CHAPTER 7.

OPERATION OF TYPICAL STATIONS.

1. Station YY. The layout of a typical station YY (say) for operation is shown in Fig. 10. The two rhombic aerials (R) are set up side-by-side pointing in the direction of the distant station. They are separated by at least 30 ft. Between the rear masts stands the jeep (J) itself, and about 75 ft. behind it stands the trailer (T) with petrol generator. The ARS aerials (D) are placed behind the rhombics about 75 ft. apart and so that the line joining them is perpendicular to the direction of the opposite station on the short link.

2. Erection of Rhombic Aerials.

The Rhombic aerials type ARV are each supported on three Army masts, Army Ordnance No. ZA3223, and one wooden mast, which, like the Army masts consists of 6 sections making a total height of 36'6". The wooden mast is placed forward. Each mast is complete with 1 base plate, 2 plates with stay holes, 1 top cap carrying stays and halyard 12 stays, 1 halyard and 4 stakes. The remainder of the equipment comprises the aerial proper, consisting of 2 lengths each of 112' of stranded wire; 1 terminating element; 1 matching section; 4 insulators, and 1 length of 150' of cable A.P.13818, terminated in a plug.

3. It is simplest to lay out the two rhombics side by side on the ground and mark the position of each mast and each stake before erecting any part.

4. As stated in Chapter 3, para. 33, the direction should be fixed by compass. The aerial proper in each rhombic forms a diamond whose length is 100' and breadth 51'. To fix the positions of the masts 4'6" is added at each end for the length of the insulators and clearance from the masts. In addition, 3' is allowed at the feeding end for the length of the matching unit. Thus the distance between the forward and rear masts is 112', and the distance between the side masts 60'. The stakes are placed 20' from the mast and are laid out in a square In this way the stays can be attached to three of the four stakes before the mast is pulled up. This can be done by a team of at most four men, one of whom pulls on the free stays, two lifting and one steadying the foot of the mast. When the masts are erected the aerial is hauled up tight on the halyards.

5. ARS Aerials. Before erecting these, it is necessary to assemble the array. It consists of (i) Dipole Unit, a rectangular wooden frame carrying the element and a triangular wooden frame bolted to it (ii) Transformer Matching Unit with cable (iii) Wooden extension of mast. Care should be taken that the required polarisation is noted. It is also important that the elements should be placed correctly in their clamps. A punch-mark is put on the reflector and director to enable them to be located correctly in the longitudinal direction; the punch-mark engages the screw on a clamp. It should be noted that the director is closer to the dipole than the reflector is.

6. The wooden mast extension which supports the array is clamped to an Army mast (see para. 2 above). The erection of the mast is as before. The top section of the mast is turned so that the aerial is pointing in the required direction, and it must be kept in this direction against the wind.

7. Connecting up. Before the motor generator is started up, the final connections of the station are made. The aerial feeders are plugged into each set, with special care that the plugging is positive for the transmitters. The ARS aerials for the transmitter and receiver are different, since these work on different frequencies. The right aerial should be connected to each set. The sets are earthed for A.C. which is best done with a metal stake, similar to those used for the aerial stays. The Radio Linking Unit is wired up, and any necessary telephone wires run. For the method of wiring and operating the R.L.U. see Chapter 8. The power cable is run from the generator to the jeep.

8. Operation. Before starting operation, see that all switches on the V.H/F sets are in the off position. The generator is then started up. Communication is first established with the distant station, using the moving coil microphone and the loudspeaker in the corresponding receiver. Tune the 30-watt transmitter. In particular the Filament switches are left on for three minutes before the H.T. is switched on. Communication is then established on the short distance link, using the carbon microphone and the loudspeaker in the corresponding receiver. The Filament switch on the transmitter is switched on some time before the H.T. switch is made. Similarly, the main switches on the receivers are switched on for a short time before switching on the H.T. Communication on both these lines is duplex, that is, both operators may speak and listen at the same time.

9. When communication has been established on both links, linking through may be carried out, or the stations may be linked to the operator's telephone, or outside telephone lines, according to the operational requirements. See Chapter 8.
The Jeep, equipped with V.H/F sets, but without Radio Linking Unit is shown in Fig. 11. The trailer, partially loaded is shown in Fig. 12.

