WIRELESS *for the* WARRIOR

Pamphlet Series

No. 13 Wireless Set No. 10.
Historical documents.

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In this WftW Pamphlet publication are scans of four rare historical interesting documents relating to the early development and operation of the British Army multichannel, pulse-width modulated, SHF radio link known as Wireless Set No. 10.

The Pamphlet Series.
The Pamphlet Series of publications was created to accommodate a future range of reprints, articles of historical importance, hitherto unpublished documents, and reports on Army signalling. These could be downloaded from www.wftw.nl, freely copied, and distributed, but only in their current form, preferably with a mention of this website.

Please note that the page layout of the Pamphlet Series was set up with mirrored pages and separate cover pages, primarily intended for double-sided (colour) printing, preferably on good-quality class A paper.

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Sept. 2024

Introduction

WftW Pamphlet No. 13 is an addition to the main description of the SHF multichannel pulse-width modulated Wireless Set No. 10, covered in WftW Volume 2.
During research over the years at the Royal Signals Museum historical library at Blandford Camp, Dorset, UK, several rare early development and operational documents of the No. 10 Set were encountered.
These were of particular interest, scanned, but only used as reference due to their length.
Because this communication set was the first of its kind, and World-wide interest was still noticed, four of the most distinct publications were put together in this WftW publication.

Contents

Acknowledgements:

With many thanks to the Director and staff of the Royal Signals Museum for granting permission to scan photographs and documents for this pamphlet, retrieved from the museum historical library.

References

- The story of the first tactical use of UHF, issued by CSO 21 Army Group, 1945.
- Operational procedure for UHF (WS No. 10), issued by CSO 21 Army Group, March 1945.
- SRDE Pamphlet No. 377A, Wireless Set No.10A, Working Instructions, August 1943.
- SRDE Provisional Pamphlet No. 451A, Wireless Sender No. 10, Working Instructions, Jan. 1944.
- Wireless for the Warrior, Volume 2, L. Meulstee, 1998, GC Arnold Partners, Dorset, ISBN 1898805 10 5.
- See also WftW 'Origin' No. 2, Pt.1 and Pt.2, at www.wftw.nl/downloads.html (scroll down to 'documents').

The Story of the First TACTICAL USE *of* U.H.F.

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ISSUED BY C.S.O. 21 ARMY GROUP

The W.S. No. 10 in North-West Europe.

HISTORY.

The WS No. 10 was originally designed for use in an L of C role. It was in this role that it was first used in the North-West European theatre of operations. Some weeks after 'D' day a link was established from VENTNOR, ISLE-OF-WIGHT, to CHERBOURG and, later, extended from CHERBOURG to BAYEUX. These links worked well although the cross channel link did not give entirely satisfactory 24-hr service. This was only to be expected since the path was long and not optical.

Two Multi-channel sections (WS No. 10) were made available to CSO 21 Army Group shortly before the breakout from the Normandy beachhead. When the breakout occurred the No. 10 sets were used to provide communication between Main and Tac. H.Q. 21 Army Group. This was successful until Tac. H.Q. moved beyond GACÉ.

This early attempt to use the WS No. 10 in a tactical role was only partially successful due to:

(a) Only eight working detachments being available.

(b) Lack of 60-foot towers.

(c) Poor state of training of the sections.

all coupled with the speed of advance into BELGIUM and HOLLAND.

On arrival of 21 Army Group H.Q. in BRUSSELS, a link was established between BRUSSELS and EINDHOVEN using two relays. This gave good service for approximately four months.

RE-ORGANISATION.

During the stay in BRUSSELS it was decided to re-organise the Multi-channel sections, with a view to using them in a tactical role for the crossing of the MAAS and the RHINE.

In pursuance of this policy, two Multi-Channel sections (WS No. 26) were changed over to WS No. 10 each being organised on a four detachment basis. The existing two Multi-Channel Sections (WS No. 10) were also converted to a four detachment basis, as was a new section which shortly arrived.

All sections were retrained locally (see Pamphlet, Operational Proceedure for UHF (WS No. 10) published by CSO 21 Army Group). A number of 60-foot towers were obtained from the War Office, although the fact that these were not obtainable in time or in sufficient numbers, made it necessary to use local resources.

Arrangements were made to have all trailers serviced by REME who had personnel available, trained on this equipment This was essential as a number of modifications were necessary on all sets and trailers before the equipment could be used. As it was intended to use the sets in forward areas, REME also produced a special 10 set Z lorry.

The Multi-Channel Sections, since their arrival in the theatre, had been affiliated to No. 1 Indep. Adm. Coy. Before the Rhine crossing it was decided, in order to obtain adequate operational control, to affiliate the sections to 21 Army Group Signals who formed a UHF Group under OC 1 Company. This arrangement proved very satisfactory.

POLICY OF EMPLOYMENT.

It was decided as a policy to run the 10 Sets as a chain along the axis of advance of TAC HQ 21 Army Group. It was also expected that this chain would be suitable to serve Main HQ Second Army.

COMMUNICATIONS ESTABLISHED.

Phase I. Prior to crossing of the RHINE.

See diagram 1

Locations	Main 21 Army Group	- BRUSSELS
	Tac 21 Army Group	- STRAELEN - BRUNEN
	Main Second Army	- WALBECK

Main Canadian Army - GRAVE
Main US Ninth Army - MUNCHEN GLADBACH

WALBECK, being on a 40 meter contour was chosen as a suitable UHF site and six sets were installed, two using 60-foot towers, and ingenious use was also made of a local windmill. Two links were established to the cable head at HORST and one to each of Tac HQ 21 Army Group, Main Second Army, Main Canadian Army and Ninth US Army, the latter using a relay. The channel allocation for this network is shown at diagram 9.

Phase II. The RHINE Crossing.

See diagram 2.

Locations
Main 21 Army Group - BRUSSELS
Tac 21 Army Group - BRUNEN
Main Second Army - DINGDEN
Main Canadian Army - GRAVE
Main Ninth US Army - MUNCHEN GLADBACH

The network already existing was extended across the RHINE by linking SCHAEPHUYSEN to WESEL utilising the latter as a relay point for both Tac HQ 21 Army Group and Main Second Army. The roof of practically the only remaining building in WESEL was utilised for the aerials of the 10 sets. This building was not in the best of shape, WESEL having received adequate coverage from Bomber Command. The RE advised almost daily that it was liable to collapse and shortly after the relay at WESEL was closed on April 14th, their diagnosis proved correct.

Phase III. The Pursuit across GERMANY.

See diagrams 3 - 8

Locations
Main 21 Army Group - SUCHTELN
Tac 21 Army Group - (SCHAPDETTEN - RHEINE -
(OSTENWALDE - BOTENBURG

Main Second Army - (BURGSTEINFURT -
(
(IBBENBUREN - BORSTEL

The chain was now rapidly extended across Northern Germany using a number of relays. It is worthy of note that the circuit to Tac 21 Army Group at BOTENBURG using two terminals and seven relay stations was still good. Almost immediately it was possible to break down three relays by picking up circuits from a new cable head near HUNXE. This allowed sets to be moved forward ready for the next move of Tac 21 Army Group and Second Army.

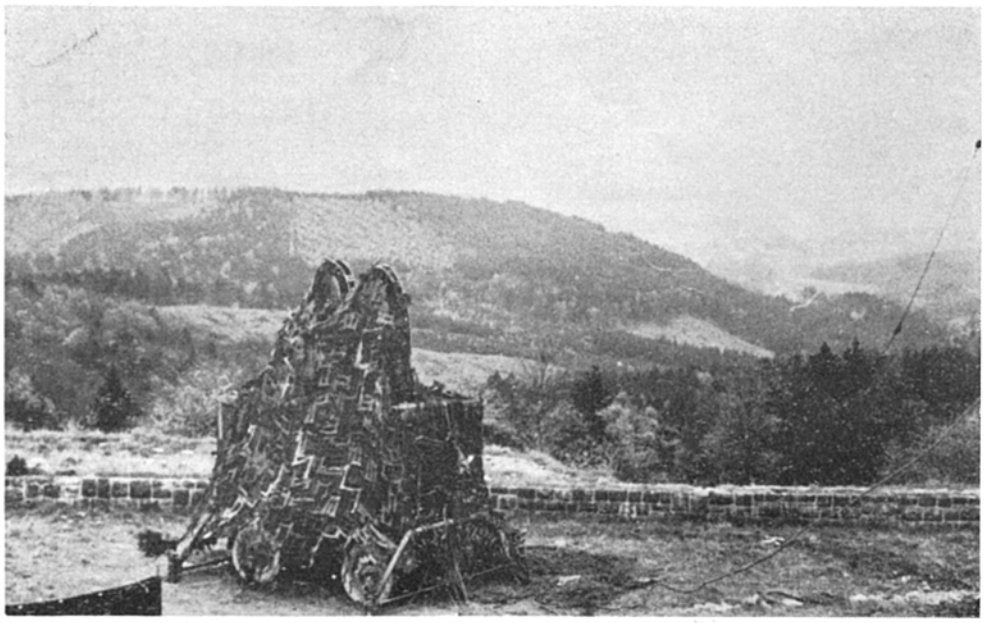
A typical channel allocation for this phase is given at diagram 10.

GENERAL

In the selection of sites every effort was made to make use of local aids to preserve the limited supply of 60 - foot towers. Examples, some of which are illustrated in the following pages, are, a windmill at WALBECK, a war memorial at SUCHTELN, an 80 - foot tower at BERG EN DAAL, and a German 100 - foot observation tower at SCHAPDETTEN.

The 10 chain was always established so as to be ready in situ when Tac 21 Army Group arrived at its new location. This, coupled with Field-Marshal Montgomery's determination to keep well up with the battle, lead to some interesting and amusing encounters. Not the least of these occurred at the KLEINE REKEN site where the officer who was in charge of establishing the relay, captured a German, resplendent in a most magnificent uniform lavishly adorned with gold braid. Convinced he had captured a General, perhaps, even a Field Marshal, he hurried his prisoner back to the nearest prisoner-of- war cage. A rather crestfallen officer returned to the 10 set detachment to explain that the prisoner had turned out to be the chief air raid warden of MUNSTER.

10 SET Trailer on Site.



Above is a typical 10 set site where no tower or other aid is required.

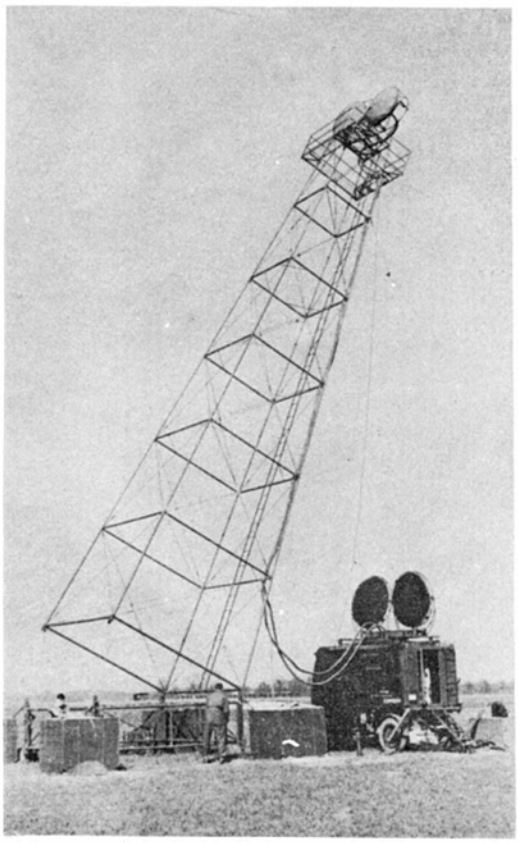
It is unfortunately rare to find a site giving a clear look out in the two directions required for a relay.

Such a site however was found at Iburg where the above photograph was taken.

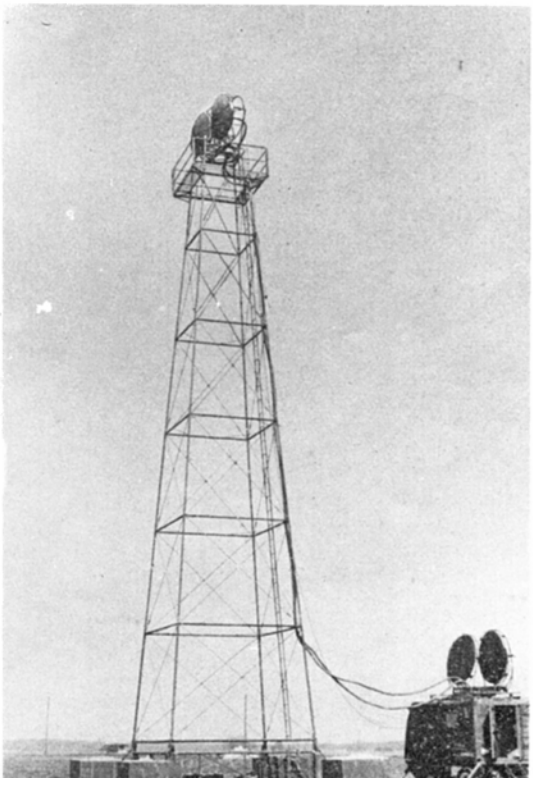
A Makeshift Tower.

View of 60 ft. R. E. tower serving Tac HQ at STRAELEN. Owing to non availability of standard radio tower and no suitable local feature it was necessary to construct a tower from R. E. resources in order to clear local trees. The tower was built by R. Sigs. personnel under R. E. supervision. It took 200 man hours to erect and was easily managed in two days.

THE 60 ft. TOWER.



Final stages of erection of a 60 ft. tower on Walbeck UHF site.



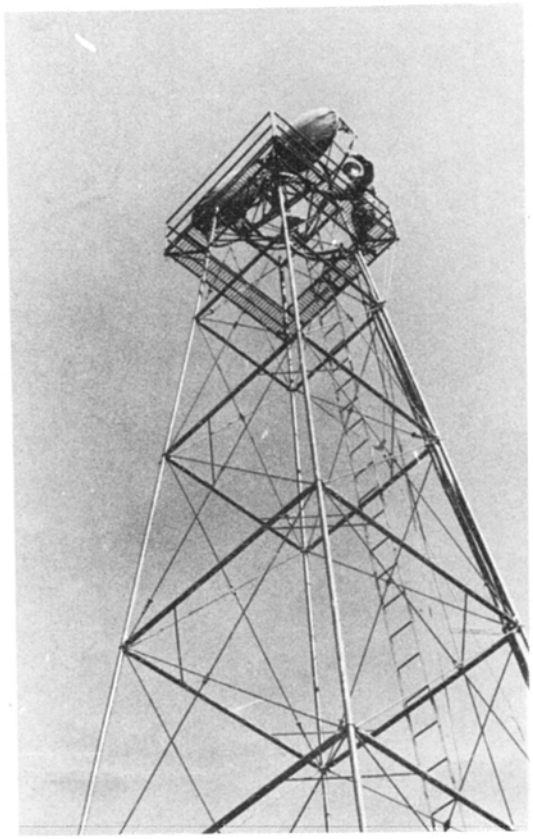
One of the 60 ft. towers in situ on Walbeck UHF site.

THE 60 ft. TOWER.

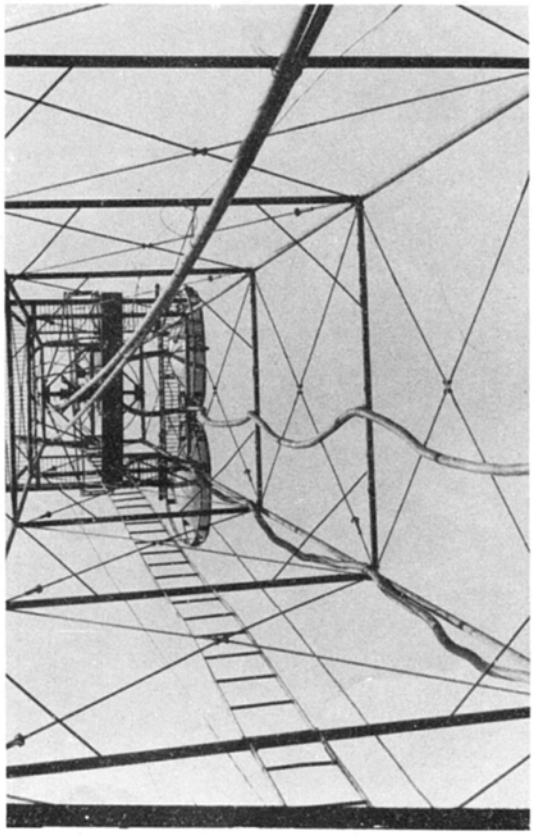
Two views of an impromptu arrangement of using two sets of mirrors on one tower HORST UHF site.

It is necessary to build the tower on the correct bearing and lash the second set of mirrors to the catwalk.

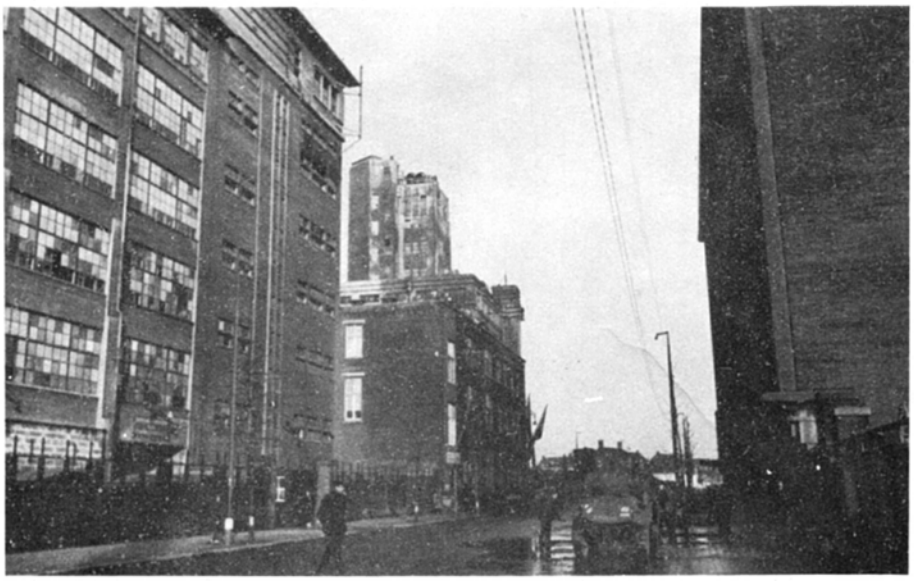
THE 60 ft. TOWER.



Adjustment of mirrors Walbeck UHF site.



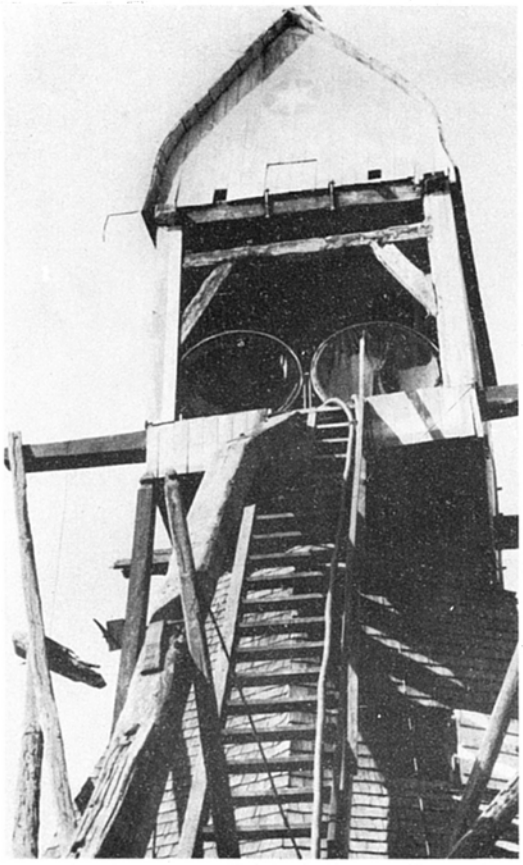
Looking up inside a 60 ft. tower HORST UHF site.



The mirrors may be seen on top of the 180 ft. tower surmounting the Philips factory at EINDHOVEN.

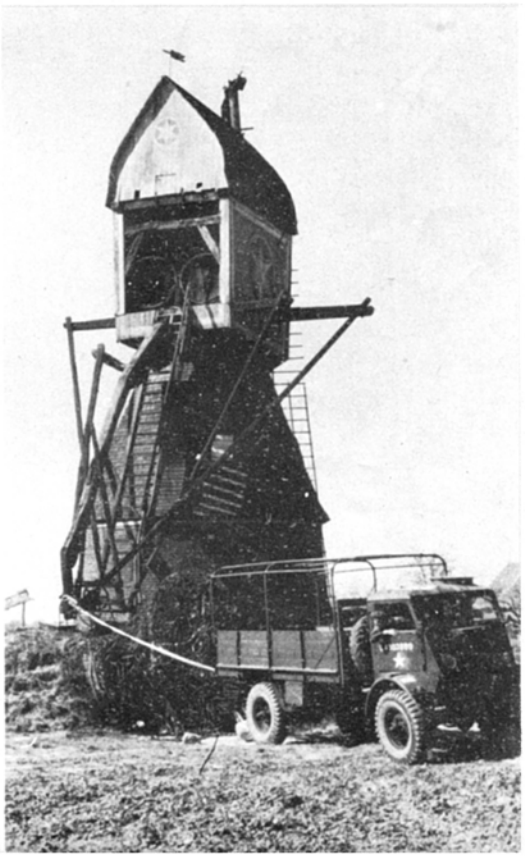
Complete trailer assembly mounted on roof of dairy building at ZONHOVEN.

Use of Local Resources.



Two views of the windmill used at WARBECK UHF site.

The mirrors were mounted in the loft of the windmill and two three ton lorries used to revolve the complete windmill onto the correct bearing.

