

THE INDIVIDUAL DOSIMETER

## FUNCTION

1. The Individual Dosimeter is designed to measure the accumulated dose of gamma - or X - radiation received by an individual over a period of time.

## FACILITIES

2. The dosimeter, which is of the quartz-fibre type, can be read at any time and is small and light enough to be clipped on to the clothing or carried in a pocket.

3. The scale is calibrated in roentgen units. The dosimeter currently used in the ROC is the No 4, with a range of 0-150r, for operational use at Posts and Controls.

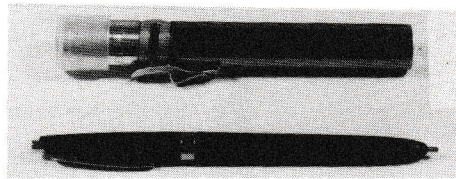


Fig L7.1  
The individual dosimeter used by the ROC  
compared with a pocket pen

## CONSTRUCTION

4. The instrument is similar in size and shape to a fountain pen ie, about  $4\frac{1}{2}$ " long and about  $\frac{3}{4}$ " in diameter (see Fig L7.1). The aluminium barrel contains in its lower portion (remote from the clip) the ionization chamber, quartz-fibre electroscope and charging pin assemblies. The upper portion contains a transparent scale and a magnifying lens system focussed on the quartz-fibre (see Fig L7.2).

5. The electroscope assembly is mounted in the ionization chamber and is insulated from the case; it consists of a thin quartz-fibre formed in the shape of an elongated "U", the ends of which are attached to a thick wire of similar shape. A spring-loaded charging pin is used with a separate charging unit (see Annex L8) to give an electrical charge to the quartz-fibre and its support.

(NOTE: Although the dosimeter is calibrated in roentgens all reporting in the ROC is now in centigrays. For practical purposes, 1 roentgen is equivalent to 1 centigray and therefore any readings from the dosimeter are to be reported in centigrays).

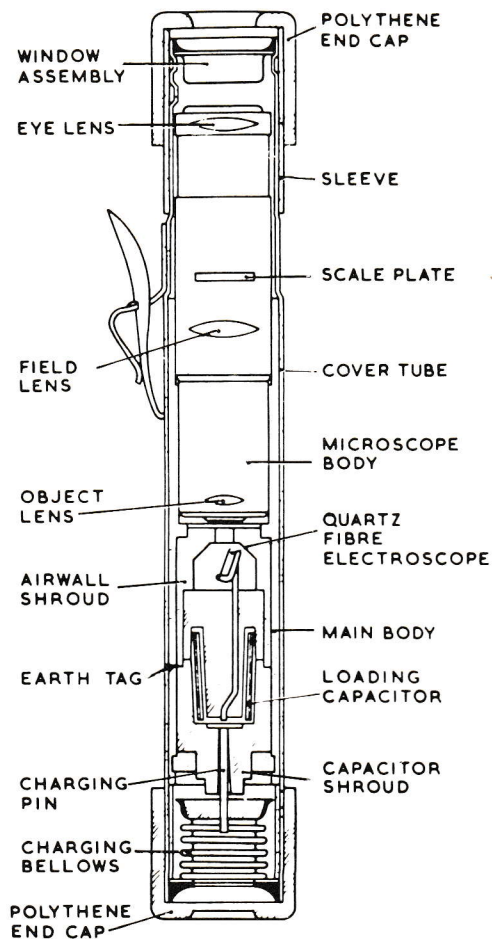


Fig L7.2  
Sectional view of Dosimeter No 4

6. When the dosimeter is charged the quartz-fibre moves away from its supporting wire so that when looking through the scale it moves towards zero. When correctly charged it will be seen to rest on the zero mark.

7. The effect of radiation on the ionization chamber is to make the air inside it, normally a good insulator, a poor one. This causes some of the charge on the electroscopes to leak away, allowing the quartz-fibre to move back towards its supporting wire and so up the scale from zero (see Fig L7.3). The stronger the radiation or the longer the exposure to radiation, the greater will be the reduction of the charge and the higher will be the reading indicated on the scale.

8. During manufacture the dosimeter is hermetically sealed and both the microscope and charging pin ends are protected by polythene caps.