10. Handcart Stations.

The erection and operation of these stations will be understood at once if the directions for Station YY have been followed. Duplex operation is provided by the two ARS aerials which are erected side by side and directed as required. Supplies for the Receiver and 7-watt transmitter are obtained either from Mains, if available, or from the Battery Generators in the Battery Handcart. These can be used for $2\frac{1}{2}$ hours operation. Communication is established in the first place using a carbon microphone and the loudspeaker of the receiver. It should be remembered that the microphone jack is at the back of the handcart. The Radio Linking Unit is wired to the terminals provided also at the back of the handcart. This unit can then be used, as described in Chapter 8, to link field-telephones, or to another handcart, or other V.H/F station. A Handcart with lids removed to show controls, is shown in Fig. 13. The Radio Linking Unit hangs on the left. A Battery Handcart is shown in Fig. 14. The Handcart Station set up for operation, is shown in Fig 15.

11. Changeover from Mains to Battery Operation.

The following directions are followed to change the sets 681 and CDJ for use with Power Supply Unit DWC:-

(i) Remove mains plugs and aerial feeder plugs from back of transmitter and receiver.

(ii) Take Transmitter and Receiver out of handcart.

(iii) Take out six bolts on front panel of Transmitter cabinet, and two screws in lid of cabinet. Similarly for Receiver.

(iv) Withdraw chassis from cabinets, depressing cut-out switch so as to clear top frame of cabinet.

(v) Remove Jones Plug from power pack section.

(vi) Remove Transmitter and Receiver proper from chassis by unscrewing the four holding down bolts underneath chassis.

(vii) Remove screws from paxolin terminal strip, reverse the strip, replace screws. (This changes the set from 6 volt to 12 volt operation).

(viii) Rebolt Transmitter and Receiver to chassis, replace in cabinet, insert panel bolts and lid screws.

(ix) Plug Jones Plug into socket on extended lead from Battery Generator.

(x) Plug in aerial feeders.

NOTE:- If the sets are replaced in the handcart it will be found that the lids must be left open, and some special method be adopted to close the gate switches.

12. CRR.

It may be convenient to operate a number of handcarts from the vicinity of the CRRs. In this case the station is laid out as described in Chapter 2, para. 42.

13. The V.H/F aerials for the CRRs by themselves are three in number, one to work the simplex link and two for the V/F links. Since these operate in more or less the same direction, they should, if the CRRs are close together, be carefully sited to avoid interference.

14. Simplex Link. The aerial feeder for the simplex link is plugged into the Aerial Changeover Relay, which is located behind the sets. Two lengths of feeder, terminated in plugs at each end, connect the relay to the sets. The relay is operated by the H.T. switch of the Transmitter, in such a way that the aerial is connected to the Transmitter and disconnected from the receiver whenever the Transmitter H.T. is switched on.

15. To obtain communication, therefore, the Mains switch of the Receiver and the Filament switch of the Transmitter are made, and after a short time the H.T. switch of the Receiver is also made. After listening for some time to allow the other station to call, the H.T. switch of the Transmitter is made and a call given to the other station. The H.T. is switched off when the call is complete.

16. In simplex operation, each operator after passing a message, says "OVER" and switches off the H.T. of his transmitter, thus switching the aerial connection through the aerial changeover relay to his receiver. The other operator, after hearing the word "OVER" is free to switch on the H.T. of his transmitter and speak. If an operator on concluding a message, wishes to pass another in a short time, he says "STAND BY" and the other operator leaves his transmitter off. When no messages are being passed, both transmitters are switched off.

17. V/F Link.

The 3-channel V/F transmitter is supplied with its own power unit. Before operation this is switched on for a short time for the valves to warm up. The output line is plugged into the microphone jack of the appropriate V.H/F transmitter. This has its aerial feeder plugged in, in the normal way. The V.H/F transmitter is switched on and operated as described above. It is set going and left on throughout the time that the H/F transmitters are on. If this is not done, the H/F transmitters will radiate constantly, since the "space" is only made by the note transmitted over the V.H/F link.

