

RESTRICTED

**The information given in this document
is not to be communicated either directly
or indirectly to the Press or to any person
not authorised to receive it.**

**USER HANDBOOK
(PROVISIONAL EDITION)**

for

MINE DETECTOR No.4c.

**EDITED AND REPRODUCED BY
DPG FOR OES ENGINEERS**

AUG 1960

C O N T E N T S

SECTION		PAGE
CHAPTER 1 - GENERAL DESCRIPTION		
1	Purpose and Facilities.	1
2	Construction	3
3	Power Supply	6
4	Weight and Dimensions	6
CHAPTER 2 - OPERATION		
5	Connecting up	7
6	Installation of Battery	8
7	Setting-up	10
8	Searching for mines	17
9	Repacking the Transit Case	18
CHAPTER 3 - USER SERVICING & ADJUSTMENT		
10	Adjustment for maximum sensitivity in the Search-head	19
11	Operators Servicing	20

I L L U S T R A T I O N S

FIG.		PAGE
1	Detector Mine No. 4C	Frontispiece
2	Transit case correctly packed	2
3	Search-head showing sensitivity adjustors	3
4	Telescopic pole collapsed	4
5	Amplifier Unit	5
6	Method of securing pole to forearm	7
7	Battery installation (Above 32°F)	8
8	Battery cable extension connections (Below 32°F)	9
9	Test Box No. 1 in use	12
10	Test Box No. 2 in use	14
11	Detector in Use - Upright position	16
12	Detector in Use - Prone position	17

CHAPTER 1

GENERAL DESCRIPTION

SECTION 1. PURPOSE AND FACILITIES

The Detector Mine No. 4C (Fig. 1) has been designed to locate buried metallic mines; it achieves this objective by generating an audible note in a pair of earphones whenever the search-head is placed in proximity to metal.

This Detector is a modified version of the Detectors Mine No. 4 and 4A, the modification consisting mainly of a new amplifier unit using transistor circuits in lieu of a valve amplifier previously used.

The effect of the modification is to combine the Amplifier and Control Unit into one compact lightweight unit, which can be hooked on to the operator's webbing belt, thus obviating the necessity for carrying a satchel on the back. The electronic components of the amplifier are contained within a hermetically sealed and desiccated compartment of the unit.

The amplifier is powered by a 9 volt battery which is housed in a separate splashproof compartment at the rear of the Amplifier Unit.

The complete assembly, i.e. search head, telescopic pole, and amplifier unit, together with a test unit, headphones, battery connector for Arctic use, measuring gauge, User Handbook, and miscellaneous spares, including spare battery, are contained in a wooden transit case. (Fig.2 overleaf).

