THE

ROYAL OBSERVER CORPS

RADIAC INSTRUMENT

HANDBOOK

1963/64

THE INDIVIDUAL DOSIMETER

TO safeguard the health of those working in contaminated areas it is essential for each one to know the amount of radiation which he personally has received (the dose), so that he can be removed from the danger area before the safety limit is reached. The instrument which measures this amount is known as the *Individual Dosimeter*.

There are three types of Individual Dosimeter used by the Royal Observer Corps, each measuring a different range of intensity of dose. They are :—

Type No. 1 measuring 0–0.5R. May or may not carry a black identification band and is sometimes called the Training Type Individual Dosimeter.

Type No. 2A measuring 0–5R. Identified by a blue band.

Type No. 3 measuring 0–50R. Identified by a red band.

All three are fitted with pocket clips and are similar in appearance and size to a fountain pen (see Fig. 1).

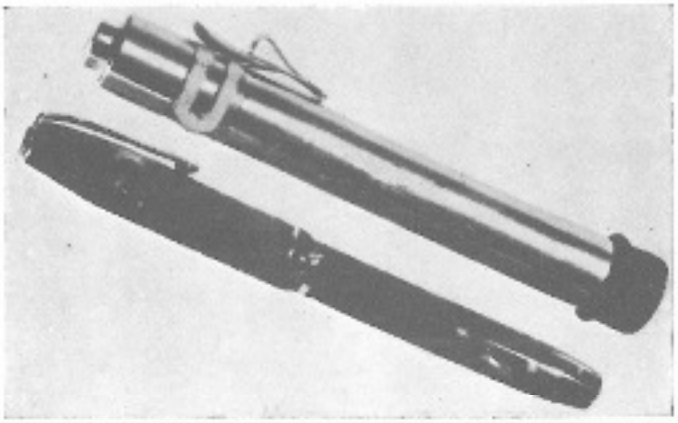


Fig. 1. An Individual Dosimeter photographed alongside a standard sized fountain pen.

Each Dosimeter consists of a quartz-fibre assembly, a scale and a lens system through which the position of the fibres may be viewed on the scale (see Fig. 2).

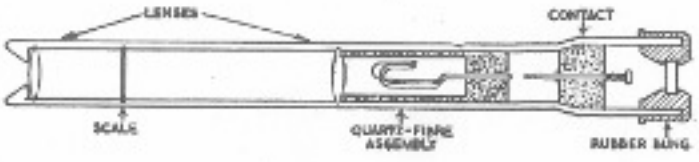


Fig. 2. Sectional diagram of the Individual Dosimeter showing the principle by which the instrument works.

The quartz-fibre, which is very thin, is formed in the shape of an elongated " U ", the ends of which are attached to a thick wire similar in shape. When charged with electricity the quartz-fibre moves away from the wire, *i.e.*, towards zero on the scale.

When the Dosimeter is taken into a contaminated area radio-activity causes the electric charge to leak away and the quartz-fibre to move back towards the wire and up the scale from zero. The stronger the radiation or the longer the exposure to radiation the greater will be the leakage and the higher the reading on the scale. Those in the same contaminated area for the same time will absorb similar doses.

The Dosimeter is kept in a polythene bag to ensure that radio-active particles do not alight on the Dosimeter itself. If the polythene bag becomes contaminated it can be washed or disposed of and the Dosimeter needs to be removed from its protective bag only for reading to be taken or for re-charging.

To read the Dosimeter, hold the clip end to the eye and look towards a source of light. Note the position of the hair line on the scale, and then return the Dosimeter to its polythene bag. Dosimeters should be carried in outer pockets for convenience.

Before use in radio-active regions the Dosimeter must be checked for accuracy and, if necessary, re-set. Normally it should read zero. If it does not it must be charged by the following means (see also Fig. 3) :—

(i) Fold back the skirt and withdraw the rubber bung. For safety, keep this in the top right-hand breast pocket of the uniform until the charging is completed.

(ii) Unfold the generator handle of the Charging Unit until it clicks into position. Turn the handle briskly clockwise at about five revolutions per second for two or three seconds.

(iii) Looking through the charging socket, adjust the chromium mirror to give maximum light reflection.

(iv) Push the Dosimeter firmly into the socket and turn until the scale is horizontal. If the Dosimeter is discharged the hair line will be on the right-hand side of the scale, even though it may not be visible.

(v) Turn the switch cam at the side of the Charging Unit until the hair line moves on to zero on the scale.

(vi) Still looking through the instrument, withdraw it about half an inch to break contact ; you will see that the hair line has kicked a little to the right of zero.

(vii) Note how much the hair line has moved to the right, make contact again by pushing the Dosimeter firmly home and turn the switch cam until the hair line is the same distance to the left of zero as it originally was to the right.

(viii) Withdraw the Dosimeter and check the reading. The hair line should have kicked back to zero.

(ix) Re-insert the rubber bung, but before folding over the skirt press one side of the bung firmly to release any air pressure (which might otherwise cause the instrument to give a false reading.)

If you have overcharged, the hair line will be to the left of zero and the charge must be reduced before re-setting This is done by touching the centre-pin of the charging socket and its casing simultaneously with the finger to cause a short circuit.

When charging Dosimeters Type 2A or 3 the "kick" described in (vi) above may not take place. Obviously the action described in (vii) is then unnecessary. In some cases when the Dosimeter is re-inserted as in (vii) above

the hair line will kick sharply to the right again. On other instruments the hair line may revert to zero. Ignore both "kicks" and continue to charge as described above.

In addition to its primary use of measuring the dose of radiation, the Dosimeter can also be used as an improvised measure of the dose-rate as follows :—

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 will conveniently divide into 60. The difference between the two readings is then multiplied by 6, 5 or 4 as appropriate, to give an approximate dose rate in roentgens per hour. For example, if a Dosimeter originally reading zero reads 12 roentgens after 15 minutes exposure the dose rate will be 12 + 4 = 48R/hr. This method does not produce so accurate a result as the radiac survey meter and should only be used in emergency.

No maintenance whatsoever is permitted on the Individual Dosimeter. If a Dosimeter is thought to be faulty it should be returned to Group Headquarters who, after checking, will forward it to appropriate authority for repair. Maintenance on the Charging Unit is limited to keeping the charging socket free from dirt and moisture to avoid possible leakage of the charge from the centre contact to the frame. Mirrors should be kept clean and polished with a soft dry cloth. No other maintenance is permitted. Both Dosimeter and Charging Unit are reasonably robust, but nevertheless are delicate instruments and must be treated as such.

It is in every observer's own interest that he should become conversant with the method of reading and charging the Individual Dosimeter. In nuclear war the life of an observer would depend upon his knowledge of this invaluable instrument.

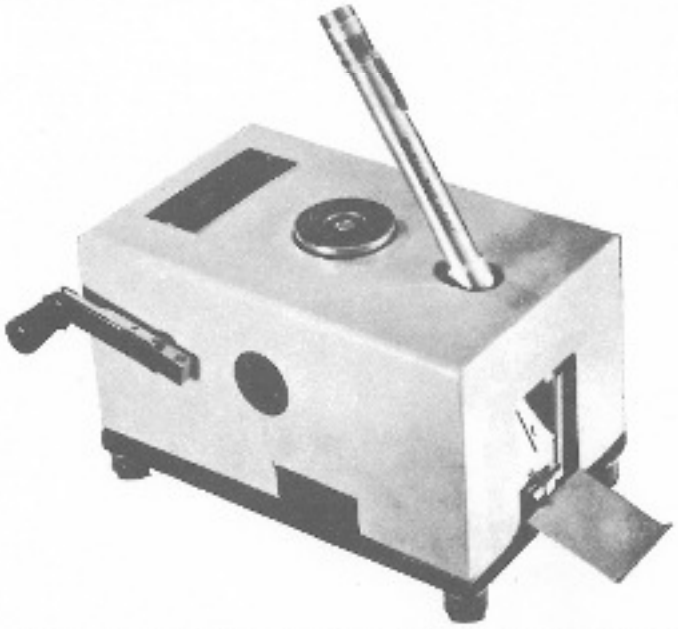


Fig. 3. The Dosimeter inserted in a Charging Unit for re-charging.