18. The single-channel V/F link, in the original models, has the power supply taken from the V.H/F transmitter power pack and is switched on with it.
The interior of the CRR containing the Simplex Link and three-channel V/F link, is shown in Fig 16 looking aft. The Simplex Link is on the left nearest the door, Receiver above and Transmitter below. The V/F Transmitter Bay is on the right of the door, and the V.H/F Transmitter carrying the V/F is on the back on the left between the Simplex Link and the key. The Aerial Changeover Relay can be seen behind the Simplex Receiver.

19. The interior of the CRR containing the single-channel V/F link is shown in Fig.17. The Note Modulator is behind the V.H/F transmitter. Above are shown two G.E.C. Rejector Filters (the smaller cans), and two A.S.E. Acceptor Filters (the larger tubes) available for insertion in case of interference.

20. Transmitter Vans.

There are three V.H/F aerials for this station alone, one for the Simplex Link and two for the V/F links. They are carefully sited to avoid interference. The operation of the simplex link is exactly as for the CRR's. The three-channel V/F receiver has its own power pack, and this is switched on shortly before starting operation. The input is from the loudspeaker terminals of the V.H/F receiver, and the output consists of three separate lines from the terminals provided to the appropriate terminals on the control panels of the H/F transmitters.

21. Station Z.

The erection of the rhombic aerials and the operation of the 30-watt transmitter and accompanying receiver are exactly as described under Station YY (para. 1 above). Duplex operation is provided.

22. Teleprinter Operation on V.H/F Link.

First establish communication over the V.H/F link. Then connect up the equipment according to the layout as shown in Fig. 9. Speech is then at once available on the Field Telephone.

23. Plug the Teleprinter into the S plus D, making sure that the S plus D has correct voltage applied before switching on. Put 7-pin plug from Teleprinter into "Teleprinter Test" socket and set S plus D for "Local Record". The Teleprinter should then provide local copy. This test is done at both ends of link.

24. Turn on S plus D oscillator by coin screw on front panel. A note should now be heard at the further end of the link in a pair of phones connected across "Line" terminals of S plus D. (Local Oscillator should be off for this test). Make the same test in the opposite direction.

25. Plug teleprinter into "Teleprinter Working" socket. The operator at one station now sets his S plus D frequency switch to "A" and the operator at the other station sets his S plus D frequency switch to "B".

26. Both operators now turn up the "Detector Sensitivity" control. Switch S plus D to "Local Record".

27. Simplex operation is now available. If the keys are not pressed the motors at both ends will run, but both type-heads will remain silent.

28. To obtain Duplex Teleprinter working, switch both S plus D's to "Blind Duplex".

CHAPTER 8.

MOBILE RADIO LINKING UNIT.

(LINKING UNIT, R/T MOBILE, PATTERN W.9099).

OUTLINE DESCRIPTION AND OPERATING NOTES.

1. A Mobile Radio Linking Unit is shown in simplified outline diagram form in Fig.18 and a detailed wiring diagram is given in Fig.19. A view of the face plate of the instrument showing arrangements of the jacks is given in Fig.20. (The jack connections shown in Fig.20 only illustrate one particular use of the linking unit, described in paragraph 10 below).

FUNCTIONS.

2. The functions of the Mobile Radio Linking Unit when used in conjunction with a V.H/F transmitter and receiver are as follows:-

(a) To enable the local V.H/F set to be operated by a local telephone (e.g. Army Field Telephone).

(b) To enable the local V.H/F set to be operated by a distant telephone or telephone switchboard (e.g. Army Field Telephone or Switchboard) or, in certain circumstances, shore telephone systems.

(c) To enable the telephone operators in (a) and (b) above to communicate with each other through the telephone.

(d) In cases where two V.H/F sets are used in close proximity each with its own linking unit, to enable the two sets be cross connected on a 4-wire basis through the respective linking units.

(e) To enable the local operator to monitor communication in both directions in conditions (c) and (d) above. In cases where Simplex working is used the local operator must be able to listen to the R/T procedure employed by the distant operators and effect the necessary changeover from "transmit" to "receive", and vice versa, at the correct moments.

EXTERNAL CONNECTIONS.