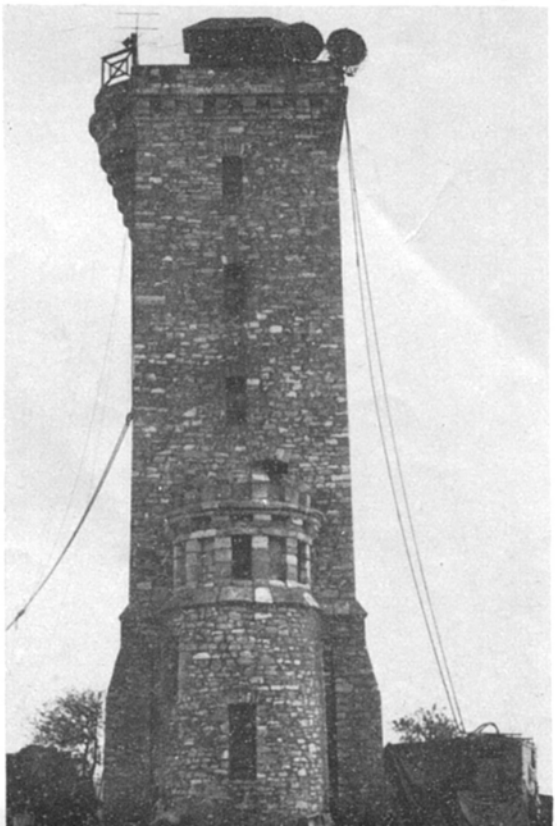


Use of Local Resources.

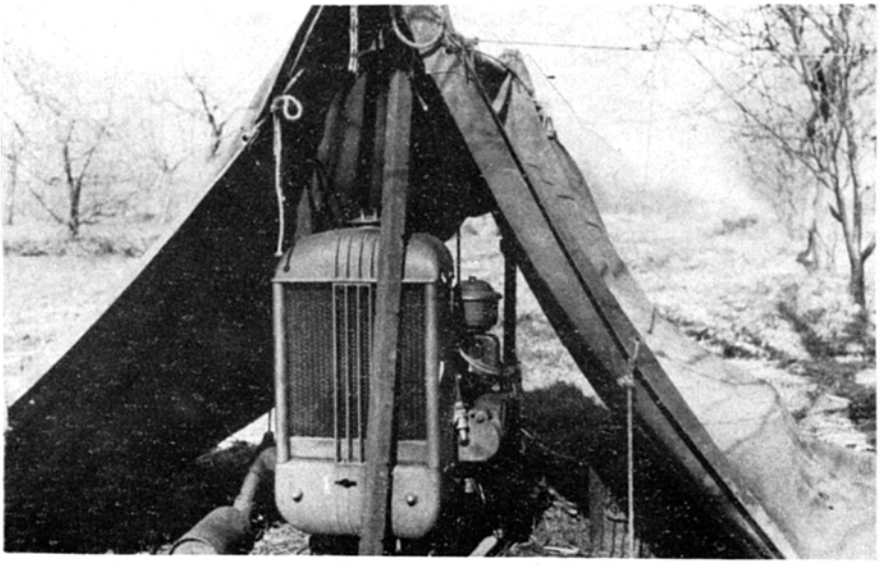
A German last war memorial put to more constructive use in this war.

A German observation tower at SCHAPDETTEN proved of great value.

The aerial array of an AN/TRC UHF system can be seen at top left of tower.



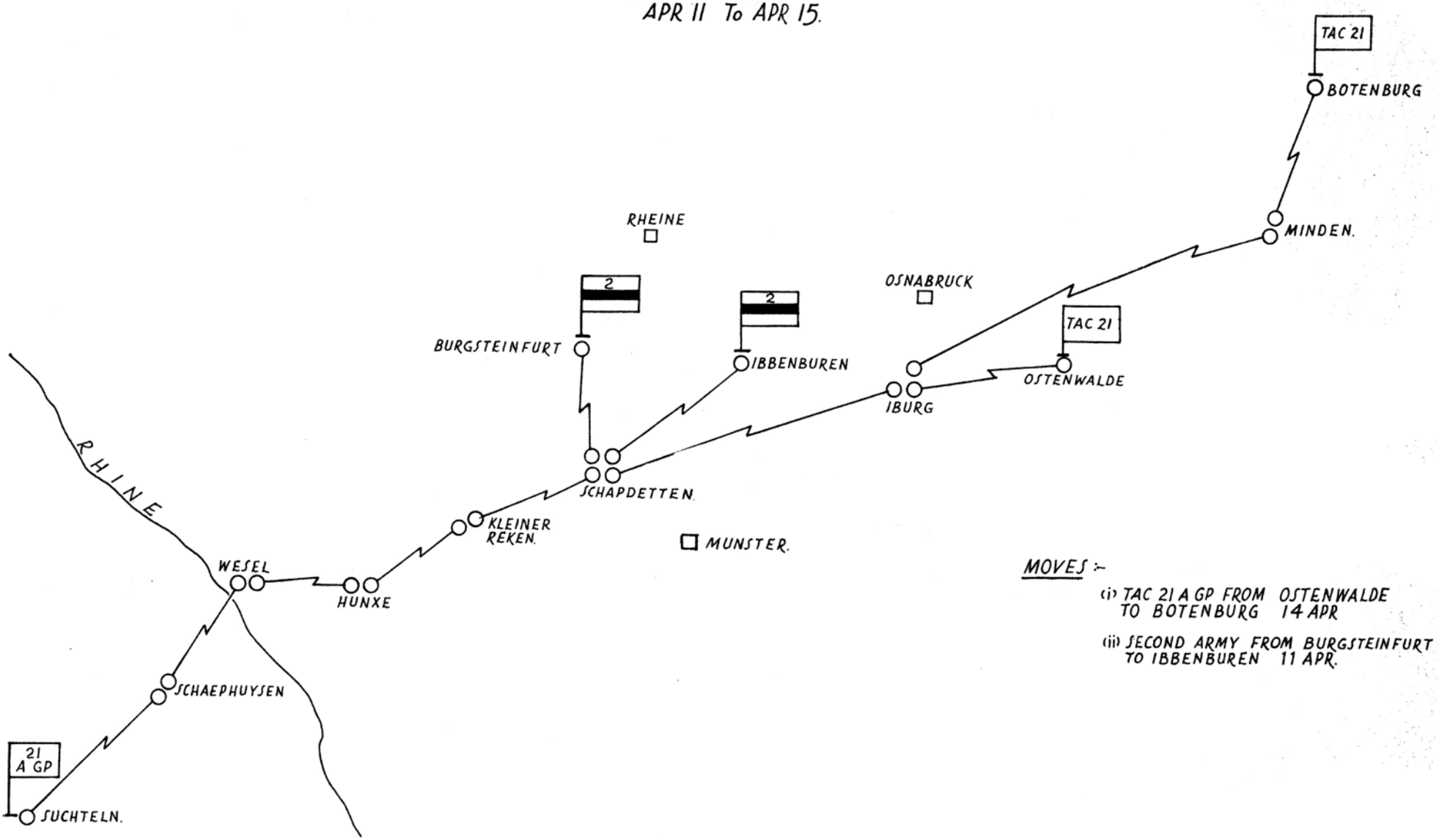
GENERATORS.



Generators are always taken out of the trailer and set up a minimum of 20 yards away to avoid risk of fire.

Above illustration, taken at HORST shows a typical weatherproofing arrangement for a generator where several sets were working at the same site e.g. WALBECK.

DIAGRAM 5
10 SET CHAIN
APR 11 To APR 15.

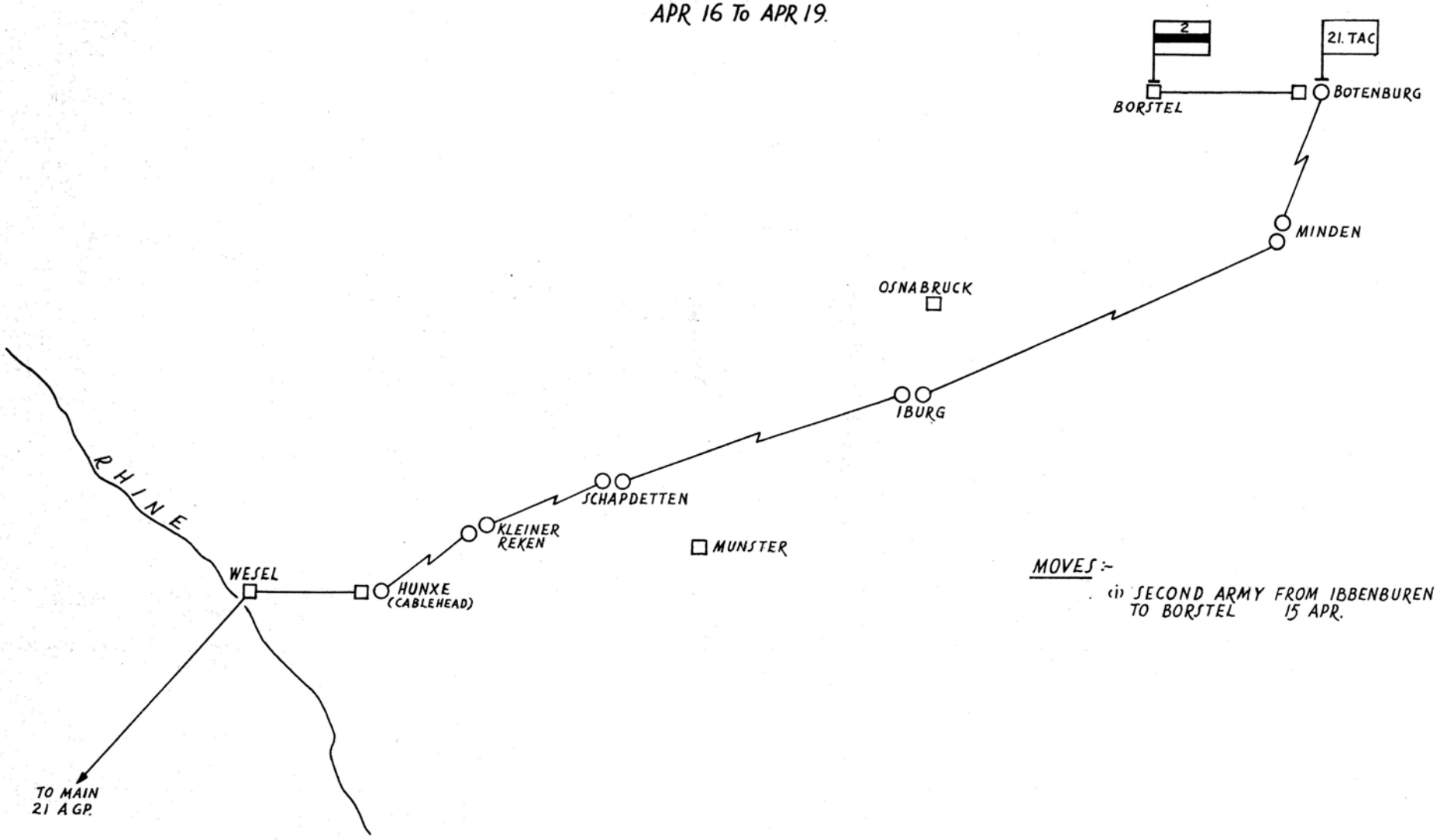


MOVES :-

(i) TAC 21 A GP FROM OSTENWALDE TO BOTENBURG 14 APR

(ii) SECOND ARMY FROM BURGSTEINFURT TO IBBENBUREN 11 APR.

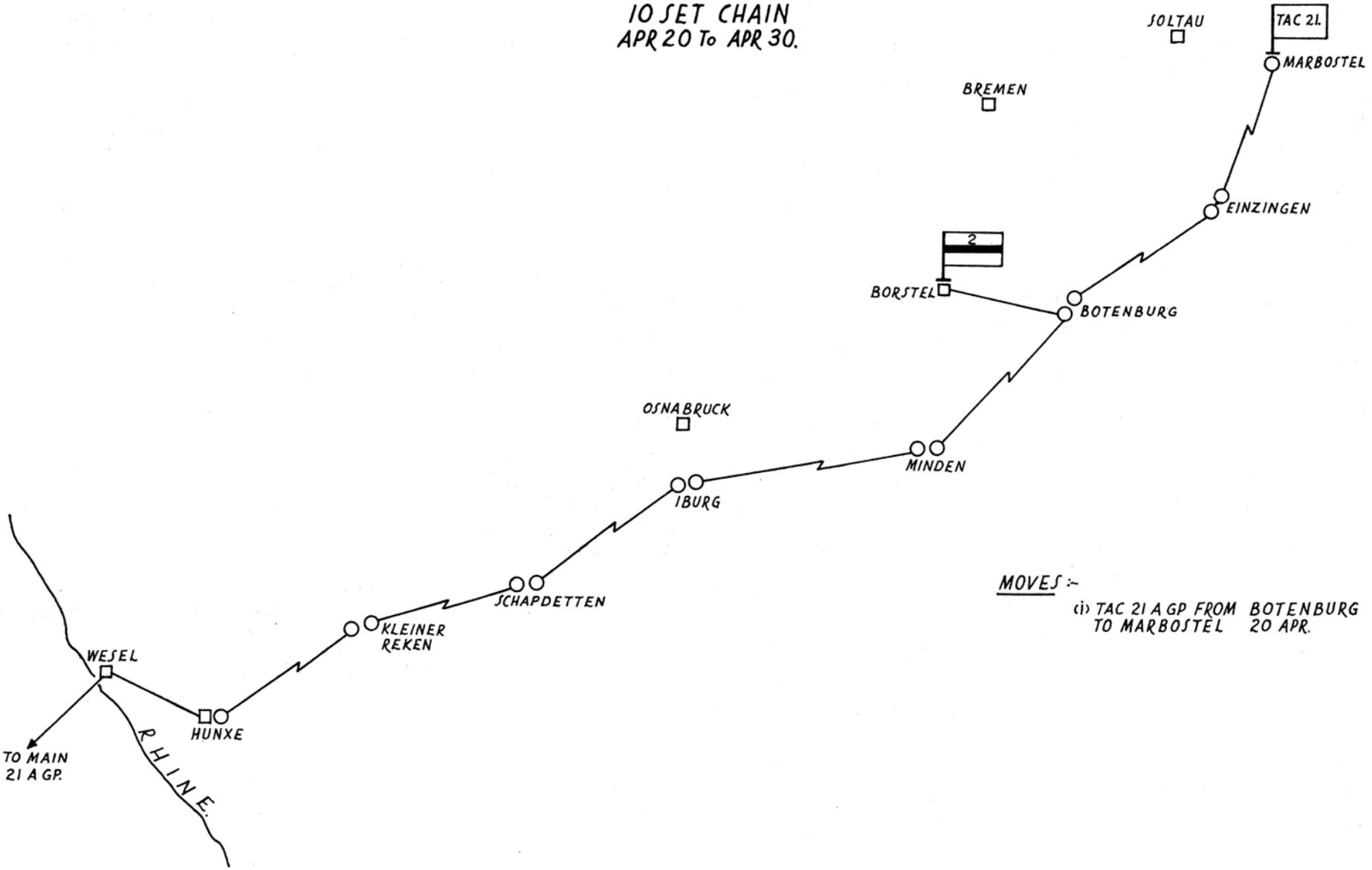
DIAGRAM 6
10 SET CHAIN
APR 16 To APR 19.



MOVES :-

(i) SECOND ARMY FROM IBBENBUREN TO BORSTEL 15 APR.

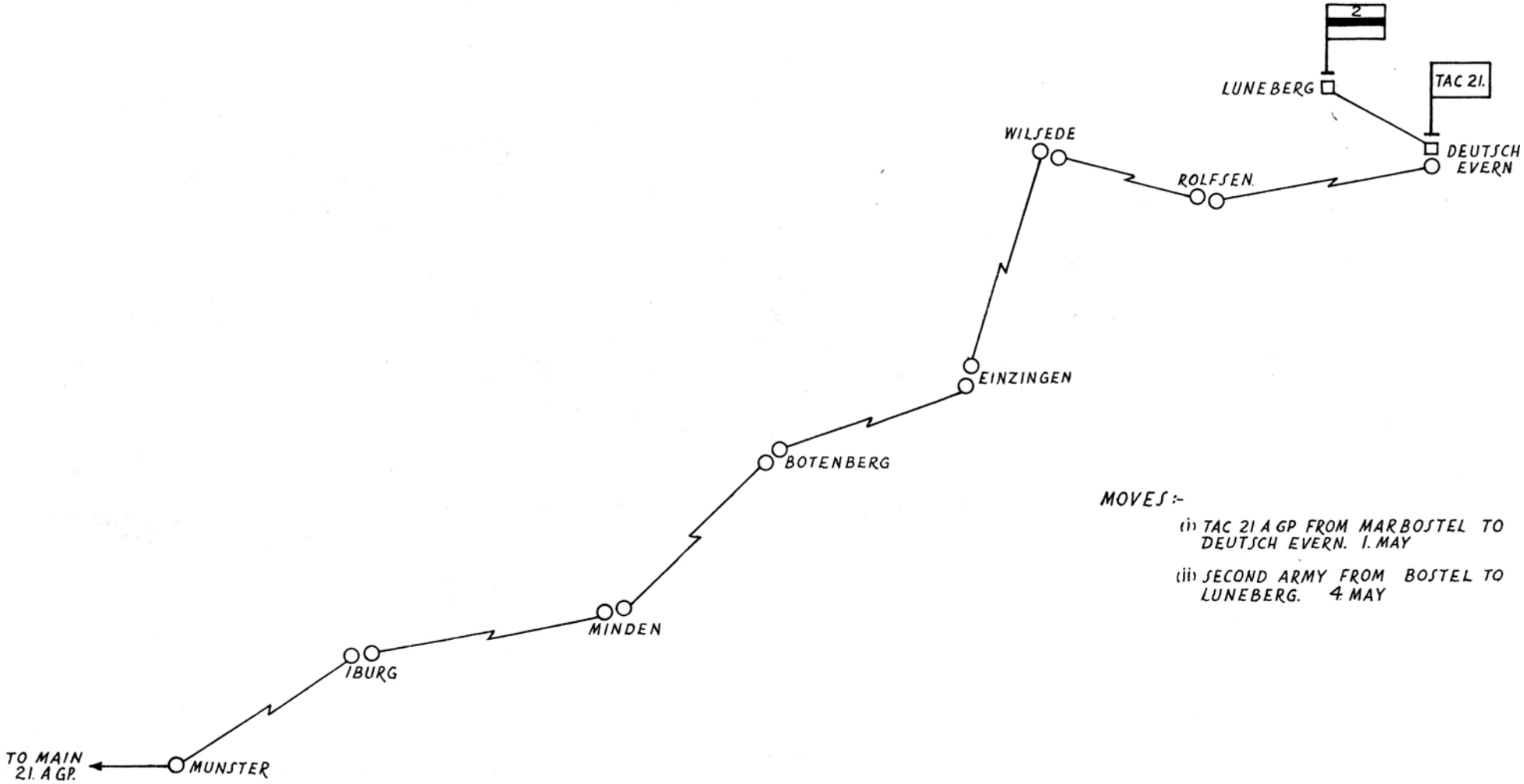
DIAGRAM 7
10 SET CHAIN
APR 20 To APR 30.



MOVES :-

(i) TAC 21 A GP FROM BOTENBURG TO MARBOSTEL 20 APR.

DIAGRAM 8
10 SET CHAIN
APR 30. ONWARDS.