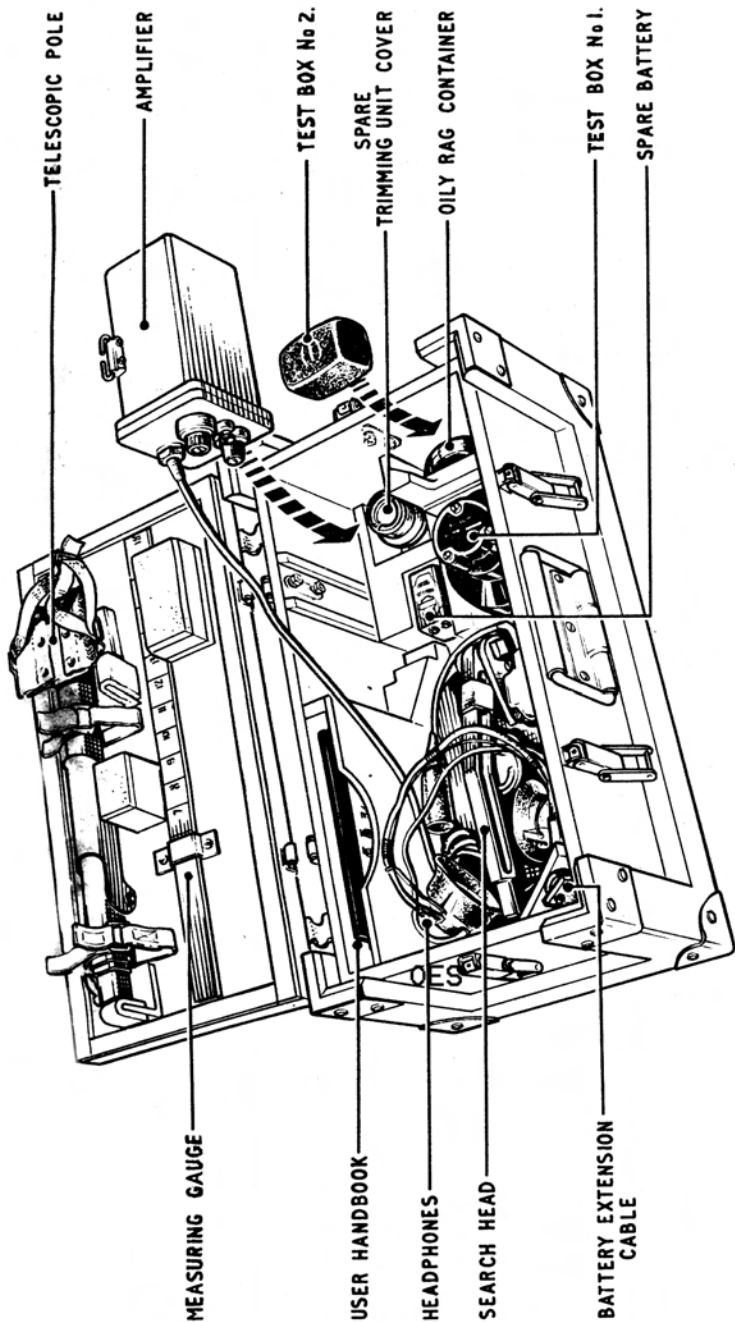


FIG.2 TRANSIT CASE (PACKED)

SECTION 2. CONSTRUCTION

2.1 THE SEARCH HEAD

The search head is a flat container (see Fig. 3) in which the search coils are sealed. It is the same as the one used with the Detectors NO. 4 and 4A equipments with the following modifications:

- (a) A new dust core trimmer assembly
- (b) A new cable entry gland

The new dust core trimmer assembly replaces the old type and provides coarse and fine adjustment of the mutual inductance of the two coils in the search head. This trimmer assembly consists of a cylindrical block of plastic material in which a kidney shaped dust core is embedded. The centre of this core is pierced to allow entry of a cylindrical threaded dust slug, which fits into a threaded hole in the block, fine adjustment is obtained by screwing the slug in or out, in a direction perpendicular to the plane of the search coils. The complete trimmer assembly fits into a well in the search head, and is carried on a conical spigot which mates with a conical hole. The rotation of the assembly on this spigot provides coarse adjustment of the mutual inductance. A locking nut is provided to secure the assembly after coarse adjustment has been achieved.

Entry into the search head by the amplifier lead is made via a rubber sealing gland which is waterproof.

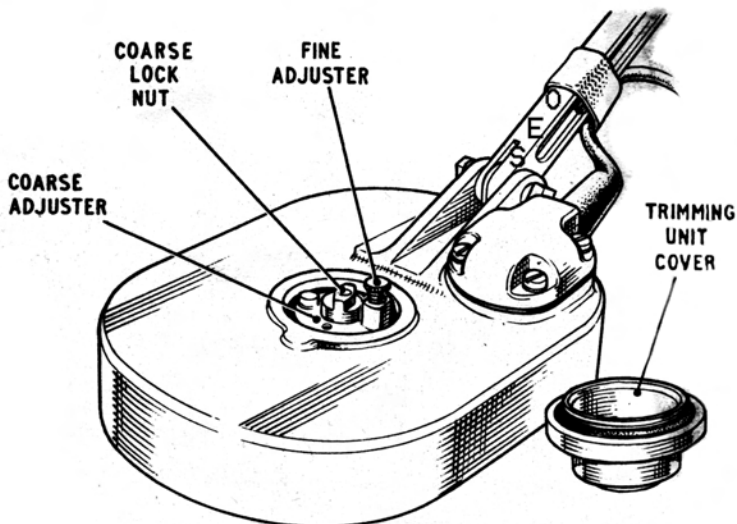


FIG. 3 SEARCH HEAD SHOWING SENSITIVITY ADJUSTERS

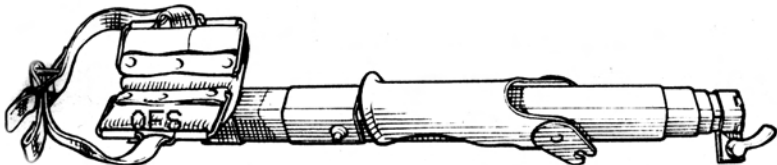


FIG. 4 TELESCOPIC POLE COLLAPSED

2.2 THE TELESCOPIC POLE (Fig. 4)

This consists of four metal sections so graded in diameter that they may be collapsed into one section, which when pulled out forms a pole approximately four feet in length. The narrow section of the pole fits over a handle attached to the search head and is securely held in position by means of a clamping nut which is permanently attached to the narrowest section of the pole. The largest section of the pole has a collapsible hand grip attached, also a padded forearm rest. In the operating position the forearm is strapped to this rest by means of a captive webbing strap. (Fig. 6).