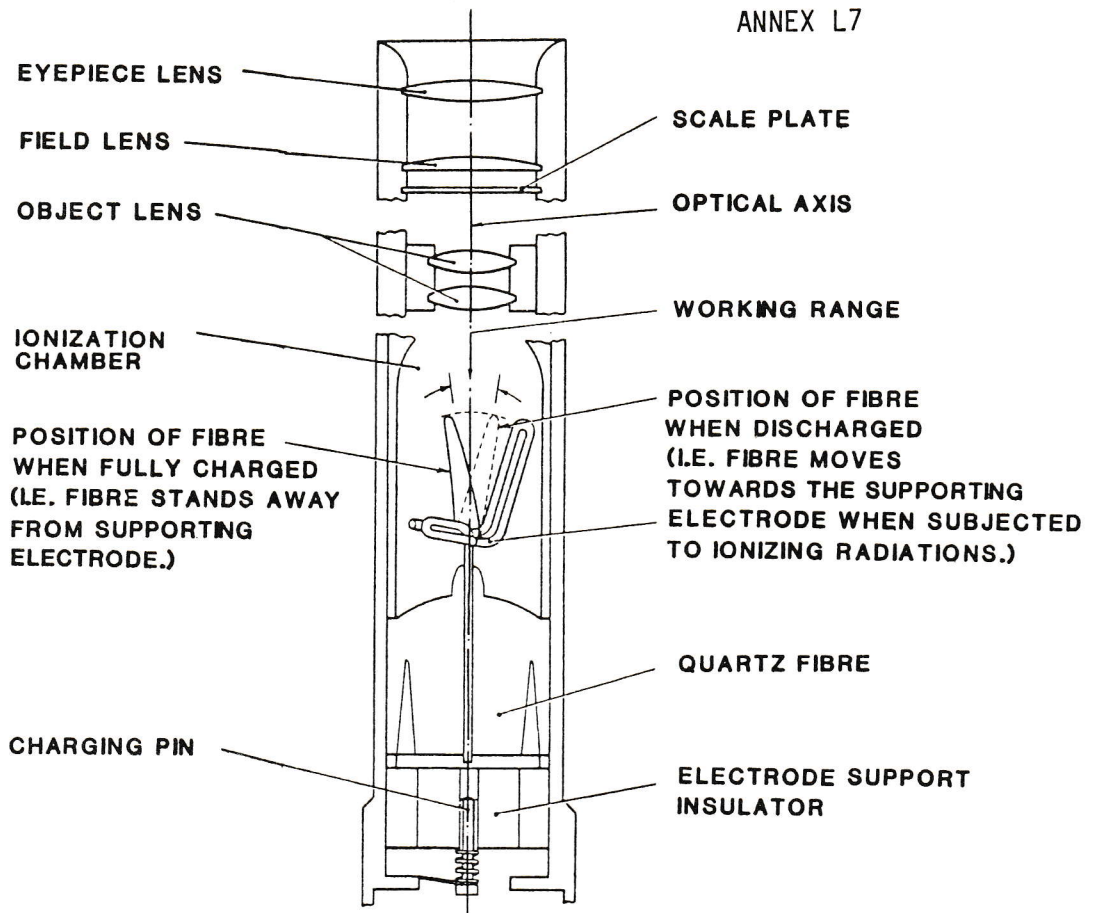


Fig L7.3

Diagram showing principle of dosimeter operation.

#### STORAGE

9. For long-term storage the instruments require conditions of controlled temperature and humidity. They are, therefore, stored at Posts in suitable packaging.

#### OPERATING INSTRUCTIONS

##### Preparation

10. Before use the dosimeter must be correctly charged so that the setting of the quartz-fibre image coincides with the zero mark on the scale. The charging operation is carried out with the portable charging unit described in Annex L8.

11. During operational use the dosimeter is normally carried in a polythene bag to ensure that radioactive particles do not alight on the dosimeter itself. If the polythene bag becomes contaminated it can be washed or disposed of; the dosimeter should be removed from its polythene bag only for a reading to be taken or for re-charging.

12. The dosimeter is normally carried on the person.

## Operational use

13. To read the dosimeter, remove it from the polythene bag, hold the clip end to the eye and look towards a source of light. Note the position of the quartz-fibre image in relation to the scale and then return the dosimeter to its polythene bag.

14. The small divisions of the scale of the No 4 dosimeter represent 10r. (see Fig L7.4). Unless the fibre image is exactly on a division or exactly mid-way between divisions, the dosimeter will be read to the nearest 5r. above.

EXAMPLE: A reading in excess of 5r. but less than 10r. will be recorded as 10 cGy; a reading which is more than half-way between 30r. and 40r. will be recorded as 40 cGy.

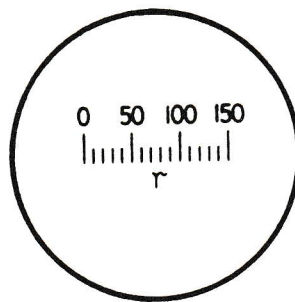


Fig L7.4  
Diagram of the scale of dosimeter No 4 used by the ROC

## Secondary Use

15. In addition to its primary use for measuring the radiation dose, the dosimeter can also be used as an improvised means of measuring the dose rate as follows:

- a. Note the reading on the scale and expose the dosimeter to radiation for a measured time, say 10, 12 or 15 minutes, any of which can conveniently be divided into 60.
- b. Note the reading on the scale at the end of the measured time.
- c. Multiply the difference between the two readings by 6, 5 or 4 as appropriate to give an approximate dose-rate in centigrays per hour (cGy/h).

EXAMPLE: If a dosimeter originally reading 12r. were to read 25r. after 10 minutes exposure, the dose-rate would be  $13 \times 6 = 78$  cGy/h.

