PORTABLE APPARATUS FOR CABLE AND PAIR IDENTIFICATION AND THE LOCATION OF CABLE TRACKS AND OTHER METALLIC SERVICES

1 INTRODUCTION This Instruction describes portable apparatus available for the following functions:-

(i) identification of cables and pairs within cables;

(ii) location of the route and position of buried cables, cables within ducts, and other metallic services where direct access to the cable or service is available (except AC mains electricity);

(iii) location of the route and position of buried cables, cables within ducts, and other metallic services where access to the cable or service is not available (including AC mains electricity), or, when AC mains is causing considerable interference and apparent loss of an applied 1 kHz tone.

(iv) detection and location of the route and position of AC mains electricity cables.

*2 CLASSIFICATION Collective groups of apparatus used for these functions are called testers and locators, but are not stocked as such by Supplies Division. Paragraph 3 shows the items to be requisitioned to make up the apparatus in question. Some items are common to more than one apparatus so each is described separately in the following paragraphs. Apparatus suitable for the functions in 1 are:-

for (i) the Tester 132B and Tester 137A;

for (ii) the Locator 2A;

for (iii) the Locator 1;

for (iv) the Tester 132B and Locator 2A.

General principles of operation are:-

For (i) and (ii) a 1 kHz tone is applied by direct connection from an oscillator to the cable or service, detected, amplified, and fed into a headset. In (i) identification of the cable is by detection of the 1 kHz alternating magnetic field with an inductive probe, and identification of the pair is by detection of the 1 kHz alternating electric field with a capacitive probe. In (ii) location is by detection of the 1 kHz alternating magnetic field with an inductive coil and for (iii) a radio frequency signal is applied by inductive coupling and detected by an inductive coil; full details of the locator 1 and its use are given in A1004. For (iv) an inductive probe (or coil) is used to detect the 50 Hz alternating magnetic field which is inherently present round AC mains electricity cables. ON NO ACCOUNT SHOULD A 1 kHz TONE BE APPLIED TO A MAINS ELECTRICITY CABLE: THE SEARCH COIL NO. 2B IS THE ONLY COIL WHICH MAY BE USED FOR THE DETECTION AND LOCATION OF ELECTRIC CABLES.

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*3 CONTENTS OF APPARATUS (Numbers shown in brackets are items quantities).

3.1 **Tester No. 132B** The method of use is described in A1003.

SENDING EQUIPMENT	DETECTING EQUIPMENT	COMMON AND ANCILLARY EQUIPMENT
Oscillator No. 87B or Oscillator No. 87C (1)	Amplifier No. 109D or Amplifier No. 109E (1)	Case No. 110A (1)
Cord Test No. 2/72AT (1)	Search Coil No. 2B (1)	Receiver headgear No. 16T (2)
	Probe No. 5B (1)	Handle extension No. 1 A-32 in (1)
	Cord Connecting No. 2/12A(1)	For Oscillator 87B:-
	Satchel No. 4 (1)	Battery dry No. 23 (1)
		Satchel No. 3A (1)
		For Oscillator 87C:-
		Cells dry R6 (6)
		Satchel No. 8A (1)
		For Amplifier 109D:-
		Battery dry No. 23 (1)
		For Amplifier 109E:-
		Cells Dry R6 (6)
		Adaptor Coaxial No. 72A (1)

3.2 **Tester No. 137A** The method of use for this is described in A1003.

SENDING EQUIPMENT	DETECTING EQUIPMENT	COMMON AND ANCILLARY EQUIPMENT
Nil	Amplifier No. 109D or Amplifier No. 109E (1)	Case No. 116A (1)
	Probe No. 5B (2)	For Amplifier 109D:-
	Receiver headgear No. 16T (1)	Battery dry No. 23 (1)
		For Amplifier 109E:-
		Cells dry R6 (6)
		Adaptor Coaxial No. 72A (1)