2.3 THE AMPLIFIER UNIT (Fig. 5)

The amplifier unit consists of a die cast metal case having two compartments. The first compartment which is hermetically sealed and desiccated, houses the printed circuit five transistor R. C. coupled amplifier. The second compartment, entry at the rear of the case, houses the 9 volt battery which supplies power to the amplifier. This compartment is rendered splash proof by a specially designed cover, or bung. This bung consists of two metal plates between which two rubber gaskets are placed. The act of tightening a knurled nut after the bung has been placed in position causes the gaskets to be compressed between the metal plates so that the rubber flows out, thus providing a good splash proof seal between the bung and the sides of the compartments.

The battery (Battery Dry 9 Volts YC.02272) is fitted with press stud terminals and for normal use is fastened by

these to mating terminals mounted on a terminal block attached to the inner face of the bung. For Arctic use, i.e. below 32°F, to ensure the efficiency of the battery, an extension cable is provided which enables the battery to be carried inside the operator's clothing. When this extension cable is used, the two metal plates and gaskets on the bung are so positioned that cut-outs on their peripheries are aligned, giving entry for the cable to the battery compartment. The extension cable is connected by press studs to the terminal block, (Fig.8), led through the bung, and the remote end connected to the protected battery.

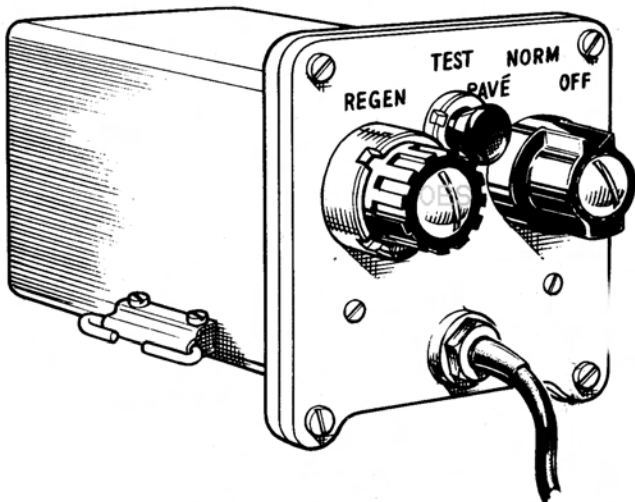


FIG. 5 AMPLIFIER UNIT

All controls are grouped on a panel at one end of the unit, termed the control panel.

The amplifier unit is equipped with hooks which enable it to be attached to the user's belt, the most convenient carrying position is at the left side rear, with the control panel facing downwards, in such a position that when controlling the sweep with the right hand, the user can easily tune the REGEN control or operate the PRESS TEST button, with the left hand. (See Figs. 11 and 12)

SECTION 3. POWER SUPPLY

Power is supplied from a single battery, the service designation of which is Battery Dry 9 Volts YC.02272.

Normal current consumption is between 3.3 mA & 3.6 mA at 9 Volts.

When used intermittently the battery will give approximately 300 hours service.

SECTION 4. WEIGHT AND DIMENSIONS

The complete detector in transit case:

Weight	32 lb. approximately
Length	21 $\frac{5}{8}$ inches
Width	11 $\frac{1}{4}$ inches
Height	8 inches

CHAPTER 2

OPERATION

SECTION 5. CONNECTING-UP

Remove the search-head, telescopic pole, headphones and amplifier unit from the transit case.

Open out the telescopic pole and fit the narrow end to the handle of the search-head, so that the white painted squares on the two units match, clamp in position using the captive clamping nut.

Wind three or four turns of cable around the pole, and secure in the press studded webbing sleeve at the elbow rest end of the pole. Attach the amplifier unit to the rear left side of the user's webbing belt, with the control panel of the unit facing downwards. Connect the headphones, by means of the snatch coupler, to the lead from the amplifier unit. Open the pistol type handgrip and lock in position by means of the sliding catch. (Fig. 6).