16. This method does not produce readings as accurate as those given by the Fixed Survey Meter or Radiac Survey Meter and should only be used if neither of these is available. Such readings would be for local use only and would not be reported to the Control unless requested.

## MAINTENANCE

## Warning

17. Although the case of the dosimeter is reasonably robust, some of the internal parts are more delicate. Accordingly, the instruments should be handled with care; if this is done they should remain serviceable for a considerable period. They should also be kept clean and dry to avoid electrical leakage.

18. No maintenance whatever by ROC personnel is permitted. If it should be suspected that a dosimeter is faulty, it is to be returned to the Group Headquarters for exchange.

NOTE: The "quartz-fibre" image is generally known as the "hair-line".

THE CHARGING UNIT

## FUNCTION

1. The Charging Unit is a portable hand-operated instrument designed for charging quartz-fibre dosimeters of the type and range described in Annex L7.

## FACILITIES

2. The Charging Unit used in the ROC is the Type N105A transistorised charging unit which can charge or discharge the No 4 dosimeter (see Fig L8.1).

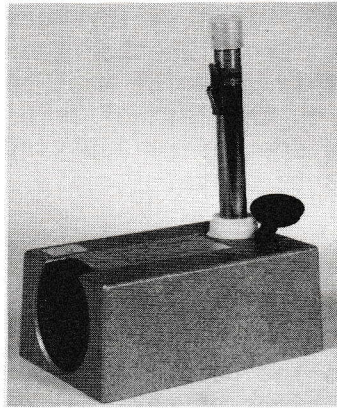


Fig L8.1

Type N105A with dosimeter in position for charging

3. The Type N105A provides a DC supply from a battery power supply. The charge is transferred to the dosimeter through a rotating switch which will charge or discharge the dosimeter, depending on the direction of rotation.

4. The Type N105A has a case of all metal construction housing all components. The Charging socket holds the dosimeter vertically against a spring loaded switch which operates a bulb for scale illumination. A swivelling plastic protective cover is provided to the charging socket.

## STORAGE

5. For long-term storage the instruments require conditions of controlled temperature and humidity. They are, therefore, stored at Posts in suitable packaging.

## OPERATING INSTRUCTIONS

## Preparation and Charging

6. To charge a dosimeter:

- a. Place the charging unit on a level surface, lift and swivel aside the plastic cover from the charging socket.

b. Remove the lower polythene end cap from the dosimeter and insert the open end of the dosimeter into the charging socket. Apply slight downward pressure on the dosimeter to illuminate the scale. Look through the eyepiece and rotate the dosimeter so that the scale is in the horizontal position with the zero position to the left. Apply further downward pressure which will provide charging voltage.

c. If the fibre image is to the right or left of the zero position or if the fibre image cannot be seen on the scale, it can be moved to zero simply by rotating the knob at the left-hand side of the charging unit forward or backward whilst maintaining full downward pressure.

d. Still looking at the scale, ease the pressure on the dosimeter allowing it to lift approximately  $\frac{3}{4}$ ". This will remove the charging voltage but leave scale illumination on. Check whether the fibre image moves slightly to the right of zero. If so, this movement must be allowed for by setting the fibre image the same amount to the left of zero as it is observed to have moved to the right. This is done by re-applying pressure on the dosimeter and rotating the knob as in para 6c above.

#### Local Maintenance

7. Batteries. The charging unit is powered by a single 1.5v dry battery.

8. Under operational conditions the battery should be checked at not more than weekly intervals and if showing signs of physical deterioration it is to be removed from the instrument at once to avoid the risk of leakage and corrosion. For the same reason, when the instrument is not in continuous use, the battery should be removed; a label should be attached indicating that the battery has been removed.

9. To charge the battery, unscrew by means of a coin the screw in the base of the instrument and remove the base plate. Remove existing battery and insert new battery so that the base of the battery is in contact with the spring. Replace the base plate and tighten the screw (Fig L8.2).

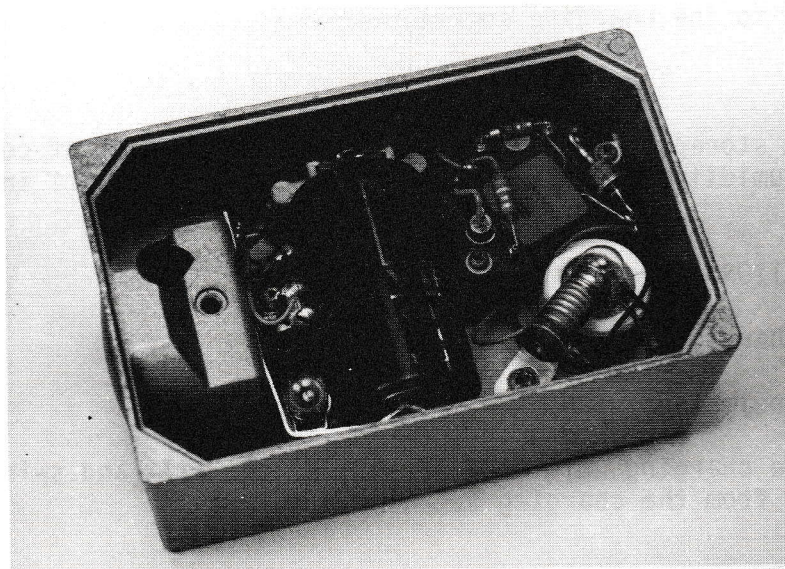


Fig L8.2  
N105A Charging Unit with base plate removed  
showing location of battery and bulb

10. In the event of failure of the small light bulb which provides the internal illumination, first remove base plate (as in para 9). Unscrew the defective bulb and insert spare bulb contained in spring retaining clip (Fig L8.2). Replace base plate and tighten screw.