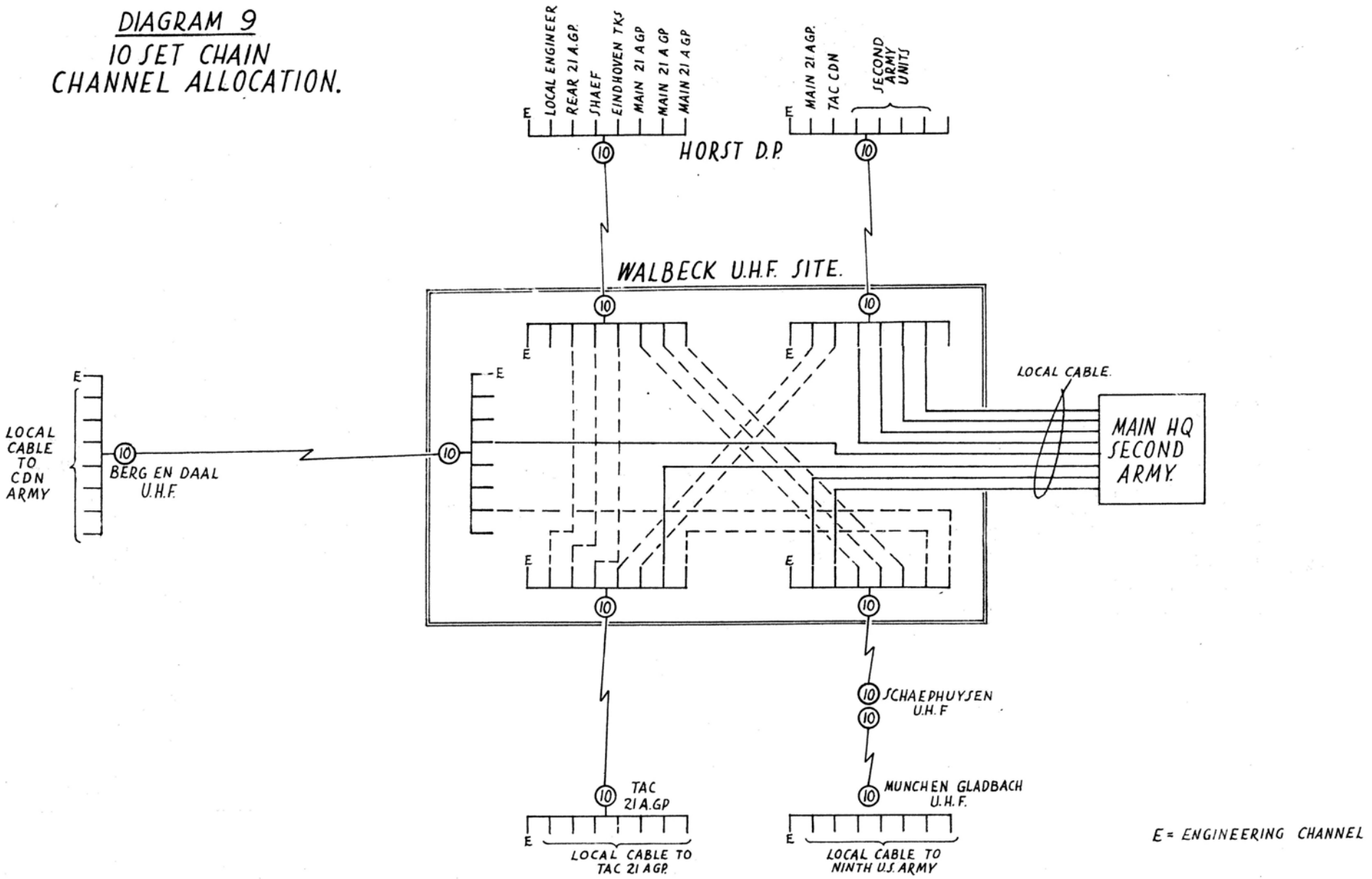


MOVES :-

(i) TAC 21 A GP FROM MARBOSTEL TO DEUTSCH EVERN. 1. MAY

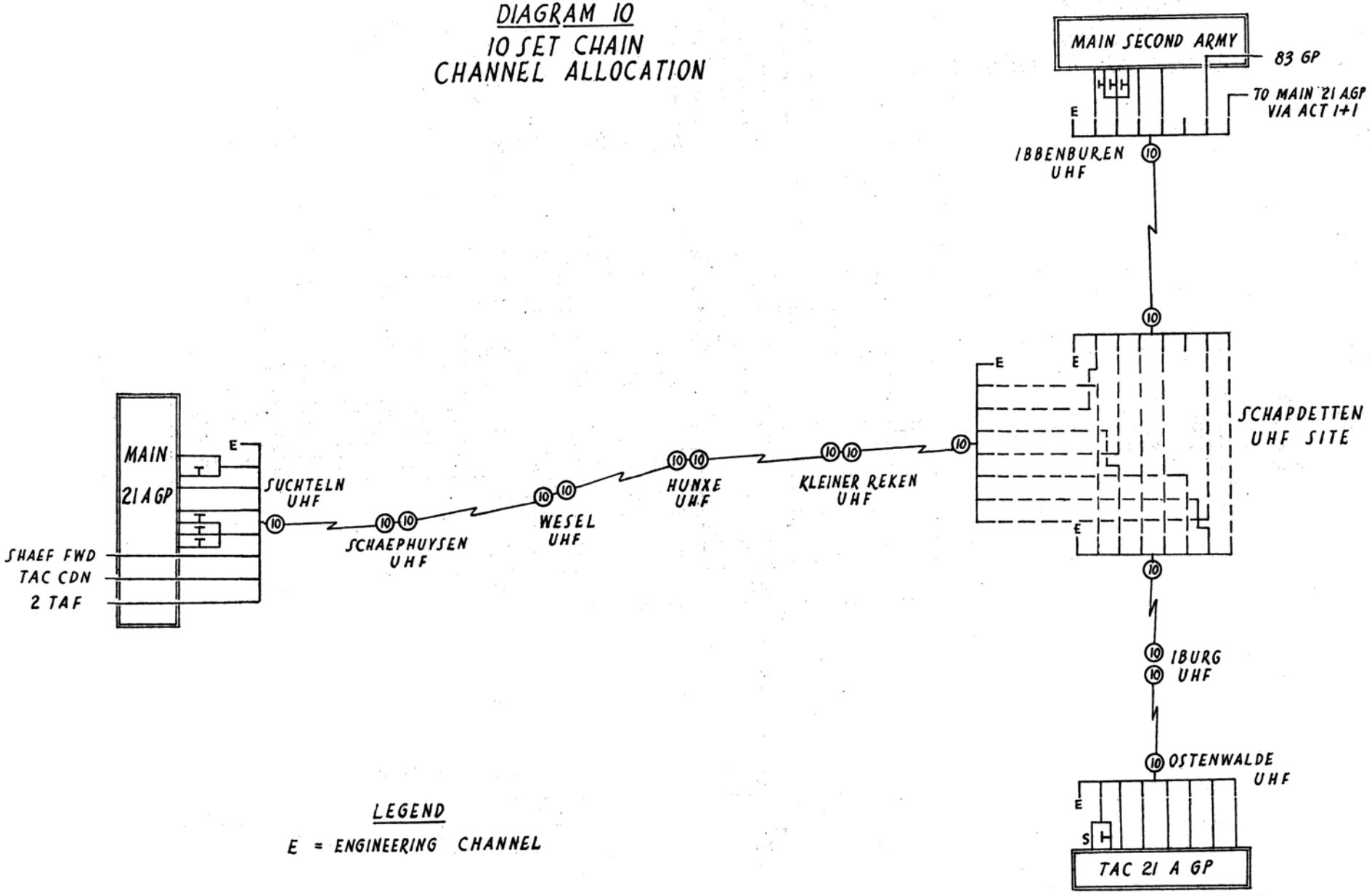
(ii) SECOND ARMY FROM BOSTEL TO LUNEBERG. 4. MAY

DIAGRAM 9
10 SET CHAIN CHANNEL ALLOCATION.



E = ENGINEERING CHANNEL

DIAGRAM 10
10 SET CHAIN
CHANNEL ALLOCATION

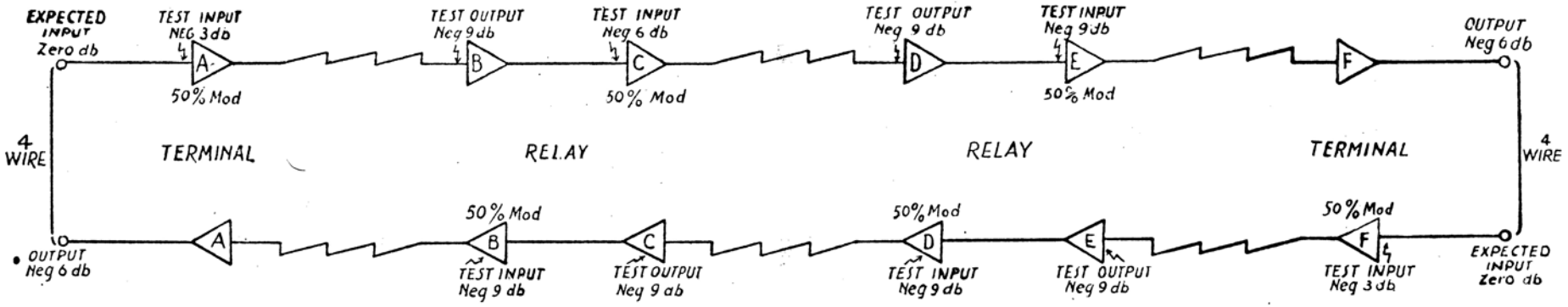


LEGEND

E = ENGINEERING CHANNEL

4-WIRE SPEECH OPERATION

Fig 11



OPERATIONAL PROCEDURE

FOR

U H F

(WS No. 10)

NOT TO BE PUBLISHED

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ISSUED BY CSO 21 ARMY GROUP

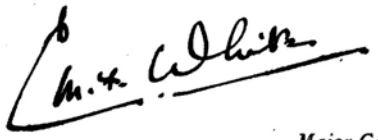
FOREWORD

When the WS No. 10 was first introduced into 21 Army Group it suffered badly from the teething troubles inevitably associated with new and complex equipment.

These difficulties have been carefully analysed and a series of simple drills evolved, the adoption of which has been found to be effective in enabling the WS No. 10 to provide first-class and reliable communication.

I have directed that this pamphlet be written in simple language, as it is not intended as a technical publication so much as a practical guide to the sections in the field.

I have always had great faith in the WS No. 10 and believe that, properly handled, it has a great future in Army communications.



Major-General,
Chief Signal Officer, 21 Army Group.

CONTENTS

CHAPTER I

On first taking over a WS No. 10 section, the officer may seem to be confronted with several difficult problems. The section is equipped with new and unusual equipment. WE No. IV/158/1 allots each section eight trailers and only five Electricians Signals (ESs) and three Linemen Mechanics (LMs) for technical operating and maintenance.

These difficulties can, however, be overcome by careful organisation.

SECTION ORGANISATION

1. General

Within 21 Army Group it will be accepted as a fundamental that all sections organised on WE No. IV/158/1 will man four trailer detachments only. One ES and one LM, or two ESs will be allotted to each station as the technical crew. In addition, a serjeant will always be placed in charge of each two stations where they form a relay.

The section officer will bear in mind that detachments, by nature of their employment, are often in isolated sites. He will give special care to ensuring that adequate provision is made for supplies of rations and petrol, collection and delivery of mail, paying the crews, etc.

Normal Army discipline will apply to all detachments, irrespective of location. Trailers will be kept clean and tidy. Crews will be smartly turned out.

2. Technical

Within 21 Army Group it will normally be arranged that both stations of a link will be worked by detachments of the same section. In the rare cases where this is not possible, the detachment forming the outstation will be placed under the operational command of the section providing the control detachment.

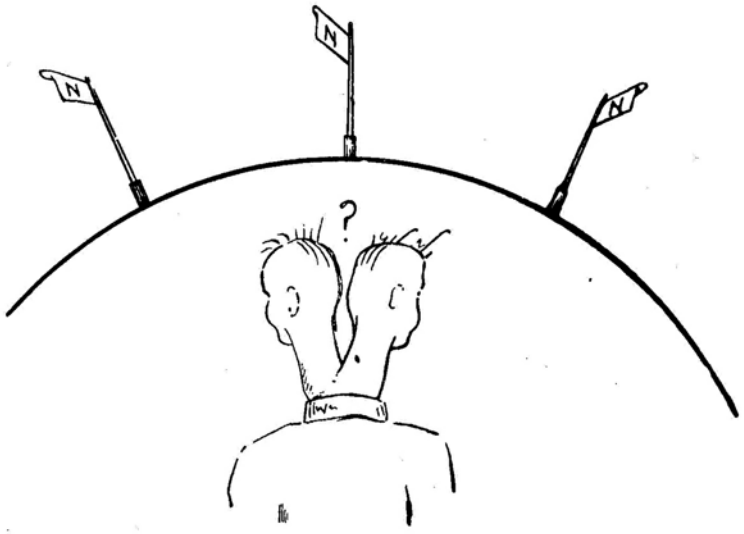
Thus the responsibility for the working of any link is always that of the section officer providing the control detachment.

Detachments may normally work from a trailer, with or without the use of an aerial tower, or from a building. The section officer will ensure that each detachment is familiar with all conditions of working.

He will tell each detachment of the particular role that it plays in the main communication build-up.

He will keep in close liaison with the associated lines officers and ensure that detachments, particularly the terminal stations, keep in close touch with the lines test clerks.

He will ensure that all trailers carry petrol and incendiary bombs for destruction, in emergency, of the complete station, and that the members of the crew are fully conversant with the procedure to be adopted.



"THERE ARE THREE NORTHS!"

CHAPTER II

MAP READING; PROTRACTOR; COMPASS

1. General

Normally, as a section commander or detachment NCO, you will receive orders to set up a WS No. 10 to work from one given point to another. You may not always be given the bearing on which to align your set, so you must be able to work this out for yourself. You will obtain maps covering the area over which the link is to work; these maps should be at least of scale 1/25,000 or 1/50,000; only in exceptional circumstances should so small a scale as 1/100,000 be used. You must also have an Army prismatic compass and a protractor.

A reconnaissance will be made by an officer or NCO, during which the exact location of each terminal will be decided. Having determined these locations, you can now calculate the bearing on which each station must align its aerial system in order to work to the other. The exact locations will be expressed as six-figure map references, by the aid of which the sites can be marked on a map.

2. Map References

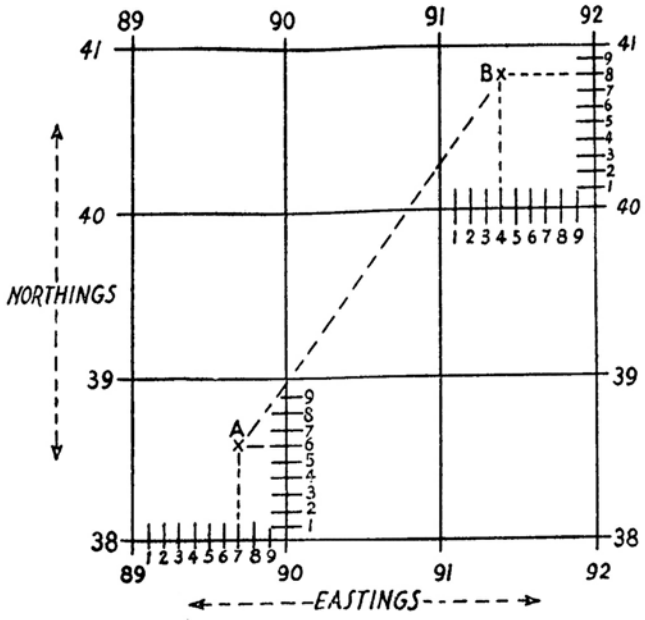
All Army maps are gridded; that is, they have printed on them a number of vertical and horizontal lines, which are numbered in the margin. The numbers of the vertical lines are given along the top and bottom margin of the map sheet, and by quoting these numbers we can show how far EAST (of a reference point from which the grid is drawn) any point on the map is; for this reason we call these vertical lines EASTINGS. Also, the numbers of the horizontal lines are given in the margin at the sides of the map sheet, and, by quoting these numbers, we can show how far NORTH (of a reference point from which the grid is drawn) any point on the map is; for this reason we call these horizontal lines NORTHINGS.

You will normally find the grids numbered as two figures (that is, 41, 42, 43 or 73, 74, 75); your point usually falls part way in between these grid lines, so you divide the distance between grid lines into ten parts and add an extra (third) figure to your EASTING and NORTHING.

Figure 1, page 8, is part of a map and two sites, A and B, are marked on it. The EASTINGS are numbered 89, 90, 91, 92, and the NORTHINGS are numbered 38, 39, 40, 41. Thus you get, for Site A, the first two figures of your EASTING as 89; and the first two figures of your NORTHING as 38. On the figure the grid rectangle, in which Site A lies, has been divided into ten parts, both horizontally and vertically. Notice that Site A is seven-tenths of the way over from the left and six-tenths of the way up. Thus the third figure of your EASTING is 7 and the EASTING of Site A becomes 897. Likewise, the third figure of your NORTHING is 6, so the NORTHING of Site A becomes 386. In expressing a complete map reference, *always* give EASTINGS first and then NORTHINGS. So the complete six-figure map reference of Site A in Figure 1 is 897386.

The map reference of Site B in Figure 1 is 914408. Make sure that you understand how it was obtained.

Figure 1



3. Bearings

Mark the exact location of both terminals of the link on your map. You must now find out in what direction to point your equipment, in order to work to the distant station. In the Army, direction is indicated as a *bearing*; bearings are measured in units called degrees. There are 360 degrees (written 360°) in a full circle, and each degree is subdivided into 60 minutes (written 60′).

The bearing of a distant WS No. 10 Site from your site is the angle measured clockwise *from* a line pointing NORTH from your site *to* a line pointing to the distant station from your site. Since these angles are ALWAYS measured FROM THE NORTH clockwise around to the direction line in which you are interested, you express bearings merely as "so many" degrees, and do not usually add "from the NORTH". Thus a station due EAST of yours would have a bearing of 90°; one due SOUTH would have a bearing of 180°; and one due WEST would have a bearing of 270°.

Unfortunately, there are three different kinds of NORTH!

(*a*) MAGNETIC NORTH—this is the direction in which a compass needle points. The compass needle is attracted magnetically by a large metallic deposit near, but NOT at, the North Pole.

(*b*) TRUE NORTH—this is the direction of the North Pole from the observer. Since the North Pole and the metallic, magnetic deposit mentioned above are not at the same place, obviously the direction of True North differs from that of Magnetic North. The difference is called the Magnetic Variation, and is always given in the margin of all British Army maps. It tells the number of degrees which Magnetic North is from True North. This is usually between 6° and 10° WEST in North-West Europe; that is, Magnetic North is between 6° and 10° WEST of True North. The exact variation is given for the particular area concerned, in the margin of the appropriate map. You usually have to make a correction to this variation since Magnetic Variation changes yearly. The annual change and the effective date of the Variation quoted are stated on all Army maps.

(*c*) GRID NORTH—you have seen how useful the grid on a map can be for giving locations; since you continually use the grid lines for giving locations, you will also find it convenient to use them for giving directions. Thus, you can say the vertical grid lines point to an imaginary Grid North. Of course, since these grid lines are parallel to each other, they never actually meet, so there isn't actually a Grid North Pole, but it is convenient to use Grid North when working on a map. Obviously, Grid North will rarely coincide with either True North or Magnetic North since the grid is only a set of guide marks on a particular map sheet. Thus, there will be a difference between the direction of Grid North and True North. This difference is given as an angle called CONVERGENCE, and is the angle which Grid North is from True North. Usually the Convergence is of the order of 2° West; that is, Grid North is 2° West of True North. The exact Convergence for a particular map is given in the margin of a map; usually the Convergence is given for each side of the particular map sheet. Say the Convergence for the map sheet you are using is given as 2°30′ for the WEST (left hand) side, and 2°11′ for the EAST (right hand) side, and suppose your site is about two-thirds of the way across the sheet from the WEST (left hand) side. To determine the Convergence at your particular site on the map, you take two-thirds of the difference between the convergences for either side of the map sheet (in this case it would be two-thirds × 19 minutes = 13′ approximately), and subtract the result from the larger. The result will be the Convergence at your site on the map. (In this case, then, the convergence at your site would be 2°30′−13′=2°17′.) You must always make the correction for your site on the map, as the error involved in not so doing may result in your set being pointed sufficiently far from the right direction to prevent you from getting through.

4. Use of Bearings

Since there are three different kinds of North, there are three different kinds of bearing. A GRID BEARING is the angle obtained when you measure from a line through your site on the map, parallel to a vertical GRID line, clockwise to the line joining your site to the distant site; TRUE BEARINGS are those measured from

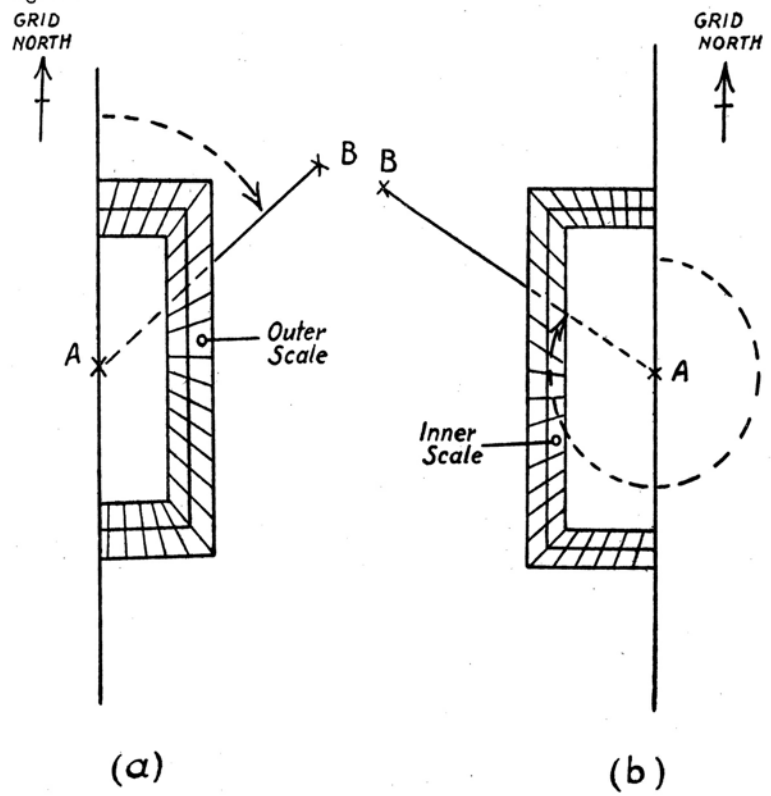
True North; and MAGNETIC BEARINGS are those measured from Magnetic North.

When measuring a bearing on a map, you *always* measure from a vertical grid line; therefore, you get a Grid Bearing. However, you want to go out to the actual site, and to use your compass to find *on the ground* the direction of the distant station; that is, you want to know the Magnetic Bearing. So you must know how to convert Grid Bearings, which you get from the map, to Magnetic Bearings, which you can use in pointing your aerials at the distant station.

5. Use of the Army Protractor

To measure on a map the Grid Bearing of a distant station, draw a line from your station to the distant one. If the angle from Grid North clockwise to the distant station is *less* than 180°, place the protractor as shown in Figure 2(*a*), and read the angle on the *outer* scale. If the angle is *greater* than 180°, place the protractor as shown in Figure 2(*b*) and read the angle on the *inner* scale.

Figure 2



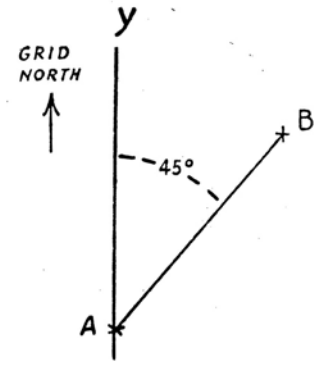
6. Converting Grid to Magnetic Bearings

The conversion is done in two steps. Grid Bearings are converted to True Bearings (using the Convergence, obtained as described above) and then True Bearings are converted to Magnetic Bearings (using the Magnetic Variation, obtained as described above).