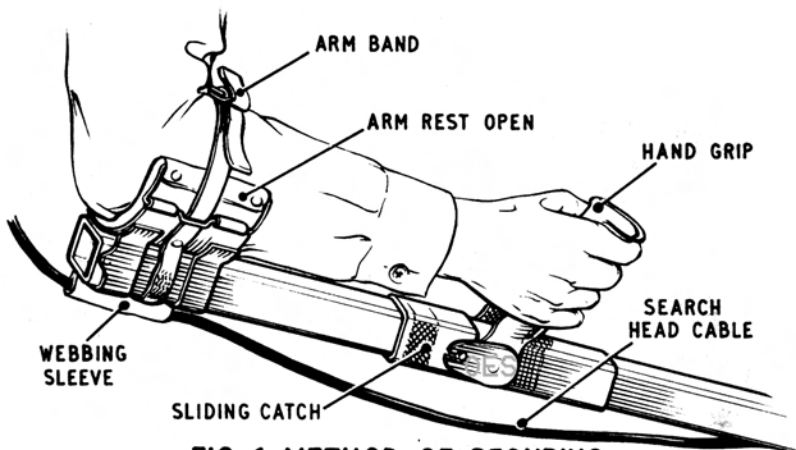


FIG. 6 METHOD OF SECURING
POLE TO FOREARM

SECTION 6. INSTALLATION OF BATTERY

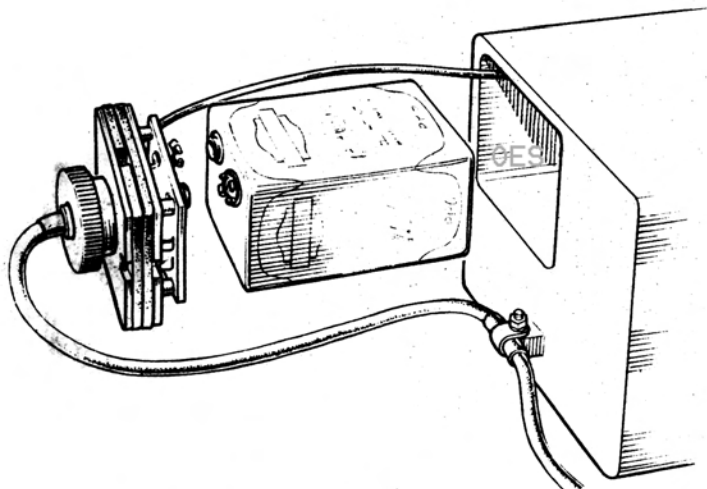
6.1 FOR USE AT TEMPERATURES ABOVE 32°F (FIG.7)

Ensure that the OFF/NORMAL/PAVE switch is in the OFF position. Loosen the knurled nut at the rear of the amplifier unit and pull out the bung.

Press the battery against the terminal strip at the rear of the bung, so that the press stud connections are mated. Ensure that the cut-outs on the peripheries of the two gaskets are out of alignment.

Slide the battery into the compartment and manoeuvre the bung into its correct position.

Tighten the knurled nut by rotating it in a clockwise direction until the bung is firmly locked in position and cannot be dislodged.



**FIG. 7 BATTERY INSTALLATION
(ABOVE 32°F)**

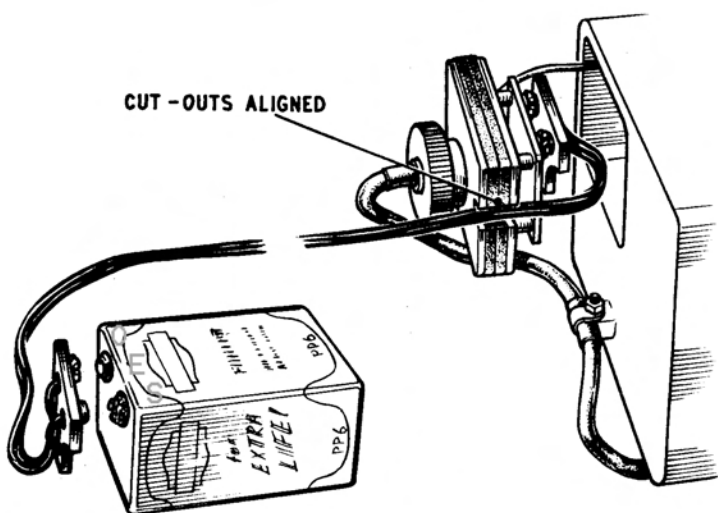


FIG. 8 BATTERY CABLE EXTENSION CONNECTIONS (BELOW 32° F.)

