterioration in the action of the controls.

(*f*) Check the morse key, slide and clamp and examine the leads.

(*g*) Replace the chassis in the case and secure by means of the screw at the back. Make sure the screw is tight and report any damage, such as stripped thread.

(*h*) Check all the connections to the unit, looking for signs of wear and tear. Repair any leads which are tending to fray. Look over the headgear, microphone and drop lead connections (on unit No. 1).

(*i*) Carry out the daily tasks.

Monthly maintenance

23. At least once a month each unit should be thoroughly overhauled by maintenance personnel. Whenever this operation is carried out the work done and any workshop repairs required should be recorded on the maintenance chart.

24. Proceed as follows:—

(*a*) Remove all external connections and withdraw the chassis from the case.

(*b*) Clean the interior thoroughly and rectify any loose connections or loose nuts and bolts. Disconnected wires may be reconnected correctly with the aid of the circuit diagram (Fig. 1002 in Tels. F 282) and the wiring diagrams. Seal tightened nuts with shellac varnish or other approved cement which may be available.

(*c*) Remove the batteries and clean away any corrosion in the holders. Insert only clean batteries with voltages above 1.26V per cell.

(*d*) This includes the ringer switch which should change over as the generator handle is turned. Key switch contacts may be cleaned with a plain contact cleaner if necessary. The contact cleaner must itself be thoroughly clean before use. Clean with pure carbon tetrachloride if available, if not, use a clean, dry cloth. The slightest trace of grease must be avoided. Lubricate switch bearings where necessary but use lubricants sparingly.

(*e*) Inspect relays in unit No. 1. Slide off the top relay cover to facilitate this. Do not interfere with relay adjustments. See that the pole pieces are clear of dust. Clean relay contacts if necessary but in the case of the upper relay A/1 in unit No. 1 the cleaner must not be more than 3 mils thick; a clean feeder gauge will suit.

(*f*) Check the relay circuits as follows. In unit No. 1 put switch S1 to remote unit and switch S2 to EXCH or REMOTE OP. USES SET, then connect a battery of 20–24V to the CONTR LINE terminals; with the negative battery lead to the E terminal, relay A/1 should operate, and with the battery reversed, relay B/1 should operate when the connection is made. In unit No. 2 see that the 24V battery is connected, put switch S5 to EXCHANGE USES SET, switch S7 to EXCH SEND and then operate switch S6. The relay A/2 should be operated when S6 is in the MUTE position (do not leave the switch in this position). Record any operational failure.

(*g*) When relay inspection is complete in unit No. 1, replace the top relay cover and wedge it in position with insulation tape.

(*h*) Clean and adjust the morse key. Examine the leads to it and repair or replace if showing signs of wear. Check the clamp action.

(*i*) Insert the headphones plug several times in each phones jack to check contact springs.

(*j*) Check the mic. plug with a corresponding socket. If loose fitting, open the plug pins sufficiently to ensure good contact and clean the pins if necessary.

(*k*) Examine the snatch plug lead on unit No. 1 carefully for signs of damage. See that the anchoring cord is securely attached to the block inside the unit and that the spring round this lead is undamaged and firmly fixed to the front panel.

(*l*) When all the procedure requiring access to the interior has been completed, replace the unit in its case and fasten by means of the screw at the back of the case.

(*m*) Thoroughly examine the headphones and microphone; clean out the latter, checking capsule contacts and pressel switch. Inspect the leads, especially at each end and anchoring.

(*n*) If the unit is in use with a Wireless set No. 22, reconnect the external leads and have the daily tests carried out to ensure that the unit is in working order. If the unit is to be returned to stores, it should be connected as in para. 17 for test before being handed over. When closing the front cover of unit No. 1 see that the drop lead is correctly stowed flat on the front panel.

Mechanical adjustments and replacements

25. All adjustments are covered in the preceding paragraphs, but to facilitate adjustments in some cases, e.g., a faulty switch, it may be more convenient to remove a component. To remove a part, first unsolder the connections, then release the fixing screws or nuts. In the case of controls, knobs have to be removed before withdrawing the component. No special difficulty is involved. When replaced, components can be wired correctly with the aid of the circuit diagram (Fig. 1002 in Tels. F 282) and the layout and wiring diagrams. Adjustments or replacements of relays are not part of first echelon work.

Localization of faults

26. The maintenance tests will reveal most faults, and if a fault develops, the daily tests should first be carried out and any results noted. Then, to trace the actual fault, select the appropriate tests. It is assumed that simple faults confirmed by the daily tests, e.g., defective headphones, may be checked for continuity with an ohmmeter across the top and sleeve of the plug and across each earpiece to localize the disconnection (the resistance of the headphones should be about 150Ω). Further, with the headphones plugged into a unit or receiver, either earpiece may be short-circuited, and if that earpiece only is faulty, signals should be heard in the other. Intermittent disconnection may be confirmed by shaking the lead while listening in the headphones. Similarly the continuity of the microphone capsule and pressel switch circuits may be checked with an ohmmeter, referring to the circuit diagram for connections.

MECHANICAL REPLACEMENTS AND ADJUSTMENTS

Removal of meter

27. Disconnect both leads and loosen clamping screw behind the panel. *Note*: Some sets have Weston type meters. These are of lower resistance than others generally used, and have a series resistor of 190Ω fixed to the terminals. This should be removed with the meter, and should be replaced only with Weston type meters.

Meter switch

28. By first removing the meter, this switch can quite easily be changed.

Hct. tone control

29. To remove, first take off base cover. The connections can then be unsoldered and the control withdrawn. When replacing make sure that the knob pointer is in the upright position when the slider is in the centre of the winding.

Removal of netting switch

30. Unsolder connections, remove fixing nut and withdraw switch from the rear. It may be necessary to remove V1A in order to accomplish this.

Normal-remote control switch

31. Remove base cover and unsolder wires, if necessary first removing fixing nut. Remove switch.

Sender on-off switch

32. Replace as remote-normal switch.

L.F. gain control

33. Remove base cover. Unsolder wires, remove knob, and withdraw control. When replacing, turn control so that knob pointer is at 2 o'clock when control is at maximum.

R.F. gain control

34. Remove knob and felt pad. Loosen the fixing nut on the bracket behind the front panel and withdraw control. When replacing rotate control so that when the knob is located by the grubscrew on the "flat" of the spindle, the pointer is at 4 o'clock.

Removal of snatch plugs and sockets

35. Remove base cover and disconnect leads from terminal block. Remove screw holding strain cord. Care should be taken to ensure that connections are screwed tight on the terminal block and that there is no possibility of their swinging round and causing a short-circuit. See Tels, F 287, Mod. Inst. No. 3.

LOCALIZATION OF FAULTS

PRINCIPLES OF FAULT-FINDING

General

36. If a fault develops in the installation, the simple tests for the operator's daily maintenance should be carried out; these will localize most faults. This section describes the

action to be taken when the various symptoms are recognized.

37. WARNING. By indiscriminate probing about in the wiring of the set, you will cause more faults than you cure. If the relative positions of wires and components are altered, the performance and calibration of the set will be upset. This is especially important around the oscillator sections, both M.O. and receiver. For this reason operators must never remove the bottom covers of the set. Headsets are also liable to damage through unnecessary dismantling.

System

Carry out each test methodically and in the correct order. Correct each fault as it is located and see that the test which led to the discovery of the fault gives satisfactory results before proceeding to the next test. Short cuts do not pay.

General fault-finding

39. Remember that external faults are much more common than internal ones, and if any test fails, look for faults in the following order:

(*a*) Faults in setting of switches or other controls, e.g., gain too low.
(*b*) External faults, e.g., aerial battery or headset connections.
(*c*) Internal faults.

Valve circuit testing

WARNING. Switch off set before removing any valves.

The operator can test valves by replacing them with new ones. He must not connect up or switch on the set until he has put it back into its case. A Signals electrician or an instrument mechanic can test the receiver valve stages very simply by tapping the top cap (i.e., the control grid) of each valve in turn with a wet finger. A loud "plonk" in the headphones when the top cap is tapped means that all stages between that point and the headphones are working properly; a faint click, or no sound at all, indicates a fault. He must, therefore, work back through the receiver stages from the headphones to the aerial in the order V1E, V1D, V1C, V1B and V1A, thus testing stage by stage.

Component faults

41. A fault in a valve stages does not necessarily imply a fault in the valve itself; the fault may be in one of the other components of the stage. The more likely components are mentioned in Tables 3-9 but any component is liable to go wrong. Electricians should have an ohmmeter or some instrument suitable for checking components for short-circuit or open-circuit. Valve voltages should be checked with a high-resistance voltmeter; an Avometer, universal, 46 range, is recommended. A condenser suspected of being open-circuited may be checked by connecting a condenser known to be good in parallel with it.

Sequence of testing

42. The tables which follow show how to locate a fault. The tests should be carried out in the order shown, starting with Table 3. The order in which they are carried out is very important as one test possibly hinges on three or four previous tests to prove a part of the set working.

Circuit tested	Positive of meter to	Negative of meter to	Voltage	Set meter	
				Series resistance	Reading on 600 scale
V1A	Pin 4	Chassis	70	200kΩ	420
V1B	Pin 4	Chassis	80	200kΩ	480
V1C	Pin 4	Chassis	80	200kΩ	490
V1D	Pin 4	Chassis	70	200kΩ	420
V1E	Pin 4	Chassis	80	200kΩ	470
V2B	Pin 4	Chassis	45	200kΩ	270
V3A	Pin 3	Chassis	90	200kΩ	540

Table 1—Valve test figures on receive

Note: Voltages taken on 400V range on Avometer, model 7.