Example:

The easiest way to do the conversion is to draw a simple diagram (see Figure 3). Let your site be shown as Site A and the distant site as Site B. Mark Site A and draw through it a vertical line representing a line parallel to a grid line. This is line AY in the figure, and it points to Grid North. Having measured on your map the grid bearing of Site B from Site A and found it to be 45°, draw freehand a line at approximately 45° from AY, and mark it AB. Mark the angle between these lines as 45°.

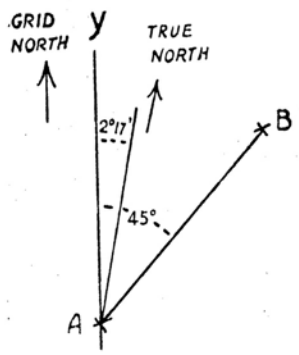
Figure 3



You can find from the margin of the map sheet, as described above, the Convergence for the part of the map at which Site A lies. Say it is, as in the previous example, 2°17′ W; this means that Grid North is 2°17′ West of True North. You can now add to your diagram a line indicating True North (see Figure 4).

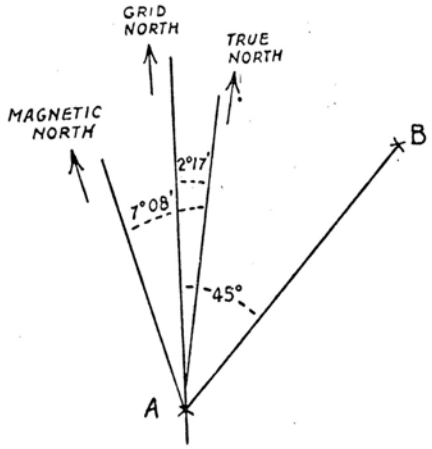
You now want to find out where Magnetic North fits into your diagram. You can find, from the margin of the map sheet, the Magnetic Variation, as described

Figure 4



previously. Assume it is 7°08′ W; that is, Magnetic North is 7°08′ West of True North. You can now add to your diagram a line indicating Magnetic North (see Figure 5).

Figure 5



From this diagram you can now find the angle between Magnetic North and line AB (that is the Magnetic Bearing of Site B from Site A).

In the example the angle is obviously

45° + (the angle between Magnetic North and Grid North),

that is 45° + (7°08′ − 2°17′),

or 45° + 4°51′ or 49°51′.

Thus, the Magnetic Bearing of Site B from Site A is 49°51′. This is the compass bearing of the distant station from your station.

NOTE: On some maps, the variation between Grid and Magnetic North is given directly, so you do not have to make the calculation involving True North given above. However, you must always make the correction for the yearly change in Magnetic Variation.

7. The Army Prismatic Compass

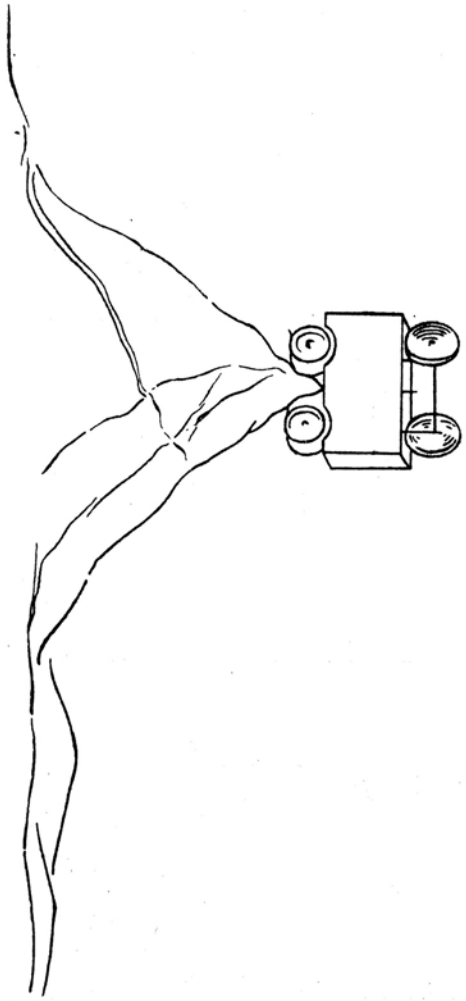
To use the compass by day, proceed as follows. Open the outer cover of the compass case, and adjust it at right angles to the body of the compass. Pass the thumb of the left hand through the compass ring, and curl the left index finger around and rest the compass on it. Turn the prism up into position. Look through the prism and through the glass of the outer cover of the compass case. You will be able to see the figures of the compass card in the prism. Move around until the figures representing the Magnetic Bearing you wish to set up appear against the zero mark in the prism. The line from your eye through the prism and in line with the hairline on the outer cover of compass case is on this magnetic bearing.

Quite frequently it will be necessary for you to set your equipment up at night. The Army Prismatic Compass is treated with luminous paint at certain points so that it can be read at night. To set the compass at night, proceed as follows. Open the folding cover of the compass so that it is flat. Pass the thumb of the left hand through the ring and curl the index finger around so that the compass rests on it, with the open compass cover pointing in the direction of the thumb. Loosen the lock screw which secures the glass face above the compass card. Rotate the glass face until the figure representing the bearing you want to establish appears over the luminous face just beside the hinge of the cover; then fasten the lock screw.

Now turn the compass until the (luminous) pointer on the compass card is coincident with the luminous mark on the glass face of the compass. The axis of the compass (and your left thumb) are now pointing on the required Magnetic Bearing.

Setting by night is less accurate than setting by day.

You can now proceed to align your aerials on the correct compass bearing as described in E & ME Regs Tels F163.



"PHYSICALLY IMPOSSIBLE TO LOCATE WS No 10 ON A SPOT HEIGHT"

CHAPTER III

PLANNING WORKING PATHS

It will be a rule within 21 Army Group that WS No. 10 will ALWAYS be worked over an optical (line of sight) path.

Before it can be decided as to whether the projected path is optical it is necessary to draw a contour section and apply the correction factor for the curvature of the earth's surface.

1. Parabolas

Construct two parabolas as follows:—

Draw the parabola of the equation of $D = 1.23 \sqrt{H}$ where D = distance in miles and H = height in feet.

Convenient scales are

(i) for links 5 to 30 miles
Horizontal scale one inch equals two miles
Vertical scale one inch equals fifty feet.

(ii) for links 25—80 miles
Horizontal scale one inch equals five miles.
Vertical scale one inch equals one hundred feet.

If these are drawn on a suitable medium (talc is excellent, cardboard adequate) the parabolas can be cut out (see Figure 6).

2. Contour Sections

Graduate the long edge of a piece of foolscap paper in miles according to the scale of the map being used. Lay this edge along the line joining the two proposed working terminals with the zero miles point on the paper coincident with the left hand terminal.

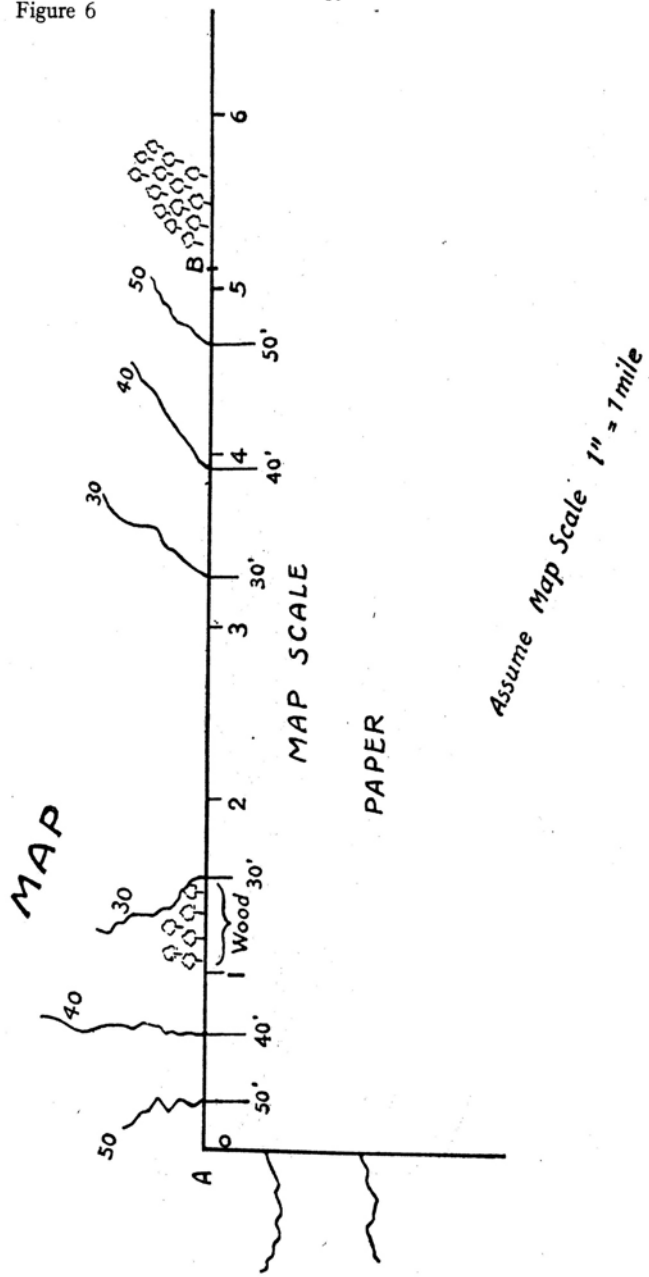
Carefully mark off on the paper all contours and spot heights occurring in the path, inserting heights in feet. Maps of Europe normally have the contours marked in metres. A simple conversion table is printed at the back of this pamphlet.

Where spot heights occur along the path they will be included normally. A spot height however will never be taken as the height of a terminal. The highest normal contour will always be taken for the working height of a terminal. Practical experience has shown that it is frequently impossible physically to locate a WS No. 10 on a spot height.

Mark on the paper all woods and forests that occur in the path (see Figure 7).

It is now necessary to project the contour section to the scale of whichever parabola is to be used.

Figure 6



To do this, first graduate in miles the adjacent side of the paper which must be at right angles to the side previously used, according to the horizontal scale of the parabola, i.e. for parabola (1) a scale of one inch equals two miles. Ensure that the zero miles graduation is coincident with the zero miles point used for the contour path. Join the mile points of both scales by a series of parallel lines.

Now transfer accurately to the new (parabola) scale, all detail re contours shown on the old (map) scale. This is simply done by drawing lines from contour markings on old scale parallel to the mileage lines. Where they cut the new scale will be the corresponding correct position (see Figure 8).

Using a new sheet of paper draw a base line and graduate in miles according to the horizontal scale of the parabola to be used. At each of the left hand (zero miles) and right hand extremities draw a line vertical to the base line and graduate in feet according to the vertical scale of the parabola. Mark off directly on the base line the same detail as is on the new contour-lines path line ensuring that the zero miles point of both lines are coincident. From the information marked on the base line plot the full contour section (see Figure 9).

3. **Assessing Paths**

It now only remains to apply the correction factor for the curvature of the earth's surface.

To do this place the parabola, with the horizontal scale at the top, on the paper slightly above the contour section. The vertical scale of the parabola must be kept vertical to the horizontal base line of the contour section. Now slide the parabola down and sideways until the curve exactly passes through the two proposed terminal points. Take great care to keep the vertical scale of the parabola vertical to the base of the contour section (see Figure 10).

Draw the curve made by the parabola between the two proposed terminal points.

If this curve cuts the contour section the path is NOT optical.

If the curve is above the contour section the path is optical subject to there being no screening. For purposes of judging possible screening the height of trees will be assessed at 30 feet.

4. **Reconnaissance**

Having decided from a map survey that a link is possible between two points, the section officer or serjeant will visit both proposed terminal points and decide on the best possible exact site to be used. Even though the map survey has shown the link to be optical, every effort will be made to obtain additional height at the terminals. Advantage will be taken of buildings and small rises in ground not shown on the map.

The exact bearing will then be calculated.

Both detachment commanders concerned will then be advised of the exact site at which their station will be located and the bearing on which aerials will be aligned.

Figure 8

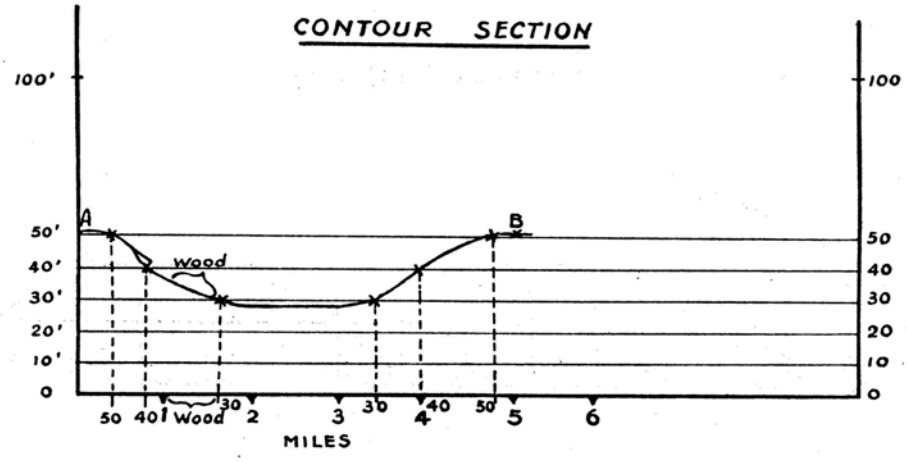


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Figure 7

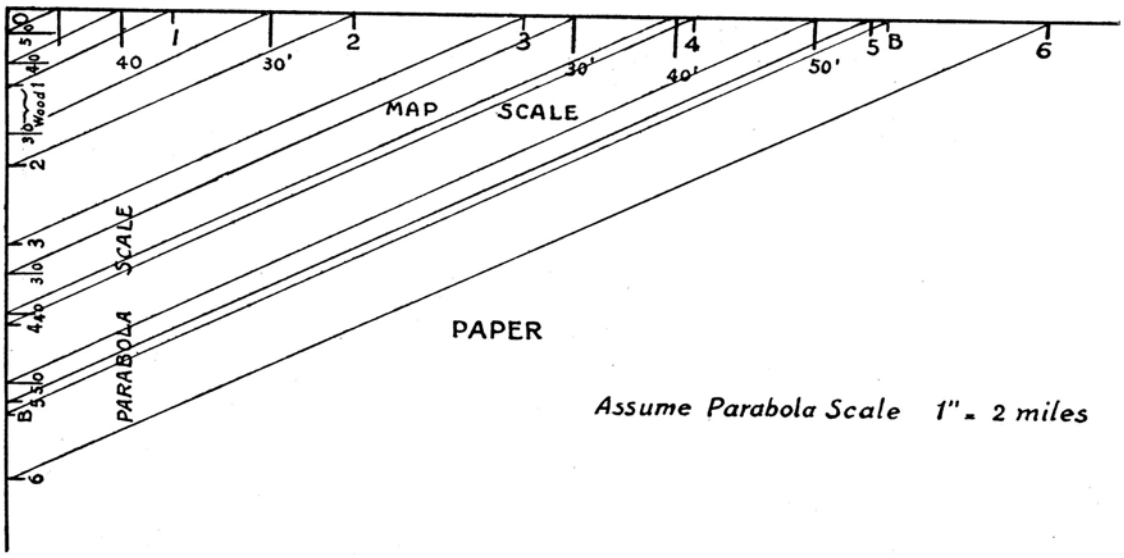

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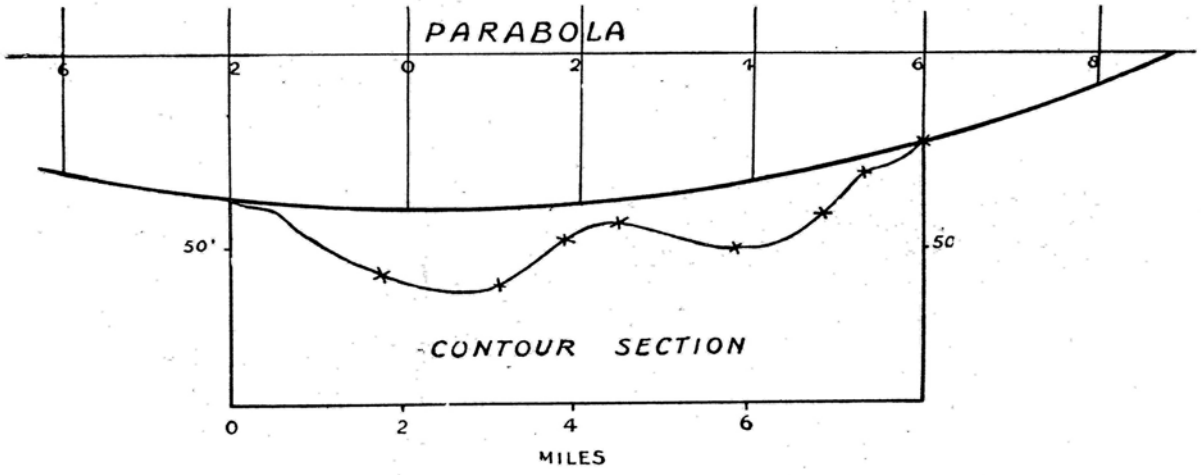
Figure 10



Parabola showing optical path between terminals

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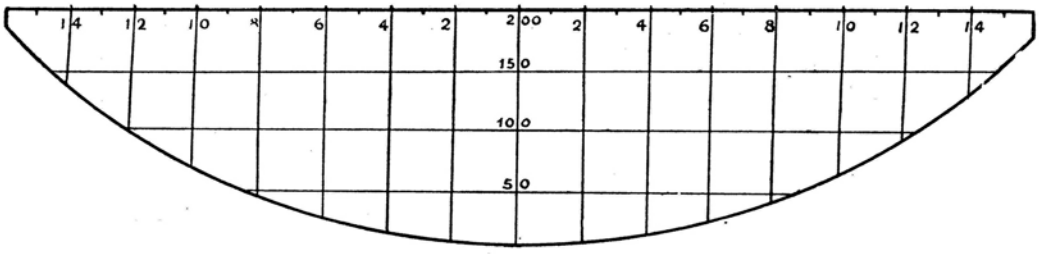
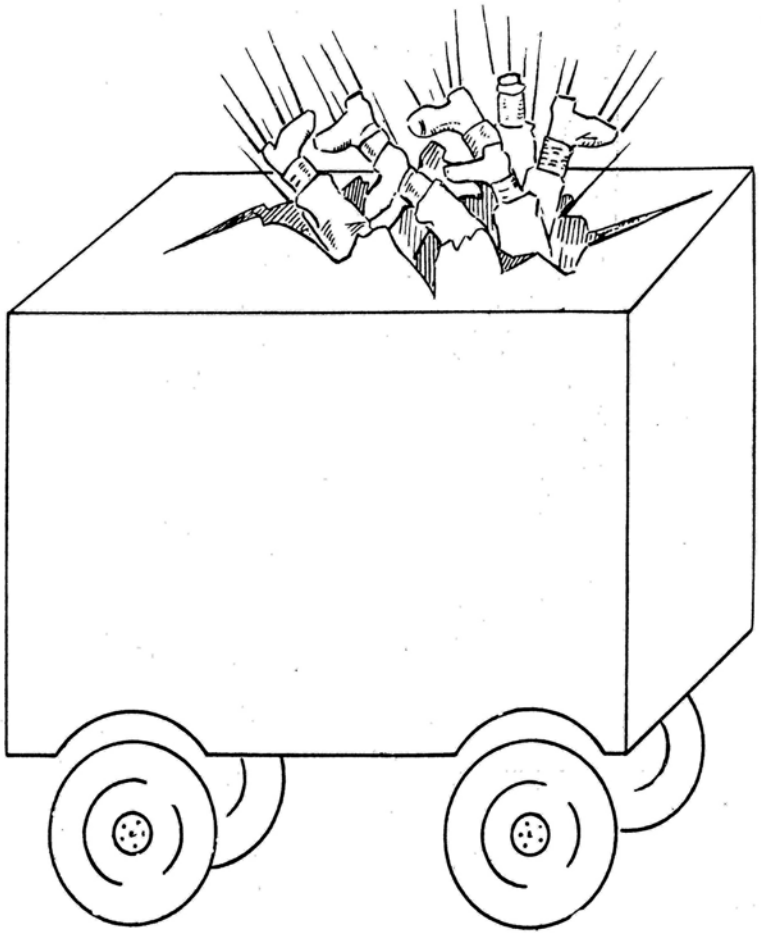
Figure 9



Parabola (1) (approx ⅓ actual size)

20



"NO MORE THAN TWO MEN WILL STAND ON THE ROOF AT THE SAME TIME"

CHAPTER IV

DRILLS

The section officer will always name each trailer with a letter corresponding with its position in the link. The control terminal station will always be named "A" and first outstation "B". "C", "E", and "G" will be allotted to further control stations, and "D", "F", and "H" will be allotted to further outstations.

He will ensure that his section carries out the drills detailed below.

These drills will be read in conjunction with E & ME Regs on the WS No. 10. The section officer will ensure that all trailers have a copy of the E & ME Regs.

Where this pamphlet conflicts with the E & ME Regs on any point, the procedure laid down herein will be followed.

DRILLS FOR WS No. 10—No. 1

Drill for setting up a WS No. 10 Set Station ready for working

1. Remove generators from trailers and set them up a minimum of 20 yards from the trailer and 10 yards from each other. Weatherproof the generators with waterproof canvas covers.

2. Jack up trailer and erect stays.

3. Unlace the canvas cover and hang it on the hooks provided on the offside of the trailer roof. If an awning is required, the outer edge of canvas cover may be secured by poles and guy ropes.

4. Erect aerial system.

5. Remove the waterproof canvas covers from the front of the mirrors.

6. Check that the dipole pick-ups are vertical.

7. Check that the reflector plates are 5 cm from the end of the guides and 30 cm from the back of the mirror.

8. Slacken the vertical and horizontal adjusting bars and set both mirrors vertically and in line with the frame horizontally. A piece of cord may be held across the mirror edges to align them, and an improvised plumb line used to set them vertically.