3. The External Connections are illustrated in Fig.21 which illustrates, not only the connections of local and distant telephone, but also the cross connections between the two linking units of two adjacent V.H/F sets. This diagram illustrates also the use of one of the 2-wire telephone circuits to provide intercommunication between the local operators and the V.H/F sets (which may be some distance apart).

INTERNAL CIRCUIT PRINCIPLES.

4. "Operator's Telephone" Circuit. This is a plain circuit connecting the "Operator's Telephone" to the corresponding jack.

5. 2-wire Telephones 'A' and 'B'. These two circuits connect the respective terminals so marked to the corresponding jacks. In addition a bell and rattler are provided on Circuits 'A' and 'B' respectively to provide a call-up from the distant telephone connected to Circuits 'A' and 'B' respectively. The use of a bell on one circuit and a rattler on another provides immediate distinction as to which telephone is calling.

6. "Local Radio" Circuits. Two circuits - one for connection to the local transmitter and one for connection to the local receiver are provided. These connect the terminals so marked to the corresponding jacks. A balancing transformer is inserted in the receiver circuit in case the equipment should be used with a V.H/F receiver employing an unbalanced output.

7. "Distant Radio" Circuits. A pair of circuits are provided for connection (by field telephone line or other suitable twin cable) to the "Distant Radio" terminals of the linking unit of the other V.H/F set. The two internal circuits simply connect the terminals to the respective jacks.

8. "Hybrid" Circuit. A "Hybrid" transformer is provided for converting any 2-wire circuit to any 4-wire circuit and vice versa. The circuits connected to the local and distant V.H/F sets are 4-wire circuits (2-wire for transmitter and 2 wires for receiver). Before these can be connected to a distant telephone or a local field telephone (operator's telephone) or the shore telephone system, they must be converted into a 2-wire circuit, and this is done by means of the "Hybrid". The two "Hybrid" jacks, marked 'Transmitter' and 'Receiver' are connected to the corresponding "Local Radio" jacks (or in special cases to the "Distant Radio" jacks) and the 2-wire "Hybrid" jack is connected to the appropriate telephone jack.

OPERATING INSTRUCTIONS.

9. In the first instance communication over the V.H/F link can, if necessary, be obtained without the linking unit at all, by using the local microphone or headphones and loudspeaker, and in cases where straight forward local communication is all that is required the linking unit could be dispensed with. In cases where the linking unit is to be used, this will be connected up wholly or in part as shown in Fig. 21.

10. Control of local V.H/F Set from Local Operator's Telephone. The "Operator's Telephone" jack is plugged across to the 2-wire "Hybrid" jack; the transmitter and receiver "Hybrid" jacks are cross connected to the corresponding "Local Radio" jacks. This arrangement is illustrated in Fig. 20.

11. Operation of Local V.H/F Sets from Distant Telephone. A Jack cross connection as above except that the 2-wire "Hybrid" jack is plugged across to the appropriate telephone jack 'A' or 'B' instead of to the operator's telephone. Should the Distant Operator in this case wish to call the Local Operator, he will transmit a "ring" and this will operate the bell or rattler. The Local Operator will then transfer the connection from the 2-wire "Hybrid" jack to the "Operator's Telephone" plug, which operation connects the Local Operator's telephone to the Distant Telephone.

12. "Local Operator" Calling a "Distant Operator" by Telephone. The operator's telephone jack is cross connected to the appropriate telephone jack 'A' or 'B'. Communication between operators can then be carried out in the normal manner.

13. Cross Connection of Two V.H/F Sets. Communication having been established on the local V.H/F set as indicated above, the "Local Operator" may receive instructions either locally or from the other end of the V.H/F link to connect through an adjacent V.H/F link. Assuming semi permanent cross connection to the distant V.H/F set has been effected as shown in Fig. 21, the standard drill for through linking will then be carried out by the operators. The two stations must decide which will do the operating. The other then plugs his "local radio" to the "distant radio" and leaves it, but continues monitoring to receive any further instructions. The operating station then treats the other station and its link as his "distant radio". The controlling operator will operate his linking unit as described in this drill, taking care first to adjust the volume carefully as described below.