THE
RADIAC SURVEY METER

THE RADIAC SURVEY METER No. 2, as this operational type is known, is a portable battery-operated instrument designed to measure the dose-rate of gamma radiation over a range of 0–300 roentgens per hour (R/hr.). (It may also be made sensitive to beta radiation but this application will not be described in this article.) As in the Meter Trainer No. 1, the working parts of Meter No. 2 are contained in a metal case which is hermetically sealed except for the battery compartment which is, however, waterproof. Fig. 1 gives a general view of the No. 2 meter. In order to maintain low relative humidity in the sealed compartment, a silica-gel desiccator is fitted; when dry, the colour of the indicator shows azure blue, which turns to salmon pink when in a saturated condition.

The instrument is normally used in a haversack which is made of P.V.C.-covered cotton material and which has a hinged lid with a toughened glass window for viewing the scale and a side flap for operating the controls. It is smaller and much lighter than the training type, comparative figures being as follows:—

	Meter Trainer No. 1	*Meter No. 2*
Length (in case)	12½ inches	11 inches
Width (in case)	6 inches	5 inches
Height (in case)	8 inches	7 inches
Weight (including batteries)	12 pounds	6½ pounds

The power supply is contained in a special compartment which is sealed by a cover plate. Two 1.5-volt cells, one 9-volt battery and one 30-volt battery are used. The 1.5-volt cells are covered by circular caps which screw into the cover plate; the other two batteries are held in a special holder which is kept in position by the cover plate: they have a long working life, and should not require frequent changing.

To operate the instrument the following instructions are carried out :—

(*a*) Turn the On/Off switch to the Battery Check position.

(*b*) Check the meter indication. If the needle falls below the lower red line it indicates that the 1.5-volt cell requires to be replaced.

(*c*) Adjust the On/Off switch to the appropriate On position, *i.e.*, with or without lamp, by turning it anti-clockwise.

(*d*) Turn the Range switch to the Set Zero position. If the meter indication is not directly on zero, set the needle to zero by adjusting the Set Zero control with the screwdriver provided in the lid of the haversack. The instrument is now ready for use.

(*e*) To measure the dose-rate it is advisable initially to adjust the Range switch to the least sensitive range, *i.e.*, 0–300 R/hr. (Red scale).

The instrument may be held in any position to take a reading of gamma radiation and is normally used, as has been stated, without being removed from the haversack. Care should be taken to ensure that the instrument is switched off after use.

Maintenance by the operator is normally limited to replacement of the two 1.5-volt cells, one of which, the filament cell, is tested by means of the Battery Test position of the On/Off switch, while the other is the lamp cell. No other maintenance is attempted by the operator, any other servicing being carried out by the maintenance authority concerned.

The controls are situated in the side of the instrument and consist of two four-position switches and a pre-set control. The upper of the two switches is the On/Off switch.

The sequence of positions when turned anti-clockwise is as follows :—

Off
Battery Check
On with Lamp
On without Lamp.

A flag on the meter, which is mechanically linked to the switch movement, indicates whether the instrument is on or off.

The lower switch is the Range switch. When this is turned anti-clockwise the sequence of positions is :—

Set Zero
0–300 R/hr. (Red scale)
0–30 R/hr. (Blue scale)
0–3 R/hr. (White scale).

A moving scale on the meter is mechanically linked to the switch movement to indicate the range in use. (See Fig. 2.)

The pre-set control below the switches is the Set Zero control for the adjustment of the meter zero. The calibration control is covered by a protective panel which prevents adjustment by unauthorised persons. The lamp provided for illuminating the scale is intended only for intermittent use ; as it is hardly visible in daylight, care should be taken that whenever, possible, the On/Off switch is used in the " On Without Lamp " position.

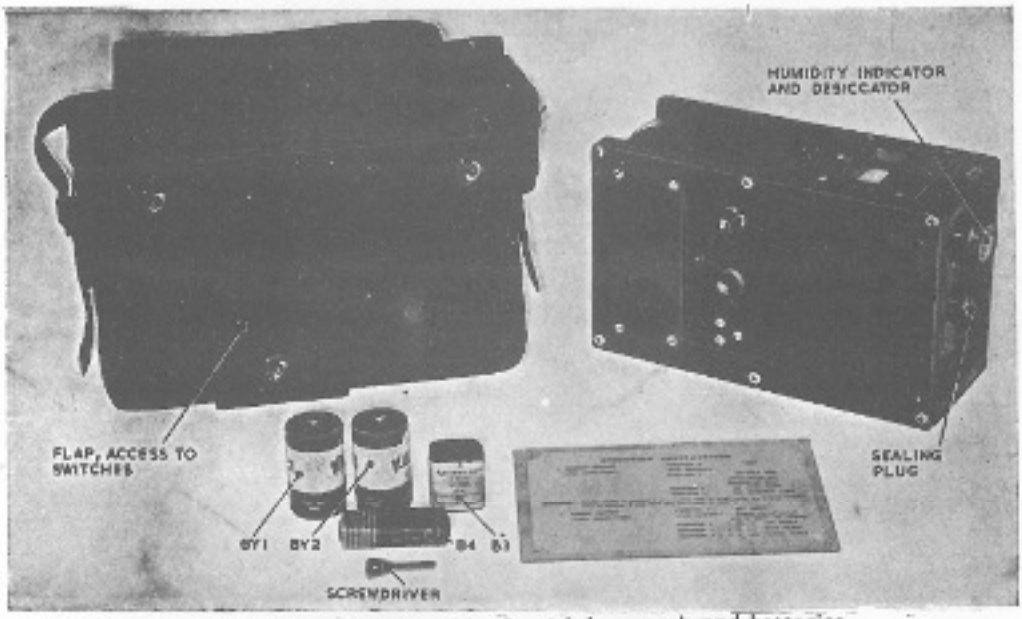


Fig. 1. The Radiac Survey Meter No. 2, with haversack and batteries.

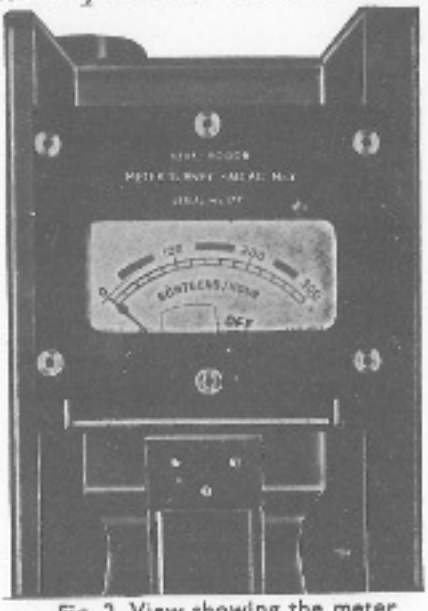


Fig. 2. View showing the meter scale and On/Off indicator.

THE GROUND ZERO INDICATOR

CERTAIN BASIC INFORMATION about a nuclear burst is required at the Home Office operations room so that the scientists who are responsible for forecasting the area likely to be contaminated by radio-active fall-out may produce a display from which fall-out warnings may be issued to the civil and military authorities. This basic information includes such details of the burst as its position, whether it was air-burst or ground-burst and the power of the weapon, as well as local meteorological conditions including wind speed and direction at all heights, etc.

It will be a responsibility of the R.O.C. group operations room to supply the Home Office operations room with information about nuclear bursts. Special instruments will be installed at posts so that the observers can report the bearing and elevation of the burst and the intensity of the pressure wave which results from it. This information will be reported to the operations room where it will be correlated and assessed before being passed on.

The ground zero indicator is the instrument which provides the basic information used to establish the position and height of the burst, and it will be part of the post observers' task to know how to operate it and how to report correctly the information obtained from it. This article is concerned with describing the principles on which the instrument was designed and the way in which it will be used by the observers.