11. The only other maintenance permitted is:

a. Instrument to be kept clean and dry, particularly the surface of the insulator in the charging socket.

b. The protective plastic cover (Fig L8.1) should always be replaced after use.

12. In the event of the instrument failing to function correctly, it should be returned to Group Headquarters.



THE HAND OPERATED SIREN

## FUNCTION

1. The hand-operated siren is a portable instrument designed for giving audible warnings to the public.

## FACILITIES

2. The pitch of the note given out by the siren varies according to the speed of rotation of the handle. A shutter is provided so that the sound can be damped, enabling an intermittent note to be given.

## CONSTRUCTION

3. Two types of sirens are available, the Service Electric "Secomak" (see Fig. L9.1) and the Carter (see Fig. L9.2). Both have the same facilities and are similar, but not identical, in construction.

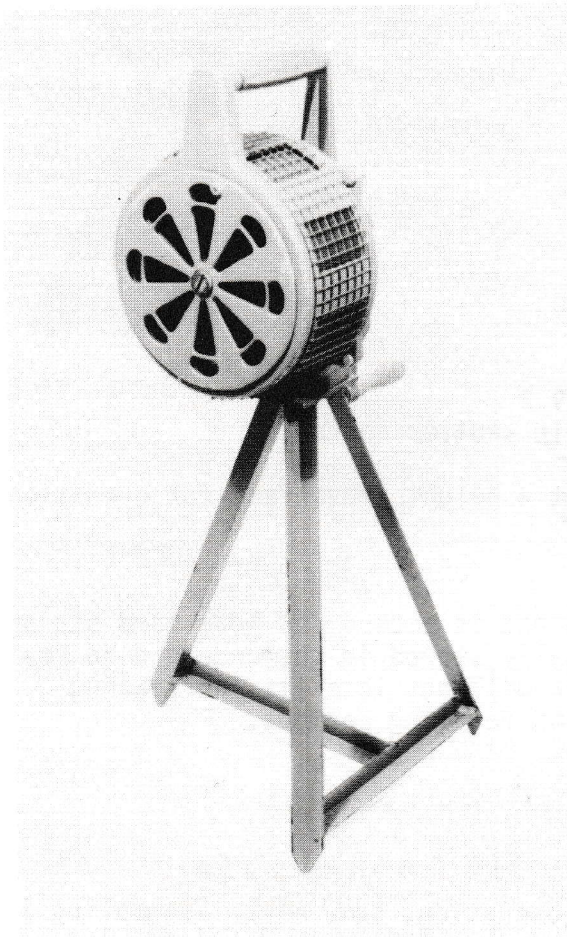
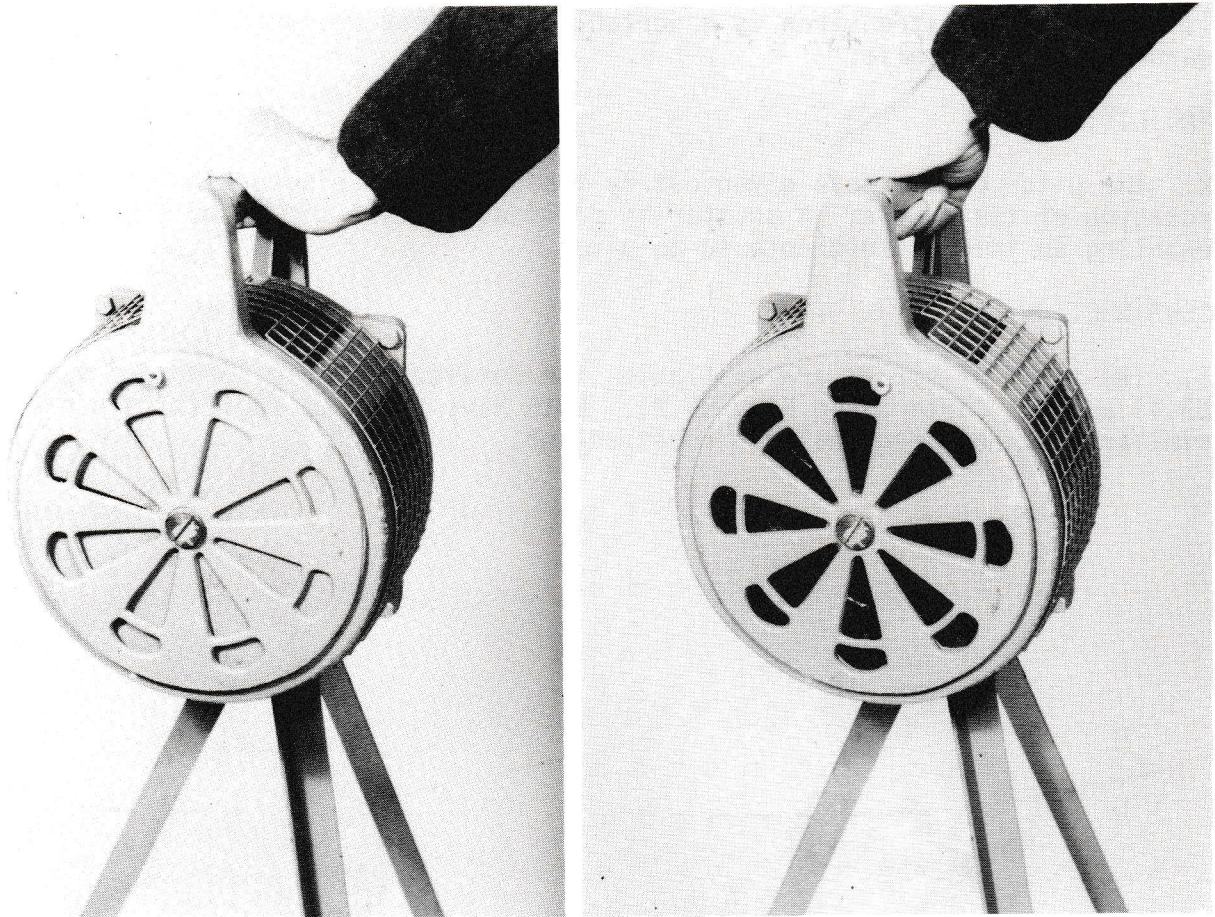