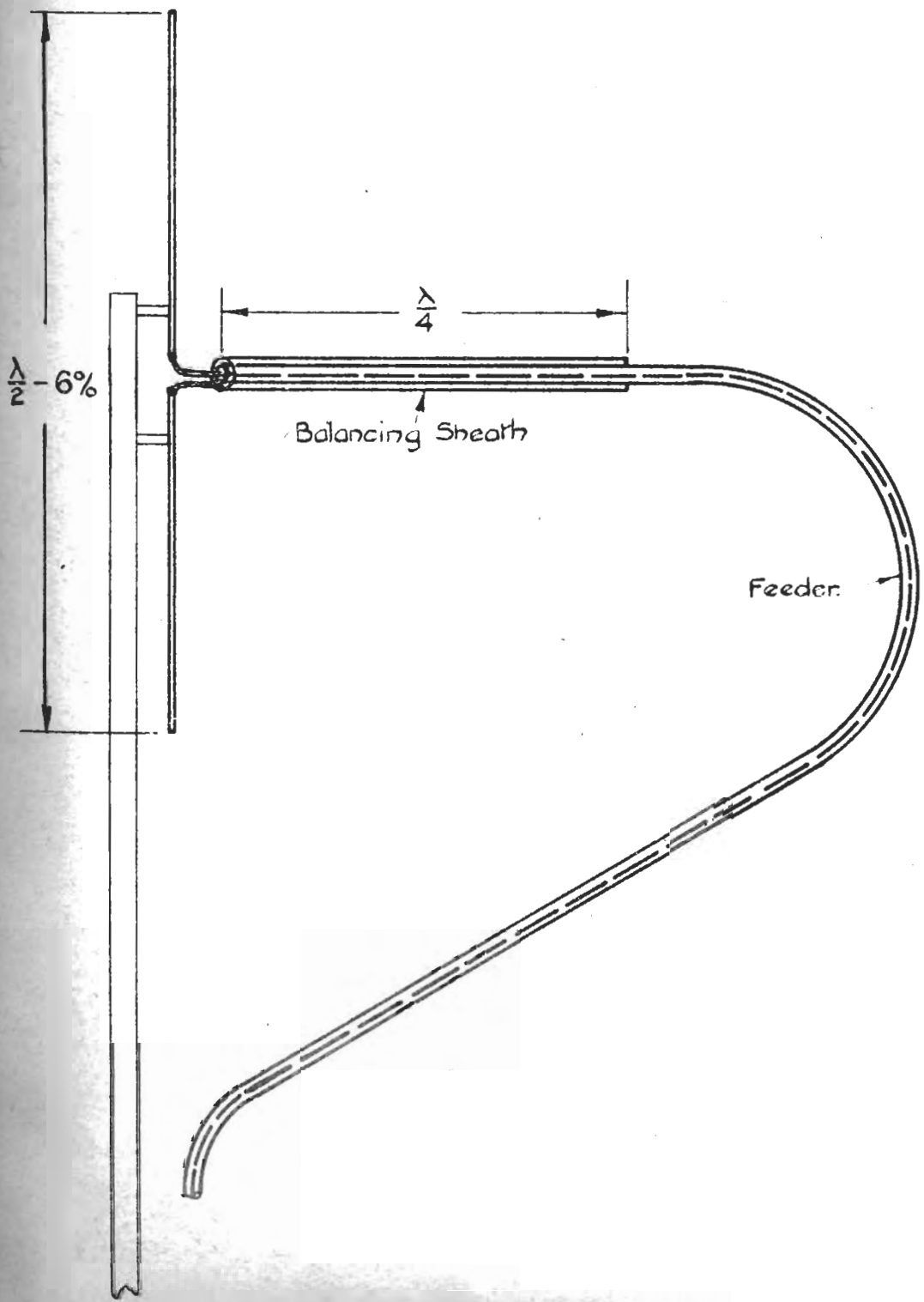
14. Adjustment of Volume. It is essential that the speech-level be correctly adjusted by means of the volume controls on the linking unit, particularly when "linking through". When operating from field telephones or shore telephone system, it is only necessary to ensure a reasonable telephone level which operators will learn by experience.