Many readers will be aware that if a sheet of photographic paper or film is fixed to the inside of a light-proof box and a small hole is made with a pin in the side of the box opposite to the paper or film, this hole will take on the properties of a lens and "photograph" any objects which may be within view. As with all lenses the image is inverted and reversed in the process and the resultant picture is a negative, *i.e.*, black appears white, and white

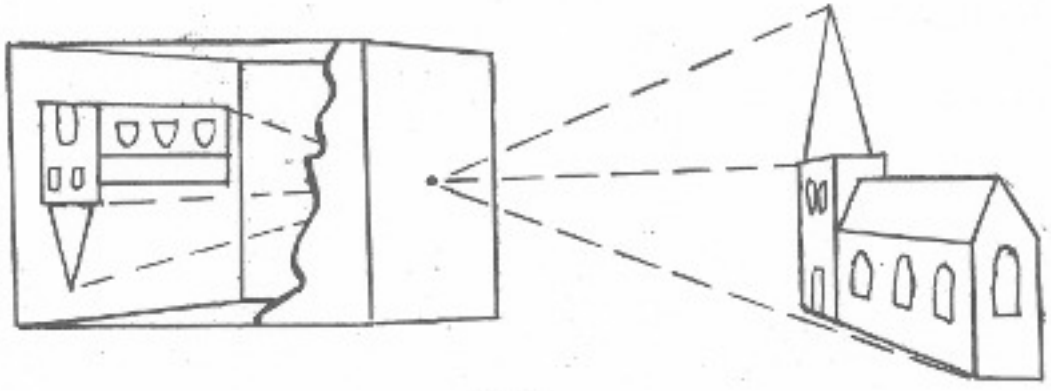


FIG. 1
Sketch showing the principles of the "pin-hole" camera

appears black. It is this "pin-hole camera" principle which is applied to the ground zero indicator for recording nuclear bursts.

The instrument is cylindrical in shape and is 10 inches in height and 14 inches in diameter. When the handle on top of the instrument (which replaces a bolt fitted on early models) is unscrewed, the cover, consisting of the top and sides of the cylinder, can be lifted off. This reveals a central structure with four incurved faces. Each of these incurved faces is fitted with a transparent plastic pocket, known as a cassette, which is marked with a graticule graduated in degrees of bearing and elevation and which holds a sheet of photographic printing-out paper which, when exposed to light, gradually darkens without the need for chemical development. Four holes are positioned in the sides of the instrument cover, one opposite each cassette.

The four cassettes are positioned so that one faces each of the cardinal points of the compass and are so designed that it is not possible to insert the wrong cassette in any of the incurved faces. This is achieved by fixing a small circular lug at the bottom of each face and making a small matching cut-out at the bottom of the appropriate cassette. The position of the lug and cut-out varies between each of the cassettes. Thus if an attempt is made to place the wrong cassette into any one of the incurved faces, it will be found impossible to push it right home and into place.

The graticule on the cassettes is graduated at five-degree intervals and the appropriate number is marked against each line. In addition, the letter of the cardinal compass point is marked against the line running down the centre of the cassette. Thus if the graticule is not clearly defined on a paper the correct bearing can still be established. The limits of the cassettes are as follows:—

N (North) 305° to 55°	S (South) 125° to 235°
E (East) 35° to 145°	W (West) 215° to 325°

It will be noted that there is an overlap of 20 degrees between each of the cassettes. Therefore the same burst could appear on two papers from the same instrument.

The ground zero indicator will be set up at each post so that it is level and correctly orientated. The actual position of the G.Z.I. in relation to the post and the method of mounting have yet to be decided but it seems likely that it will only be necessary for the instrument to be lowered on to the mounting so that the three bolts under the instrument pass through the three holes in the mounting for it to be correctly levelled and aligned. The three bolts, for which special nuts are provided, are eccentric so that they can only pass through the holes correctly.

The intense light emanating from the fireball of a nuclear burst will pass through one or more of the holes in the instrument cover and on to the printing-out paper, exposing it and causing a brownish mark to appear. If the papers are then removed from the instrument the bearing and elevation can be assessed from the position of the mark in relation to the white line left by the graticule on the cassette.

As each hole acts like a lens for "photographing" a nuclear burst it will, like the "pin-hole camera", record any other objects which are sufficiently well lit. There-

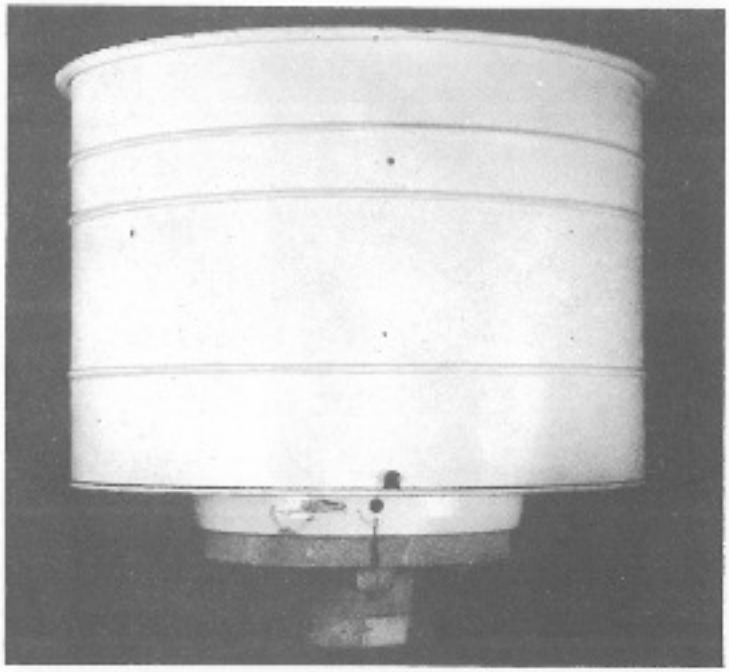


FIG. 2

The Ground Zero Indicator with cover in position. Points of interest are the "pin-hole" directly above the lug on the base of the instrument with corresponding cut-out in the cover; also the three bolts which secure the instrument to the "mushroom-head" mounting

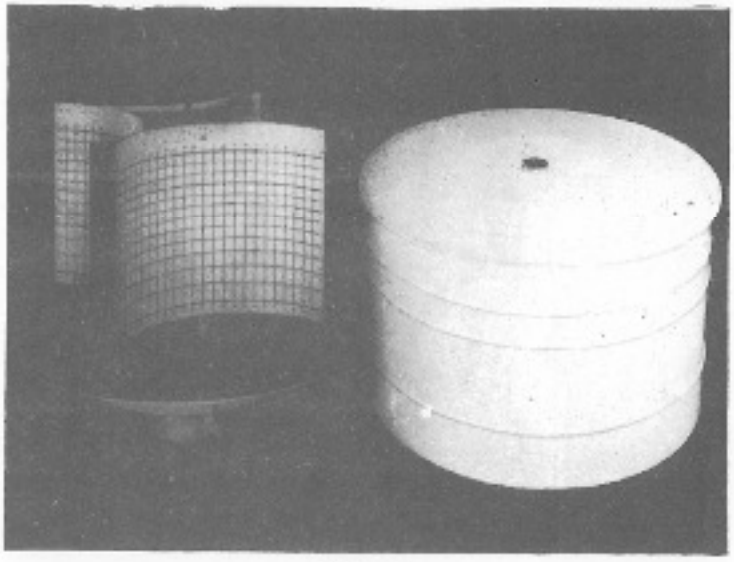


FIG. 3

The instrument with cover removed to show the central structure and lug (marked N) which ensures that only the North cassette can be inserted on this incurved face. The bolt on top of the cover has been replaced on later models by a handle

fore the post observer may expect to find on the printing-out paper such things as a trail caused by the sun, a horizon line and the images of any light-coloured objects in the vicinity. The sun trail may be well defined after a period of sunny weather, absent entirely when it has been overcast or intermittent when it has been cloudy with bright intervals. Obviously it cannot appear on all four of the papers.

The size of the mark caused by a nuclear burst will be related to the power of the weapon which causes it and the distance from the post, and may be anything from a pin-head to an inch or more in diameter. The mark may be easy or difficult to detect and will normally be more intense at the centre than at the edges which will tend to diffuse into the normal reddish-brown colour of the exposed paper.

The shape of the mark will also vary considerably. An air burst will normally produce a mark which is roughly circular. A ground burst, however, may produce a mark which is like the setting sun in appearance or, more probably, like a mushroom on a short stalk. This latter shape is due to the fact that a nuclear weapon bursting at or near ground level causes a tremendous amount of dust, rubble, etc., to be thrown up, obscuring to some extent the lower part of the fireball.

It will be appreciated that, although it is not difficult to assess the bearing of a mushroom-shaped mark, it may be very difficult to assess the elevation.

The possibility of bursts occurring simultaneously must also be borne in mind. When this occurs or when bursts follow in quick succession with insufficient time between them for the printing-out paper to be changed, marks may be found on two or more of the four papers. Also, if two bursts occur on almost the same bearing, two marks, partly superimposed, may be seen.