3.3 Locator No. 2A The method of use for this is described in A1002.

SENDING EQUIPMENT	DETECTING EQUIPMENT	COMMON AND ANCILLARY EQUIPMENT
Oscillator No. 99A (1)	Amplifier No. 109D or Amplifier No. 109E (1)	Case No. 110B (1)
Satchel No. 5 (1)	Satchel No. 4 (1)	Satchel No. 6A (1)
Cord test No. 1/60A (1)	Receiver headgear No. 16T (1)	Handle extension No. 1A - 18 in (1)
Cord test No. 1/360A (1)	Cord Connecting No. 2/12A (1)	Spike testing No. 11A (1)
Clip test No. 38A (2)	Indicator depth No. 1A (1)	Spike testing No. 12A (1)
Clip test No. 39A (2)	Search Coil No. 2B (1)	For Oscillator 99A:-
		Batteries dry No. 29 (2)
		For Amplifier 109D:-
		Batteries dry No. 23 (1)
		For Amplifier 109E:-
		Cells dry R6 (6)
		Adaptor Coaxial No. 72A (1)

*4 OSCILLATOR No. 87 (See Fig 1) This low power oscillator operates from an internal dry battery producing an output at a frequency of 1 kHz. The output may be adjusted to give a continuous tone, or a tone interrupted at a rate between 2 and 20 pulses per second.

Mounted on the top of the case is an ON-OFF switch, an edge operated pulse rate control, an output jack for the balanced output cord (Cord Test 2/72AT), and a monitoring jack for the Receiver Headgear No. 16T. The output tone is heard in the receiver if the leads of the output cord are short circuited; this provides a quick and easy method of checking the operation of the oscillator. Similarly, short-circuiting the pair at the distant end provides a method of one-way signalling from the receiving to the sending end.

The oscillator 87B may be carried in a Satchel No. 3A, the 87C in a Satchel No. 8A; these oscillators perform the same function but have different internal designs.

Fig 1 follows

FIG.1 OSCILLATOR No. 87C (LEFT) AND 87B (RIGHT)

*5 **AMPLIFIER NO. 109 (See Fig 2)** This is a small, variable gain amplifier which operates from an internal dry battery. The maximum gain is approximately 70 dB.

Mounted on top of the case are two toggle switches, a UHF, coaxial input socket and an output jack together with a battery state indicator lamp. One switch has 3 gain settings, Low (L), medium (M) and high (H). The other has OFF, ON and BATTERY TEST positions.

The output jack receives the plug of the Receiver Headgear No. 16T. Removing the plug disconnects the internal battery. The coaxial input socket connects with the Cord Connecting No. 2/12A which may be connected to the Search Coil No. 2B or the Probe No. 5B. Earlier versions of the amplifier eg Amplifier 109D will only have an edgewise gain control potentiometer with integral switch, instead of the advanced features of the amplifier 109E.

NB: The following items of equipment will be obsolete when stocks are exhausted owing to the changeover to the latest versions of the Amplifier, Search Coil Probe and Cord:-

Amplifiers 109A, B, C, Search Coil No. 2A, Probes No. 4 and 5, Cords Test No. 2/72A, and No. 2/112A.

During the changeover period, amplifiers with the screw-thread UHF socket may be used with existing cords, probes and search coils if an adapter coaxial No. 72A is used.

The Amplifier may be carried in a Satchel No. 4 if the restraining strap on the satchel makes operation of the toggle switches difficult, it should be removed.

FIG. 2 (FROM LEFT TO RIGHT) SATCHEL No. 4, ADAPTOR COAXIAL No. 72, AMPLIFIER 109E, AMPLIFIER 109D

6 RECEIVER HEADGEAR No. 16T (See Fig 3) This is a single receiver of the rocking armature type with an impedance of 150 ohms at 1 kHz. The earpiece is fitted to a wire headband provided with two plastic pads for comfort. These pads enable the receiver to be WORN OVER a safety helmet when required (see Fig 4).