Circuit tested	Positive of meter to	Negative of meter to	Voltage	Set meter	
				Series resistance	Reading on 600 scale
V1E	Pin 4	Chassis	50	200kΩ	290
V1A	Pin 3	Chassis	150	1.2MΩ	150
V3A	Pin 3	Chassis	85	200kΩ	510
V4A	Pin 4	Chassis	170	1.2MΩ	170
V6A	Pin 4	Chassis	280	1.2MΩ	280
V6B	Pin 4	Chassis	280	1.2MΩ	280
V6C	Pin 4	Chassis	280	1.2MΩ	280

Table 2—Valve test figures on send

Note: Voltages taken on 400V and 1,000 V ranges on Avometer, model 7

Table 3—Test for localizing faults in the supply system

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Power supply	1	Switch on set by switch on power supply unit	Red lamp lights and vibrator buzzes	(i) Red lamp does not light. Vibrator does not buzz	(*a*) Vehicle master switch off	Switch on
					(*b*) Battery lead faulty	Check and repair
					(*c*) Fuse in supply unit blown	Replace fuse. If it blows again, disconnect snatch plug lead between unit and try again. If O.K. now, the set is faulty and should be examined for a short-circuit. If not, check C35A and B in the power unit. Check vibrator by substitution
					(*d*) Battery connections faulty	Check by connecting direct to battery
					(*e*) Battery discharged	Replace battery
				(ii) Red lamp lights but no buzz from vibrator	(*a*) Vibrator faulty	Replace vibrator
				(iii) Red lamp out, vibrator working	(*a*) Bulb burnt out	Replace bulb
L.T. supply	2	Set meter switch to L.T.	Meter reads 10.5–12V	Meter reads below 10.5V	(*a*) Battery discharged	Replace battery
					(*b*) Battery lead faulty	Check resistance and repair
					(*c*) Snatch plug or socket faulty	Repair or replace
H.T.R. supply	3	Set meter switch to H.T.R.	Meter reads about 90V	(i) Meter reads zero, or reads intermittently	(*a*) Snatch plug or socket faulty	Repair or replace
					(*b*) Vibrator faulty	Replace vibrator
					(*c*) Electrical fault	Check C21A, R12A, R26A
				(ii) Meter reads 250–300V	Receiver faulty	If test 2 is O.K., switch off and check receiver valve filament circuit for continuity. Replace valve or valves. Check R16A
H.T.S. supply	4	Set meter switch to H.T.S. Switch sender on. Set system switch to R/T, press pressel switch	Meter reads 250–300V	(i) Meter reads zero or intermittently	(*a*) Power snatch plug or socket faulty	Repair or replace
					(*b*) Faulty headset	Replace
					(*c*) Relay faulty	Check relays L6A and L7A. Check continuity of S7A
					(*d*) Sender or receiver faulty	Check drive; if between 6.5–9V on C.W. on either band, check H.T.S. meter circuit if no drive, check sender circuits, i.e., R14A

Table 3—Test for localizing faults in the supply system—*continued*

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
				(ii) Meter reads high, i.e., 400V	Internal fault	Observe if filaments of V6A–C are alight. If not, replace valves or/ and check heater circuits for continuity symptoms. Check R23A for continuity

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Headgear (earpiece)	1	Switch on set and tune receiver	Stations should be heard	No hiss or stations	(*a*) Headphones	Replace headsets. Check leads to earpieces. Short-circuit each earpiece in turn; if faulty, the other one will work
					(*b*) Snatch socket faulty	Repair or replace
					(*c*) Internal fault	Check receiver by touching grid caps. Carry out following tests, starting at Table 5. Check resistance between pins 2 and 3 to be 100Ω
Headgear (microphone)	2	Switch on set and depress pressel switch. System switch to R/T, speak into microphone. Meter reading A.V.C.	Voice should be heard clearly in headphones, also A.V.C. reading on meter should kick	(i) Voice not heard or heard very weakly. No movement of A.V.C. meter	(*a*) Remote - normal switch in remote position	Change to normal position
					(*b*) Sender switch off	Switch sender on
					(*c*) Microphone fault	Replace headset. Change capsule if necessary. Inspect pressel switch and adjust if necessary. Inspect microphone leads and snatch plugs. Inspect and adjust contact holding capsule
					(*d*) Sender - Receiver faulty	Check relays. Check continuity of T2A. (*Note.* If the A.V.C. reading on receive shown on the meter varies from 5–12V as the R.F. GAIN is varied from max. to min., the secondary is not open-circuit
						Check valves, etc. after V1E by tapping V1E grid with wet finger
				(ii) Voice not heard or heard very weakly; normal movement of A.V.C. meter	V2A at fault	Check if Ae current fluctuates (*a*) if not, check L1A (V2A) (5) if it does, check R4D C16F

Table 4—Headgear faults

Table 5—Receiver fault-finding

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Receiver	1	Set system switch to R.T. Set meter switch to A.V.C. Turn both gain controls fully clockwise. Tune to any strong R/T signal	Signal heard in headphones in normal manner; meter reads normally	(i) Set "dead," and meter reads zero	Internal fault	Check C21B, C10F for short-circuit. Check R21A, R4C for open-circuit. Change V1E.
				(ii) Set "dead" but meter reads normally and rises when tuned	Internal fault	Check S1D for bad contacts. If HTR is high (i.e., above 200V), replace V3A. If fault still persists, check R11A, R9A, C20A and relay contacts S5C
				(iii) Set "dead," meter reads normally and remains steady, even when tuned	Internal fault	Try replacing V1D. Check S5A. Check C10A for short-circuit. If R13A gets very hot, there is most certainly a short-circuit in the H.T. line
				(iv) Set sounds "alive" but no station is heard on either band	(*a*) Aerial circuit faulty	Check if aerial tuning controls are correct. If the aerial coupling is very high and the aerial tuning very low, stations may be heard faintly on the R.F. band. Switch to send and check aerial current. An unusually low reading with the aerial circuit tuned means that the aerial is disconnected. Examine pigtails in aerial base. This may be checked by short-circuiting the aerial to earth on send. The current should drop
					(*b*) Internal fault	Try replacing V1C. Touch grid of V1B with wet finger. A loud "plonk" should be heard. Repeat at grid of V1A. The set may be checked at the grid of V1B by injecting an R.F. signal. An aerial may be connected to the grid of V1B when the louder signals on the band will be heard. A similar test can be made at the grid of V1A. If nothing is heard from the grid of V1B, replace valve. Check voltages on valve, etc. If signals are heard at V1B and not V1A (they may be very weak), replace V1A. Check voltages, etc.

Table 5—Receiver fault-finding—*continued*

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
				(v) Set is "dead" for a short while after sending, but recovers its former sensitivity	(*a*) Internal fault	Check L5B for open-circuit Check A.V.C. wiring
				(vi) Signals are audible but weak	Internal fault	Change all receiver valves one by one. *WARNING*: Switch off set before removing any valves. Measure resistance of I.F. transformer windings. They should be between 6.5Ω and 9Ω according to which I.F. transformer is being measured. Check for open-circuit in L8A, L9A, L10A and L11A, also noting if any switch contacts are faulty (S2A, S3A)
				(vii) Signals good on one range but not on other	Internal fault	If 2–4.5Mc/s is good, check L8A, L9A and associated switches S2A and S3A; if 4.5–8Mc/s is good, check L10A, L11A also switches S2A and S3A
				(viii) Set unstable, producing unusual noises or whistles	Internal fault	Check decoupling of each stage, particularly I.F. decoupling. Reduce L.F. GAIN slowly. If change in instability occurs (e.g., instability stops), check C18A, C19A, C23B for open-circuit. If not, change V1B
				(ix) Signals very noisy	(*a*) Atmospherics	Disconnect aerial. If noise now ceases, it is due to outside interference
					(*b*) Vehicle suppression faulty	Stop engine. If this effects a cure, check vehicle suppression system
					(*c*) Loose connections	Check aerial and aerial connections
					(*d*) Earthing bad	Check earthing of set. If in vehicle, the bonding must be checked
					(*e*) Internal fault	Change vibrator. Check continuity of lead joining chassis of vibrator unit to set chassis
	2	As tests 1 but with system switch set to C.W.	Beat oscillator should heterodyne incoming signals and produce a beat note which can be adjusted by the HET. TONE control	(i) Beat note is heard	Internal fault	Change V2B. Examine S1F contact. Check L16A, L17A for continuity. Voltages on V2B should be checked.
				(ii) Beat note is heard but when R19A is varied there appears to be intermittent contact	Internal fault	Examine R19A; clean or replace

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Netting	1	Switch set to NET and tune to incoming signal for zero beat. Depress netting switch and rotate C6A between the limits of 0-10 divisions	It should be possible to obtain zero beat within the range of the netting trimmer	(i) No beat is heard	Internal fault	Make sure sender switched on. Examine S1C contacts. Examine S2E, S3C for bent contacts. Change V4A. Try another station on the other band. If working on one band but not on other, examine S2E, S3C for bent contacts. Check continuity of coils, etc. on range that does not work. If coils O.K., return set to R.E.M.E. workshops
				(ii) It is impossible to obtain a zero beat within the range of the trimmer	(*a*) Tuning incorrect (*b*) Internal fault	Retune signal and try again Trimming out. Send set to R.E.M.E. workshops.