9. Slacken the five wing nuts clamping the turntable, and align the aerial accurately on the given bearing. Finger tighten the five wing nuts.

10. Replace waterproof covers.

11. Connect up apparatus as described in Table 1, E & ME Regs Tels F163 (2nd Edition).

12. Start one generator.

13. Keeping the mains input to equipment at 230 v AC, carry out the following operations in the order given:—

(*a*) Switch on "Pulser" and "monitor".

(*b*) Set up "Pulser" wave form as in E & ME Regs Tels F163 (2nd Edition), Table 4.

(*c*) Check and log all test point readings.

(*d*) Check that both senders have correct magnetrons and field settings.

N.B.—Transmitting magnetrons will always differ at each end of a one to one link and always be the same at relay stations.

(*e*) Check that "HT Volts" control is at minimum.

(*f*) Switch on Sender and adjust "Field Angle" for maximum "osc current" dip. Adjust "HT volts" for correct "osc current".

(*g*) Set up sender with "Resonator" at or as near "100" as possible, ensuring that "Resonator" and "line matching" controls are set to the most stable point on their output curve.

(*h*) Check and log all test point readings.

(*j*) Switch on "Blowers".

(*k*) Switch on receiver L.T., wait two minutes, then switch on receiver H.T.

(*l*) Switch on "Separator" Unit.

(*m*) Tune receiver to local sender and note that the "First Channel" tuning point is in the correct tuning band, i.e. 2 to 15 for C V 89 and 16 to 26 for C V 79.

(*n*) Check and log all receiver test point readings.

(*o*) Set up "Separator" wave form as instructed in Drill No. 2.

(*p*) Check and log all test points.

(*q*) Check all alarm circuits.

(*r*) Check modulation, voice output and ringing on all channels.

(*s*) Check wiring between Signalling Equipment and Boxes terminal signal office via Frames D & P.

14. Repeat (13) using all spare equipment, including changing round sender and receiver aerials.

15. Camouflage trailer ensuring easy access to aerial systems for adjustment.

16. Switch channel 1 to 2 wire and connect a Tele F; this channel will always be used for the engineering speaker circuit.

17. The station is now ready for operation.

DRILLS FOR WS No. 10—No. 2

Drill for setting up Separator Gate Picture

1. Separate any overlapping gate pulses and if necessary reduce the "Gate Widths".

2. Set Channel 8 "Gate position" to 5.

3. Set "Group Adjustment" so that the interval between arrival of Channel 8 gate pulse and arrival of Channel 8 signal pulse is equal to 1 time unit.

4. Adjust Channel 8 "Gate Width" so that the right hand edge of gate and signal pulse intersect at the lowest point.

5. Adjust Channel 1 "Gate Position" so that the interval between arrival of Channel 1 signal pulse is equal to 1 time unit.

6. Adjust Channel 1 "Gate Width" so that the right hand edge of gate and signal pulse intersect at the lowest point.

7. Adjust Channel 2 "Gate Position" so that the left hand edge of Channel 2 gate pulse and right hand edge of Channel 1 gate pulse intersect on the C.R.T. flyback.

8. Adjust Channel 2 "Gate Width" so that the right hand edge of gate and signal pulse intersect at the lowest point.

9. Repeat operations 7 and 8 for Channels 3 to 8 inclusive.

DRILLS FOR WS No. 10—No. 3

Drill for establishing communication between two WS No. 10

1. It is assumed that stations are named "A" and "B" respectively and "A" is control.

2. Both stations will have been set up ready for working in accordance with Drill No. 1.

3. It is essential that the following times be strictly adhered to. Starting time is taken as 0000 hrs.

4. 0000—0015 hrs. "B" sends also searching on receiver. "A" searches on receiver and at the same time sends, but is allowed to switch off sender as required.

0015—0030 hrs. "A" sends continuing to search if no signal has yet been received.
"B" searches on receiver and at the same time sends but is allowed to switch off sender as required.

If the aerials have been correctly oriented, communication will now have been established. Should this not be so, the following procedure will be adopted:—

0030—0035 hrs. One member of the crew of both sets will take up position on the roof of the trailer ready to swing aerials.

0035—0215 hrs. "B" will send for periods of 10 mins. on each of the following bearings in order $+1°$, $-1°$, $-2°$, $+2°$, $+3°$, $-3°$, $-4°$, $+4°$, $+5°$, $-5°$, and search on receiver during the whole of this period.

"A" swings aerial between $+5°$ and $-5°$ searching on receiver at each $1°$ interval. This operation is repeated every $1°$ change of "B", i.e. every 10 mins.

Communication will by now have been established.

0030—0040 hrs. or 0215—0225 hrs. — "A" will align both send and receive aerials on "B", notifying "B" when changing aerials.

"B" during this period will remain sending and under no circumstances touch any controls.

0040—0050 hrs. or 0225—0235 hrs. — "B" will align both send and receive aerials on "A" notifying "A" when changing aerials.

"A" during this period will remain sending and under no circumstances touch any controls.

0050—0100 hrs. or 0235—0245 hrs. — Both stations will carefully mark and note bearing.

0100—0105 hrs. or 0245—0250 hrs. — "A" will swing aerials through an arc from +20° to −20°. "B" will remain sending on correct bearing.

0105—0110 hrs. or 0250—0255 hrs. — "B" will swing aerials through an arc from +20° to −20°. "A" will send on correct bearing.

The last two operations are to ensure that neither station has lined up on a side lobe. If either station has done so it will re-align on the main lobe.

All wing nuts on aerial systems will be securely clamped.

The stations are now ready for channel allocation and alignment.

DRILLS FOR WS No. 10—No. 4

Drill for aligning VF Channels

1. **General**

(*a*) Assume all input and output levels to be zero db (zero level = 1 mw = .775v RMS into 600 ohms) for four wire circuits.

(*b*) Assume all input levels to be zero db and output levels to be neg 3 db for two wire circuits.

(*c*) The following instructions are based on the above assumptions. If other levels are specified, add or substract from levels given.

(*d*) Use Test Oscillator on 800 cps and Tester TMS No. 2 for all operations.

2. **Setting up four wire circuits for Speech operation**

(*a*) Station "A". With test oscillator set to neg 3 db adjust "Modulation Level" to 50% modulation (approx three to one Blurred to Clear ratio).

(*b*) Station "B". Using Tester TMS No. 2 set "Voice Output" control to give neg 6 db.

(*c*) Station "A" repeats as for Station "B" in (*b*) above.

(*d*) Station "B" repeats as for Station "A" in (*a*) above.

(*e*) Above procedure will be adopted for all channels required for four wire speech working.

3. **Setting up four wire circuits for S + Dx or VF Telegraph working**

(*a*) Station "A". With test oscillator set to zero db adjust "Modulation Level" for 30% modulation (approx one to one Blurred to Clear ratio).

(*b*) Station "B". Using Tester TMS No. 2 set "Voice Output" to give neg 3 db.

(*c*) Station "A" repeats as for Station "B" in (*b*) above.

(*d*) Station "B" repeats as for Station "A" in (*a*) above.

(*e*) Above procedure will be adopted for all channels required for four wire VF Telegraph working.

4. **Setting up two wire circuits for Speech operation**

(*a*) Station "A". With test oscillator set to neg 3 db adjust "Modulation Level" for 50% modulation.

(*b*) Station "B". Using Tester TMS No. 2 set "Voice Output" to give neg 6 db.

(*c*) Station "A" repeats as for Station "B" in (*b*) above.

(*d*) Station "B" repeats as for Station "A" in (*a*) above.

(*e*) Above procedure will be adopted for all channels required for two wire speech working.

5. **Setting up two wire circuits for S + Dx or VF Telegraph working**

(*a*) Station "A". With test oscillator set to zero db adjust "Modulation Level" for 30% modulation.

(*b*) Station "B". Using Tester TMS No. 2 set "Voice Output" to give neg 3 db.

(*c*) Station "A" repeats as for Station "B" in (*b*) above.

(*d*) Station "B" repeats as for Station "A" in (*a*) above.

(*e*) Above procedure will be adopted for all channels required for two wire VF Telegraph working.

6. The above procedure holds good for one to one links only. For tandem working the procedure needs slight modification as shown in Figures 11 and 12.

DRILLS FOR WS No. 10—No. 5

Maintenance and Records

1. **General Maintenance**

(*a*) The trailer will be kept clean and tidy at all times.

(*b*) The equipment will be kept dry and, when not in use, dehumidifiers will always be used.

(*c*) All moving metal parts of trailer and aerial system will be kept greased.

(*d*) Tyres will be kept at correct pressure.

(*e*) No more than two people will stand on the roof at the same time.

(*f*) Under no circumstances will unserviceable equipment be left in the working or spare positions. All such defects will be logged and reported immediately.

2. **Technical Maintenance**

(*a*) Generators will be changed every six hours.

(*b*) Oil in the generators will be changed every 100 working hours.

(*c*) Generators will be thoroughly serviced including de-carbonising, tappet adjustments, etc., every 1000 working hours.

(*d*) Aerial alignment will be checked daily.

(*e*) All spare equipment will be brought into service for a period of 24 hours every four weeks.

(*f*) All operational channels will be checked and re-aligned if necessary every two days. These adjustments will be made at a time chosen to cause the least interference to operational traffic. Adjustments will never be made without advising the line test clerks concerned.

(*g*) Under no circumstances will adjustments be made to senders, pulsers and aerials without notifying the distant station.

(*h*) Operators will give a check call to the distant station at every hour, using the engineering channel.

(*i*) If the signal from the distant station disappears, attention should be drawn by switching local sender off and on three times quickly, and then tune receiver to expected dial reading for distant station's spare sender.

(*j*) All faults will be noted together with details of action taken.

3. **Records**

The following records will be carefully maintained.

(*a*) *Trailer History*

This will contain details of trailer number, section, detachment commander, crew, mileage, overhauls and repairs. Also locations of sites, bearings worked, times of opening and closing.

(*b*) *Technical Logs*

These will be detailed in E & ME Regs Tels F163 (2nd Edition), Tables 10, 11 and 12.

Table 10 will be amended to include an hourly check of Signal Level, Magnetron Current and Supply Volts. Any deviation from the previous recorded reading will be entered in the log.

Channel Allocation Log

Will contain the following information:—

(i) Channel number.
Circuit number IN, and circuit number OUT.

(ii) Type of circuit (two or four wire).

(iv) "Level In" and "Level Out".

(v) "Modulation Level" and "Voice Output" control settings.

(vi) Types of ringing—17 cps, 50 cps, 500/20 cps, etc.

(vii) Subscribers' designation.

(viii) Time brought into service. Time taken out of service.

4. Station commanders will check daily that routine maintenance has been done and records correctly entered.

5. Section Officer or Serieant will check all stations of their section once per week and initial all records.

S.R.D.E. PAMPHLET NO. 377A COPY NO. 32

NOT TO BE PUBLISHED

WIRELESS SET NO. X10A

WORKING INSTRUCTIONS

NOTE

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This document is the property of H.B.M. Government and is to be returned to the Superintendent, Signals Research and Development Establishment Somerford Christchurch Hants., in accordance with the table below:-

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S.R.D.E. PAMPHLET NO.377A COPY NO.

WIRELESS SET NO.X10A

C O N T E N T S

S.R.D.E. PAMPHLET NO.377A

WIRELESS SET X10A

CHAPTER I - GENERAL DESCRIPTION

1. Purpose.

The Wireless Set X10A provides communication, using centimetre waves, between stations remote from one another and each employing up to eight channels.

The channels are connected by line equipment to the Wireless Set X10A apparatus which provides a radio link, having propagation properties of an optical character.

2. Range.

Ranges of fifty miles over land and seventy miles over sea have been obtained. The radio beams employed take optical paths so that the distances covered depend to a large extent upon there being no obstacles.

Relay stations can be used to increase the total distance covered and a link with seven relays has been operated satisfactorily under conditions simulating a total separation of 210 miles.

3. Frequency.

Each station has its sender operating at a spot frequency corresponding to either 6.6 cms, or 6.3 cms wavelength. The sender at the other station is operated at the other of these two wavelengths.

4. Power Supply.

The installation requires a power supply of 200-250 volts A.C. 40-60 c/s single phase. The power consumption is approximately IKW.

The power supply compartment of the vehicle installation is provided with two 2½ KVA alternators and two 6V170AH batteries with charger. The batteries provide vehicle lighting, start the motors and ring alarm bells (if used.)

5. Aerials.

The aerial system consists of two 4-ft diameter paraboloid reflectors mounted in a frame on a turntable. Each reflector is independently adjustable over a small angle about both horizontal and vertical axes.

The signals are fed between sender and receiver and their respective reflectors through concentric cable and flexible waveguides.

A dipole fitted in the sender reflector acts as a monitoring aerial pick-up.

6. Sender (see Fig.3.)

This is housed in a single small case and consists of a power supply portion, modulation amplifier and u.h.f. magnetron oscillator.

The power supply portion employs two rectifying valves (type AU5). The modulation amplifier is a single valve (type ATS 25) to the grid to which is fed the output of the pulse portion of the multi-channel apparatus (S.E.No.10). The output of the modulation amplifier valve is applied to the anode of the u.h.f. oscillator valve (type CV79 for wavelength of 6.6. cms, or type CV89 for a wavelength of 6.3 cms). Horseshoe magnets encase the magnetron valve and provide a magnetic field of about 650 oersteds.

The u.h.f. output of the sender is approximately 250 milli-watts.

7. Receiver. 2.

The earlier type of receiver is fitted into two rectangular chassis side by side in a case; the later type receiver is fitted into two 119 set cases mounted in a rack, one above the other. (see Figs 4,5, and 6).

The earlier type employs a CV52 valve as local oscillator, while the later type employs a CV9C valve for this purpose. In both types the incoming waves and an harmonic of the local oscillations are fed through a waveguide and mixed in a crystal valve (CV 102) placed across the guide and connected to a 45 Mc/s I.F. amplifier A.V.C. and A.F.C. circuits are incorporated.

A 'slicer' valve may be utilised to cut off the extremes of the received signal pulses to free the treated signals from noise. The later type receiver incorporates a slicer which is housed in the power supply unit.

8. The Signalling Equipment No.10.

This provides multi-channel operation and consists of (i) pulser (ii) separator and (iii) monitor and line units.

The pulser provides a marker pulse, and eight channel pulses width-modulated in accordance with the audio inputs on the eight channels. The pulser output is applied to the grid of the sender modulator amplifier valve.

The separator has eight channel circuits each triggered in turn to provide gate signals on to which the appropriate received pulses are super-imposed. Each of the line channel circuits has a ringing relay operated on the absence of a pulse in the signal received on that channel.

The monitor has a 6-inch cathode ray tube and incorporates a two-stage amplifier, power supply portion and four-position switch. The switch enables any one of the following four images to be viewed:-

(i) The signals from the monitoring pick-up. i.e. the radiated pulses;
(ii) The pulser output.
(iii) The separator gate pulses with superposed received pulses;
(iv) The receiver output;

The earlier type of S.E. No.10 is housed in four boxes, while the later type is in three boxes.

CHAPTER II - OPERATION

9. Preliminary.

Select suitable sites for the equipment. Its efficiency is so dependent on the propogation properties of the various radio paths, that too much emphasis cannot be laid on the need for selecting the best available sites.

For instance, the use of two short paths having optical characteristics and two relay stations may be preferable to one long path which gives only a marginal signal, contributing a large proportion of noise and failing completely as soon as one piece of apparatus deteriorates slightly.

10. Setting up.

(a) Mounting the units.

Tow the chassis with the complete station mounted on it into position. If the site is inaccessible, break down the trailer body, haul the items of equipment separately into their required positions and reassemble the trailer body on the site.

(b) Aerial System.

(i) If the reflectors are in a horizontal position, undo the fixing bolts and erect them in a vertical position.

If possible place the vehicle in line with the remote station; these will then be less tendency to rock in the wind.

Turn reflectors round to face approximately towards required remote station. Use a compass if necessary for determining the initial approximate reflector setting.

(ii) See that a 2-inch bore cylindrical waveguide is fitted into the centre part of each paraboloid reflector.

(iii) See that a 5-inches diameter plate is filled at a distance of 2-inches from the end of the 2-inch bore waveguide.

(iv) See that two more 2-inch bore cylindrical waveguides are fitted in the roof close to the sender and receiver.

(v) Connect the first pair of cylindrical waveguides to the second pair of flexible copper-bronze tubing, (power-flex 2-inch bore).

(vi) Check that the dipole fitted in the sender reflector is in a verticle position. Insert a rectifying crystal in the dipole assembly.

(vii) Cover the reflector apertures with the proofed canvas cover.

(c) Sender (see Fig3).

(i) Set OFF-ON switch to OFF.

(ii) Check that the following valves are correctly inserted:-

(A) Type ATS 25 valve in 5-pin holder towards middle of chassis;
(B) The two valves, type AU5, in 5-pin holders towards left-hand side of chassis. Connect top caps;
(C) Withdraw the oscillator valve head projecting from the front of panel, see that the magnetron valve, type CV79 or CV89 is inserted in octal base. Replace oscillator valve-head with valve in chassis.

(iii) Connect concentric lead from Pulser out into MOD INPUT. Switch off pulser.

(iv) Connect 230 VOLTS A.C. plug to mains supply, 230 V A.C. 40-60 c.s.

(v) Connect socket for waveguide feeder at top of case sender to waveguide by concentric lead.

(d) Receiver (earlier type).

(i) Check that the following valves are connectly inserted:-

(A) Oscillator valve, type CV52, in mixer unit. This is accessible by unscrewing the middle plate on top of the oscillator box
(B) Crystal valve type CV102 under can at left-hand rear of mixer.
(C) Head amplifier valve, type VR136, in valve holder on top left hand side of mixer chassis.
(D) The three rectifying valves, type 5Z4G, horizontally in the three valve holders in the middle of the right hand panel.
(E) Open left-hand front door and check the valves in the I.F. unit, ten type E.F.50 valves one small diode VR92, two type 6V6G, and two type ARDD5.

(ii) Connect the leads (see Fig 4)

(A) Power supply unit to I.F. amplifier unit internally by six way lead.
(B) Receiver input (right-hand side of mixer unit) to waveguide by concentric lead.
(C) Mixer output to head amplifier input by short concentric lead.
(D) Head amplifier output to INPUT socket of I.F. Unit by concentric lead.
(E) Fit 7-point plug at end of cable into 7-point socket at top of right-hand panel.
(F) If slicer is used connect receiver OUTPUT to slicer input by concentric lead. Connect unsliced output to Monitor Unit and sliced output to separator unit. If slicer is not used connect receiver OUTPUT plug directly to separator input.

(iii) Set MAINS switch to OFF. Connect to 230 V.A.C. 40-60 c.s. mains supply

(e) Receiver (Later type)

(i) See that the power-unit is mounted below the I.F. Unit.
(ii) See that the valves are properly inserted.

(a) In the I.F. Unit:-
one CV90 oscillator valve at end of resonant cavity fixed against front panel, 13 EF 50 valves on bottom panel of chassis, two pairs of VR 92 diodes fixed under screening covers to bottom panel of chassis, a crystal valve type CV 102, (front panel)
(b) In the power-unit:-
One type 6V6G
One type EF50
One type VU71

(iii) Connect the leads.
(a) 12-pin plug on power unit to 12-pin plug on I.F. Unit.
(b) Red-coloured plug on power-unit to either of red coloured plugs on I.F. Unit.
(c) Connect plain plug on power unit to separator INPUT.

(iv) Set POWER switch to OFF
Connect POWER INPUT socket to 230 V 40-60 c.s. supply,

(f) Signalling Equipment No.10 (Multi-channel apparatus) - Fig 2.
(I) Two types of S.E.No.10 exist.
The earlier type consists of four units which are, from top to bottom:-

(i) The moniter unit.
(ii) The pulser unit.
(iii) The separator Unit.
(iv) The line unit.
The later type consists of three units which are, from top to bottom:-

(i) The pulser unit
(ii) The monitor and line unit
(iii) The separator unit
(II) Fit all leads securely in correct sockets.
In the earlier type these leads are:-

(i) Three short leads running vertically from pulser unit to monitor unit.
(ii) Three leads from separator unit to monitor unit running round left-hand side of chassis.
(iii) Two leads, terminated at their ends by 10-pin plugs, from upper pulser unit sockets to upper outer sockets of line unit.
(iv) Two short leads, terminated at their ends by 10-pin plugs, running vertically from separator unit toline units.
(v) Pulser unit OUTPUT socket to sender MCD INPUT socket.
(vI) Separator unit INPUT socket to receiver OUTPUT socket.
If a slicer is used, the separator unit INPUT socket is connected to sliced OUTPUT socket of slicer. Connect the INPUT socket of slicer to receiver OUTPUT socket.
Connect the unsliced OUTPUT socket of slicer to topmost left-hand socket of monitor unit.
Connect power supplies - 400 V.D.C. 6.3 V.A.C. and earth to slicer from pulser panel.
(vii) Connect mains - 230 V.A.C. 40-60 c.s. - to separator mains sockets socket.
Inter-connect separator and pulser, pulser and monitor mains by short vertical leads terminated by 10-pin plugs.
In the later type these leads are:-

(i) Three short leads running vertically from pulser unit to monitor unit.
(ii) Three short leads running vertically from monitor unit to separator unit.
(iii) The corresponding 20-pin sockets by two leads terminated in

20-pin plugs.

(iv) OUTPUT plug from pulser unit to MOD INPUT of sender and INPUT of separator unit to OUTPUT of receiver. If a slicer is used, connect the INPUT of the separator to sliced OUTPUT socket of slicer, the INPUT socket of slicer to OUTPUT of receiver and unsliced INPUT socket of slicer to lower left-hand socket of monitor.
Connect 4-pin socket for power supply to slicer to corresponding plug on pulser.

(v) Mains to 2-pin plug on separator.