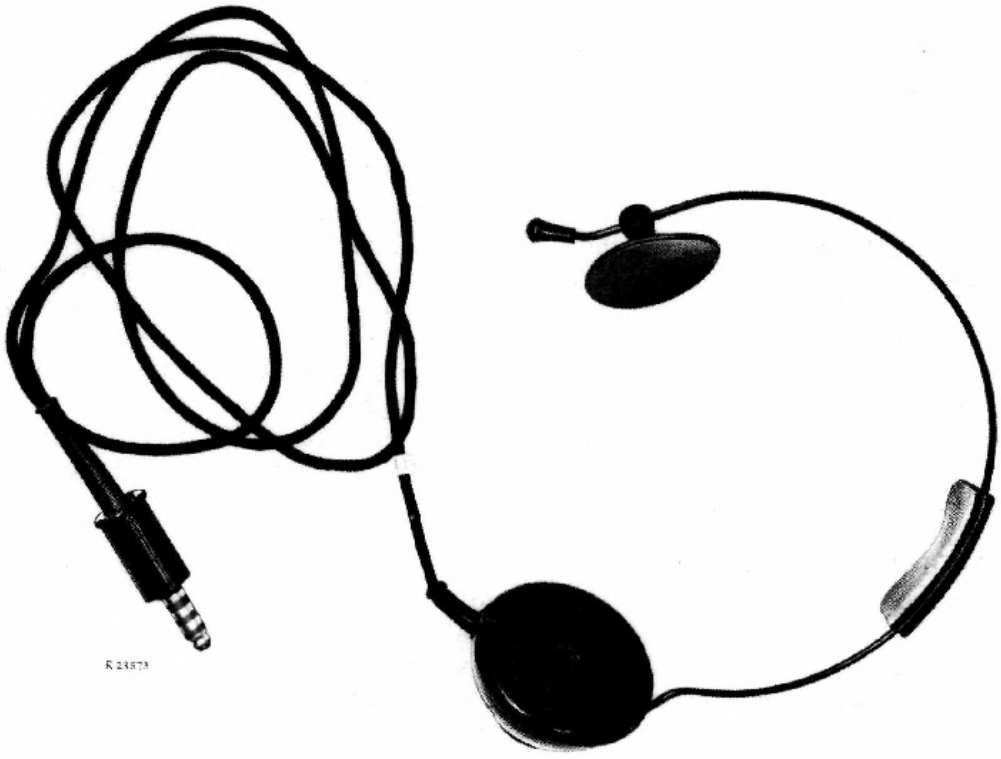

FIG.3 RECEIVER HEADGEAR No16T BLACK-I

A combined plug and cord (Plug No. 420 Black with Cord 2/138AB (54 ins)) is fitted to the receiver for use with the amplifiers or oscillators described in this Instruction. The complete item is available as a Receiver Headgear No. 16T but for maintenance purposes the combined plug and cord may be obtained without the receiver for local replacement. The cord has two conductors which are terminated on the receiver terminals at one end; and the outer terminals of the 4-way plug at the other end. The inner plug terminals are wired together inside the plug to provide a link in the battery circuit of the amplifier. This prevents the amplifier being switched on unless the receiver is connected.

FIG.4 RECEIVER HEADGEAR No16T BLACK-I WORN WITH SAFETY HELMET

*7 SEARCH COIL No. 2A (See Fig 5) This item is a 178 mm long rectangular coil of 6000 turns wound on a polystyrene former over a flat mumetal core. A capacitor is wired in parallel with the coil to tune it for maximum sensitivity at approximately 1 kHz. Fitted to the coil former are a recessed bayonet and a UHF coaxial output socket. The output socket connects to the Amplifier No. 109E by means of a coaxial Cord Connecting No. 2/12A and the bayonet socket is provided for use with either an extensible carrying handle (Handle Extension No. 1A) or a depth indicator (Indicator Depth No. 1A). All the components are encapsulated in a shock-proof moulding which is embossed to indicate the planes of maximum and minimum response of the coil. The moulding is also embossed to show a length of 15 cms (6 in) for use with the depth indicator.

8 INDICATOR DEPTH No. 1A (See Fig 5) The indicator is a scale and pointer device mounted on an anodized aluminium plate and supported by a spring-loaded bayonet plug which may be inserted into the bayonet socket of a Search Coil No. 2B. When so fitted the plate is held at right-angles to the line of the cable being located. The plate is engraved on one side with a quadrant depth scale and on the other side with instructions for use. The metal pointer is pivoted and moves across the scale as the indicator is tilted. The scale calibration (0-10 divisions) may be interpreted in metres, when the centre of the coil is 1 metre from the line of the cable. Alternatively, the indicator may be held

with the pointer on 1 and the distance between the coil and the line of the cable varied. This permits a direct overground measurement of depth. The lower range of the scale from 0-4 is divided into thirds of a division to simplify reading.