Obviously under operating conditions, it will not be possible for the post observers to make the papers permanent by the use of a chemical fixer. In these circumstances, therefore, it would be essential for great care to be taken when handling them in order to prevent, as far as possible, the gradual darkening of the paper which takes place if they are exposed to light. In particular, they should never be exposed for an instant to direct sunlight. Unfixed papers should be kept in their envelopes or in a light-proof bag until they are required and as soon as they are removed they should be placed face downwards. They should be taken up one at a time for examination after which they should be returned at once to their envelopes. For training and exercise purposes, G.Z.I. papers are usually fixed.

The details of the operating procedure for the instrument have not yet been finally decided, but may be similar to the following:—

A spare set of cassettes already filled with printing-out paper would be available and ready for use. These might have to be pre-exposed for a short while to ensure that the graticule is marked on the paper, but would thereafter be kept in a light-proof bag.

After a burst had taken place an observer would go to the G.Z.I. taking with him the bag containing the spare cassettes, remove the cover

from the instrument and slide the four cassettes containing the exposed papers out of their holders and place them in the light-proof bag.

Insert the spare cassettes into the holders and replace the cover on the instrument.

Return to the post and remove the papers from the cassettes for examination. Assess the bearings and elevations of any marks which may appear and report them to the operations room.

Place new papers in the empty cassettes, pre-expose them (if necessary) and place them in the light-proof bag ready for use.

The actions above would have to be carried out as speedily as possible in order to ensure that the reports of instrument readings reach the operations room without delay.

From the readings thus reported the operations room can establish the position and height of the burst by means of triangulation on a special map, leaving only the power of the weapon to be established.

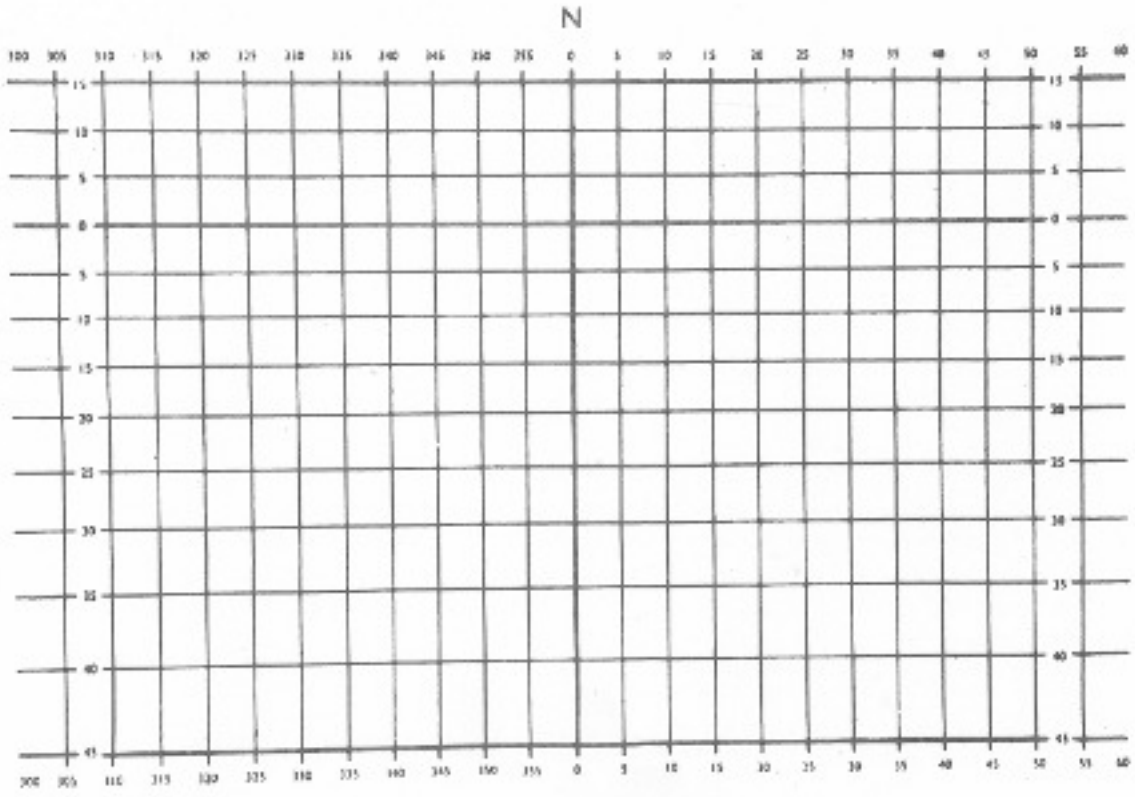


FIG. 4
The North cassette showing the marking of the graticule

The Operational Use of the Ground Zero Indicator

DESCRIPTION AND STORAGE OF INSTRUMENT

The G.Z.I. is issued in a cylindrical transit case complete with a mushroom-shaped base and one set of cassettes. A spanner is also provided. The base is detached from the instrument and concreted in position at the post (*see Fig.* 1) and then the G.Z.I. itself is stored in its transit case in the underground post.

The normal position of the G.Z.I. base mounting will be on the front ventilator turret next to the access hatch. If this is not suitable the rear ventilator turret will be used or, in exceptional cases, it may be mounted on the above-ground post or a purpose-built pillar. Whichever position is used, it will be correctly levelled and orientated before being concreted in place.

The complete equipment required for operational purposes comprises:—

One Ground Zero Indicator,
Two sets of four cassettes (N, E, S and W),
One spanner,
One light-proof satchel,
Printing-out paper.

All these items, including one box of printing-out paper, will be stored at the post. The main stock of printing-out paper will be stored at group headquarters for immediate distribution in the event of an emergency.

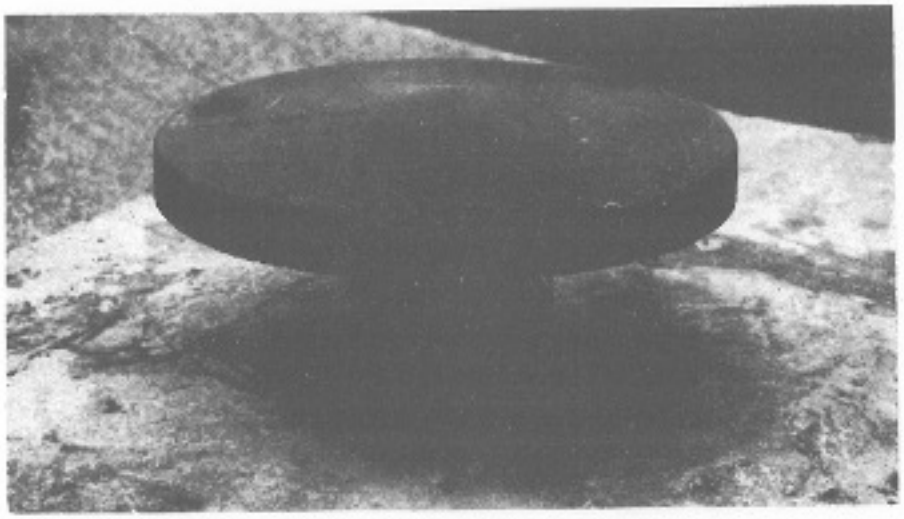
The spanner is chromium-plated and double-ended. The end marked $\frac{1}{2}$" BS $\frac{7}{16}$" W fits the nuts which hold the G.Z.I. to its base mounting; the other end now serves no useful purpose.

A spare light-proof satchel is provided for use if required.