Fig. L9.1  
Hand-operated siren (Service  
Electric "Secomak" type)



Fig. L9.2  
Hand-operated siren  
(Carter type)

4. The siren consists of a cast metal sound box containing the rotor which is turned through gears by winding a handle. A steadying handle is fitted to the top of the sound box incorporating a twist-grip shutter control; turning this grip opens or closes the damping shutter fitted to the sound box (see Fig. L9.3).



a. Shutter Closed

b. Shutter open

Fig L9.3

Operation of twist-grip shutter control

5. The siren is mounted on a metal stand at a height convenient for operation.

#### STORAGE

6. The siren is supplied in a wooden crate and is packed for long-term storage in a dry-unheated room; it is, therefore, normally stored in the underground Post. The grease used in the assembly of the siren will not lose its lubricating properties even though left without attention for long periods.

#### OPERATING INSTRUCTIONS

##### Preparation

7. In order to prepare the hand-siren for operation, some minor assembling is required after the unit has been removed from its crate.

The method of uncrating and the amount and nature of the work of assembly will depend on whether the siren was manufactured by Service Electric Co Ltd or Carter & Co (Nelson) Ltd.

8. Identification by make while the siren remains crated is easy. The Service crate has a hinged lid; the Carter crate has not. Normally the Service crate has a label on the lid bearing the maker's name but this may become dislodged in transit.

#### The Service Electric Siren ("Secomak")

9. The hinged lid of the crate containing the Service hand-siren is opened by removing the nut and washer by which the lid is secured. The siren, which is stowed upside down, should be lifted out of the crate and prepared for use as follows:

- a. Unscrew the clamp and, supporting the siren from underneath, give the clamp plate a quarter turn so that the siren may be removed from its stowed position within the stand.
- b. Mount the siren on top of the stand cross members with the handle of the siren one inch from the side of the stand marked "Handle This Side". (This gives maximum stability).
- c. Screw up the clamp plate (now positioned underneath the siren) with its groove fitting snugly into the frame cross member.
- d. Slide the rubber ring clear of the rotating handle and unscrew the wing bolt holding the handle in its stowed position.
- e. Remove the handle from the spindle, then replace it with the wooden part pointing outwards from the unit (see NOTE below para 12).
- f. Replace the wing bolt and ensure that it is tightly screwed to hold the handle firmly in position (See Fig. L9.4a).
- g. Remove the packing material surrounding the sound box and the steadying handle.

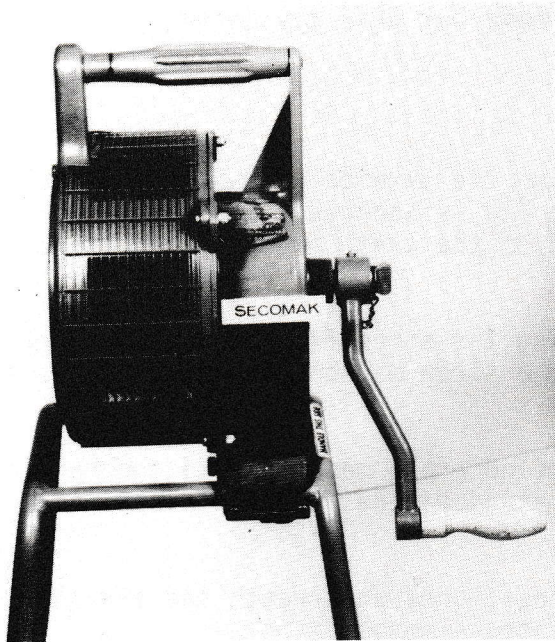
10. The siren is now ready for use. Additional steadiness will be obtained during operation if the left foot is placed on the left side of the lower cross member of the stand.