FIG. 5 SEARCH COIL No.2B WITH INDICATOR DEPTH No.1A

*9 **PROBE No. 5B (See Fig 6)** This is a 120 mm (5 in) long capacitive probe having a brass rod electrode extending from the centre conductor of a coaxial socket. The electrode is sheathed in moulded plastic except for the tip. The probe is terminated in a coaxial socket for direct connection to a Cord Connecting 2/12A.

Fig 6 follows

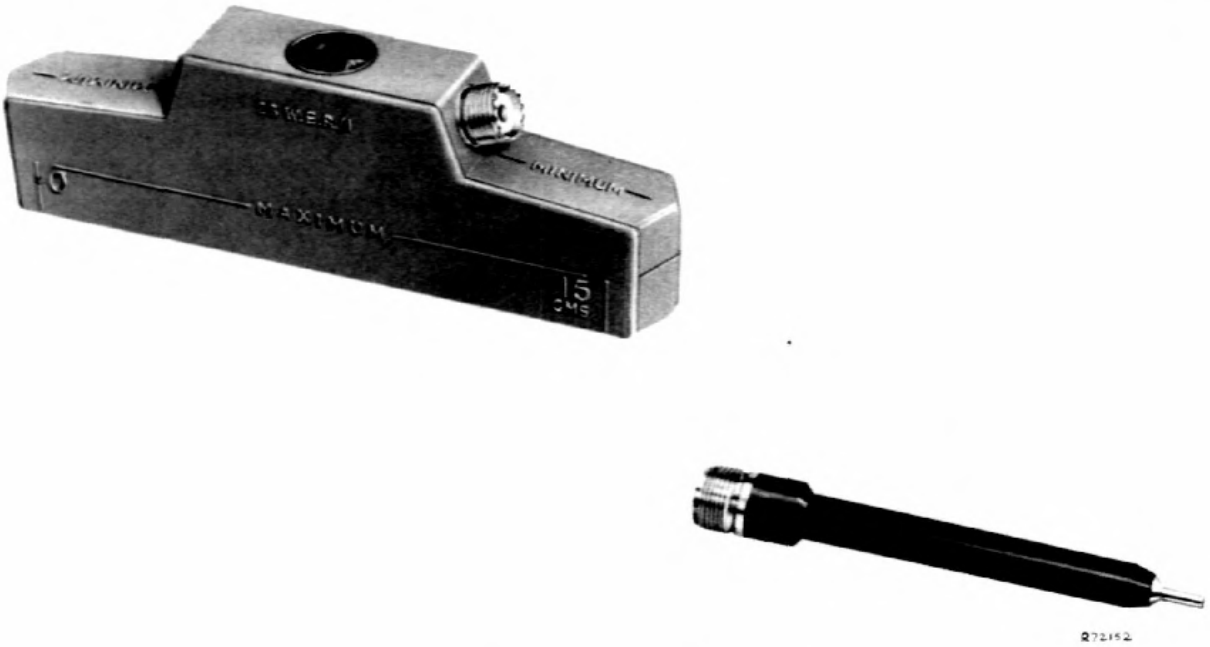

FIG. 6 SEARCH COIL No. 2B (LEFT) AND PROBE No. 5B (RIGHT)

*10 **HANDLES EXTENSION No. 1A - (18 in) and (32 in) (See Fig 7)** These telescopic extension handles consist of two aluminium tubes with a locking ring. A rubber hand grip, and rubber clips for the coaxial cord are fitted. A bayonet plug is attached to the inner telescopic tube by a ball and socket swivel joint. The length is adjusted by loosening the locking ring, withdrawing the inner tube to the desired length and re-tightening the locking ring. The bayonet plug accommodates the Search Coil No. 2B.

The 460 mm (18 in) handle is suitable for use with the Search Coil No. 2B and space is provided for it together with the earth spikes (Spikes Testing Nos. 11A and 12A) in the Satchel No. 6A. It is used for carrying the Search Coil No. 2B above the ground when locating the route of a cable track.

The 810 mm (32 in) handle extends to a length of 1.32 mm (52 in) and can be used to lower the Search Coil No. 2B into a manhole, or can reach to ceiling height when identifying cables within buidlings.