When "linking through ", however, the receiver speech level must be adjusted exactly so as to modulate fully the opposite transmitter without over-modulating. If the transmitter is over-modulated, bad distortions will result; if under-modulated, the signal-to-noise ratio will be unnecessarily low.

A preliminary idea of the correct level will be obtainable by an experienced operator by means of the monitoring headphones (i.e. the double-plug headphones which should be plugged into the receiver monitoring jack of the local and distant ratio so that one earpiece will indicate the local radio receiver output speech level (as corrected by the appropriate volume control) and the other earpiece will do the same for the distant radio receiver. The final decision as to whether the volume has been correctly adjusted, however, must come from the operator at the far end of the respective V.H/F radio links who must inform the operator at the linking station whether the transmitter on that link is being over-modulated or under-modulated.

N.B. In Fig. 20 two volume controls are shown, one for "distant" and one for "local" receiver. In some of the earlier Radio Linking Units, however, there is actually only a volume control for the "local" receiver, and therefore, in cases where two Radio Linking Units are separated by a short distance, there will have to be an operator monitoring and controlling each one separately. In Fig. 22 the terminals at the back of the Radio Linking Unit are shown but in some of the earlier models these terminals are "staggered". Their function is exactly the same as shown in Fig. 22 but operators must remember that the first upper and lower terminals (starting from left-hand side) are for one pair of lines, the second upper and lower terminals for another pair of lines, and so on, right until the seventh upper and lower terminals, which constitute the final pair.

HALF-WAVE DIPOLE
VERTICAL POSITION



VERTICAL DIPOLE POLAR DIAGRAM

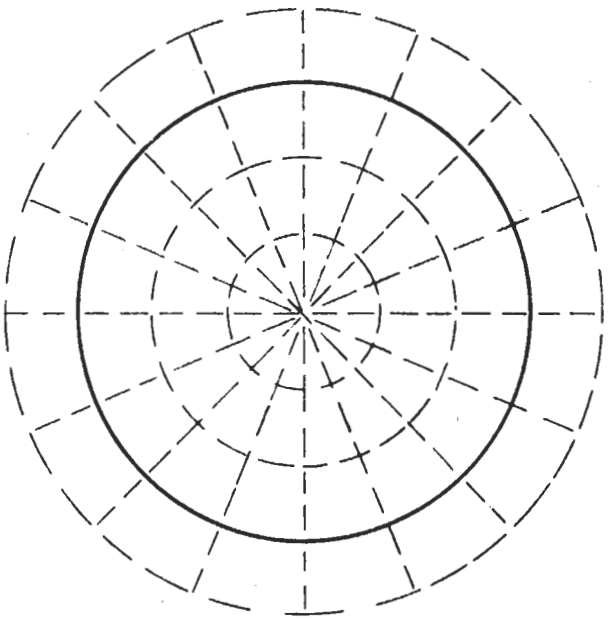


FIG. 2(a)