PREPARATION FOR OPERATIONAL USE

Mounting the G.Z.I. is carried out by removing the three nuts from the bolts projecting from the underside of the instrument, lowering it into position so that the bolts pass through the corresponding holes in the base mounting, replacing the nuts and tightening them with the fingers. It should be noted that the three holes in the base mounting and the three bolts in the underside of the G.Z.I. are placed eccentrically so that incorrect orientation is impossible. In addition, one face of each nut is of a

Fig. 1. The base mounting after concreting in position



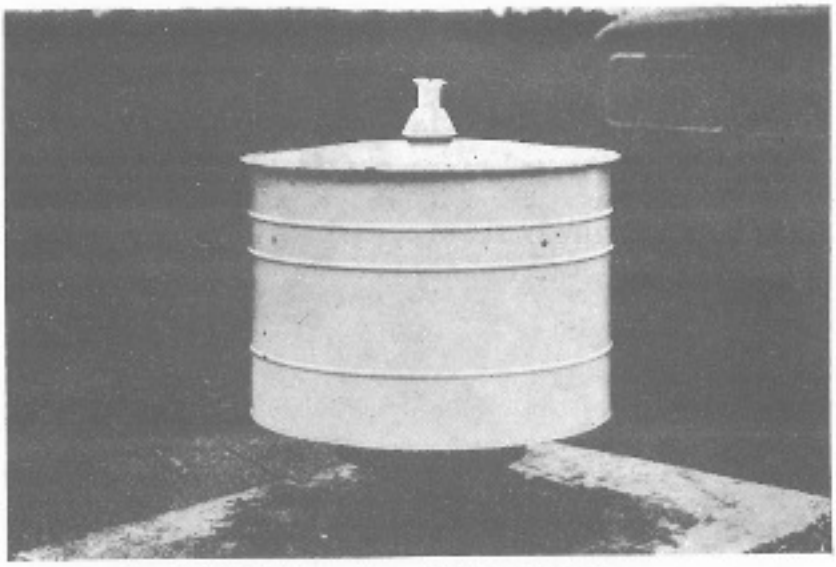


Fig. 2. The G.Z.I. in position on its base mounting

conical shape and fits into a countersinking in the underside of the base plate.

It is sufficient to tighten the nuts with the fingers and the spanner is not to be used for this purpose; it is provided in case a nut becomes jammed by grit, etc.

The next stage in the preparation of the G.Z.I. is the pre-exposure of printing-out paper. It is now considered doubtful whether, in the weather conditions prevailing in this country, the flash from a nuclear weapon would expose the paper sufficiently to print out the graticule and numerals clearly enough to be easily read. In order to obviate this, at least ten sets of papers should be prepared by exposing them in cassettes to daylight for about 1 to 30 seconds according to the strength of the light; that is, just sufficient to print out the lines and numbers.

As they are prepared, the papers, except for the last two sets, should be returned to their box in sets ready for re-loading cassettes as may be necessary; before this is done, however, the appropriate letter (N, E, S or W) should be pencilled on the back in one corner to facilitate loading the correct exposed sheet of paper in its proper cassette. The last two sets prepared should remain in the cassettes ready for immediate use, but before they are placed in the light-proof satchel the paper should be locked in position in each cassette by two small pieces of cellotape to prevent slip.

When further pre-exposed sets are loaded into cassettes care must be taken to ensure that the pre-exposed lines correspond with the lines on the cassettes and, of course, that each paper is loaded into the appropriate cassette. The paper should again be locked in position with cellotape.

When placing sets of cassettes in the satchel, each set should be arranged in the order N, E, S, W and placed so that when the satchel is worn the sensitized side of the paper is next to the wearer's chest.

As has been mentioned above, in the first instance two sets of cassettes will be placed in the satchel. The set of cassettes from the inner pocket, i.e. that nearer the wearer's chest, should then be loaded into the G.Z.I. using the procedure described later in this article. The satchel, now containing one set of cassettes in the outer pocket, should be returned to the underground post where it is stored until required.

The G.Z.I. is now ready for operational use.

ROUTINE MAINTENANCE

If there is a waiting period between a post being brought to readiness and the commencement of an attack, some routine maintenance will be required. This will consist of changing the papers regularly to ensure that they are reasonably fresh when the attack develops; if this were not done, the paper might be so darkened by exposure that it would be extremely difficult to distinguish any marks caused by nuclear bursts.

The intervals at which papers will be changed have not yet been decided but it is known that the papers can safely be left in the instrument for longer periods in the winter than in the summer, because during the winter the light is less strong.

Whatever interval is decided upon, the changing of papers will always be carried out just after sunset so that as long a period as possible can elapse before the papers start to darken. As sets of pre-exposed papers are used up for these routine changes, further sets should be prepared so that the stock remains at ten complete sets in all.

A routine reminder to change the papers will be given by the operations room.

In addition to the routine changes, the papers should be changed upon receipt of an "Attack Warning Red," if a considerable period of daylight has elapsed since the papers were last changed.

DUTIES OF OBSERVERS

Before describing in detail the drill for changing the G.Z.I. papers it is necessary to refer to the duties of the four observers at the post.

Nos. 1 and 2 Observers will be carrying out their normal duties in the above-ground post or, if there should be no essential air reporting task, they will form the off-duty watch in the underground post, resting on the double bunks.

Nos. 3 and 4 Observers will be the duty watch. No. 3 Observer, who will be in operational charge of the post, will be seated at the instrument table, wearing the head and breast set, watching the Bomb Power Indicator and Fixed Survey Meter and reporting and logging as required. He will also be responsible for assessing the G.Z.I. papers when they are brought in. No. 4 Observer will be seated on the single bunk ready to carry out such duties as No. 3 Observer directs. These may include changing G.Z.I. papers, handling dosimeters, etc.

WHEN TO CHANGE THE PAPERS

When a nuclear burst takes place its occurrence will be evident to the observers in the underground post in one or both of two ways; an explosion will be heard or felt and there may or may not be a movement of the needle on the Bomb Power Indicator (B.P.I.).

If a movement of the B.P.I. needle takes place, No. 3 Observer will instruct No. 4 to change the G.Z.I. papers.

If no movement is seen but a loud explosion is heard, No. 3 Observer will log the fact, wait one hour, and then instruct No. 4 to change the papers. The reason for the hour's delay is that it is unlikely that a mark will have been made on the G.Z.I. papers and it is considered that in this case, the risk that another burst might occur is greater than the risk that information might be missed.

The papers may also be changed on instructions from the duty controller, if he knows that a burst has occurred but the triangulation team has insufficient information to work on and if he considers that the post might be able to supply information which would enable the triangulation team to complete their task.

In order that there shall be no delay in changing the G.Z.I. papers, No. 4 Observer will put on the light-proof satchel as soon as an "Attack Warning Red" is received. (*See Figs.* 4 *and* 5.) When it is worn the inner pocket should be empty and the outer pocket should contain a fresh set of cassettes.

CHANGING THE PAPERS

On receiving instructions to change the G.Z.I. papers, No. 4 Observer will leave the monitoring room, closing the door behind him to prevent the entry of unnecessary daylight which may spoil the vision of No. 3 Observer who has become accustomed to the rather dim light in the post. He must take with him the key for the access hatch as he will require it for re-entering the post. He will then climb the ladder and open the access hatch. Stepping out of the post, he must then close the access hatch to prevent the possible entry of blast which, in a small structure such as a post may be greatly intensified by bouncing off walls, floors and ceiling and

may cause greater damage inside the post than outside. At this stage he should insert the key in the access hatch. He will then unscrew the handle of the G.Z.I., remove the cover and place it on the ground. Immediately he has done this, he will take out all the exposed cassettes and place them in the empty inner pocket of the satchel. Next, he will take the fresh set of cassettes from the outer

Fig. 3. The G.Z.I. in its normal position next to the access hatch

pocket and insert them in the holders, starting on the North face and continuing clockwise, i.e., N, E, S, W.

The best method of inserting each cassette is to place one vertical edge in position with the bottom edge about half an inch above the bottom step, snap in the other vertical edge and tap the top of the cassette so that it drops down on to the stop. This is quicker and more satisfactory than sliding the cassette all the way down as it then tends to stick and often causes damage by cracking the edges of the cassette.

Whilst the cover is off the G.Z.I. great care must be taken to ensure that no unnecessary light falls on the papers. Particular care must be taken when the sun is shining, and the observer should place himself between the sun and the papers to prevent sunlight falling directly on to the papers.

When all the fresh cassettes have been inserted, he will replace the cover, screw the handle down, re-enter the post, removing the hatch key and closing the hatch behind him, descend the ladder and hand the cassettes to No. 3 Observer for assessing.

If fall-out has previously affected the post, No. 4 Observer must pass the cassettes through the door to No. 3 Observer and then take any necessary decontamination action before re-entering the monitoring room.

As soon as the cassettes are handed to him, No. 3 Observer will remove the papers, assess them and report accordingly. The empty cassettes will be handed to No. 1 or No. 2 Observer for re-loading, after which they will be given back to No. 4 Observer who will place them in the outer pocket of the satchel ready for use if a further burst occurs.