6.2 FOR USE AT TEMPERATURES BELOW 32° F (Fig.8)

Ensure that the OFF/NORMAL/PAVE switch is in the OFF position. Loosen the knurled nut at the rear of the amplifier unit and pull out the bung.

Connect one end of the extension cable to the terminal strip at the rear of the bung, using the press stud connections.

Align the cut-outs, on the peripheries of the rubber gaskets and the metal plates of the bung, so that the extension cable will pass through them.

Place the bung into the mouth of the battery compartment in its correct position and tighten the knurled nut by rotating it in a clockwise direction until the bung is firmly locked in position and cannot be dislodged.

Connect the battery by means of the press stud fasteners to the free end of the extension cable.

Place the battery into an inside pocket of the operator's protective clothing. This enables the temperature of the battery to be kept above freezing point by the operator's body heat thus maintaining the normal efficiency of the power supply.

SECTION 7. SETTING-UP

7.1 PRELIMINARY

There are two methods of setting-up the detector, the method used for any particular sweep will depend on the type of terrain to be searched. The first method termed Set-up NORM, is for use when searching for metallic mines buried in ordinary soil. If the ground being searched contains metallic ores, as found in pavé and clinker, they will cause a detector under Set-up NORM conditions to respond continuously, whether mines are present or not.

Set-up PAVE is intended for use in these circumstances and makes the detector less sensitive to the ferrite-bearing materials, so that no signal will be heard unless the search-head is held very close to them, when they will cause a very high-pitched note.

Buried mines will generate a distinct note in the headphones in the usual way, so that the operator will be able to judge whether metallic ore or a mine has been detected.

Typical depths in ordinary soil and pavé, at which the British Mk. VII mine can be detected are approximately 20 inches and 12 inches respectively.

It will be noted that the range at which mines can be detected is less when they are buried in pavé than when they are buried in ordinary earth.

It is also advantageous to use Set-up PAVE when searching for large metallic mines (e.g. British Mk. VII) in ordinary earth (not pavé), as the range at which these mines can be detected under Set-up PAVE is some inches better than with Set-up NORM. If the ground to be searched is covered with metal fragments, Set-up PAVE will make the detector less sensitive to the fragments without impairing the range of detection for large mines.

Either the TEST BOX No. 1 or the TEST BOX No. 2 will be issued with the equipment, these test boxes provide the ONLY means of ensuring that the detector is set up correctly.

The chief differences in the test boxes, as far as the user is concerned, are that the TEST BOX No.2 is less bulky, lighter, and more convenient to use.

NOTE: *During setting-up, the search-head must be held at least four feet away from the ground and any metal. When setting-up for use in the upright position, the search-head should make approximately the same angle to the pole as it will have when in use.*

7.2 SET-UP 'NORM'

To be used when searching ground which is free of pave, clinker, or similar metallic material. Place the earphones over the ears in a comfortable position. Set the REGEN control to the fully anti-clockwise position.

NOTE: *When adjusting the REGEN control, press the plastic portion of the knob towards the casting in order to make the adjustment free of friction. The knob is designed to have appreciable friction to prevent accidental change of setting.*

Set the PAVE/NORM/OFF switch to the NORM position. Rotate the REGEN control clockwise until oscillation begins (indicated by a loud note in the headset), then "back it off", i.e. turn the REGEN control anti-clockwise just sufficiently to stop the oscillation.

Check that the set-up is correct by means of the Test Box (see sub-section 7.4). If the Test Box readings are satisfactory the Detector is ready for use.

If satisfactory readings cannot be obtained, it will be necessary to carry out sensitivity adjustments, see Section 10.

7.3 SET-UP 'PAVE'

To be used when searching for mines which are covered by pave, clinker or similar material. Carry out the same instructions as for Set-up NORM, 7.2, with the exception that the PAVE/NORM/OFF switch must be set to the PAVE position. Check that the Set-up is correct by means of the Test Box. See sub section 7.4.