#### The Carter Siren

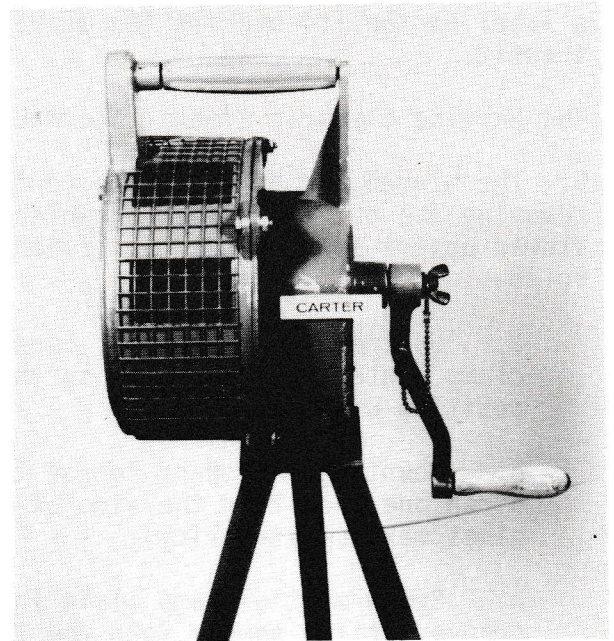
11. The wooden crate containing the Carter hand-siren has a solid end and a slatted end. It is the solid end which should be opened by removing the screw holding it in position. The siren can now be lifted out of the crate. At this stage the rotating handle will be in the "reversed" position. To prepare the siren for use:

- a. Put the handle into its operational position by unscrewing the wing bolt, removing the handle from the spindle and replacing it with the wooden part of the handle pointing outwards from the unit and the groove in the turning arm engaging with the rod through the spindle (See NOTE below para 12).

- b. Replace the wing bolt and screw it up tightly (see Fig. L9.4b).
- c. Remove the packing material placed around the voice box and the steadying handle.



Wing bolt securing handle  
("Secomak" type)  
Fig. L9.4a



Wing bolt securing handle  
("Carter" type)  
Fig. L9.4b)

12. The siren is now ready for use. Additional steadiness will be obtained during operation if the left foot is placed on the cross member of the stand.

NOTE: When used at ROC Posts, the siren is prepared for use and then the handle is removed. The siren is then taken above ground and laid on its side close to the access hatch ready for use when a warning is received. The handle, which can be fitted in a few seconds, is kept in the underground Post until required, to avoid the possibility of unauthorised sounding.

#### Location of the Siren for its Warning Function

13. When used at a ROC Post, the siren is to be operated from a position conveniently near to the access hatch. When used at a Control it is to be operated from a position which is immediately accessible but which is above ground level if possible.

14. After the RED warning has been sounded, the siren is to be taken into the Post/Control with it's handle reversed.

#### Types of Warning Signals to be Sounded

15. There are two types of warning signal which the hand-siren has been designed to sound:

- a. The RED warning against air attack, notice of which will have been given through the Carrier Receiver in the form of an alarm signal (a continuous warbling note). The warning will also be broadcast over the BBC network.
- b. The WHITE warning ("All Clear") which will have been received verbally through the Carrier Receiver.

#### Methods of Operating the Siren

##### 16. a. To sound a RED warning:

- (1) Ensure that the damping shutter on the sound box is in the "open" position and that it remains open for the duration of the signal. (The open and shut positions of the damping shutter are controlled by a twist of the steadying handle on the top of the siren).
- (2) With one hand grasping the rotating handle and the other holding the steadying handle, give the rotating handle five revolutions at a very fast speed by continuously increasing the pressure on the handle. (It is difficult to define "very fast", but the object will be to turn the handle for these five revolutions as quickly as possible).
- (3) After these five revolutions have been given, drop the rate of turning to a slow speed by decreasing the pressure on the handle for the next five revolutions. (The "slow speed" rate of turning need be no greater than the speed at which the handle would rotate by itself from the momentum resulting from the previous five turns).
- (4) Then give another five turns at high speed, followed by five turns at slow speed, and so on. This sequence should be followed for ONE MINUTE and it is important that this timing is strictly maintained since it is one of the distinguishing features of the signal. It is also most important that there should not be any variation of the five in number revolutions of the rotating handle during which the pressure is successively built up and then reduced. The resultant noise from the siren would be the wailing note with which many persons are familiar.