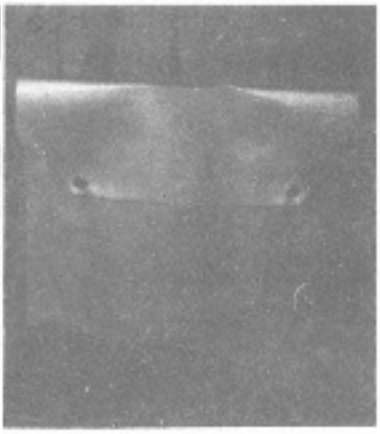
THE IMPORTANCE OF TRAINING

It is essential that the whole procedure of changing the G.Z.I. papers is carried out as quickly as possible, so that the information can be passed to the operations room without delay—the triangulation team cannot start its work until the G.Z.I. detail has been received.

To achieve speed, it is necessary for every observer to have complete and regular practice in the drill at the post. Each action must be known so thoroughly that it is carried out automatically; practices will, no doubt, normally be carried out in daylight and in reasonably good weather, but those who have experience of all-night exercises will know that this is very different from carrying out the same task on a dark night and in pouring rain. This is certainly a case of "Practice makes perfect."

Fig. 4. The light-proof satchel

Fig. 5. The light-proof satchel



THE R.O.C. FIXED SURVEY METER

GENERAL DESCRIPTION

Function

1. The R.O.C. Fixed Survey Meter is a battery-operated instrument designed to measure gamma radiation dose-rate.

2. The range normally covered by the instrument is 0.1 roentgens per hour (r.p.h.) to 500 r.p.h.: but the upper limit can be increased to 5,000 r.p.h. or more by shielding the probe unit, e.g., by withdrawing the probe unit down the probe pipe until the reading is reduced by a known factor (see paragraphs 12 to 16).

Facilities

3. The dose-rate is read on the scale of a meter in the Indicator Unit. This scale is about five inches in length and is roughly logarithmic (see Fig. 1).

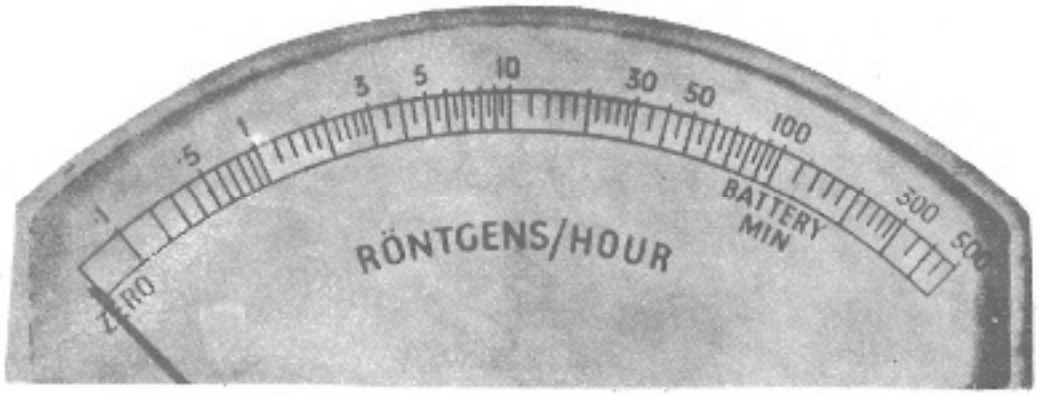


Fig. 1. The meter scale. The line labelled "Battery Min." is marked in red.

4. It is possible to check the instrument zero and full-scale settings whether or not radioactivity is present.

5. Provision is made for checking the state of the individual batteries fitted in the battery pack.

Construction

6. (a) Probe Unit. The unit consists of an ionisation chamber (see Fig. 2) attached to the top section of a telescopic rod (see Figs. 3 and 4) inserted into a pipe fitted into the roof of the underground post monitoring room. The chamber is connected to the indicator unit by an electric cable. A clamp (see Fig. 5) is also provided to fix the rod in the retracted position when shielded readings are being taken.

Fig. 2. The Ionisation Chamber. The cap over the connector socket is shown removed.

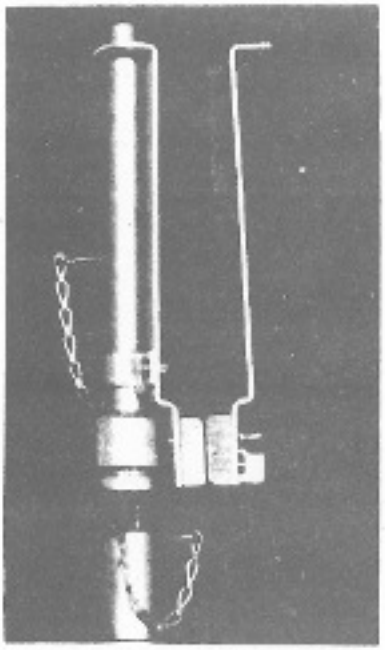


Fig. 3. The top of the telescopic rod with Cable Clamp Assembly attached.

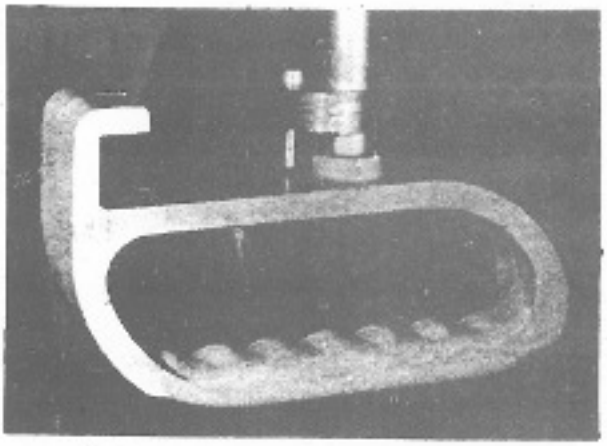


Fig. 4. The handle of the telescopic rod.

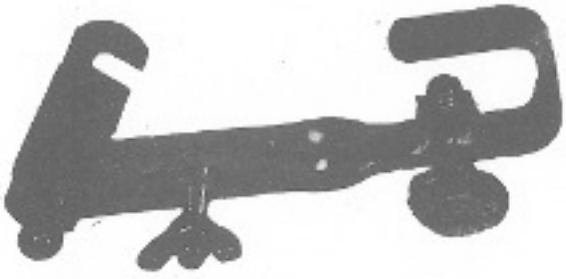


Fig. 5. The Rod Clamp.

(b) Indicator Unit. The indicator unit (see Fig. 6) is enclosed in a metal case designed for screwing to the instrument shelf of the post monitoring room. Two rotary switches, with a mechanical interlock to prevent operation of one when the other is in an operational position, provide means for operating the instrument and checking the batteries. Two external pre-set controls provide facilities for adjusting the meter zero and full-scale deflections.

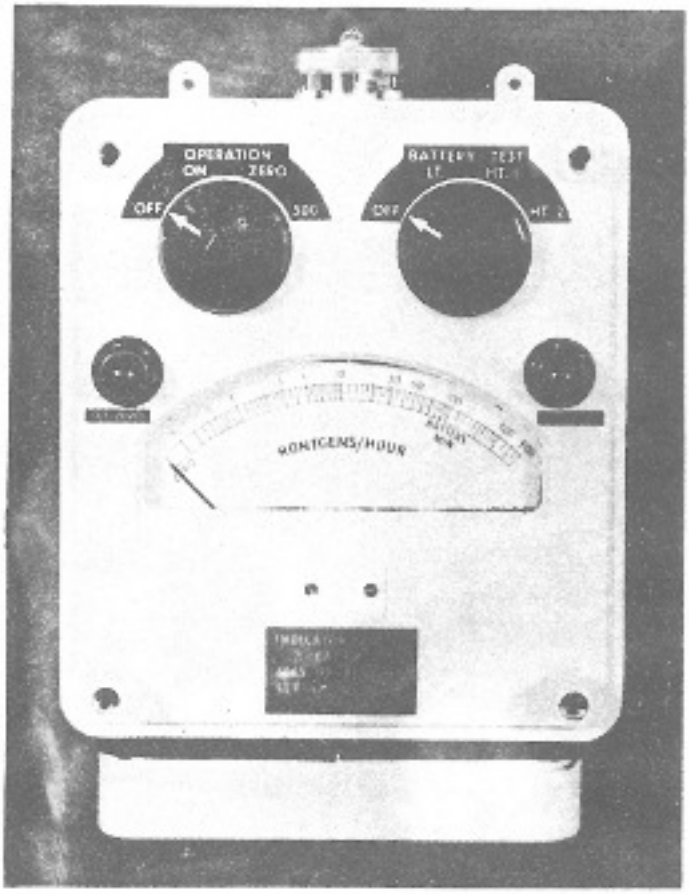


Fig. 6. The Indicator Uint with cover removed. Note the cable socket at the top and the lugs for screwing the unit to the instrument shelf. There are similar lugs at the bottom which are not visible in this view.