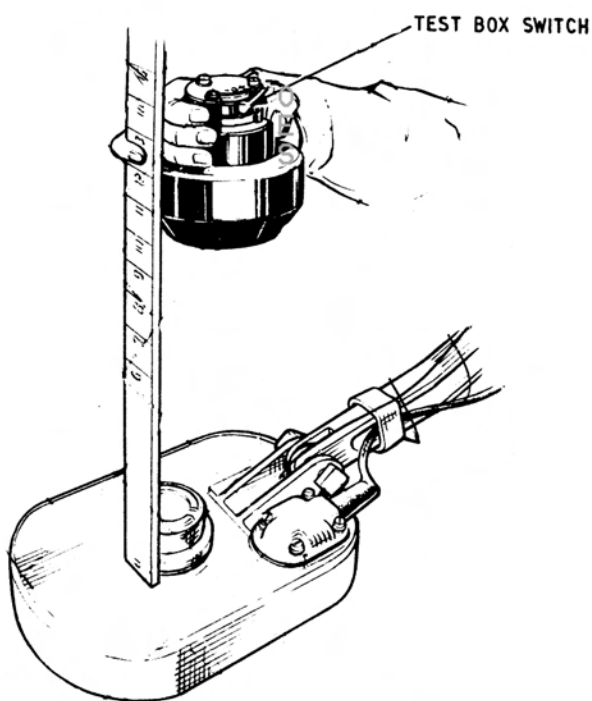


FIG. 9 TEST BOX No.1 IN USE

7.4 USE OF TEST BOX TO CHECK DETECTOR SET-UP

(a) TEST BOX NO.1 (Fig. 9)

Ensure that the search-head is at least four feet away from the ground and any metal.

- (1) Set the Test Box switch to the '0' position.
- (2) Hold the Test Box about two feet above the centre of the search-head.
- (3) Slowly bring the Box towards the search-head until it just causes oscillation to commence (loud note in headset).

- (4) Measure the distance from the top face of the search-head, (not the face of the trimming unit cover), to the bottom of the Test Box with the wooden measuring stick provided and note the measurements. Do not press on the search-head.
- (5) Set the Test Box switch to the '-' position and repeat the instructions given in (2), (3) and (4).
- (6) Set the Test Box switch to the '+' position and repeat instructions (2), (3) and (4).
- (7) If the Detector is correctly adjusted to Set-up NORI and is working satisfactorily, the measurements should be:-

Test Box switch set to the '0' position
not less than 12½ inches.

Test Box switch set to the '-' position
not less than 9 inches.

Test Box switch set to the '+' position
Not less than 9 inches. The difference
between the distances obtained at the
'+' and '-' settings shall not be
greater than 1 inch.

- (8) If the detector is correctly adjusted to Set-up PAVE and is working satisfactorily, the measurements should be:-

Test Box switch set to the '0' position
not less than 10 inches

Test Box switch set to the '-' position
not less than 10 inches.

Test Box switch set to the '+' position
Not more than 3 inches.

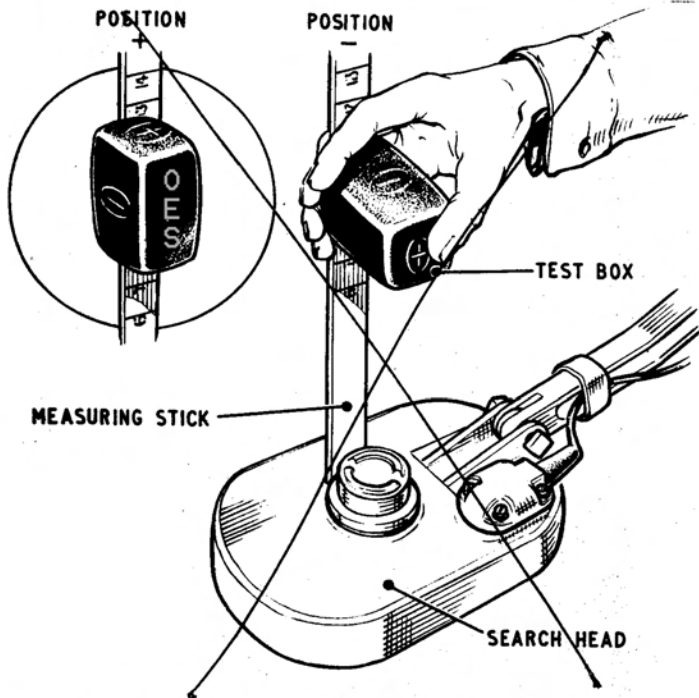


FIG 10 TEST BOX No.2 IN USE

(b) TEST BOX NO. 2 (Fig. 19)

Ensure that the search-head is at least four feet away from the ground and any metal.