Table 6—Tests to localize faults in the netting system

Sender	1	System switch to NET. Net sender to receiver by adjusting netting trimmer for zero beat. Switch meter switch to A.V.C. Switch system switch to R/T and depress pressel switch. Rotate aerial tuning inductor (with coupling condenser set at figure given in table on power unit) for maximum reading	When connected up to a 12 ft. vertical aerial, reading of at least 6V is shown on the meter at any frequency	(i) No reading on meter. Relays are not working (Click in set not heard)	Pressel switch circuit faulty	Change headset. If still faulty, plug in key and operate. If O.K. now, snatch lead faulty; if not, internal fault in relay wiring or open-circuit keying relay L7A
				(ii) No reading on meter but relays are heard to work	Internal fault	Check drive. If, approx. 5 on R/T. and 7.5V on C.W. note if valves are running at normal temperature. If unduly hot but with drive about normal, check continuity of L1B. Should there be no drive check H.T.S. Check S9C, S5E. Depress net switch; drive should drop from 7.5V to 6.5V on C.W. and from 5V to 3V on R/T. If no change observed, check S6A and V4A anode circuit. Insert bulb from spare bulb holder inside power unit in series with aerial and tune aerial circuit. If bulb lights up when aerial circuit is in resonance aerial transformer T1A, and/or associated components are at fault

Table 7—Sender faults

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Modulation circuits	1	As Table 7, but in addition speak into microphone. Switch meter switch to AERIAL	AE reading should kick and sidetone be heard in headphones	(i) Meter reading steady and no sidetone in headphones	(*a*) Controls incorrectly set up	Note if REMOTE/NORMAL switch is in NORMAL position
					(*b*) Headset or headset connections faulty	Check microphone for continuity; also check action of pressel switch
					(*c*) Internal fault	If on receive the A.V.C. indication does not change when the R.F. gain is altered, the microphone transformer secondary is open-circuit. Set meter switch to A.V.C. and speak into microphone. Meter should kick; if not, check S5F for operation, T2A for short-circuit. If O.K., check R8A, L1A
				(ii) Meter reading steady but sidetone satisfactory	Internal fault	Check C10K for open-circuit. Replace V2A. If no improvement, check C16A, C10K, L1C and R4J
				(iii) Meter kicks but no sidetone	(*a*) Headset or headset connections faulty	Change for tested headset
					(*b*) Internal fault	If set works on receive, check S5C for faulty contacts. Check R4D for continuity and C16F for open-circuit

Table 8—Modulation faults

Part tested	*Test No.*	*Test*	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
Keying circuits	1	Switch set over to C.W. and press key	Aerial reading should rise to a figure slightly higher than that on R/T Receiver stops and nothing is heard in the headphones	(i) Receiver still works and there is no aerial current	Key or key jack faulty	Try depressing pressel switch on microphone. If set now sends, examine and repair (or replace) key or key jack
				(ii) Set stops receiving but aerial current meter reads zero	Internal fault	If set works and modulates on R/T, check S1A–C contacts. Check drive. Should be 5V approx. on R/T and 7.5V approx. on C.W. If not, check S1E
C.W. reception	2	Release key	After approx. ½ sec. the receiver should start working and produce a whistle controllable by het. tone control	(i) Receiver does not operate	Relays sticking	Clean and adjust if necessary
				(ii) Receiver operates but no whistle is heard	(*a*) Incoming sig- too strong	Reduce R.F. gain control
					(*b*) Internal fault	Check S1F: Measure voltage at anode of V2B. If over 60V, change V2B. If correct, check continuity of L16A. (anode of V2B to pin 2 of V1D). If no whistle heard after checking and repairing any of the above points, return to R.E.M.E. workshops for checking and re-trimming

Table 9—C.W. faults

Tag No.	Connections	Circuit reference
1	Red wire to No. 1 slugged relay. Red wire to B5	S9C
2	White wire No. 7 (high-speed relay)	S9B
3	Yellow wire to No. 5 slugged relay. Yellow wire to Pin 6 V6A	S9C
4	White wire to No. 17 slugged relay	S9B
5	Orange/black wire to R12 (system switch)	S9A
6	Black/white wire to R4 (system switch)	S9A
7	White wire to No. 2 (high-speed relay). White wire Pin 7 to V6B	L7A
8	Blue wire to S2 (key socket)	L7A

Table 10—High-speed relay connections

Tag No.	Connections	Circuit reference
1	Red wire to No. 1 (high-speed relay)	S5E
2	Orange wire to B1	S5D
3	Brown wire to V2A, pin 4	S5D
4	White wire to B2	S5B
5	Yellow wire to No. 3 (high-speed relay)	S5E
6	Black/white wire to V2A, pin 2	S5D
7	Orange/black wire to S4B	S5F
8, 9, 10, 11	Mauve wire to H3 .... Green wire to V3A, pin 6	S5F S5C
12	Pink wire to D1	S5A
13	Black wire to E2	S5F
14	Brown wire to L1	S5C
15	Blue wire to G3	S5C
16	Red black wire to L12B, tag 2	S5A
17	White wire to A3. White wire to No. 4 (high-speed relay)	L6A
18	Tinned copper wire to C3	L6A

Table 11—Slugged relay connections

Tag plate	Connections	Circuit reference
P1	Brown wire to V2A, pin 4	S1H R/T
P2	Blank	,, C.W.
P3	Blank	,, Net
P4	Brown wire to V2B, pin 7	,, Common
P5	Blank	S1J R/T
P6	Pink wire to centre tag R19A	,, C.W.
P7	R19A to R32A	,, Net
P8	Pink wire to J1A, earthy	,, Common
P9	Blank	S1G R/T
P10	Blank	,, C.W.
P11	Blank	,, Net
P12	Blank	,, Common
Q1	Tinned copper wire to Q3	S1E R/T
Q2	Brown wire to tap on R16A	,, C.W.
Q3	Tinned copper wire to Q1. Brown wire to F3	,, Net
Q4	Green wire to V6A, pin 5	,, Common
Q5	Blank	S1F R/T
Q6	Blue wire to C4 tinned copper wire to Q7	,, C.W.
Q7	Tinned copper wire to Q6	,, Net
Q8	Red wire to D1	,, Common
Q9	Tinned copper wire to Q11	S1D R/T
Q10	Mauve wire to remote/normal switch	,, C.W.
Q11	Tinned copper wire to Q9. RED/BLACK wire to B2	,, Net
Q12	Yellow wire to E4	,, Common
R1	Tinned copper wire to R3 .... Blue wire to V6B, pin 5	S1B R/T
R2	Tinned copper wire to R8 .... Black wire to M.O. coils (cold couplers)	,, C.W.
R3	Tinned copper wire to R1	,, Net
R4	Black/white wire to high-speed relay L7A, contact No. 7	,, Common
R5	Tinned copper wire to R7	S1C R/T
R6	Blank	,, C.W.
R7	Tinned copper wire to R5 .... Tinned copper wire to R10	,, Net
R8	Tinned copper wire to R2	,, Common
R9	Tinned copper wire to R11	S1A R/T
R10	Tinned copper wire to R7 Yellow wire to V6C, pin 5	,, C.W.
R11	Tinned copper wire to R9 Pink wire to V6C, pin 6	,, Net
R12	Orange/black wire to high-speed relay L7A, contacts No. 5	,, Common