11. TO OPERATE.

(1) Sender.

(a) Rotate FIELD control clockwise to withdraw magnet shunt as far as possible.
(b) Set meter SWITCH below milliammeter to position 4.
(c) Set ADJUST H.T. control for minimum H.T. i.e. white spot as far anti-clockwise as possible.
(d) Set mains OFF-ON switch to ON.
(e) Rotate magnetron holder for dip in milliammeter current reading. Lock in position.
(f) Check that MOD INPUT plug is connected to pulser. Switch pulser on.
(g) Set meter SWITCH to position 3 and increase H.T. voltage with ADJUST H.T. control until meter reads about 0.64.
(h) Set meter SWITCH to position 4 and rotate FIELD control anti-clockwise until meter reads between 0.6 and 0.7.
(i) Set monitor tube switch to pulse out position - position 1. Examine picture on screen. Adjust LINE TUNING control and RESONATOR control on sender for maximum picture deflection.
(j) Re-adjust FIELD control and ADJUST H.T. control to give greatest stability of output keeping magnetron current between 0.6 and 0.7 with meter SWITCH at position 4.
(k) If necessary, re-adjust LINE TUNING and RESONATOR controls for best picture on screen.

(2) Receiver (Earlier type).

(a) Set MAINS switch to ON.
(b) Put monitor switch to received picture position - position 4.
(c) Switch local sender ON.
(d) Turn tuning control on front of oscillator resonator from one end of range of indicating figures until picture on monitor tube indicates reception of local sender.
(e) Adjust line tuning at right-hand side of resonator cavity to improve monitor tube picture.
(f) Adjust cavity piston at back of resonator cavity to improve monitor tube picture.
(g) Adjust tuning control on front of oscillator resonator for other tuning points. Select best tuning point.
(h) Switch local sender OFF.
Search for wanted remote signal, making only slight adjustments to the controls as set in (e), (f) and (g) above.
(j) Improve, if possible, the received picture signal by:-
(i) Adjusting plane of polarisation of received signal by rotating end part of cylindrical waveguide,
(ii) Adjusting length of probe projecting into waveguide,
(iii) Adjusting cap on end of waveguide,
(iv) Adjusting cavity piston at back of oscillator resonant cavity.
(k) With I.F. INPUT plug disconnected adjust tuning meter "Set Zero" screw to give zero indication on meter, replace plug.
(l) Turn tuning control or fine tuning control (to left of tuning control) and note direction of meter deflection; this gives required direction of tuning to bring meter back to zero reading when receiver drifts.

(3) Receiver (Later type)
(a) Set POWER switch to ON.
(b) Put monitor switch to received picture position - position 4.
(c) Switch local sender ON.
(d) See that flick lever on TUNING control is flat against tuning knob i.e. in manual tuning position. Turn TUNING control from one end of range of dial indicating figures until monitor picture indicates reception of local sender.
(e) Adjust waveguide piston for maximum received pulses.
(f) Switch local sender OFF.
Search for wanted remote signal, making only slight adjustments to TUNING control and receiver waveguide piston.
(g) Adjust plane of polarisation by rotating lower end of waveguide for best picture.
(h) Adjust length of probe projecting into waveguide for best picture.

If automatic tuning is required set AUTO-TUNING switch on power unit to 1st CHANNEL or 2nd CHANNEL and raise flick lever on TUNING control of I.F. Unit.

(4) Signalling Equipment No.10.
(a) Switch on mains input by switches on pulser, separator and monitor units. See that the three red lamps and the eight white lamps light.
(b) Set the monitor unit switch in position 2 to obtain picture of sender channel pulses. Set the sawtooth control potentiometer in its mid-position. In the earlier type this sawtooth control is situated below the eight pulser channels potentiometers; in the later type this sawtooth control is situated above the eight pulser channel potentiometers.
Adjust pulser channel potentiometers until spaces between pulses are equal, and the first and eighth pulses are approximately one and a half pulse widths from the beginning and end of base line respectively. On the later type equipment the pulser channels potentiometers are along the lower row on the front panel.
(c) Set the monitor unit switch in position 3 to obtain picture of strobes superposed on pulses.
Set the separator sawtooth control potentiometer in its mid-position.
Adjust the separator channel potentiometers until the right-hand sides of the strobes almost coincide with the right-hand sides of the pulses. On the later type equipment these potentiometers are along the lower row on the front panel. If necessary re-adjust the separator sawtooth control potentiometer for strobes to take up these positions with respect to the signal pulses.
If it is found impossible locally to attain the correct positions of strobes with respect to pulses, communicate with the remote station and instruct it to re-adjust the sawtooth control potentiometer until the required positions are obtained.
(d) It may be found necessary to alter the widths of the pulses; in this case adjust the preset trimmer condensers which are situated, in the earlier type equipment, under the chassis, and, in the later type equipment, on the front panel of the chassis.

12. Maintenance.
(1) Sender.
When the sender has been tuned in satisfactorily the meter readings with the switch in the four positions should be noted in the log. These readings will be taken by each shift and should be approximately:-

(i)	Modulator current	6 (x 100)
(ii)	Magnetron volts	4 (x 1000)
(iii)	H.T. volts	64 (x 1000)
(iv)	Magnetron current	64 (x 1000)

Should these change appreciably valve failure should be expected and the valve changed at a suitable moment.

(i) Modulator current very low - no pulses.
(ii) " " " " - 807 losing emission
(iii) Magnetron volts low - 807 soft
Modulator current very high- 807 soft.
Magnetron volts high - 807 losing emission.
(iv) H.T. volts high - 807 " "
" " Low - AU5 " "

(v) Magnetron current low with
Magnetron volts normal. - Magetron losing emission

Magnetron current high with
Magnetron volts normal - Magnetron soft.

(2) Receiver.

When a signal has been tuned in satisfactorily the readings obtained at the various test points should be noted. Some of these are required for inclusion in the log. These will help to locate any faults which may develop. It is advisable to mark all adjustable parts with pencil for reference.

Should a signal be lost the tuning controls should be adjusted slightly. It is probable that the distant sender has failed. This can be checked to some extent by tuning in the local sender. If all controls are moved at random difficulty may be found in finding the required signal when it is re-radiated.

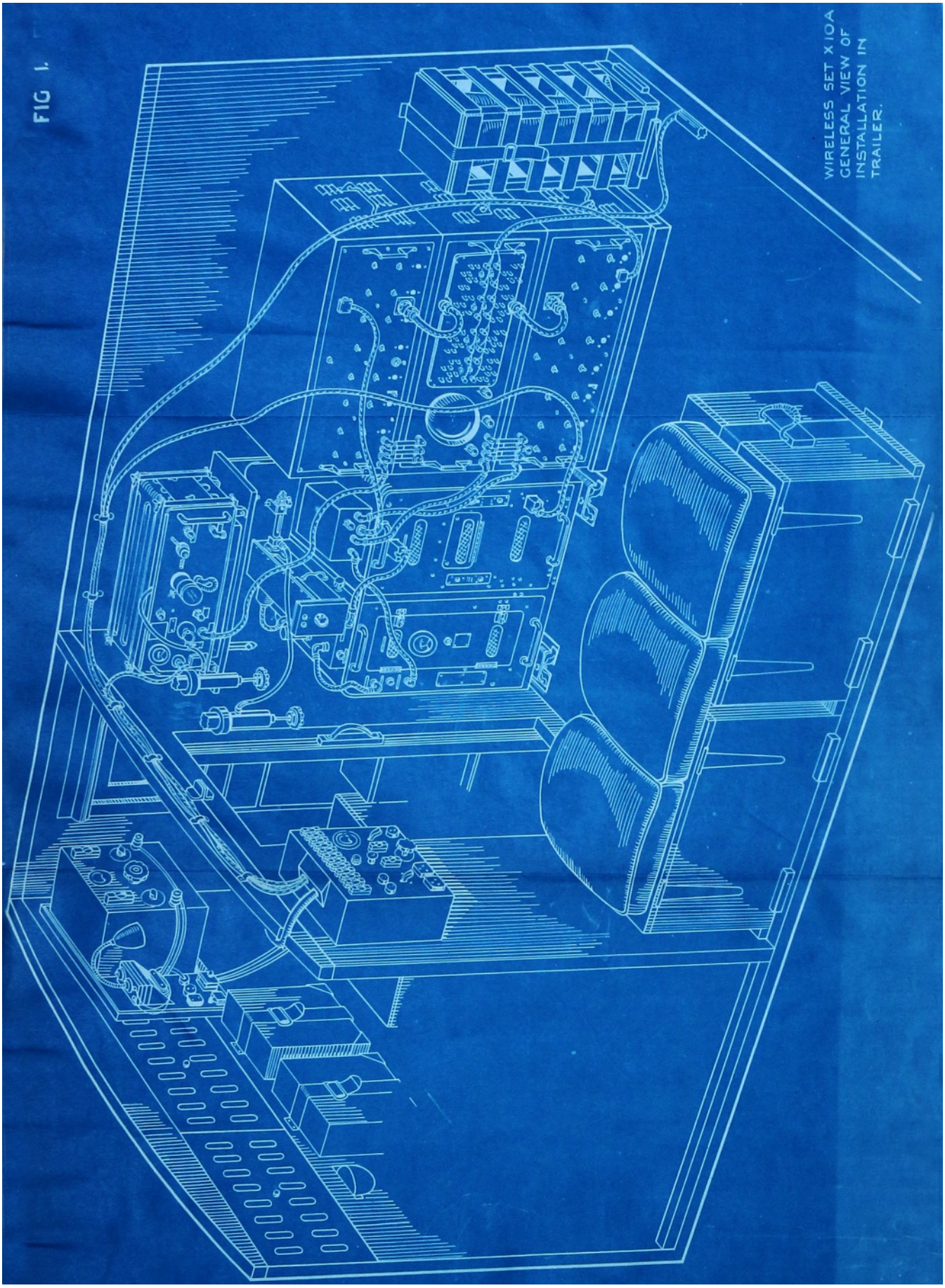

Fig. 1 Wireless Set X 10A. General view of prototype trailer (1943).

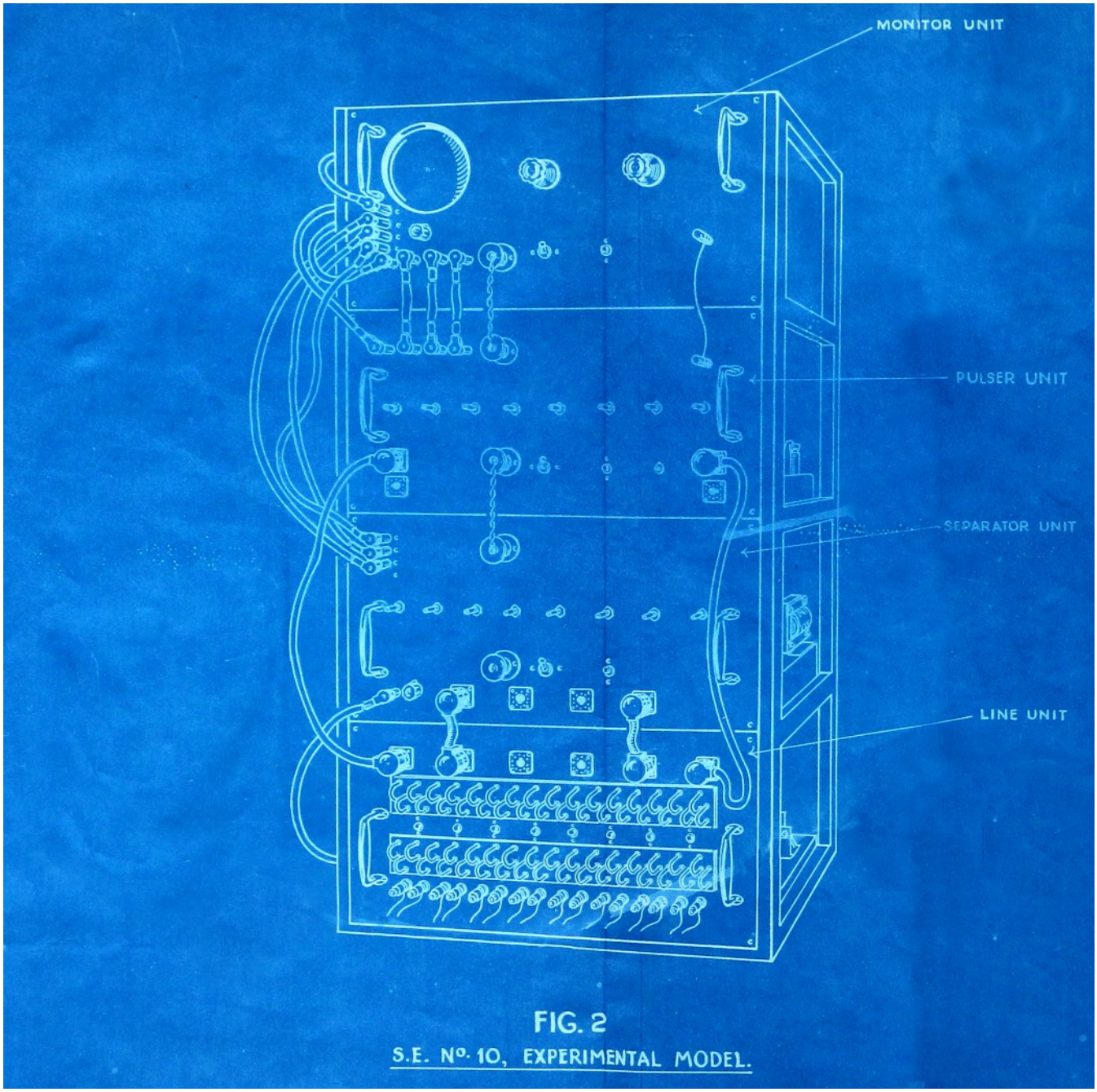

Fig. 2 Wireless Set X 10A. Signalling Equipment No. 10, experimental model (1943).

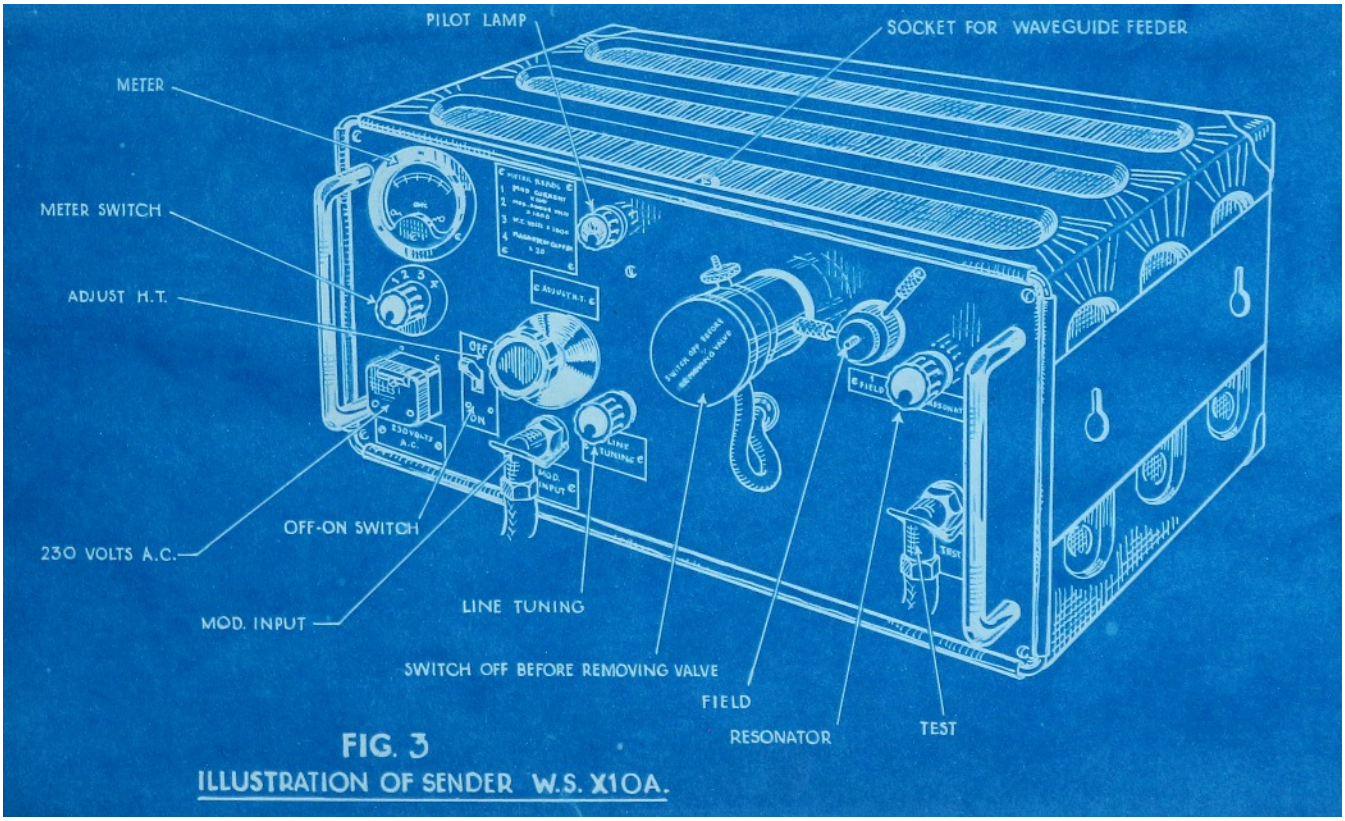

Fig. 3 Wireless Sender X 10A prototype (1943).

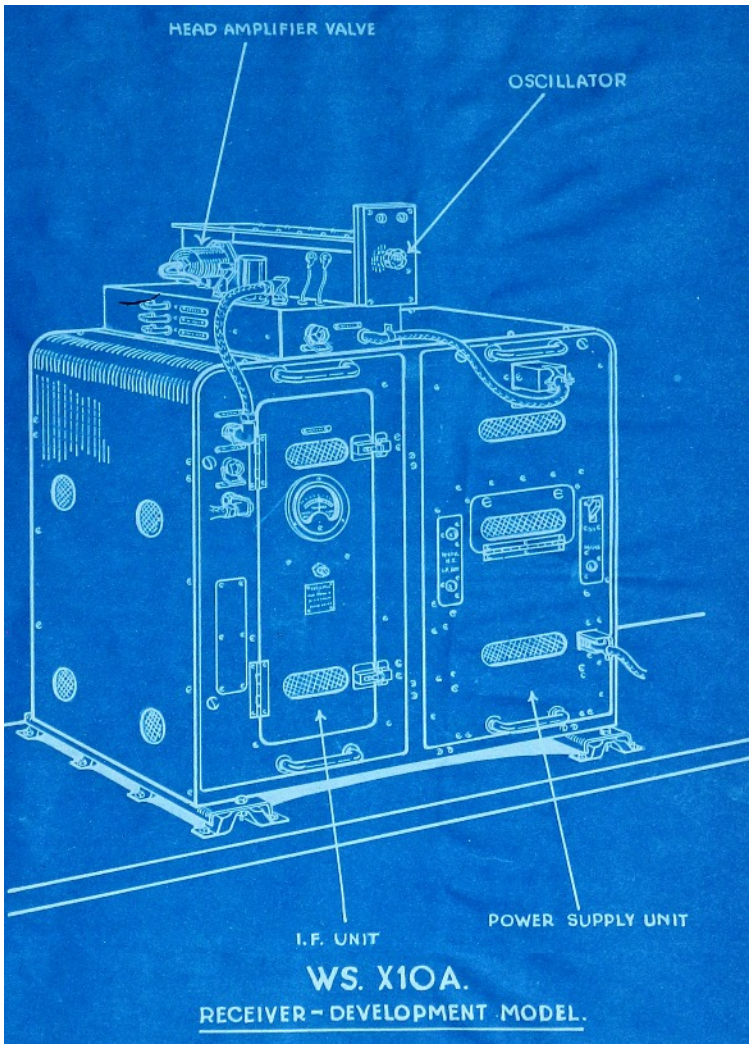

Fig. 4 Wireless Set X 10A. Receiver development model (1943).