- (1) Hold the Test Box at the top of the measuring stick as shown in Fig. 10, i.e. the measuring stick resting lightly on the face of the search-head by the side of the dust core cover and the side of the Test Box marked '-' facing upwards, with the longer axis of the oval enclosing the '-' sign parallel to the longer axis of the search-head.
- (2) Slowly lower the Test Box towards the search-head until the loud note in the phones just begins.
- (3) Note the measurement from the face of the search-head to the bottom of the Test Box.
- (4) Carry out instructions (1) to (3) with the side of the Test Box marked '+' facing upwards and with the longer axis of the oval enclosing the sign, parallel to the longer axis of the search-head (Fig. 10 inset).
- (5) If the detector is properly adjusted to Set-up NORM and is working satisfactorily, the measurements should be:-

Test Box in position '-'
not less than 9 inches

Test Box in position '+'
Not less than 9 inches. The difference
between the distances obtained at the
'+' and '-' settings shall not be
greater than 1 inch.

- (6) If the detector is properly adjusted to Set-up PAVE and is working satisfactorily, the measurements should be:-

Test Box in position '-'
not less than 10 inches.

Test Box in position '+'
Not more than 3 inches.



FIG. II DETECTOR IN USE — UPRIGHT POSITION



FIG. 12 DETECTOR IN USE — PRONE POSITION

SECTION 8. SEARCHING FOR MINES

Position the search-head to within 3 to 6 inches of the ground and parallel to it.

Sweep from side to side in wide arcs, using the free arm to help support the weight of the detector, after each sweep move forward a short distance, approximately 10 inches, ensuring that all the ground to be searched is covered by the search-head.

The proximity of a metallic mine, or similar body, is indicated by a distinct loud note in the headset whether Set-up NORM or Set-up PAVE is in use.

Small objects and also deeply buried large objects will not give a strong signal immediately, therefore searching must be slow enough to allow the weak signals to "build up" before the search-head is moved out of range. The search-head must also be held as close to the ground as possible.

When using Set-up PAVÉ the pavé etc. can usually be distinguished from mines by the much higher note which the pavé produces. The effect produced by pavé can be eliminated by raising the search-head a little, thus permitting the lower note of any mine to be detected.

Use the Test button on the amplifier control panel frequently. If all is in order a loud note will be heard in the phones whilst the button is pressed. In the event of no note or only a weak note being heard, check that the REGEN control is correctly set. Whilst the detector is in use, slight adjustments to the REGEN control may be required. The control knob should be turned as far clockwise as possible without a note being heard in the headphones, but so that the slightest additional tuning would result in the note being heard. This tuning to the edge of oscillation is most important so that the maximum response is obtained from the detector.

IMPORTANT: Always set the PAVÉ/NORM/OFF switch on the amplifier control panel to the OFF position when the detector is not in use. This prolongs the battery life.

SECTION 9. REPACKING THE TRANSIT CASE

After each operation the detector should be dis-assembled and the items packed neatly in their appropriate positions in the transit case (Fig. 2). Before collapsing the telescopic pole it must be wiped with the oily rag provided. (This rag will be found in a tin container in the transit case).

Detach the amplifier unit from the webbing belt and coil the cable around the search-head handle.

Separate the headphones from the unit by parting the snatch coupler.

Check that the PAVÉ/NORM/OFF switch is set to OFF before stowing the amplifier unit in the transit case.

NOTE: The tension of the 6 spring-loaded clips securing the cover of the transit case, may occasionally need adjustment.

To increase the tension turn, in a clockwise direction, the adjusting screw which is positioned on the underside of each clip. Only sufficient tension to cause the clips to close with a smart snap is necessary; too great a tension will cause damage.

CHAPTER 3

USER SERVICING & ADJUSTMENT

SECTION 10. ADJUSTMENT FOR MAXIMUM SENSITIVITY IN THE SEARCH-HEAD

There are two adjusters which provide coarse and fine adjustment respectively of the mutual inductance of the two coils in the search-head. (See Sect. 2.1).

10.1 FINE ADJUSTMENT

Fine adjustment only need normally be carried out, and this should be performed as follows:- (Fig. 3 refers).

Unscrew and remove the trimming unit moulded cover.

With the detector adjusted to the threshold of oscillation, rotate the FINE ADJUSTER first clockwise and then anti-clockwise until a note is heard in the headphones at a certain point of each excursion. The correct balance will be somewhere between these two points.

Using the Test Box No. 1 or No. 2, adjust the FINE ADJUSTER until the correct performance figures are obtained. It will generally be found that the FINE ADJUSTER must be moved clockwise to obtain a larger sensitivity at the '+' setting of the Test Box and anti-clockwise to increase the sensitivity at the '-' setting.