*11 **CORD CONNECTING No. 2/12A (See Fig 7)** This is a coaxial cord 2 m long with a coaxial plug at each end. It is used to connect the Search Coil No. 2B or the Probe No. 5B to the input socket of the Amplifier No. 109.

12 **CORD TEST No. 2/72AT (See Fig 11)** This is a balanced twin cord 1.83 m long with a Plug No. 420 at one end for connexion to the output jack of the Oscillator No. 87 and with two crocodile clips at the other for connexion to cable pairs or sheath.

Fig 7 follows

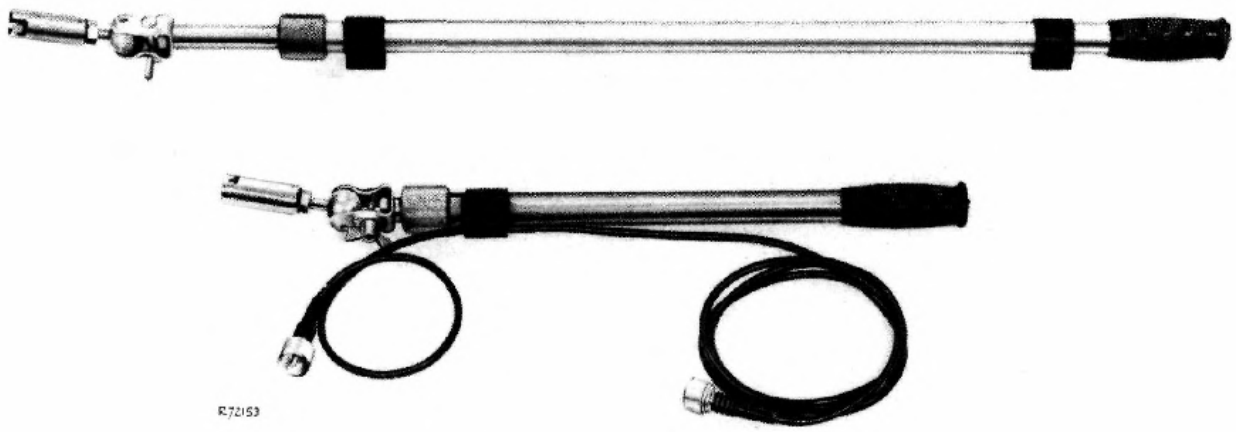

FIG. 7 HANDLES EXTENSION No.1A – 32 in (TOP)
& No.1A – 18 in. WITH CORD CONNECTING No. 2/12A (BOTTOM)

*13 OSCILLATOR No. 99A (See Fig 8) This is a 500 mW oscillator which operates from internal dry batteries. The output frequency is 1 kHz continuous or interrupted from 2-20 pps.

Mounted on top of the case are an ON/OFF switch, a rotary tone-pulse rate control and two terminals. The terminal marked CABLE is connected to bunched spare pairs in the cable or to the cable sheath, and the terminal marked REMOTE EARTH should be connected to earth 8-9 m away from the cable, or as far as possible. The output from the oscillator must never be connected across a pair of wires or to a single wire in a cable since the high output power could cause permanent ear damage to anyone who might be listening on the line. With the tone-pulse-rate control in the anti-clockwise position, the oscillator gives a continuous output tone. By rotating the control this tone may be interrupted at rates between 2-20 pps according to the degree of rotation. Using continuous tone the normal battery life is approximately 1 week, but can be increased about five times with a slow-rate interrupted tone.

This oscillator may be carried in a Satchel No. 5A.

Fig 8 follows

FIG.8 OSCILLATOR No. 99A WITH SATCHEL No. 5

14 SPIKES TESTING Nos. 11A AND 12A (See Fig 9) These are made from hardened and tempered steel rod and are finished with a hot tin dip to ensure good electrical contact. The Spike Testing No. 11A is made from 13 mm diameter rod, has a length of 460 mm and is designed to be hammered into firm ground. The slot in one end of the 100 mm long Tee handle forms a convenient connecting point for the test clip. The Spikes Testing No. 12A is a two piece spike intended for pushing by hand into medium to firm ground. It has a chisel point which may be held firmly in the slotted handle of the Spike Testing No. 11A whilst unscrewing the two portions. The upper half including the Tee handle is made from 7.9 mm diameter rod and the lower half is made from 4.8 mm diameter rod. When screwed together the total length of the Spike Testing No. 12A is 910 mm.