Table 12—System switch connections

Table 13—Tag plates and connections

Tag plate	*Connections*
A1	R29A white wire to positive of C27A
A2	Earth tag. Tinned copper wire to positive of C22A
A3	R29A white wire to slugged relay, L6A, contact No. 17
B1	Orange wire to slugged relay L6A, contact No. 2 Orange wire to E1 Tinned copper wire to negative of C22
B2	Red black wire to Q11 White wire to slugged relay L6A, contact No. 4 Black wire to T3A, tag No. 4
B3	Earth tag. Black wire to earthy tag J1A. (key socket)
B4	Not used
B5	R13A, R12A, red wire to G1 Red wire to E8. Red wire to high-speed relay L7A, contact No. 1
C1	100Ω tag of R16A. Mauve wire to end of R15A (R.F. gain control)
C2	R12A. Red wire to V3A, pin 4 Red black wire to N3
C3	Earth tag
C4	Blue wire to Q6 R4L
D1	R13A, red wire to Q8. Pink wire to slugged relay L6A, contact No. 12
D2	R20A. Red wire to V4A, pin 6
D3	R8B. Pink wire to V5A, pin 5
D4	Tinned copper wire to C16D
D5	Earth tag. C23E. Black wire to V2B, pin 6
E1	Red wire to remote/normal switch Red snatch lead wire to microphone
E2	Black wire to slugged relay L6A, contact No. 13 White snatch lead wire to microphone pressel switch
E3	Blue wire to S2 Blue snatch lead wire to relay pressel switch
E4	Yellow wire to Q12 Green snatch lead wire to headphones
E5	Mauve wire to positive of C24A. Mauve to L.F. gain control (maximum end)
E6	Black wire to negative of R10A Black wire to Q3. White power lead wire (H.T.–)
E7	White wire to test switch, white wire to V5A, pin 7 Yellow power lead wire (L.T.+)
E8	Red wire to B5. Red/black wire to netting switch. Red power lead wire (H.T.+)
F1	R4G. Orange wire to B1
F2	Earth. R4H. C19D
F3	Brown wire to V5A, pin 3 Brown wire to Q3 system switch Brown wire to end of R15A. R.F. gain control
G1	R21A. Red wire to B5
G2	Earth C18A
G3	Blue wire to L6A (slugged relay), contact No. 15. C20A
H1	Yellow screened wire to L.F. gain control R9A, C19A, R4E
H2	Earth. R5A, C10G
H3	R5A. Mauve wire to L6A (slugged relay) contact No. 9, primary of T2A
I1	L5B. Yellow wire to K1 Screened lead to grid cap of V1A
I2	Earth. Screening of grid lead to V1A
I3	L5A. C10P. R10C
J1	C28B. Brown wire to V4A, pin 3
J2	Earth
K1	C17H. Yellow wire to I1
K2	Earth
L1	C16F. Brown wire to L6A (slugged relay), contact No. 14
L2	C16F. R4D
L3	Earth. R4F
L4	C16A. R4F. Green wire to grid cap of V2A
L5	L1A. C16A. R4
M1	L1A. C19E. Pink wire to L15A, tag 2
M2	Earth. C19E
N1	Earth. Tinned copper wire to meter switch
N2	R25A. Red wire to V6C, pin 6
N3	R26A. Red black wire to C2
N4	R26A. Red black wire to S3 (meter switch)
N5	R25A. Red wire to S4 (meter switch)
O1	R29A. White wire to S2 (meter switch)
O2	Earth. Yellow wire to T3A, tag 3
L15A	
1	C11A. Pink wire to V2A, pin 5
2	R8A. C19C. R4M
3	R4E. C18A
4	R4M. Tinned copper wire to V1E, pin 3
L12B	
1	Blank
2	R4B. Red wire to V1C, pin 2. Red/black wire to slugged relay L6A, contact No. 16
3	C13B. Yellow wire to T2A
4	R4B. Tinned copper wire to V1D, pin 3
L12A	
1	C17C. R1C
2	R4A. Pink wire to V1B, pin 3
3	Yellow wire to V2A, pin 4
4	R4A. R3A
T3A	
1	White wire to V3A, pin 3
2	Blue wire to V3A, pin 4
3	Yellow wire to O2
4	Black wire to B2
5	Blank

Table 13—Tag plates and connections—*continued*

Lead colour	*Connected to*
Blue	Earth
Black	H3 tag plate
Yellow	Earth
White	V2A, pin No. 2
Red	L12B, tag No. 3

Table 14—Microphone transformer (T2A) connections

Test	*Correct result*	*Incorrect result*	*Probable cause*	*Action to be taken*
1. With S2, S4 in central positions, don headphones and blow into microphone	Sidetone in headphones only when microphone switch depressed	(*a*) Nothing heard	(i) Faulty headphones (ii) Faulty 'phones jack (iii) Faulty microphone (iv) Internal fault	Try another headset Try another jack Try another microphone Report
		(*b*) Sidetone heard with pressel switch released	(i) Faulty microphone (ii) Internal fault	Try another microphone Report
2. If connected to an exchange, put S1 to EXCH, S2 and S4 central and turn generator handle	Exchange reply heard in headphones	No reply heard	(i) Faulty line (ii) Internal fault	Check EXCH LINE connections Report
3. Ask exchange to ring	Bell in unit rings	Bell does not ring	Internal fault	Report
4. If connected to remote unit No. 2, put S1 to REMOTE UNIT, S2 and S4 central, and turn generator handle	Reply from unit No. 2 heard in headphones	No reply heard	(i) Faulty line (ii) Internal fault in either unit	Check CONTR LINE connections Report
5. Ask remote operator to ring	Bell in unit No. 1 rings	Bell does not ring	Internal fault in either unit	Report
6.* If circumstances permit, put S2 to USE SET, S4 to central	If set switched on to receive, signals or background noise heard in headphones	Receiver output not heard	(i) Receiver inoperative (ii) Snatch plug connection faulty (iii) Internal fault	Listen in receiver headphones Check connection Report
7.* As Test 6, with microphone switch pressed, blow into mouthpiece	Set switched to send and modulated	(*a*) Set not switched to send and modulated	(i) Faulty set (ii) Faulty mic. (iii) Snatch plug connection faulty (iv) Internal fault	Press set micro. switch Try another microphone Check connection Report
		(*b*) No sidetone heard	Faulty set	Listen in set headphones
8.* As Test 6, press morse key	Set switched to send	Set not switched to send	(i) Faulty set (ii) Faulty snatch plug connection (iii) Faulty morse key (iv) Internal fault	Press sender morse key Check connection (same as Test 7) Examine key and leads Report
9.* S1 to EXCH, S2 to EXCH OR REMOTE OF USES SET, S3 to EXCH SEND, S4 to R-B. W.S. 22	Set switched to send and modulated by output of receiver connected to LOCAL RECR terminals. Sidetone heard at unit	(*a*) Set not switched to send	(i) Faulty set (ii) Faulty snatch plug connections (iii) Faulty morse key (iv) Internal fault	Press sender morse key Check connection (same as Test 7) Examine key and leads Report
10.* S2 to CALL EXCH OR REMOTE OP S4 to R-B REMOTE OP LOCAL RECR	Output from receiver connected to LOCAL RECR appears at SEPARATE SENDER terminals level variable by MOD CONTROL	No output at SEPARATE SENDER terminals (if connected to mod. input of additional sender, sender not modulated)	(i) MOD CONTROL (ii) Internal fault	Turn up MOD CONTROL Report

Table 15—Daily tests for Remote control unit F No 1

Test	Correct result	Incorrect result	Probable cause	Action to be taken
1. With S5 in central position, don headphones and blow into microphone. If a receiver is connected to RECEIVER OUTPUT turn gain right down	Sidetone heard in headphones only when microphone switch depressed	(a) Nothing heard	(i) Faulty headphones (ii) Faulty PHONES jack (iii) Faulty microphone (iv) Internal fault	Try another headset Try another jack Try another microphone Report
		(b) Sidetone heard with pressel switch released	(i) Faulty microphone (ii) Internal fault	Try another microphone Report
2. If unit No. 1 does not ring at correct time, ring him with S5 at CALL SET OPERATOR	Reply from unit No. 1 heard in headphones	Nothing heard	(i) Faulty line (ii) Internal fault in either unit	Check CONTR LINE connectinos Report
3. When communication with unit No. 1 has been established, ask local operator to switch to EXCH OP REMOTE OP USES SET, put S5 to USE SET and S6 to MUTE	Output from Wireless set No. 22 receiver is heard	(a) Receiver not heard (b) Set switched to send (reported by set operator)	Fault at unit No. 1 (i) Morse key faulty (ii) Faulty microphone (iii) Internal fault	Report Check morse key Try another microphone Report
4. As test 3, with pressel switch or morse key operated	Wireless set No. 22 switched to send	(a) Set not switched by pressel switch	(i) Faulty microphone (ii) Internal fault in either unit	Try another microphone Report
		(b) Set not switched to send by morse key	(i) Fault morse key (ii) Internal fault	Check morse key Report
5. Put S5 to EXCH USES SET and operate S7 (if exchange is connected to EXCH LINE, call indicator may be operated at exchange)	Wireless set No. 22 receiver heard with S7 at EXCH REC. Set switched to send with S7 at EXCH SEND (exchange operator may be heard)	(a) Receiver not heard S7 at EXCH REC	Fault at unit No. 1	Report (same as Test 3)
		(b) Set not switched to send S7 at EXCH SEND	Internal fault	Report (compare with Test 4)
6. If a set is connected to the RECEIVER OUTPUT terminals, turn up gain and operate S6	Receiver output heard with S6 at NORMAL, not heard at MUTE	(a) Nothing heard at NORMAL	(i) Fault receiver (ii) Faulty connection to RECEIVER OUTPUT terminals (iii) Internal fault	Listen in receiver headphones Check connections Report
		(b) Receiver not muted	Internal fault	Report