(c) Inter-Connecting Cable. The cable which links the ionisation chamber to the indicator unit is a double concentric type fitted with a connector at each end. (See Fig. 7.). At one end of each cable the connector is fitted with a bayonet-type locking ring. This should always be fitted to the indicator unit when the instrument is assembled.

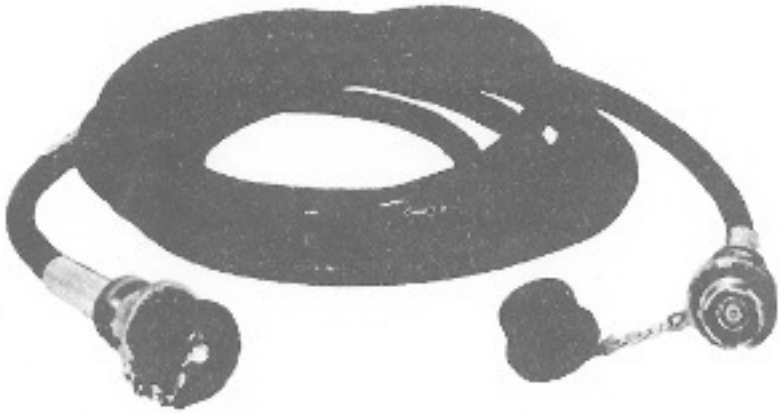


Fig. 7. The Inter-Connecting Cable. One of the connector caps is shown removed.

(d) Battery Pack. The batteries are located in a moulded, detachable pack which is plugged into the indicator unit (see Fig. 8). The three batteries perform the following functions :-

1.35 volt Mallory - Filament supply (operational life 200 hours)

10.5 volt Mallory - Anode supply (operational life 600 hours)

10.5 volt Mallory - Chamber polarising supply (operational life 2 years)

Each battery has a shelf life of some 2 years.

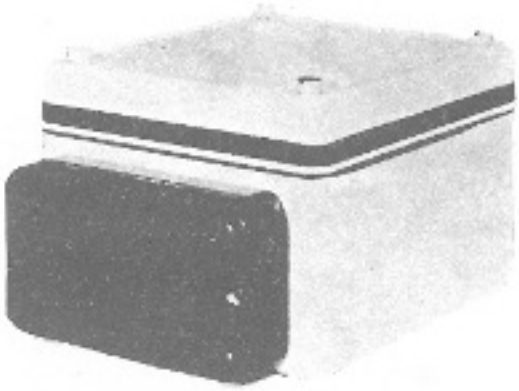


Fig. 8. The Battery Pack with its protective cover removed.

(e) Plastic Dome Cover. A cover of extremely robust rubberised P.V.C. material designed to protect the ionisation chamber. It is fixed to the upper flange of the probe pipe by means of a securing ring and four bolts.

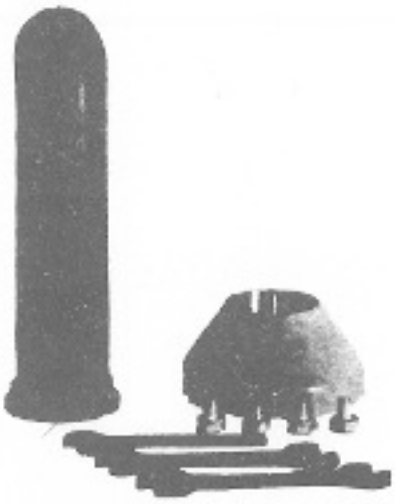


Fig. 9. The Plastic Dome Cover, with its securing ring, bolts and spanners.

Storage

7. The instrument itself will normally be stored at R.O.C. group headquarters in a portable wooden case which will contain :-

Indicator Unit	- 1
Battery Pack	- 2
Inter-Connecting Cable	- 2
Screwdriver	- 1
Screws, miscellaneous	- 1 set
Ionisation Chamber	- 1

8. The telescopic mounting rod, rod clamp and plastic dome cover with its securing ring and bolts will be stored in the underground post togetherrwith the necessary spanners, The telescopic rod and cable clamp assembly will be kept in the probe pipe.

Fig. 10. The Instrument in its Transit Case.

OPERATING INSTRUCTIONS

Installation

9. (a) Remove the protective cover from the top of the probe pipe and secure the plastic dome cover to the pipe flange by means of the securing ring and bolts. Spanners are provided for this purpose.

(b) Remove the mounting rod from the probe pipe. Remove the cable clamp assembly from the rod and attach it to the ionisation chamber with the screws provided. Make sure that the hole at the end of the cable clamp assembly, through which the mounting rod passes, is in alignment with the hole in the ionisation chamber. The mounting rod should be kept telescoped at this stage.

(c) Remove the protective cap from the end of the inter-connecting cable which is without a locking ring, then push the connector fully into the socket on the ionisation chamber. Tighten the wing screws on the cable clamp assembly making sure that the cable is firmly gripped by the clamp. Do not remove the other protective cap at this stage. It is important that no dust or other foreign matter should be permitted to accumulate at either end of the cable termination. No attempt should be made to clean or dust the cable terminations or their associated sockets. Failure to observe these precautions may render the instrument unserviceable. Care should be taken to prevent kinking or twisting of the cable.

(d) Insert the ionisation chamber into the probe pipe and feed the top section of the mounting rod up the pipe to the full extent of its travel. Pin the two sections of the rod together by means of the split pin chained to the top part of the lower section. Feed the extended rod up as far as the pipe flange and latch the curved part of the handle over the flange. Hold the rod in this position and rotate the eccentric cam fitted to the bottom of the lower rod (just above the handle), until it is possible to drop the fixing pin through the cam into the hole drilled in the handle. Ensure that the rod assembly is quite secure.

(e) Fix the indicator unit to the instrument table using the screws stored in the transit case. Remove the battery pack protective cover and ensure that the pack has been fitted. Take care not to allow the pack to fall away from the indicator unit as the cover actually retains the pack. Replace the protecive cover.

(f) Remove the protective cap from the free end of the inter-connecting cable and plug this cable into the indicator unit.

Check Procedure

10. (a) Remove the protective cover from the top of the indicator unit. Ensure that there are no signs of damage to the instrument. Check that both switches are in the "off" position.

(b) Rotate the "battery test" switch to each of the three positions, i.e., LT, HT1 and HT2. Observe the meter reading at each position. The readings must not be less than the "Battery Min." mark on the meter dial.

(c) Should any of the meter readings be less than the "Battery Min." mark, it will be necessay to change either the batteries or the battery pack. (Details of the procedure are given in paras. 18 to 23 of this handbook). Select the "off" position of the battery test" switch.

(d) Rotate the "operation" switch to the "zero" position and wait until the needle comes to rest. If the meter needle does not lie on the "zero" position on the meter scale, unscrew the bakelite cap over the "set zero" control and, using the screwdriver, make any necessary adjustment. Replace the bakelite cap. (See also para. 17).

(e) Rotate the "operation" switch to the "500" position and wait until the needle comes to rest. If the meter needle does not lie on the "500" mark on the meter scale, unscrew the bakelite cap over the "set 500" control and, using the screw-driver, make any necessary adjustment to produce the correct reading. Replace the bakelite cap. (See also para. 17).

(f) Rotate the "operation" switch to the "on" position. The meter needle will fall to the "zero" mark on the meter scale. (Should the reading not fall to zero, repeat the check sequence above. If, after the double check has been carried out, the reading still lies somewhere above "zero" and it is positively known that no external contamination exists, then there is a fault in the instrument. Refer to paras. 18 to 25).

(g) Rotate the "operation" switch to the "off" position.

(h) These checks should be repeated after the first half-hour of operation and thereafter once every eight hours.

Gamma Radiation Measurement

11. To measure the gamma radiation dose-rate, carry out the following instructions :-

(a) Rotate the "operation" switch to the "on" position. The gamma dose-rate may then be read directly on the meter scale. (See also para. 17).