HORIZONTAL DIPOLE POLAR DIAGRAM

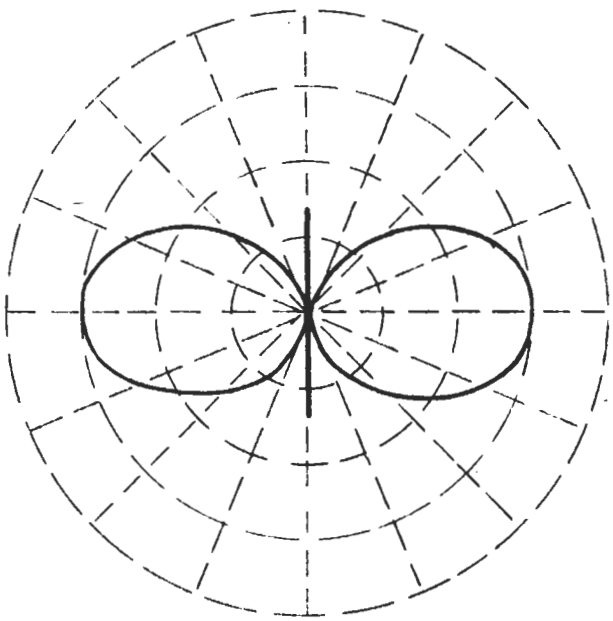
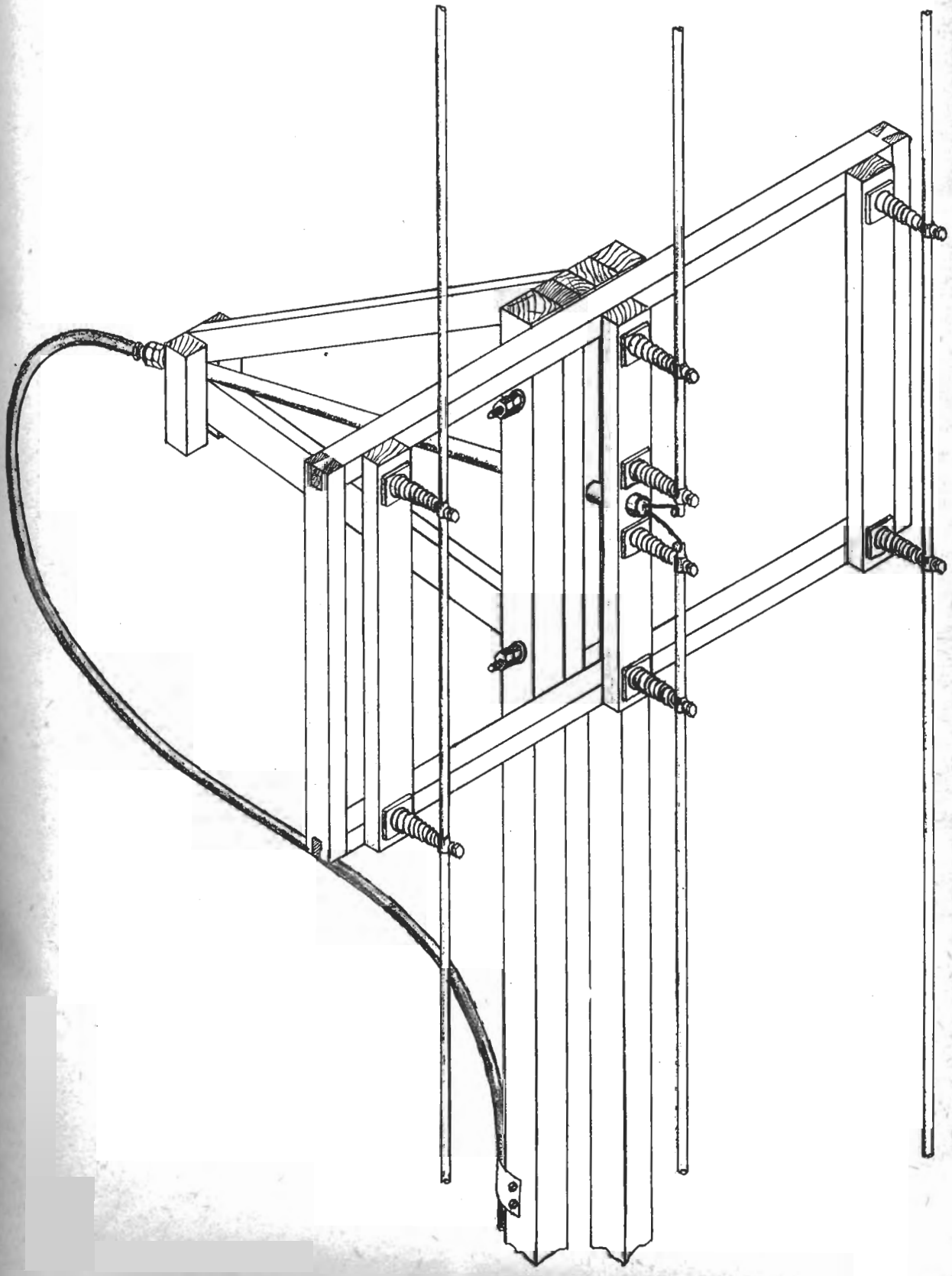


FIG. 2(b)