Table 16—Daily tests for Remote control unit F, No. 2

Table 17—Fault-finding in Remote control unit F, No. 1

Symptoms of fault	*Tests*
1. Nothing heard in headphones for all positions of S2	Check wiring from PHONES jack.
2. No sidetone from unit microphone with S2 central. If connected to No. 22 set, receiver heard and sender modulated from unit with S2 in USE SET position	Examine S2A/2 and wiring from C2A to T1A and S2A/2
3. Wireless set No. 22 receiver not heard with S2 in left-hand and/or right-hand position and S4 central	If heard in one position of S2 and not the other, examine section S2A/2 of switch. If heard in neither position, check continuity from snatch plug point 2 to point 3—resistance should be about 1,500Ω—with headphones plugged in. If different, check through to drop lead terminal strip for broken wires in lead or disconnection. Check wiring from green lead to R6A, resistance of R6A and connection to S2A/2.
4. Little or no apparent output from microphone, e.g., no sidetone with S2 central, sender not modulated with S2 at USE SET	Measure voltage across pins 1 (+ve) and 3 (–ve) of MICROPHONE plug. If less than 2.5V, replace 3V battery. If zero volts and not corrected by new battery, check wiring from pin 1 to battery +ve lead and from battery –ve lead to pin 3 through primary (1Ω) of T1A; check insulation between pin 3 and chassis. Check R2C.
5. Wireless set No. 22 sender not modulated from unit microphone with S2 at USE SET, but sidetone heard with S2 central	Check continuity of wiring and components from snatch plug point 4 (white lead) to R4A, R2A, S2A/4, T1A secondary (50Ω), 3CA, R2C and chasis. Test R3A for short-circuit
6. Excess sidetone—little modulation, with S2 at USE SET	Check R2C, R2A, R4A, S2A/4, R2C and wiring. Test continuity of T1A secondary (50Ω)
7. Overmodulation of sender from unit	Check R3A and wiring.
8. Set switched permanently to send (S1 not at EXCH, S3 not at EXCH SEND)	Put S2 in central position. If set still switched to send, check insulation between points 1 and 3 of snatch plug; if short-circuit, disconnect blue lead and localize in drop lead or connection of S2A/3. If set not switched to send with S2 central, see that morse key is not short-circuited at contacts or inleads, and examine wiring to MICROPHONE plug 4 for short-circuit to chassis. If fault only with S2 in left-hand position, examine wiring S2A/3 to S1A/2 and relay A/1 for short-circuit to chassis; see whether switch and relay tags are bent over, or if relay contacts A1 are short-circuited
9. Set not switched to send with S2 at USE SET and S4 central, when microphone and/or morse key pressed	If not switched to send in either case, put S2 to left-hand position, S1 to EXCH, S3 to EXCH SEND. If set is now switched to send, check S2A/3; if not switched to send, check continuity from snatch plug point 1 (via blue lead) to S2A/3 to pin 4 on MICROPHONE plug, or if not by morse key only, examine morse key wires and connection to S2A/3 and chassis
10. Set not switched to send for re-broadcast or exchange, use S1 at EXCH OP REMOTE OP USES SET, S3 at EXCH SEND)	Check that the set is switched to send with S2 at USE SET and with morse key of unit pressed; if not, see tests above. Otherwise check wiring and switches S2A/3, S1A/2, S3A to chassis.
11. Set not switched to send for remote use (S2 at EXCH or REMOTE OP USES SET, S1 at REMOTE UNIT)	Check that set is witched to send with S1 at EXCH, S3 at EXCH SEND; if not, see tests 9 above. Otherwise measure voltage across CONTR LINE which should be about 20V, negative to E; if less or reversed, inform remote operator. If voltage correct, measure line current—minimum for working is about 8mA. Correct line current may indicate faulty relay A/1 or disconnection at contacts A1. Remove relay cover and see whether relay is actuated as S1 is switched from EXCH to REMOTE UNIT; if relay is actuated, look for dirty contacts or disconnection S2A/3 to contacts A/1 tags to chassis. If relay is not actuated, try short-circuiting W1A and increasing voltage locally) across CONTR LINE terminals. If no line current, check S1A/1, S2A/6, S1A/3, W1A, relay coil A/1 (2,000Ω), contact B1 of relay B/1 and wiring. Try short-circuiting W1A and cleaning contacts B1

Symptoms of fault	*Tests*
12. Set receiver not heard by exchange and/or remote operator with S2 at EXCH OP REMOTE OP USES SET. Receiver heard at unit	Check reception across line terminals with line disconnected. Make sure set is switched for remote operation and check that receiver is heard in set headphones when switched to C.W.; if not, fault is probably in S5B contacts in 22 set. If set is correct, check continuity from unit snatch plug point 5 via red lead to S2A/1 to C1C and from other side of C1C to S1A/1. Try another condenser across C1C
13. Exchange and/or remote operator not heard with S2 in central position, after ringing either	If neither is heard, check S2A/6 and wiring to S1A/1 and T1A. If one is not heard, listen across corresponding line with condenser in series with headphones; overhaul line if nothing heard. If line is normal, check S1A/1. Check ringing generator in unit by short-circuiting two top contacts of switch at rear and turning handle—bell in unit should ring
14. Bell does not send when exchange and/or remote operator rings	If ring from only one source, check setting of S1; then ask calling operator to examine his ringing circuit. If no ring from either, examine wiring of S1A, C1A, generator switch and bell. Slacken centre bolt of bell and examine gong adjustment and internal wiring
15. Wireless Set No. 22 sender not modulated from local receiver S2 at EXCH OP REMOTE OP USES SET, USES SET, S4 at R–B W.S. 22)	Check output of receiver at LOCAL RECR terminals; if nothing heard, disconnect receiver from terminals and listen to receiver. If fault is in unit, measure resistance across terminals with S4 central—resistance 200Ω (R1A)—and with S4 at R–B WS 22—resistance about 150Ω (R1A, S4, S2A/4, R2A, R3A). Also check from snatch plug point 4 to non-earthy LOCAL terminal—650Ω (R4A, R2A, S2A/4, S4)

Table 17—Fault-finding in Remote control unit F, No. 1—*continued*

Symptoms of fault	Tests
1. Nothing heard in headphones	Check wiring from T1A secondary tags 4 and 6 to PHONES jack and thence to chassis via C2B; try connecting another condenser across C2B or short-circuit it if a spare is not available. Check continuity of T1A secondary, tags 3 and 5–50Ω, and from tag 5 to chassis via R2A
2. Nothing heard from unit No. 1; sidetone heard from microphone	Disconnect line and listen directly across it; overhaul line if necessary. If line is normal, check connection from E terminal to chassis and from upper line terminal to relay tag A1. If a receiver is connected to the unit and the output of this also is not heard or if no receiver is connected, continue to check wiring from tag A1 (see this is not bent back and touching chassis bracket) to L1B tag, generator switch (check contacts) C3A and tag 3 of T1A. If C3A or T1A is open-circuit, the sidetone will probably be louder than usual. Try short-circuiting C3A (but not with S5 in central position) and check continuity of T1A secondary between tags 3 and 4, 17Ω
3. Output from local receiver not heard with S6 at NORMAL	Listen across the RECEIVER OUTPUT terminals to check receiver; if not heard, disconnect leads across receiver output and aerial to unit and if now heard, check relay contacts A2 and across R1A. If fault is in unit, see that earthy receiver terminal is connected to chassis and check connection to other terminal, including R1A and to C3B and relay tag A1. Try short-circuiting C3B (not with S5 central) and check relay contacts A1. If relay is actuated, examine S6A for short-circuit
4. Exchange not heard	Examine connection from lower EXCH LINE terminal via C3C to S5A/5; try another condenser across C3C or short-circuit it (not with S5 central) and check S5A/5 contacts
5. No sidetone heard from microphone	Measure voltage across MICROPHONE plug pins 1 (+ve) and 3 (–ve); if less than 2.5V, replace 3V battery. If not corrected by replacement, check continuity from pin 1 to tag on +ve lead and from pin 3 to negative lead via T1A (1Ω)
6. Wireless set No. 22 not switched to send with correct switching, when microphone switch or morse key pressed	Press either microphone switch or morse key and measure voltage across CONTR LINE terminals; it should be not less than 20V, negative to earthy side. If low voltage, replace 24V battery. If not corrected by new battery, put S5 to left-hand position, and test again with morse key pressed and then with S7 at EXCH SEND; appearance of correct voltage when morse key is pressed indicates fault in circuit of S5A/1 and S5A/2, or if correct only when S7 is operated the morse key or its wiring are defective. If microphone switch circuit only is faulty, check MICROPHONE plug wiring to pins 2 and 4 and also S5A/3, S5A/4, L1A and wiring (resistance of L1A about 50Ω)
7. Wireless set No. 22 not switched to send for exchange use	Check that set is switched to send by microphone switch and by morse key with S5 at USE SET. If not, see above. Otherwise, check circuit of S5A/3, S5A/4 (S5 at EXCHANGE USES SET) and of S7A
8. Wireless set No. 22 switched to send permanently	Try all positions of S5 to localize fault. If fault occurs with S5 central, 24V battery or line wires reversed. If fault occurs in both side positions of S5, morse key may be short-circuited
9. Bell does not sound when unit No. 1 rings	Check generator switch and wiring to C1A and bell. Short-circuit generator switch and turn generator handle; bell should ring. If not, try short-circuiting C1A, then slacken centre bolt of bell and examine gong adjustment and internal wiring, if necessary.
10. Output from local receiver not muted with S6 at MUTE	See whether relay A/2 is actuated; if not, check continuity through L1B, S6A and relay coil to chassis (resistance of L1B about 50Ω) and check whether relay coil is short-circuited by C4A or wiring. If relay is actuated, check contacts A1 and A2

Table 18—Fault-finding in Remote control unit F, No. 2

Table 19=Valve base connections and resistance-voltage chart

Pin	V1A	V	mA	Resistance To	Resistance Ω Recv'r	V1B	V	mA	Resistance To	Resistance Ω Recv'r
1	F+	2	50	CH. L.T.+	3 4	F+	2	50	CH. L.T.+	4.5
2							4		CH	22
3	A	130		H.T.+	20k	A	104		H.T.+	30k
4	G2	70		H.T.+	70k	G2	80		H.T.+	.67k
5	G3			CH.	S.C.	G3			CH.	S.C.
6	M			CH.	S.C.	M			CH.	S.C.
7		125		H.T.+	20k		125		H.T.+	20k
8	F-			CH. L.T.+	S.C. 3	F-	4	50	CH. L.T.+	22 22
T.C.	G1			A.V.C.	27	G1			CH.	.02