If the correct performance figures cannot be obtained by use of the FINE ADJUSTER, carry out the Coarse Adjustment procedure given in Section 10.2, Page 20.

When the correct sensitivity has been obtained, replace the trimming unit moulded cover.

10.2 COARSE ADJUSTMENT

Circumstances may arise when correct balance cannot be attained by means of the Fine Adjustment procedure. e.g. in the event of the coarse adjustment having been tampered with, or the search-head having had a violent shock (physical) or large temperature change, it will be necessary to re-adjust as follows:-

Unscrew and remove the trimming unit moulded cover; slacken the locking nut on the dust core assembly. Set the REGEN control on the amplifier control panel to the fully anti-clockwise position.

NOTE: When adjusting the REGEN control, press the plastic portion of the knob towards the casting in order to make the adjustment free of friction. The knob is designed to have appreciable friction to prevent accidental change of setting.

Set the FINE ADJUSTER to its mid-travel position. Rotate the dust core trimmer assembly on its spigot and check that two notes are heard.

Set the trimmer approximately to the centre of the silent gap between the two notes, so that when the trimmer is turned clockwise the lower note is heard.

Tighten the locking nut on the dust core assembly, ensuring that the position of the dust core trimmer is such that no note is heard in the headphones. Carry out the FINE ADJUSTMENT procedure detailed in Section 10.1.

SECTION 11. OPERATORS SERVICING

- (1) Keep the equipment free from dust and damp.
- (2) Examine all connectors for signs of fraying, cuts or perishing.
- (3) Extend the telescopic pole and wipe it with the oily rag before packing it in the transit case.
- (4) Hold the search-head by the opened handle and see that it

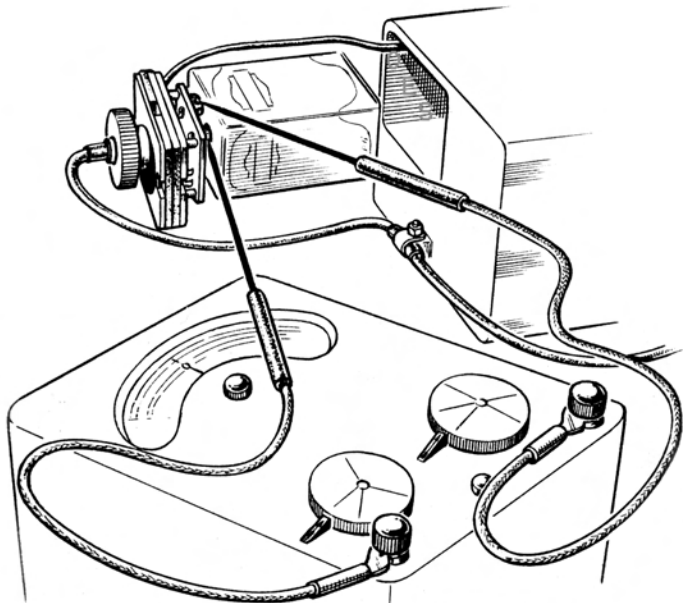


FIG. 13 MEASURING BATTERY VOLTAGE

does not 'droop' i.e. that the hinge nut and bolt are tight enough.

- (5) Check that the trimmer assembly cover is firmly screwed into position.
- (6) Check that the PAVE/NORM/OFF switch on the Amplifier control panel is set to the OFF position. If not, check the sensitivity of the detector for Set-up PAVE (see sub. section 7.4), or, check the battery voltage as described below, as if the detector has been left switched on for some time it may be necessary to change the battery.
- (7) The battery voltage should be checked with a suitable voltmeter as follows:-

Remove the battery from the battery compartment in the amplifier but do NOT disconnect it.

Set the PAVE/NORM/OFF switch to NORM.

After at least 10 minutes and with the PAVE/NORM/OFF switch still at NORM, apply the voltmeter probes to the battery terminals (Fig. 13) and measure the voltage.

If the potential is less than 7 volts, the battery should be changed but see Note below.

NOTE: *The decrease in sensitivity of the Mine Detector No. 4C, as the battery voltage drops, is very gradual and several hours satisfactory operation can still be expected with battery voltages between 5½ and 7 volts. Therefore, should a spare battery not be available, the detector may still be used in an emergency with a battery the voltage of which is within this range, but more frequent use should be made of the Test button (See Section 8).*

RESTRICTED