Fig 9 follows

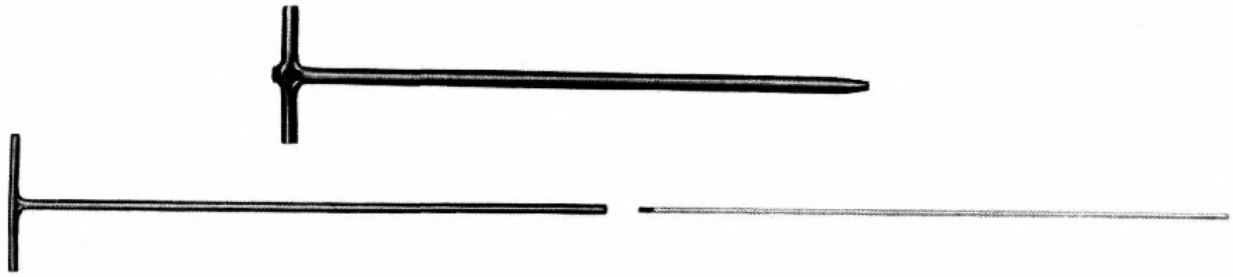

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FIG.9 SPIKES TESTING No11A (TOP) AND 12A (BOTTOM)

15 CORDS TEST Nos. 1/60A, 1/60B AND 1/360A (See Fig 13) These are rubber-insulated single-cored test cords terminated at each end by a banana plug, the insulated part being continuous with the lead insulation. The banana plugs connect with the output terminals of the Oscillator No. 99A or to Clips Test Nos. 38A or 39A.

A 1.52 mm (1/60....) cord is used to connect the Oscillator No. 99A to the bunched spare pairs or the cable sheath and a 9 metre (1/360A) cord is used to connect the REMOTE EARTH terminal to a suitable earth point.

16 CLIPS TEST Nos. 38A AND 39A The Clip Test No. 38A is a small crocodile clip suitable for connection to bunched spare pairs in a cable. The Clip Test No. 39A is a larger crocodile clip suitable for direct connexion to the Spikes Testing Nos. 11A or 12A.

17 SATCHEL No. 6A (See Fig 10) This is a canvas satchel designed to hold

1 Spike Testing No. 11A
1 Spike Testing No. 12A
1 Handle Extension No. 1A - (18 in)

It is intended to be used in conjunction with the Locator No. 2A and is fitted with two hooks and press-studs for attachment to the Case No. 110B for carrying purposes.

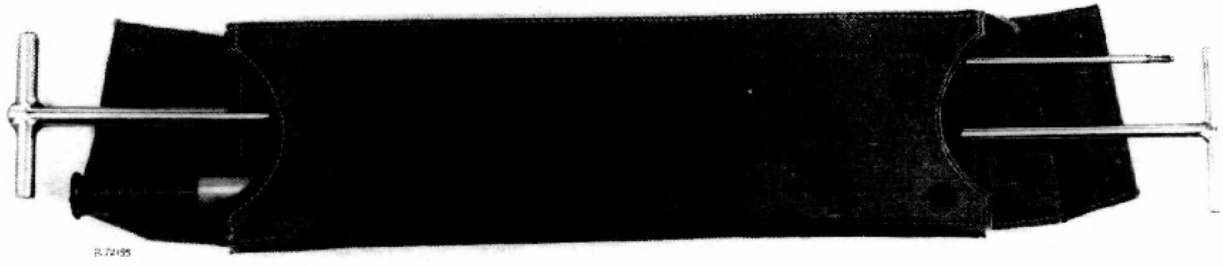

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FIG. 10 SATCHEL No.6A WITH SPIKES TESTING Nos. 11A (LEFT) & 12A (RIGHT) AND HANDLE EXTENSION No.1A — 18in. (LEFT)

18 **COMPLETE EQUIPMENTS** The following paragraphs describe complete equipments for the purposes indicated in paragraph 1 and should be made up from separately requisitioned items as listed in Tables 1 and 2.