Fig. 2=Valve base connections

Pin	V1C	V	mA	Resistance To	Resistance Ω Receiver	V1D	V	mA	Resistance To	Resistance Ω Receiver	V1E	V	mA	Resistance To	Resistance Ω Receiver
1	F+			CH. L.T.+	0.2 3.5	F+	2	50	CH L.T.+	3 4	F+	2	50	CH. L.T.+	3 4
2		125		H.T.+	20k									CH.	3.3k
3	A	83		H.T.+	30k	A	125		H.T.+	20k	A	R118 S80		H.T.+	90k
4	G2	83		H.T.+	30k	G2	70		H.T.+	70k	G2	R78 S48		H.T.+	168k
5	G3			CH.	S.C.	G3			CH.	S.C.	G3			CH.	S.C.
6	M			CH.	S.C.	M			CH.	S.C.	M			CH.	S.C.
7												R178 S125		H.T.+	168k
8	F-	2	50	CH. L.T.+	4.5 6	F-			CH. L.T.+	S.C. 3	F-			CH. L.T.+	S.C. 3
T.C.	G1			CH.	47k	G1			A.V.C.	.07m	G1			A.V.C.	4600

Pin	V2A	V	mA	Resistance To	Resistance Ω Receiver	V2B	V	mA	Resistance To	Resistance Ω Receiver	V3A	V	mA	Resistance To	Resistance Ω Receiver
1	F+	4	50	CH. L.T.+	5 5	F+	4	50	CH. L.T.+	5 5	F+	4	150	CH. L.T.+	5 5
2				CH.	500k				CH.	23k					
3	A	S1S0		H.T.+		A	C.W. only *45		H.T.+	100k*	A	R90 S80		H.T.+	50k
4				CH.	500k		C.W. only *45		H.T.+	100k*	G2	R95 S85		H.T.+	50k
5	Sig. D			CH.	1.1m	Sig. D			CH.	varied by RF gain con	G1			CH.	470k
6	M			CH.	S.C.	M			CH.	S.C.				CH.	470k
7	A.V.CD			CH.	500k	A.V.CD			CH.	500k		R175 S125		H.T.+	68k
8	F-	6	50	CH. L.T.+	4.5 4	F-	6	50	CH. L.T.+	4.5 4	F-	2	150	CH. L.T.+	3 4
T.C.	G1			CH.	100k	G1			CH.	22k					

Pin	V6B	V	mA	Resistance To	Resistance Ω Receiver	V5A	V	mA	Resistance To	Resistance Ω Receiver
1	M			CH.		M			CH.	S.C.
2	H			CH. L.T.+		H	12	200	CH. L.T.+	4.5 4
3	A	S235		CH. L.T.+	50k 200k	D1			CH.	800k
4	G2	S168		CH. L.T.+	40k 210k	K1			CH.	2.5
5	G3			CH.		D			CH.	100k
6		270		CH.	Net 60k		4		CH.	21
7	H	6	200	CH. L.T.+		H	6	200	CH. L.T.+	2.3 S.C.
8	K			CH.		K			CH.	2.5
T.C.	G1			CH.						

Pin	V6A	V	mA	Resistance To	Resistance Ω Receiver	V6B	V	mA	Resistance To	Resistance Ω Receiver	V6C	V	mA	Resistance To	Resistance Ω Receiver
1	M			CH.	50k	M			CH.	48k					
2	H	6	200	CH. L.T.+		H	6	200	CH. L.T.+	3	H	6	200	CH. L.T.+	
3	A	S290		H.T.+		A	S290		H.T.+	27	A	S290		H.T.+	
4	G2	S282		H.T.+		G2	S282		H.T.+	1500	G2	S282		H.T.+	
5		S-44		CH.			S290		CH.	40k		S168		CH.	42.5k
6				CH.	5sk									CH.	52
7	H	12	200	CH. L.T.+		H	12	200	CH. L.T.+	2.5 S.C.	H			CH. L.T.+	
8	K.G.3			CH.		K.G.3			CH.	2.5	K.G.3			CH.	2.5
T.C.	G1			CH.		G1			CH.	50k	G1			CH.	

Table 10—Valve base connections and resistance-voltage chart—*continued*

Notes: 1. Voltages are taken between chassis and valve sockets.