##### b. To sound a WHITE warning ("All Clear"):

- (1) Ensure that the damping shutter is open and remains open for the duration of the signal.
- (2) With one hand grasping the rotating handle and the other hand holding the steadying handle, rotate the handle at the highest rate it is possible to maintain for the whole of ONE MINUTE during which the speed must remain constant in order to sustain the note at a level pitch. Here again, the duration of the signal is an important distinguishing feature. The resultant noise should be the long steady note with which the public are also familiar.

NOTE An appreciable physical effort is necessary to provide the full volume of sound from the hand-operated siren, but care should be taken to avoid such violent operation that the siren loses stability. The necessary pressure should be applied to the operating handle as smoothly as possible, particularly when starting or stopping; sudden jerks may, because of the inertia of the moving parts, damage the mechanism.

#### Repacking of Siren after Use

17. After the siren has been tested or used for training, it must be returned to its crate. This will entail reversal of the steps taken to uncrate it and set it up as described in paras 9 and 11, including the re-sealing of the sound box to prevent the entry of harmful particles of grit etc.

#### MAINTENANCE

18. No maintenance is required but if the siren is unpacked for testing or training, the opportunity should be taken to inspect it carefully for any signs of deterioration. If such signs are noticed, they should be reported to Group Headquarters who will exchange the instrument if necessary.

THE FALLOUT WARNING MAROON

## FUNCTION

1. The Maroon, 3 Burst No 2, is a pyrotechnic manufactured by Pains-Wessex Ltd for giving an audible fallout warning to the public.

## FACILITIES

2. The Maroon is designed to propel the three bursts separately to a height of about 40 metres above the ground, where they detonate at intervals to produce the three bangs of the accepted Fallout Warning Black signal.

## CONSTRUCTION

3. A Maroon Kit consists of the following items:
- a. 2 Maroons, 3 burst No 2.
  - b. 1 Firing Box with 10 metres of black cable terminating in a plug connection to the Maroon.
  - c. 12 volt adaptor unit with 5 metres of red cable terminating in two crocodile clips for battery connection.
  - d. 2 Stabilising Hoops.

## STORAGE

4. The maroon kit is packed in a moulded polystyrene packing block, vacuum sealed in a foil bag and contained in a yellow outer carton.
5. As the kit is of an explosive nature, it must be kept away from direct heat and stored in a dry place. For these reasons the kits are stored by Police Forces and will be issued to Warning Points at an appropriate time.

## PEACETIME PREPARATIONS

6. Suitable sites for firing the maroons are to be selected in peacetime and the location of these sites made known to all Post members.
7. The sites must be chosen carefully, using the following criteria:
- a. Surface must be firm and level.
  - b. Two sites must be chosen at least 2 metres apart, preferably on opposite sides of the Post.
  - c. Both must be clear of overhead obstructions.
  - d. Both must be between 8 and 9 metres from the entrance shaft and must be clearly visible to an Observer standing on the ladder with the hatch almost closed.

e. Ideally, the sites chosen should have sufficient topsoil to allow the stabilising hoop to be pushed in with reasonable ease.

NOTE: It is suggested that the practice maroon kit provided to each Group is used to select these sites to ensure that they are suitable.

#### OPERATING INSTRUCTIONS

8. Upon receipt at the Post the maroon must be left in the sealed foil bag and stowed within the Post until required. After the removal of one maroon the other unit is to be replaced in the foil bag and the bag resealed.

9. On receipt of a "Fallout Warning BLACK" message for the warning district in which the Post is located, or when the reading on the fixed Survey Meter reaches 0.3 cGy/h, ONE signal must be sounded to warn the public of the approach of fallout.

10. The prepared maroon, stabilising hoop, firing box and adaptor unit are to be placed in the rope sling by No 3 Observer, who will then leave the Post taking the hatch key with him. The maroon and accessories are to be removed from the sling, the rope and sling dropped down the shaft and the hatch closed.

11. The maroon is to be placed on one of the pre-selected sites and the stabilising hoop pushed into the ground over the base projection to which the black cable will be plugged (Fig L10.1).