19 **TESTER No. 132B (See Fig 11)** This is a tone set used for identifying cables and cable pairs. It supplies a low-power tone for connexion to a cable or cable pair at one point and allows for the detection of the tone at another point by means of an inductive or capacitive probe, an amplifier and a receiver. The separate items are fitted into a plastic carrying case (Case No. 110A) which has a hinged lid and a webbed plastic shoulder strap. The interior of the case is partitioned into five compartments and an apparatus schedule is fixed inside the lid to indicate the most suitable layout. The complete list of items comprising the tester are shown in 3.1.

FIG. 11 TESTER No. 132B WITH APPARATUS DISPLAYED

20 **TESTER No. 137A** This is a tone detector used only for identifying cable pairs. It employs a capacitive probe, an amplifier and a receiver. No tone source is included as it is intended that the tester should be used mainly in exchange areas where the tone can be connected to cable pairs by equipment at the telephone exchange. The separate items are fitted in a plastic carrying case (Case No. 116A) (See Fig 12) which has a hinged lid and a webbed plastic carrying strap. The interior of the case is moulded into four compartments and an apparatus schedule is fixed inside the lid. The complete list of items comprising the Tester is shown in 3.2.

Fig 12 follows

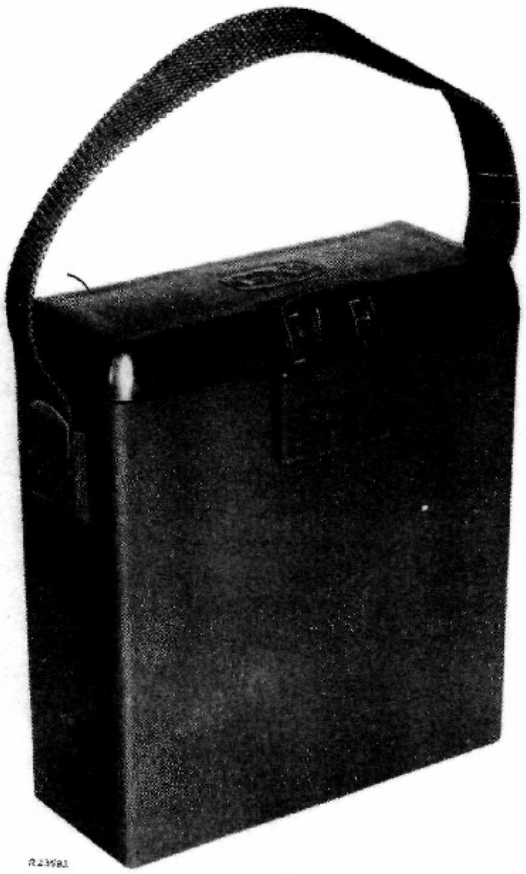

FIG.12 CASE No 116A

*21 LOCATOR No. 2A (See Fig 13) This is a tone set used for locating the route of and determining the depth of buried cables and cables within ducts, where access to the cable sheath or bunched conductors is available. The separate items are fitted into a plastic carrying case (Case No. 110B) which has a hinged lid and a webbed plastic shoulder strap. The interior of the case is partitioned into four compartments and an apparatus schedule is fixed inside the lid to indicate the most suitable layout. The complete list of items comprising the Locator No. 2A is shown in 3.3. The Satchel No. 6A containing the Spikes Testing Nos. 11A and 12A and the Handle Extension No. 1A - (18 in) clips onto the Case No. 110B for convenience in carrying.

Fig 13 follows

FIG. 13 LOCATOR No. 2A WITH APPARATUS DISPLAYED

*22 **MAINTENANCE OF APPARATUS** All oscillators and amplifiers have internal dry batteries and should be checked periodically to ensure that the items operate correctly. The Amplifier 109E has in-built battery check facilities which are described on its instruction label. If the apparatus is to be stored for periods in excess of 2 weeks the batteries must be removed to prevent damage due to battery corrosion. Repairs should not be attempted locally except for obvious defects such as broken external leads and poor battery connexions. Faulty oscillators, amplifiers, coils and probes should be exchanged for serviceable items under the normal procedure. Faulty cords for the Receiver Headgear should be replaced locally (see paragraph 5).

Service enquiries should be addressed to THQ/Sv5.1.1
(OP10.5.4)

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