2. System switch to R/T position (except *); wave-change switch to L.F. band.

3. Voltage and current shown in receive position, except where otherwise stated.

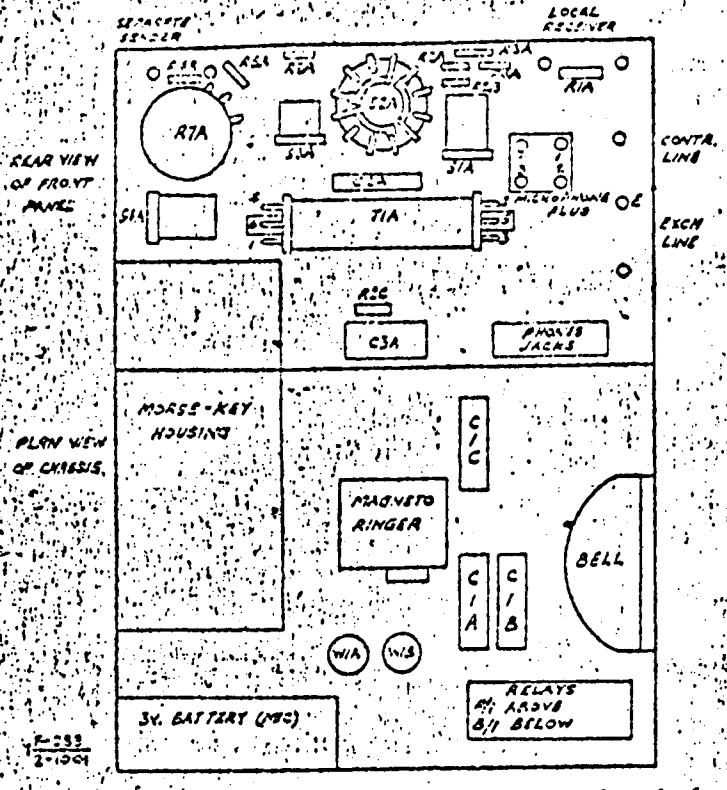


Fig. 1001—Remote control unit F, No. 1, chassis layout

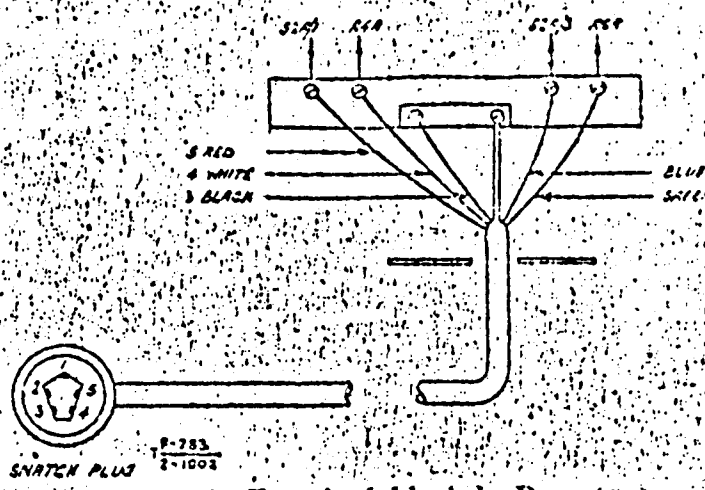


Fig. 1002—Terminal block in Remote control unit F, No. 1

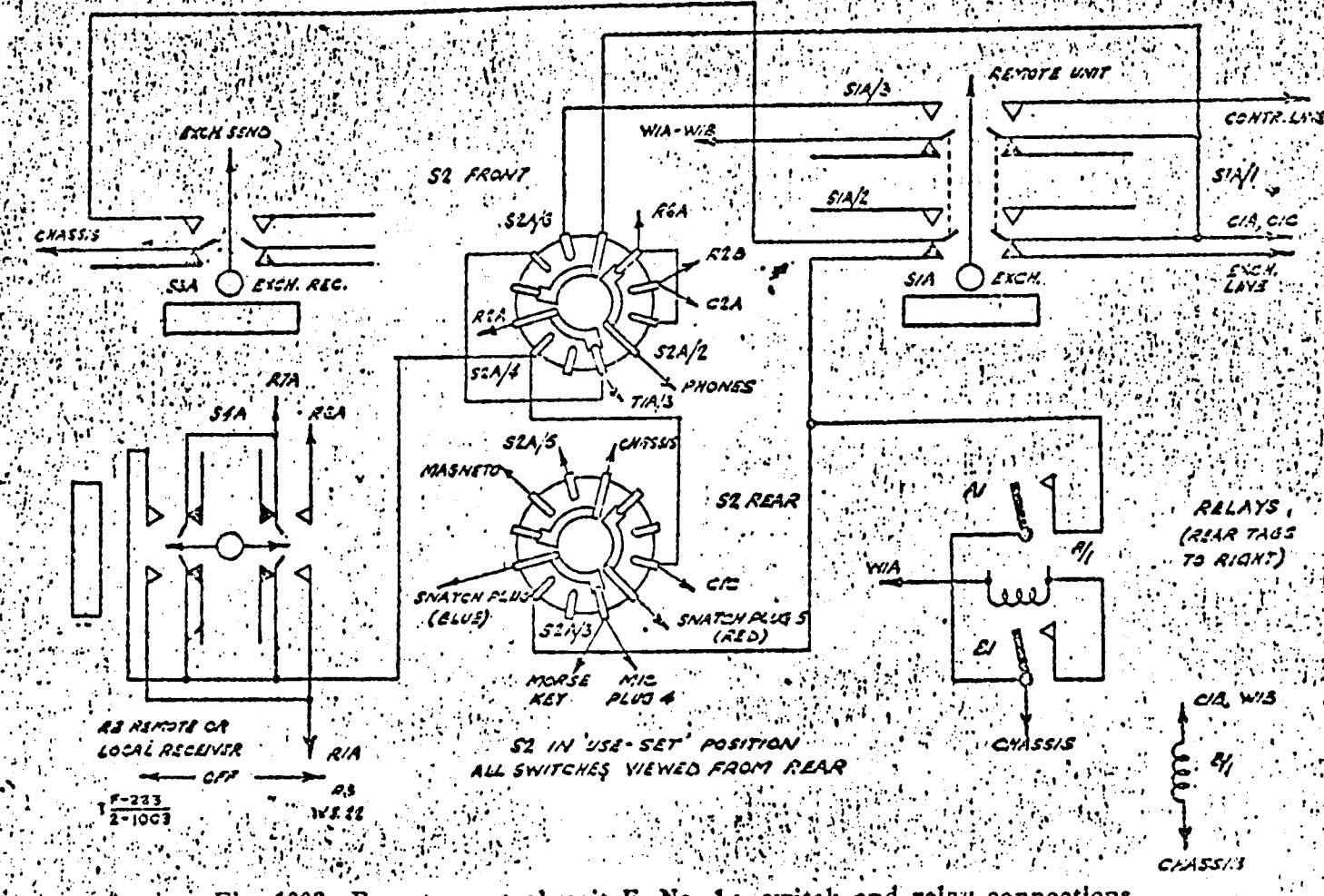


Fig. 1003—Remote control unit F, No. 1; switch and relay connections

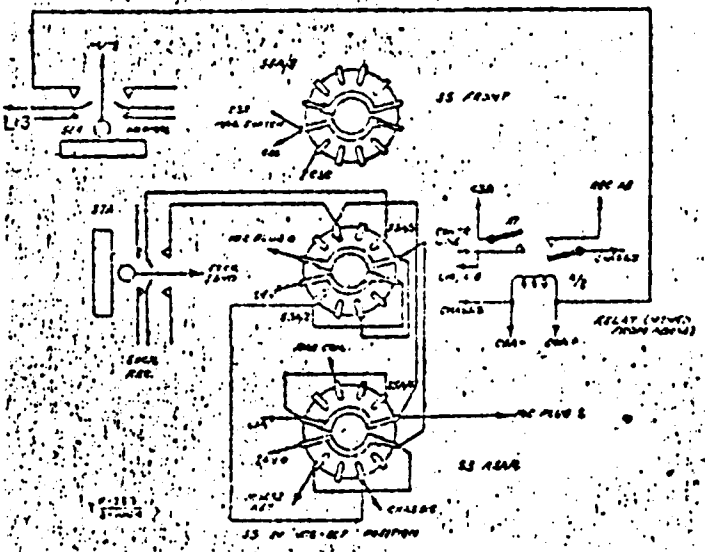


Fig. 1004—Remote control unit F, No. 2; switch and relay connections

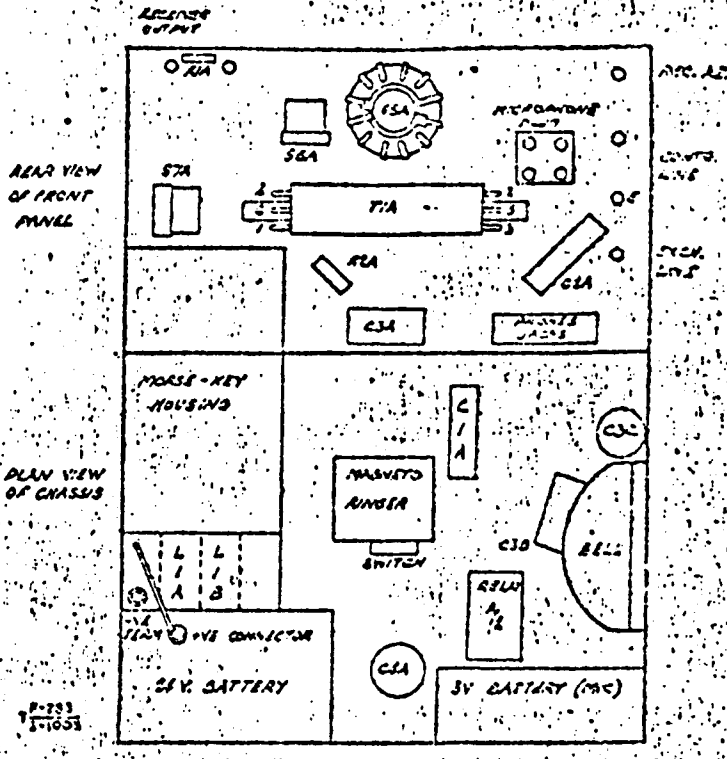
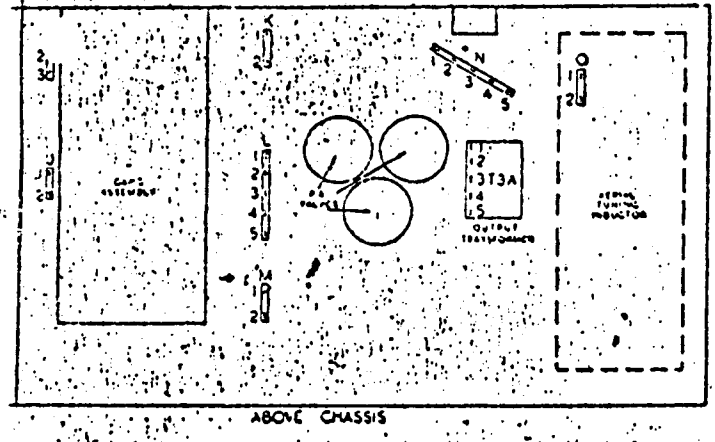