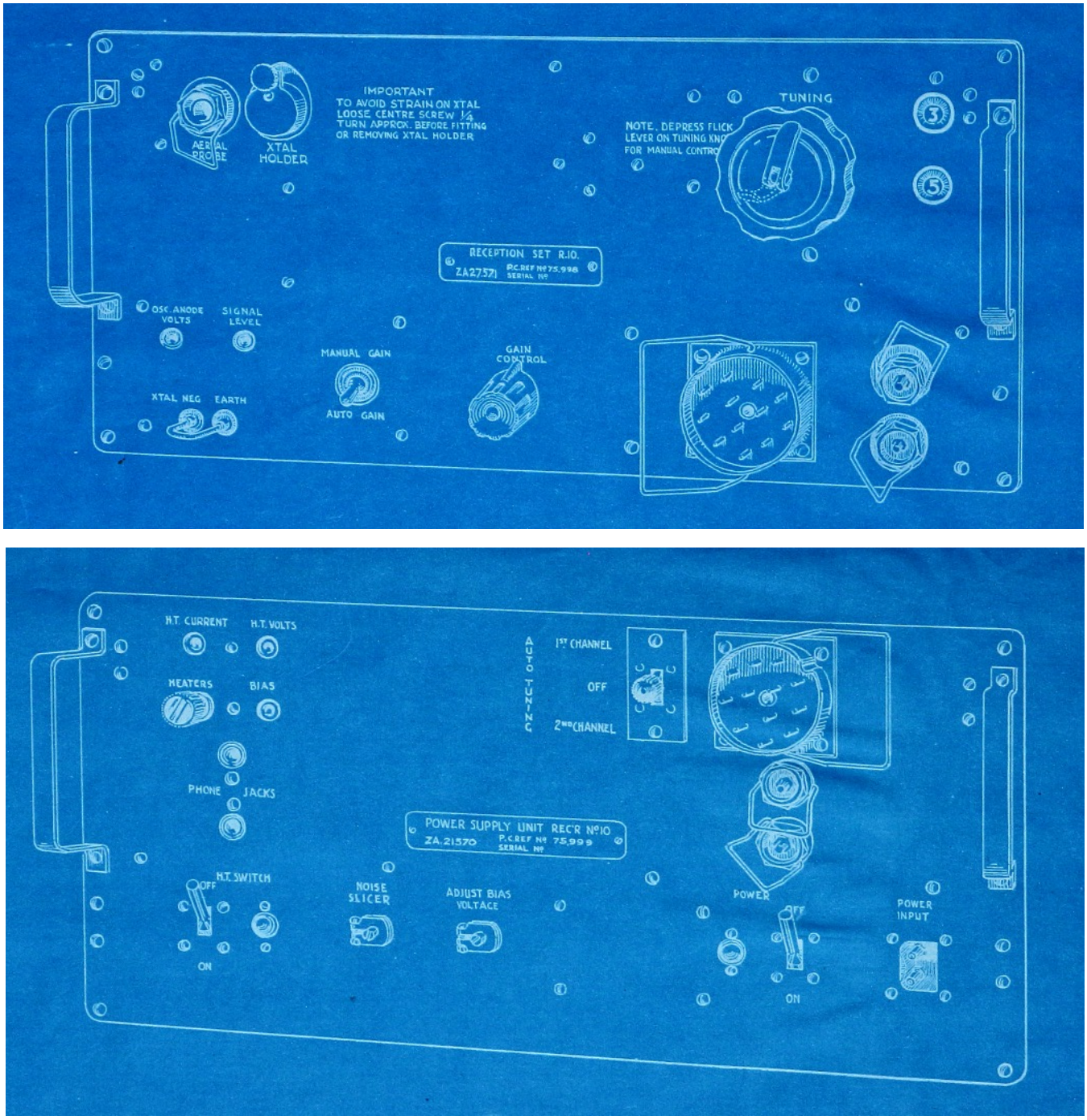

Fig. 5 and 6 Wireless Set X 10A. Reception Set R10 and associated Power Supply Unit. Prototypes (1943).

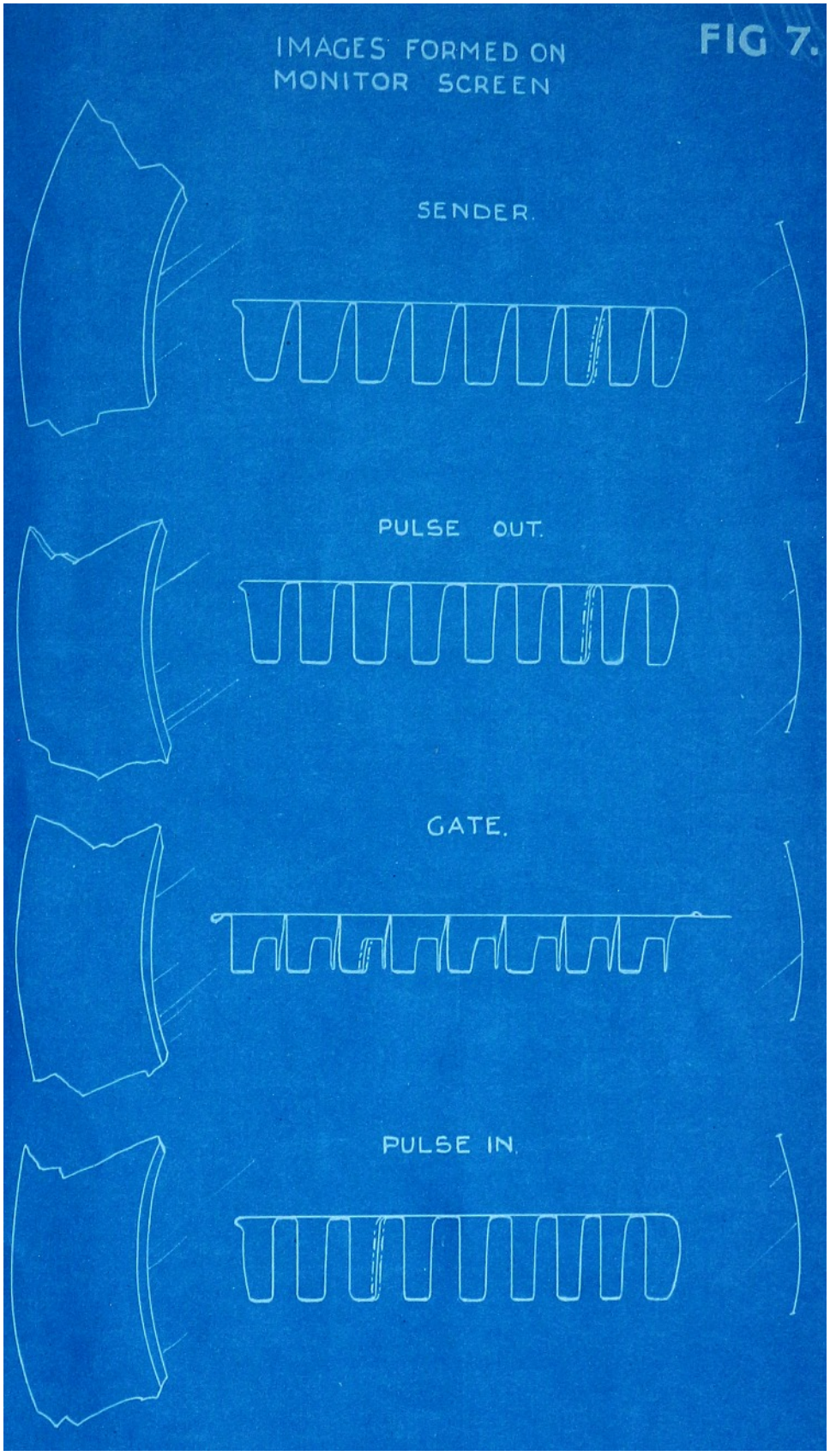

Fig. 7 Wireless Set X 10A. Images formed on monitor screen (1943).

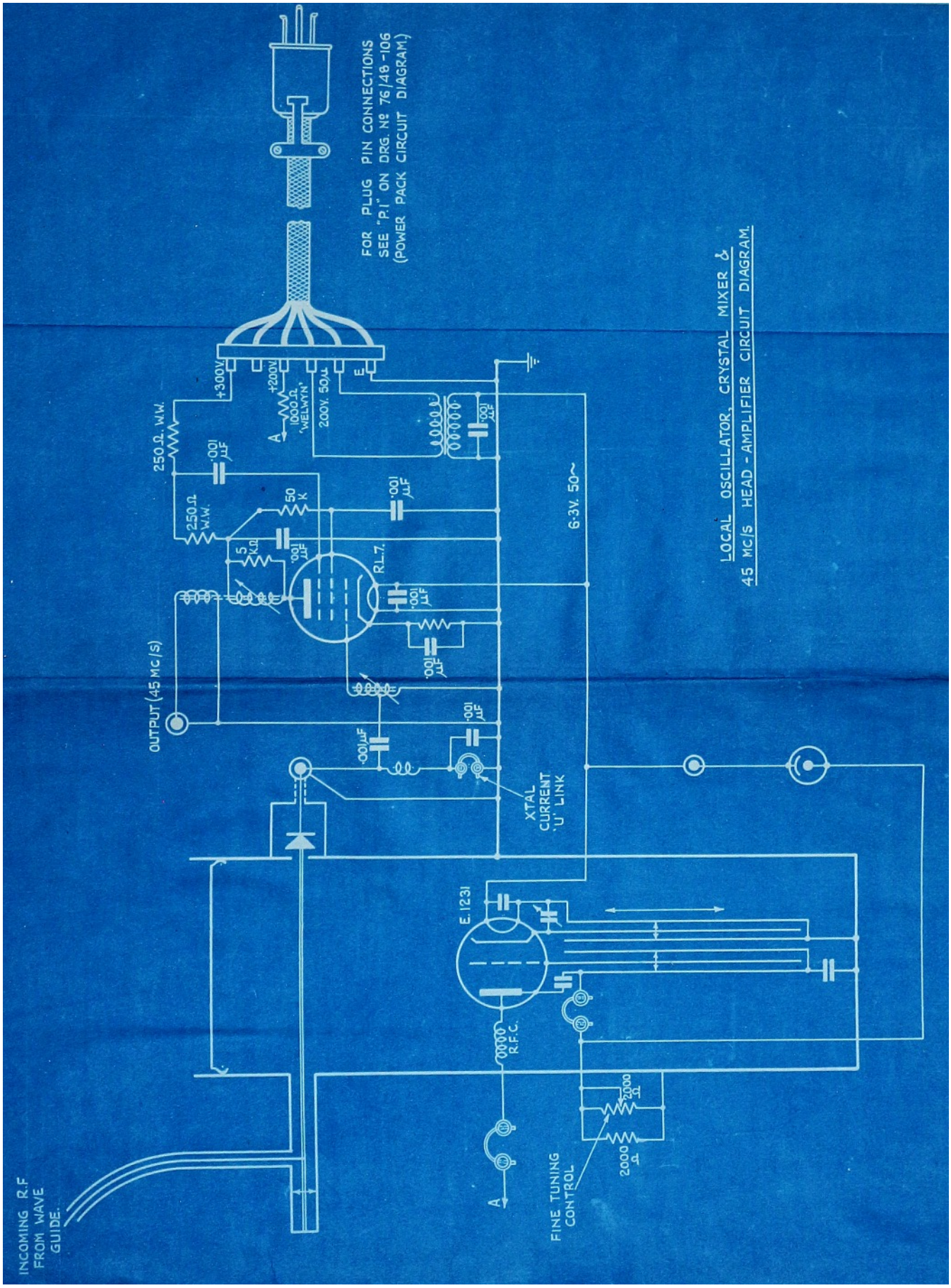

Fig. 8 Wireless Set X 10A. Circuit diagram of experimental receiver RF section, earlier type.

Copy No. 103

S.R.D.E.

Provisional PAMPHLET No. 451 A

Wireless Sender No. 10

MOST SECRET

WORKING INSTRUCTIONS

Restricted

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To whom issued	Date	Date to be returned

Signals Research and Development Establishment, Somerford, Christchurch, Hants.

DATE of ISSUE: JAN. '44

WIRELESS SENDER NO.10.

C O N T E N T S.

P A R T I

GENERAL DATA

P A R T II.

GENERAL DESCRIPTION.

TECHNICAL DESCRIPTION.

P A R T III

SETTING UP AND OPERATING.

M A I N T E N A N C E

DIAGRAMS:-

WIRELESS SENDER NO.10.

PART I - GENERAL DATA.

1.	Type of Set.	Low power using quasi-optical electro-magnetic waves with directional aerial.
2.	Function.	Radio telephone link or spur, used with Signalling Equipment No.10 and Reception Set R10. Duplex operation providing multi-channels.
3.	Range.	Given suitable optical conditions the range over land is 50 miles and over sea - 100 miles.
4.	Wavelength.	6.3 or 6.6 c.m.
5.	Power input.	230 volts, 40-60 cycles A.C.
6.	Power consumption.	100 watts.
7.	Weight.	50-lb.
8.	Dimensions (overall)	Height 8¼-in. - Length -17¼-in.-Depth 13¼-in.
9.	Valves.	V1 AU5) for H.T. full wave rectifier. V2 AU5) V3 ATS 25 Modulator amplifier. V4 CV 79 Magnetron oscillator. Wavelength 6.6. c.m. or CV 89 " " Wavelength 6.3.c.m.

WIRELESS SENDER NO. 10.

PART II - GENERAL DESCRIPTION.

Function.

1. The Wireless Sender No.10 is a low power sender used in L of C communications in conjunction with an R10 receiver to provide a radio link between two sections of telephone line not physically connected.

2. It is used for duplex operation, one sender, receiver and signalling equipment being required at each end of the link. The senders radiate on different frequencies.

3. The sender normally provides for eight channels and is used in conjunction with a multi-channel unit (Signalling Equipment No.10).

4. Radiation from the sender is highly directional so that a degree of secrecy normally associated with line communication is maintained.

Principles of operation.

5. The sender transmits U.H.F. radiation on a wavelength of 6.3 or 6.6 cm. and is designed to operate with Signalling Equipment No.10.

6. The ultra high frequency radiations are generated in a magnetron oscillator valve controlled by an amplifier modulator valve to the grid of which is fed the train of negative going pulses from the signalling equipment.

7. The magnetron oscillator which is a C.V.79 (6.6 cm.) or CV 89 (6.3 cm.) valve, according to the wavelength used, functions in a resonance mode type of circuit (E.M.E.R. Telecommunications A012).

8. For duplex working between two stations, the sender in each station must radiate at different wavelengths hence one sender uses a magnetron which oscillates at 6.3 cm. and the one in the other station oscillates at 6.6 cm.

9. The sender is cooled by air blast.

10. Normally two senders are provided at each station, one being used as a stand-by.

11. Monitoring is provided.

Wavelength.

12. The sender emits pulses of ultra high frequency radiation at a wavelength of 6.3 or 6.6 cm.

Range and power emitted.

13. The power fed to the aerial system by the sender is approximately 100 - 400 milli-watts. This power is sufficient to enable a R10 receiver to pick-up a workable signal over optical ranges. When transmitting over water the range obtainable is approximately 1.2 times optical range. An approximate formula relating the optical range R measured in miles to the heights H_1 and H_2 of the aerials above sea level measured in feet is $R = 1.22 (\sqrt{H_1} + \sqrt{H_2})$

Aerial system.

14. The aerial consists of a metal parabolic reflector. The reflector is fed by a flexible waveguide passing through it

from the rear and carrying a small circular reflecting plate in front of its output end. It is connected to the sender by the flexible wave-guide and a short length of co-axial cable. A small dipole with crystal detector mounted in the reflector and connected to a co-axial cable is used for monitoring.

Power supply.

15. The sender requires an input of 230 volts 40-60 c/s A.C. The power taken by the sender is 100 watts. The 230 V. power supply is fed to the sender in which the necessary power transformer for L.T. and H.T. is installed. The transformer feeds a fullwave valve rectifier.

Mechanical construction (Figs. 2 and 3)

16. The sender is housed in a metal case together with its power pack. The R.F. oscillator is a magnetron valve and is held in a rectangular cavity which is coupled via a co-axial cable feeder to the sender waveguide (see Fig.1). The cavity is tunable by means of a contact piston, and the co-axial cable is terminated by means of an adjustable piston. The magnetron is held between two cylindrical bar magnets giving a maximum field of about 700 oersteds. One is adjustable to give the required field for either type of valve. The valve holder assembly may be rotated to align the electrodes correctly in the field.

17. Mains are connected to the sender by a plug near the bottom of the right hand side of the front panel.

18. Cooling is by air blast which passes in at the bottom and out at the back of the case.

19. The H.T. and L.T. supplies to the magnetron valve are taken to a valve type socket on the front panel of the sender. A plug and lead attached to the oscillator, which is inserted into the resonant cavity, is plugged into the octal valve type socket.

20. The aerial co-axial cable connection is made to a socket on the front panel.

21. The separator test point socket and the modulation input socket are on the right hand side of the front panel.

22. A socket on the left hand side of the set is for a meter connection for checking purposes. This socket is connected to a key selector switch.

23. The line matching knob and dial on the front panel drive a pinion and rack attached to the matching piston. The resonator cavity piston is also driven by a pinion and rack mechanism by means of a knob and dial on the front panel.

Controls. (Fig. 2).

24. (a) Power SUPPLY ON/OFF switch.

(b) Adjustment of resonance cavity by RESONATOR dial.

(c) LINE MATCHING dial.

(d) H.T. VOLTS control MIN/MAX.

(e) FIELD STRENGTH control behind door at left hand of sender.

(f) Test key switch for checking OSC. and MOD. anode CURRENT and H.T. voltage.

Indicator Lamp (Fig. 2).

25. Lamp P1 for indicating that power supply is switched on.

Test meter. (Fig. 2).

26. Provision is made for connecting a test meter and this is located on the Signalling Equipment No.10.

TECHNICAL DESCRIPTION.

27. The circuit diagram of the sender is given in Fig.1. A full list of components with the function of each is given in Table I.

Magnetron oscillator.

28. See mechanical description above. For theory of operation see E.M.E.R Telecommunications A012. Fig.1 shows the general arrangement.

Sender.

29. The sender circuit is shown in Fig. 1. The oscillator is anode modulated by an ATS 25 valve V3. Reqtangular negative going pulses of 60 volt peak amplitude are fed to the modulator grid V3 through the MOD.INPUT socket from the Signalling Equipment No.10. These pulses are width modulated by tone and speech.

30. The output from the magnetron valve V4 is sent out through a concentric feeder and then to a wave-guide into a parabolic reflector which beams the wave over a quasi-optical path.

31. Modulation by V3 is obtained by having in the magnetron valve V4 anode and V3 anode, a common resistance (R11, R12, R13, R14 and R15) so that when current is taken by valve V3 the voltage applied to the magnetron anode drops to sufficiently low value to prevent the magnetron oscillating.

32. Normally the valve V3 is taking (without any modulation on the grid) anode current and the volt drop across the common anode resistance is of the order of 300 volts, so that the magnetron under these conditions does not oscillate. When a negative pulse is applied to the grid of V3 however, the volt drop due to the current taken by this valve is small and increases the H.T. applied to the anode of the magnetron which then oscillates. The screen of valve V3 is held at a steady voltage by means of the potentiometer comprising the resistances R5, R6, R7, R8, R9 and R10.

33. C4 is a by-pass condenser.

34. The input to the modulator is applied to the control grid across R20.

35. R18 is for auto-biasing.

36. R19 is for measuring purposes; the voltage across this resistance being applied to an external meter through a key switch S1 on the sender. C6 is the usual by-pass condenser.

37. R22 and R23 is a potentiometer for checking H.T.volts with the aid of the switch S1 and external meter. The oscillator

current is also checked with the aid of the switch and external meter, the voltage across the resistance R21 giving this check. Condenser C7 is a by-pass.

38. A socket is provided in order that the signalling equipment may be tested without radiating. This test point, SEPARATOR TEST, is in the anode circuit of V3 and therefore is 180° out of phase with the input to V3, thus providing the positive going pulses required to operate the separator unit. The test point is isolated from the D.C. H.T. voltage by the condenser C5, R17 preventing a static charge from remaining on this condenser.

Power supply (Fig. 1.).

39. The H.T. supply is obtained from a transformer associated with two half wave rectifier valves V1 and V2 giving full wave rectification. The H.T. supply to the valves is controlled by the variable resistance R 4.

40. R1 and R2 are bleeder resistances for discharging the reservoir and smoothing condensers C1, C2 and also C3. C3 provides a means for reducing the possibility of cross-talk, it is sufficiently large to ensure that the radiated pulses are truly rectangular. If the condenser were too small the pulses would become distorted and overlap thereby producing cross-talk between channels.

41. Smoothing chokes L1 and L2 are provided.

42. Windings on the transformer supply L.T. to the oscillator, modulator amplifier, indicator lamp and rectifier valves.

TABLE I - LIST OF MAIN COMPONENTS - follows on page 6.

SYMBOL	VALUE uF	RATING	TYPE	FUNCTION	FIG. NO.
C1	2	1000 V DC. working	Paper	Reservoir	1 and 3
C2	2	"	"	Smoothing	1 " 3
C3	10	"	"	Crosstalk eliminator	1 " 3
C4	0.1	"	"	By-pass	1 " 3
C5	0.1	"	"	Coupling	1 " 3
C6	6	150V DC. working	"	By-pass	1 " 3
C7	1	"	"	By-pass	1 " 3

INDUCTANCES.

L1				Smoothing	1 and 3
L2				"	1 " 3

LAMPS.

P1		6 V.40mA		Indicator	1 and 2

RESISTANCES

SYMBOL	VALUE ohms	RATING watts	TYPE	FUNCTION	FIG. NO.
R1	1 megohm ± 20%	1	Erie type 2	Bleeder	1 and 3.
R2	1 " " "	1	" " "	"	1 and 3.
R3	35 ohms ± 5%	½	GEC Woolcard	Series resistance for pilot lamp.	1 and 3.
R4	5000 "		Fox Px 50	H.T. control	1, 2 and 3.
R5	33000" ±10%	1	Erie type 2	Potentiometer for modulator amplifier screen	1 and 3.
R6	" "	"	" "		
R7	" "	"	" "		
R8	" "	"	" "		
R9	" "	"	" "		
R10	" "	"	" "		
R11	1000 " ± 10%	12	Welwyn AW 3112	Voltage dropping resistances in anodes of osc. and Mod. Amp. Tapping provided for separator test point.	1 and 3.
R12	20000" ± "	"	" " "		
R13	" "	"	" " "		
R14	" "	"	" " "		
R15	" "	"	" " "		
R16	100±10%	½	Erie type 8	Anode stopper of V3	1 and 3.
R17	1megohm ± 20%	½	" " "	Bleeder	1 and 3
R18	1000 ± 10%	12	Welwyn A W 3112	Bias for V3	1 and 3
R19	0.75 ± 2%	½	G.E.C. Woolcard	Used for anode current measurement of V3.	1 and 3.
R20	4700 ± 20%	1	Erie type 2	Self bias of V3	1 and 3.
R21	3 ± 2%	½	G.E.C. Woolcard	For measuring magnetron anode current.	1 and 3.

RESISTANCES - Continued.

SYMBOL	VALUE ohms	RATING watts	TYPE	FUNCTION	FIG. No.
R22	1.5 megohm ± 5%	1	Erie type 2	Potentiometer for measuring H.T. volts	1 and 3
R23	220 ohms ± 5%	½	Erie type 8		

SWITCHES.

S1			C6 30 key	For switching OSC current H.T. volts and Mod.Amp.Current to external meter.	1,2 and 3.
S2			2-pole	Mains supply switch.	1 and 2.

TRANSFORMERS.