12. Plug in the black cable and retire with the firing box to the entrance hatch (Fig L10.2).

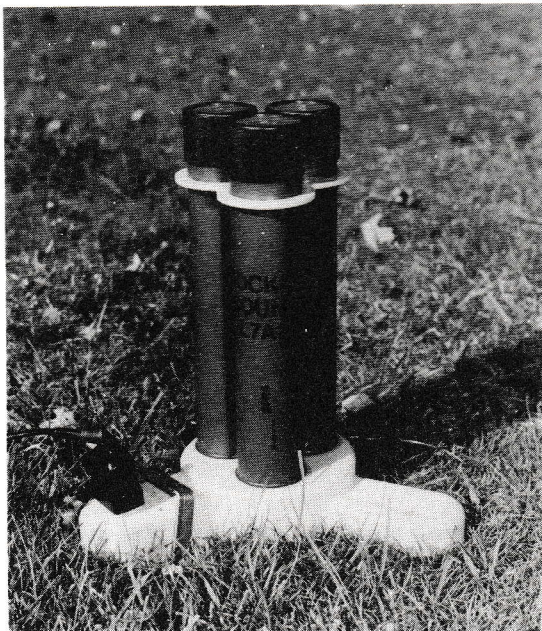


Fig L10.1

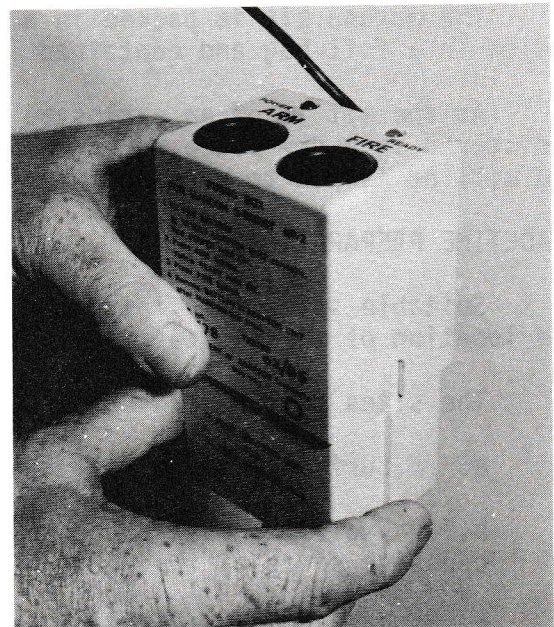
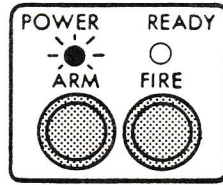


Fig L10.2

13. Open the hatch and descend the ladder holding the firing box and the adaptor unit and cable until the eyes are just above the level of the top of the shaft. Lower the hatch cover until it is just above the head.



14. Plug the adaptor unit into the firing box and lower the red cable to No 1 Observer who will attach one crocodile clip each to the positive and negative terminals of the Post battery. No 3 Observer will know when this action has been completed as the red power light on the top left of the firing box will glow (Fig L10.3).

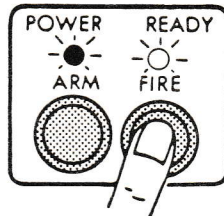


**'POWER' LIGHT ON**

Fig L10.3

15. If the power light fails to glow, the battery connections should be checked. Should this fail to make the power light glow, it indicates that the battery voltage is low. PP9 battery (if available) may be plugged in instead of the adaptor unit or the red cable may be connected by the crocodile clips to the positive and negative terminals of a car battery (at Master Posts the connections should be transferred to the radio battery).

16. No 3 Observer will then arm the firing box by pressing the "ARM" button immediately below the red power light. This action will cause the yellow ready light at the top right of the firing box to glow (Fig L10.4).

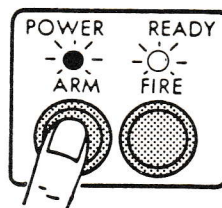


**'READY' LIGHT ON**

Fig L10.4

17. Should the "Ready Light" fail to illuminate when the "ARM" button is pressed, detach the adaptor unit, check all connections and carry out actions in paras 14 to 16 inclusive again.

18. When both lights are glowing No 3 Observer will inform No 1 Observer. When instructed No 3 Observer will fire the maroon by pressing the "FIRE" button (Fig L10.5). He is to observe the maroon whilst firing to ensure that all three projectiles are fired. He is also to listen for the three bangs as the three projectiles burst in the air.



**FIRE!**

Fig L10.5

19. If, as a result of these observations, either of the following conditions apply:

- a. The maroon fails to fire completely, or in part.
- b. One or more of the projectiles fail to burst in the air.

No 3 Observer is to detach the adaptor unit from the firing box, obtain the second maroon from the Post, together with its stabilising hoop and set it up in the alternative selected firing position. If two minutes has not then elapsed since the first maroon misfired, wait until this period has elapsed before detaching the black plug carefully from the first maroon without leaning over the projectiles; attach the plug to the second maroon.

20. Proceed with the actions detailed in paras 13 to 18 above. In the unlikely event of the second maroon misfiring, retire to the Post and report the fact to No 1 Observer.

21. No 1 Observer will instruct No 2 Observer to report the double misfire to the Post Supervisor.

22. Actions described in paras 8 to 21 are to be carried out as quickly as possible, commensurate with safety.

#### TRAINING EQUIPMENT

23. Each Group Headquarters has available a Maroon Kit Training Unit. The Kit contains the following:

- a. Maroon Simulator
- b. Dummy Maroon
- c. Firing Box
- d. Adaptor Unit
- e. Dessicant Bag
- f. Polystyrene halves
- g. Yellow Caron
- h. PP9 Battery
- i. Instructor's Information Leaflet
- j. Instructions for use cards
- k. Stabilising hoops
- l. Foil bag
- m. Foam Insert
- n. Spare bulbs and lamp unit.

24. Using the Training Unit it is possible to exercise all actions necessary to fire maroons in an emergency. These actions must be practised regularly so that no time is lost in issuing the BLACK warning in an emergency.