Fig. 1005—Remote control unit F, No. 2; chassis layout



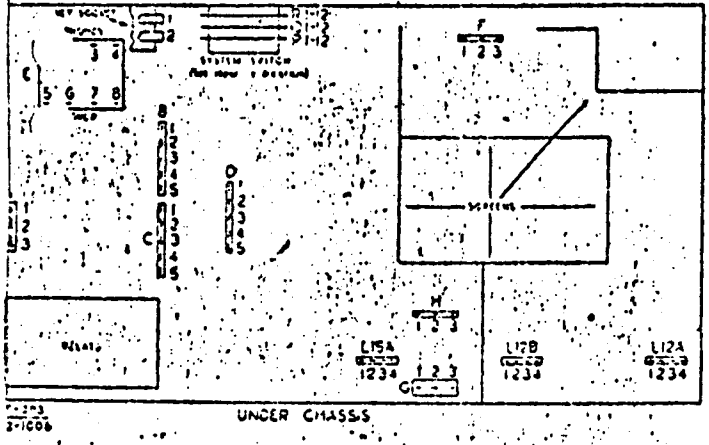


Fig. 1006—Position and numbering of tag pads

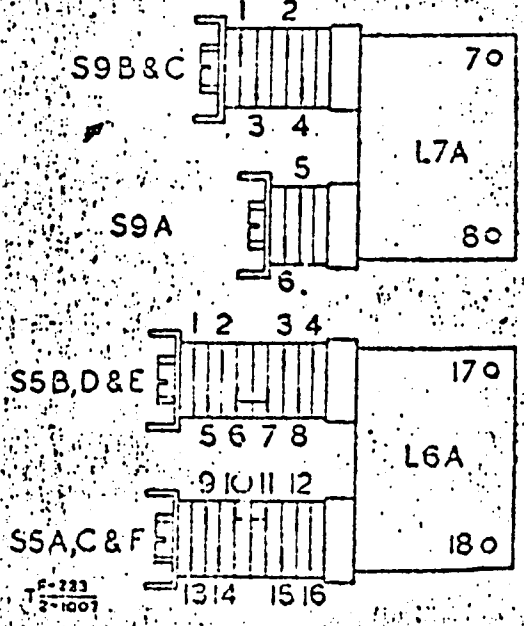


Fig. 1007—Relay tag numbering

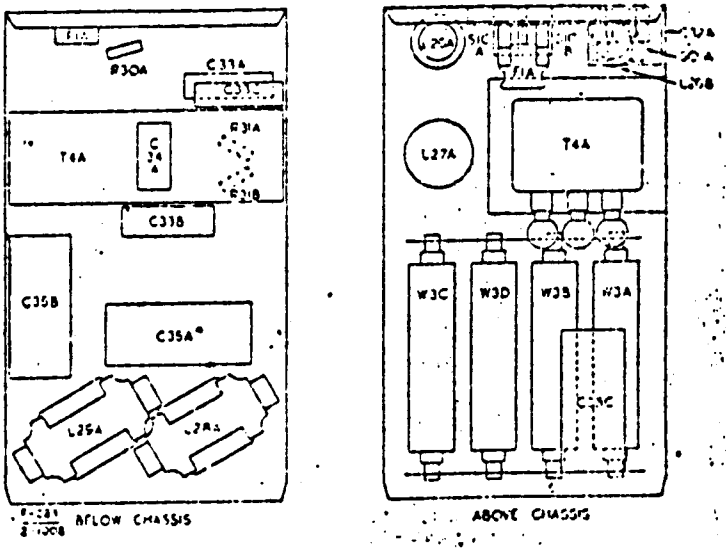


Fig. 1008—Power supply unit, No. 4, Mk. I; chassis layout

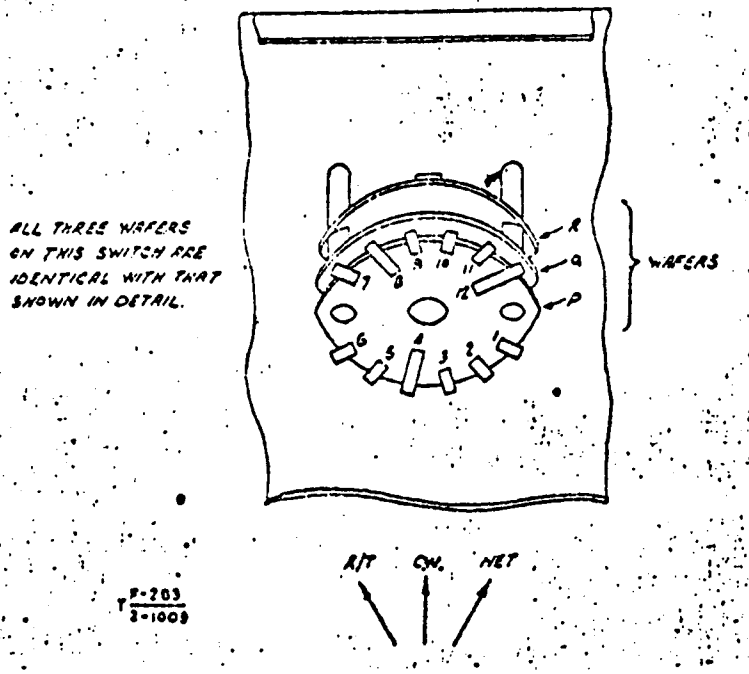


Fig. 1009—System switch connections (S1A-5)

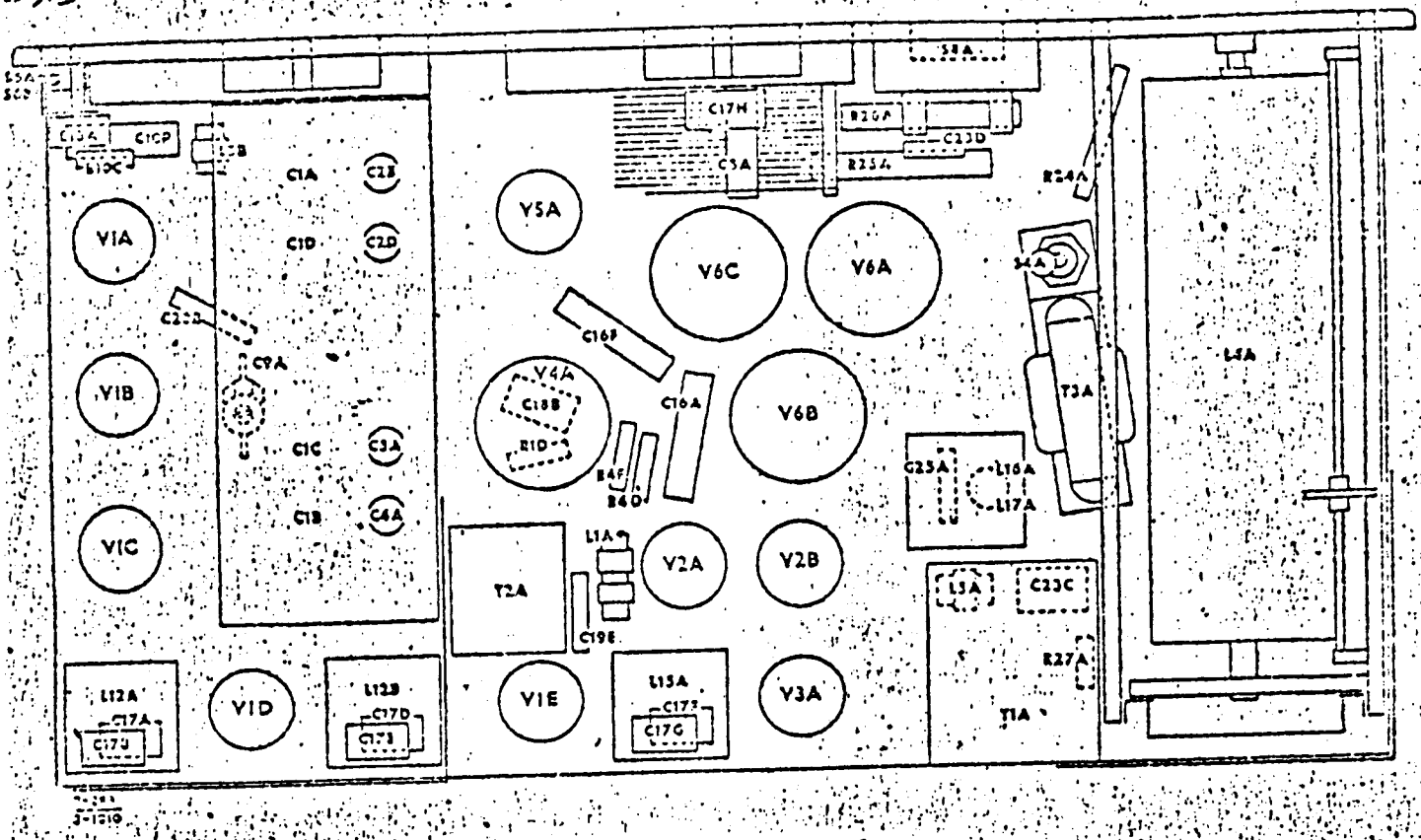


Fig. 1010—Above-chassis layout

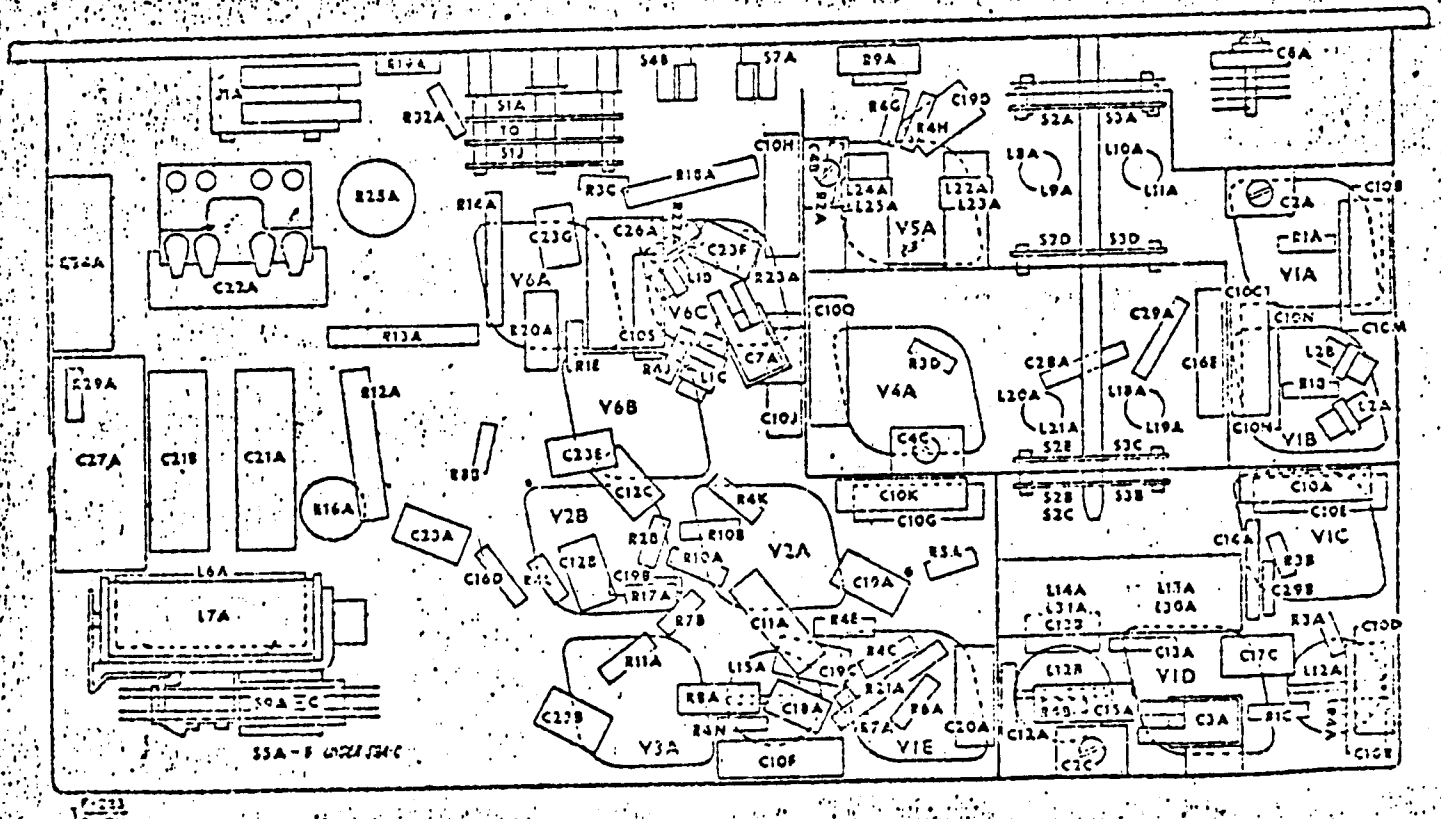


Fig. 1011—Under-chassis layout

END