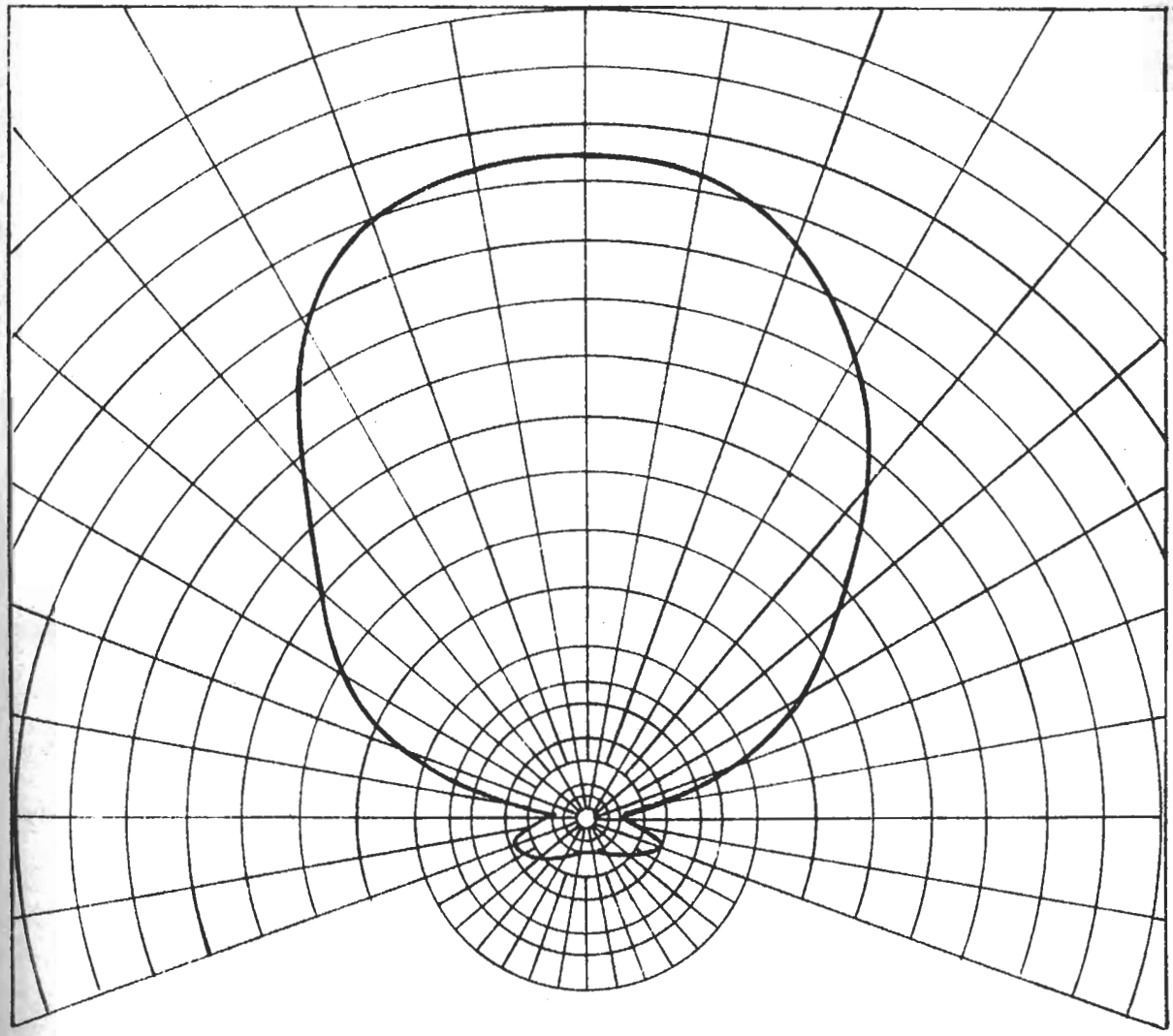
ARS ARRAY. VERTICAL ASSEMBLY.



4a

A R S
HORIZONTAL
DIAGRAM

POLAR DIAGRAM OF HORIZONTAL ARS ARRAY



4ℓ

ARS
VERTICAL
DIAGRAM

POLAR DIAGRAM OF VERTICAL ARS ARRAY