T1			Mains	For H.T. and L.T. giving 4 V. 2.2A 800 + 800 V. 75 M.A. 6.3 V. winding for lamp and magnetron heater.	1 and 3

VALVES.

V1 V2			AU 5 AU 5	Fullwave H.T. rectifier	1 and 3
V3			ATS25	Modulator amplifier	ditto.
V4			CV 79 or CV 89	Magnetron for 6.6 cm. " " 6.3 cm.	1

TABLE I - LIST OF MAIN COMPONENTS.

PART III
WIRELESS SENDER NO.10.

SETTING UP AND OPERATING

Inserting valves.

1. See that the ON/OFF switch is at OFF.

2. The positions of the valves are shown in Fig.3.

3. See that the valves are in their correct positions and held by their retaining clips and that their caps are firmly in place.

4. Unscrew the knurled nut on the oscillator valve head a few turns, retate the valve head slightly and withdraw the head from the bayonet slot.

5. For a CV 79 (6.6 cm.) or CV 89 (6.3 cm.) valve with an octal base:-

   (a) Select valve head with an octal base,

   (b) Insert valve fully,

   (c) Replace head in bayonet slot, keeping the valve retaining springs compressed..

6. For a Cv 79 or CV 89 with 9-pin base:-

   (a) Select valve head with a 9-pin base

   (b) Unscrew valve clamping ring

   (c) Insert valve

   (d) Replace and screw up clamping ring

   (e) Replace oscillator head with valve in holder.

Adjustment of field for CV 79 and CV 89 valves.

7. Open door marked FIELD STRENGTH.

8. Slacken off locking screw of adjustable magnet

9. Rotate the magnet to the correct setting for the particular valve in use:

   (a) For a CV 89 valve, the magnet setting is two complete turns from zero (0)

   (b) For a CV 79 valve the setting is three complete turns from zero (0).

10. Having set the magnet, tighten clamping screw and close door.

Connections (Fig. 2.)

11. See that:-

   (a) Lead from the magnetron valve is plugged into the OSC. SUPPLY socket in the centre of the front panel.

   (b) 230 volt A.C. supply is plugged into the 230 V. A.C. socket on the bottom right hand corner of the front panel.

24. Check that the valves are securely held in their sockets and that the valve retaining clips and springs are in place. Anode caps should fit tightly.

25. Check that the lead behind the front panel connecting the back of the aerial socket to the output socket on the oscillator unit is securely in place.

26. Check that the alternative magnetron valve head is held in its retaining clips on the chassis behind the oscillator unit.

27. See that all external leads are in good condition.

28. See that all screened leads have their screeens securely clamped where they connect on sockets and plugs. The oscillator unit contains two bar megnets and it is important that the field strength should remain constant. Therefore, on no account should the assembly be interfered with.

29. On the meter key switch see that the contacts are clean.

30. See that the MIN-MAX M.T. VOLTS control is clean.

Operational checks.

31. Frequent observations should be made of the sender output (by setting the monitor selector on the signalling equipment switch to SENDER).

32. The sender picture should be of the order of $\frac{1}{2}$-in. in amplitude. If much less than this, check mains voltage then check the magnetron current and if not correct, adjust by means of MIN-MAX M.T. VOLTS control.

33. If adjustment of M.T. is necessary re-check all adjustments as in operating instructions above.

34. If there is still no improvement in the output from the sender, check that crystal pick-up in the sender reflector is functioning properly by:-

(a) Checking that the crystal is making good contact in its holder.

(b) See that the inside of the crystal holder is free from all moisture and dirt.

(c) Change the crystal.

If the station is in continuous operation and there is no opportunity to change valves use spare sender.

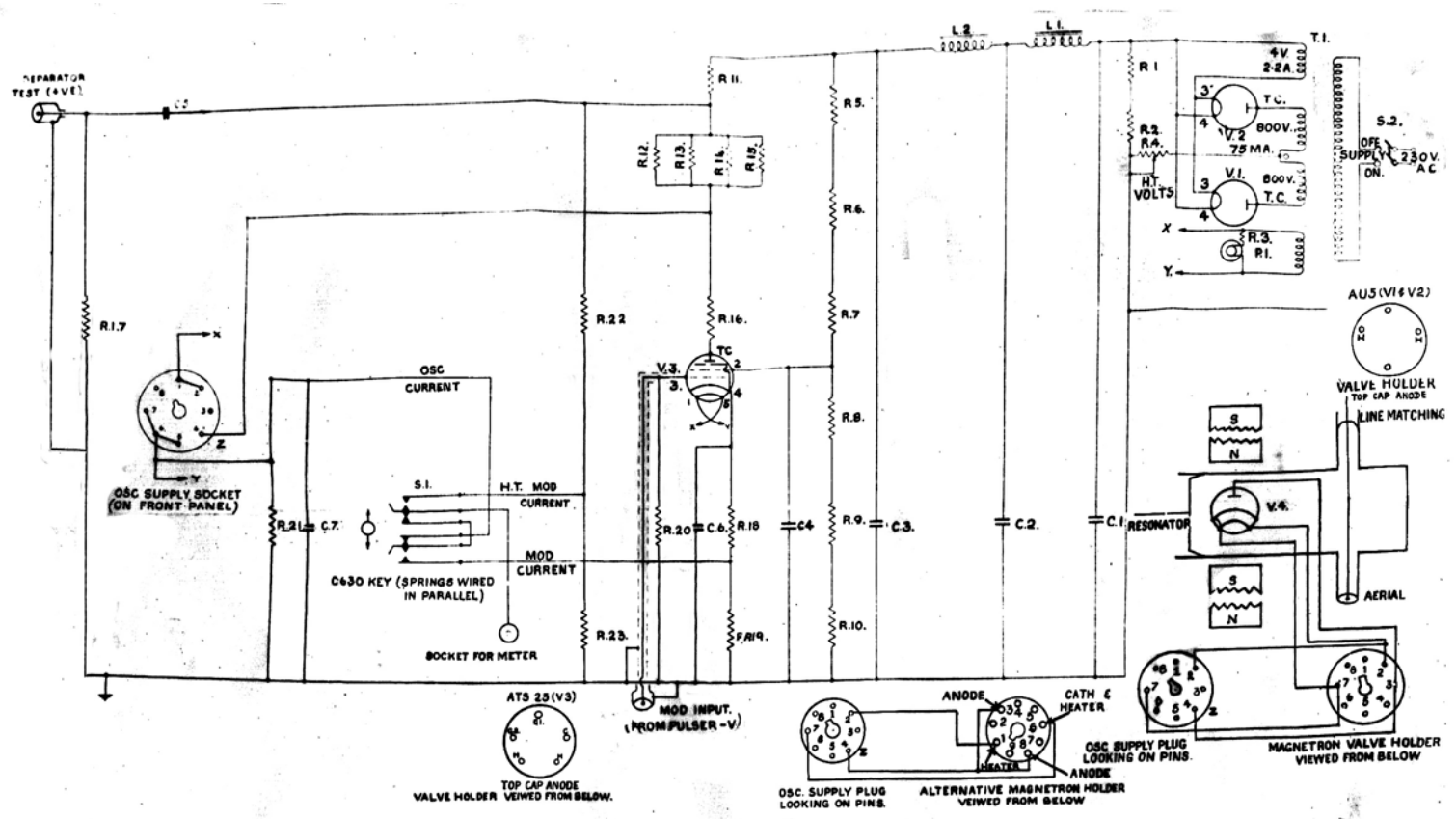
35. If the sender still works incorrectly try the following:-

(a) Change rectifier valves.

(b) Modulator amplifier valve.

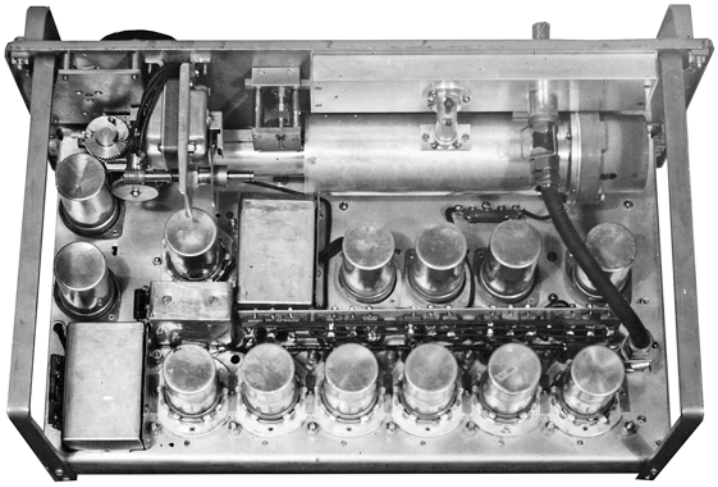
(c) Change magnetron valve.

36. Check that the monitor amplifier in the signalling equipment is functioning correctly in SENDER position and in the PULSE OUT position. The output of the pulser unit should be of the correct amplitude.



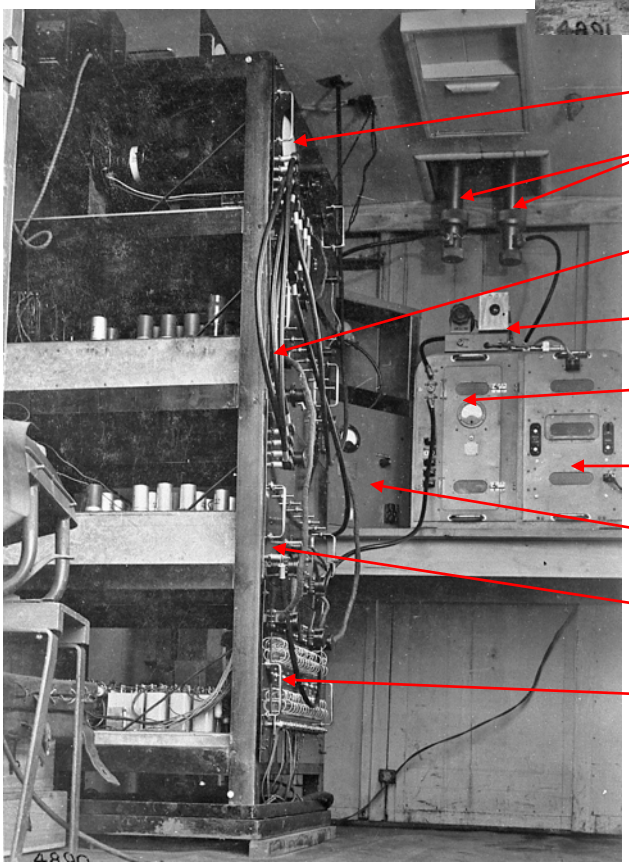
WIRELESS SENDER Nº 10 *CIRCUIT DIAGRAM*

FIG. 1



Prototype Reception Set R10.

Experimental arrangement of Wireless Set No. X10A showing multichannel and monitor equipment on the left. The transmitter in the centre, and the receiver power supply and IF unit on the right. This equipment was mounted in an extemporised vehicle. (Left photo, connected as a relay station).



Monitor Unit.

Waveguide matching units.

Pulser Unit.

Receiver oscillator/mixer.

Receiver IF Unit.

Receiver Power Unit.

Transmitter Unit.

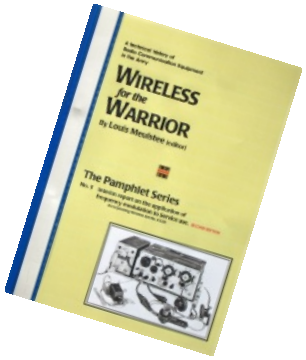
Separator Unit.

Line Unit.

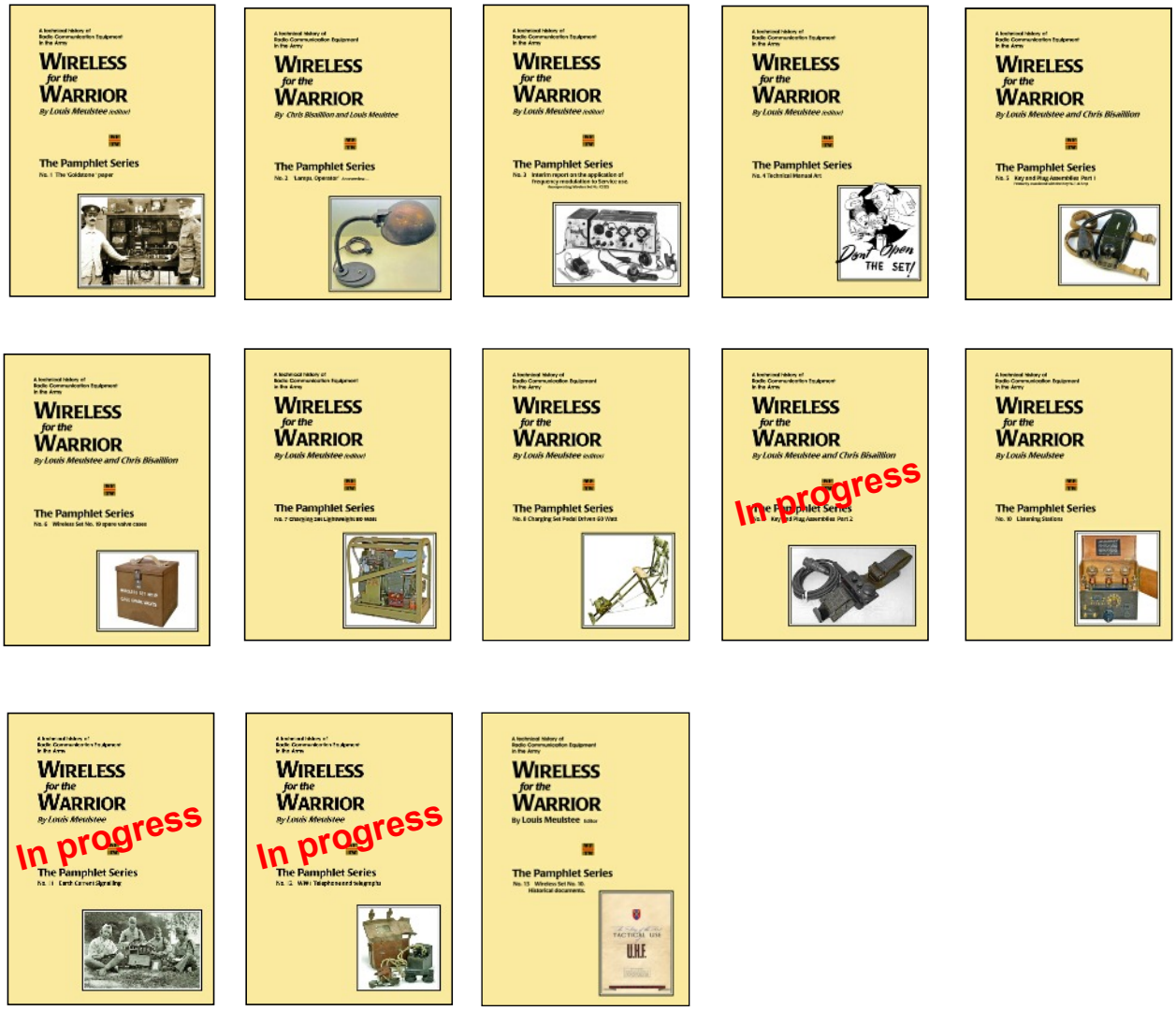
Composition of equipment in experimental set-up Wireless Set No. X10A.

A loose leaf folder for the WftW Pamphlet Series.

Shown right is a suggestion for a simple and inexpensive method to keep the printed pages together in a plastic clear view A4 document folder. Printable front and rear cover sheets, provided with the downloads, will give the folder an attractive appearance.



The WftW Pamphlet series

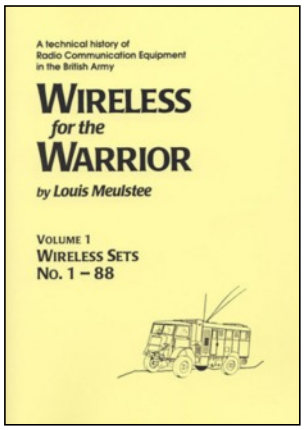


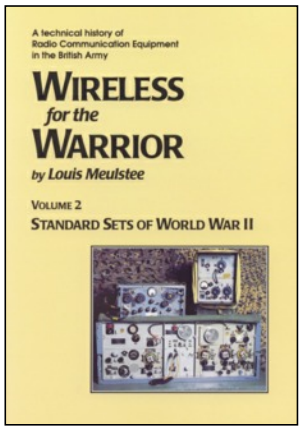
The WftW Pamphlet series is an addition to the Wireless for the Warrior range, created to accommodate a future range of reprints of articles and reports of historical importance, hitherto not published documents, and technical reports on British Army signalling. This free to download and print ready series in A4 format replaced the now discontinued 'Overview' booklets. WftW Pamphlet No. 5 replaced the earlier Compendium 7 A5 format free download and is now only available in A5 printed form and free A4 format download.

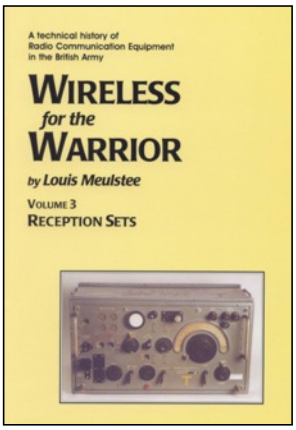
Answering requests, WftW Pamphlet No. 4 (Technical Manual Art) is also available via 'print on demand' Lulu Inc. See https://www.lulu.com/spotlight/wftw

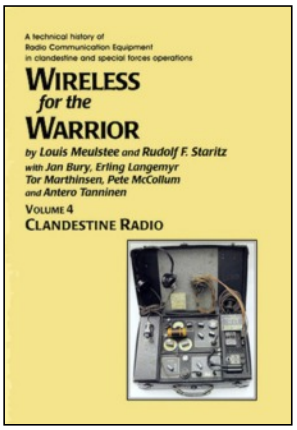
About the Wireless for the Warrior books

The Wireless for the Warrior range of books (comprising the **Volume, Compendium, Supplement** and **Pamphlet** series) are intended as a source of reference to the history and development of radio communication equipment used by the British Army from the very early days of wireless up to the 1960's. Line equipment and military radio communication equipment from other countries is also covered in the recently published Compendiums. For detailed information, review pages and order information visit www.wftw.nl

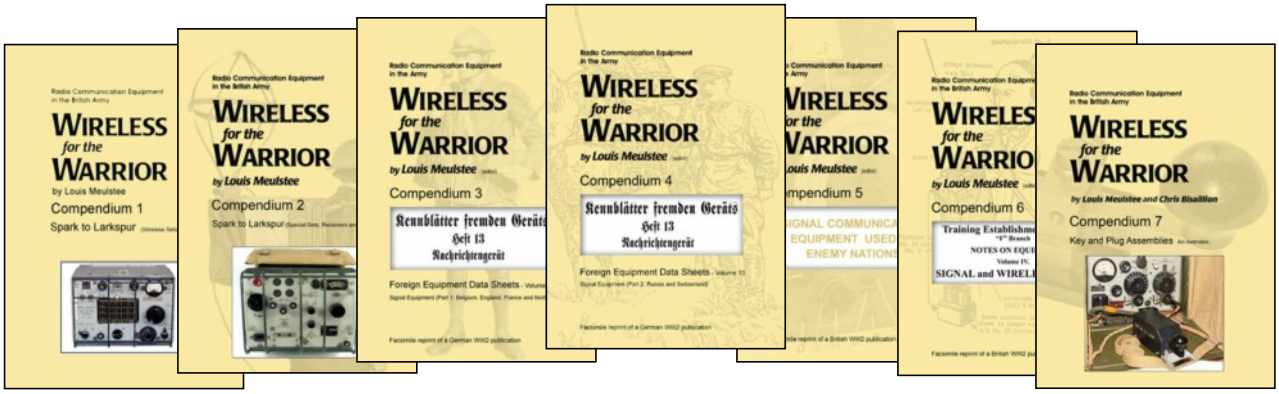






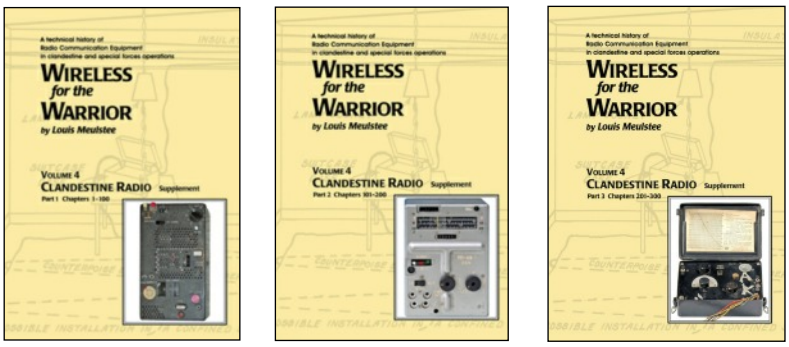


The books in the WftW **Volume** series are very detailed and include circuit diagrams, technical specifications and alignment data in addition to technical development history, complete station lists and vehicle fitting instructions. Generally no operational histories are given as these have been published extensively in numerous other books.



The WftW **Compendium** series is a new addition to the Wireless for the Warrior range, currently comprising 7 books. The new series is principally intended as a practical guide and reference source to vintage military signal communication equipment. The books are particularly valuable to anyone with an interest, professionally or otherwise, in this subject, requiring an elementary but complete quick reference and recognition handbook. Containing condensed data summaries, liberally illustrated with photos and drawings, explanatory captions and short description of the main ancillaries, its pocket size format and laminated soft cover makes it an ideal reference and reliable companion for events such as auctions and radio rallies, or just for browsing at leisure.

WftW **'BUGS'** is a recent book describing the technical history of telephone and room surveillance systems of the Stasi. It was written in cooperation with Detlev Vreisleben.



The WftW **'Supplement'** series are full colour reprints of previously published WftW Vol. 4 Supplement 'Chapters'.