(b) For operational purposes it may be necessary to leave the instrument switched on during the whole time for which readings are required and further instructions will be given about this. But, in any other circumstances, care should be taken to ensure that the instrment is switched off after use.

Shielded Readings

12. To measure a gamma radiation dose-rate in excess of 500 r.p.h. (the maximum deflection on the scale of the indicator unit) the probe unit is withdrawn down the probe pipe until the reading falls to one-tenth of the reading obtained with the probe unit in its original position. It is not possible to establish prior to the arrival of fall-out the exact position to which the probe unit will have to be withdrawn but it has been calculated that a one-tenth reading will probably be obtained when the ionisation chamber is about four inches below the ground surface, i.e., when the chamber has been withdrawn a distance of about 3'4". The probe rod is capable of being telescoped by 2'8".

13. The following procedure is to be adopted :-

(a) If the dose-rate reading rises to 350 r.p.h., fix the rod clamp to the pipe flange in the post.

(b) When the reading approaches 400 r.p.h., unclamp the handle of the telescopic rod by lifting and turning the eccentric cam. Take care not to allow the probe unit to fall out of the probe pipe.

(c) As soon as a reading of 400 r.p.h. is reached, withdraw the probe unit, remove the split pin holding the two sections of the rod together, telescope the rod, re-insert the split pin to pin the rod in the telescoped position and feed the ionisation chamber up the probe pipe until a reading of 40 r.p.h. is obtained. Slight up or down adjustment may be necessary but this must not take more than a few seconds. Use the clamp to fix the probe unit in this position. (See note below).

(d) If, after attempting (c), a reading of 40 r.p.h. is not obtainable with the probe unit in its highest position, withdraw the probe unit, remove the split pin, extend the rod, replace the split pin and feed the ionisation chamber up the probe pipe until a reading of 40 r.p.h. is obtained. Clamp in this position. (See note below).

(e) In the event of (c) and (d) being unsuccessful, or taking so long a time that the accuracy of the shielded reading is suspect, restore the probe unit to its original position and repeat the whole procedure when the outside dose-rate reaches 450 r.p.h. The shielded reading to be obtained will, of course, now be 45 r.p.h. In the event of a further failure, a final attempt can be made when the outside dose-rate reaches 500 r.p.h., to obtain a shielded reading of 50 r.p.h.

NOTE: Clamping is carried out by positioning the rod in the jaws of the clamp and tightening the wing nut sufficiently to hold the probe unit in position. Over-tightening must be avoided or the rod will be distorted.

14. Readings reduced by a factor of 10 (as described above) will be reported in accordance with current instructions regarding shielded readings.

15. When radioactive decay has taken place and the reading has fallen to 40 r.p.h. with the ionisation chamber in the shielded position, the probe unit is to be restored to its original position, i.e., fully inserted up the probe pipe and with the handle locked in position by means of the eccentric cam. Normal reporting is then resumed.

16. If, exceptionally, the dose-rate were to rise above 5,000 r.p.h., a further withdrawal of the probe unit beyond the position of one-tenth reading (e.g., to a position where a one-hundredth reading were obtained) would enable the operator to continue to record the dose-rate. A drill for this additional withdrawal has not yet been devised.

Time for Meter to Stabilise

17. The instrument takes about three minutes to stabilise. When the meter is switched on, this period of time must be allowed to elapse before the "set zero" and "set 500" check are carried out or dose-rate readings taken.

MAINTENANCE INSTRUCTIONS

Warning

18. Maintenance by R.O.C. personnel of those items which are stored in peace-time at group headquarters is limited to the replacement of the battery pack, changing the batteries in the pack or replacement of the inter-connecting cable. Maintenance of those items stored at posts is described in paras. 28 to 30.

Batteries

19. Should a battery test as detailed in para 10 (b) show meter readings less than the "Battery Min." mark it will be necessary to replace either the battery pack (if a full pack is available) or the batteries in the pack. (It should be noted that the low tension battery has the shortest operational life - see para. 6 (d) above).

20. The pack may be removed from the indicator unit by unscrewing the two screws retaining the cover over the battery pack. Take care not to allow the pack to fall away from the indicator unit as the cover actually retains the pack. Withdraw the pack by pulling down on either side by means of the moulded recesses.

21. Fit the new pack in the reverse order to that detailed above.

22. To change a battery, open the pack by removing the four fixing screws from the corners. The batteries will be displayed as shown in Fig. 12.

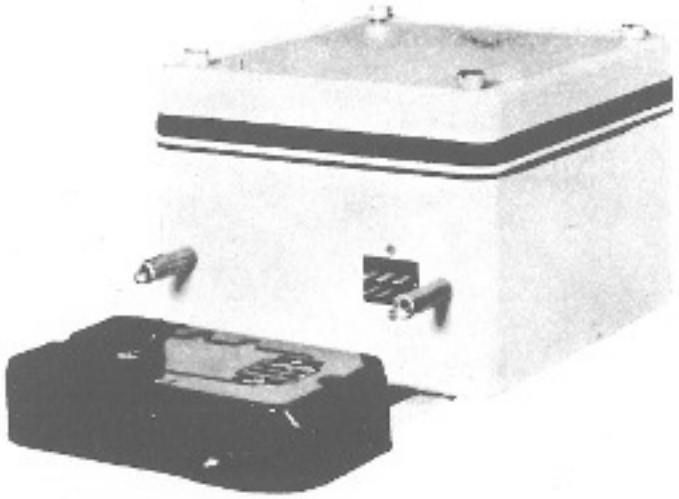


Fig. 11. The Battery Pack removed from the indicator unit.

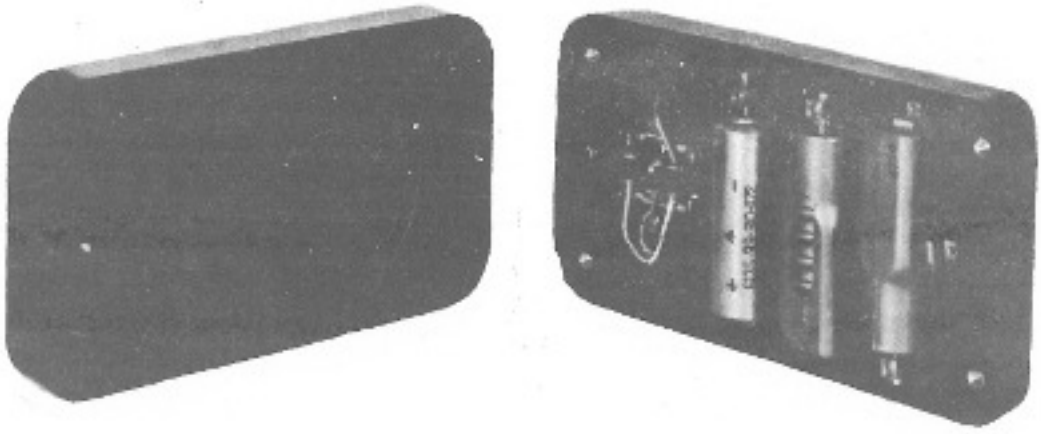


Fig. 12. The Battery Pack open.
Note the side contact on the ~~HT2~~ HT1 battery.

23. The batteries are held in position by screws and may be readily removed. It should be noted that the HT2 battery has a side contact in addition to the normal positive and negative contacts. It is essential that this battery be inserted correctly so that the side contact is made. Failure to do so will render the instrument non-operational although the battery checks will still give satisfactory meter readings.

24. In the event of an emergency, when replacement batteries may not be available, the following procedure may be adopted :-

(a) Should a check of the individual batteries show meter readings of about the "Battery Min." mark or even lower, it may be possible to continue to use the batteries, although more frequent adjustment of the "zero" and "500" settings will be necessary. Eventually the battery voltage will drop to a point outside the range of adjustment of the pre-set controls.

(b) Should two battery packs be available and both packs contain one or more defective batteries, it may be possible to make up a usable pack by a selection of the batteries.

(c) Should a choice be necessary between batteries fitted to HT1 or HT2, it is preferable that HT1 be fitted with the better battery, i.e., the battery which provides the larger deflection of the meter needle when a battery test is being carried out as detailed in para. 10 (b) above.

25. Battery packs must be emptied when being placed in store: separate storage for batteries is essential to prevent possible corrosion.

Inter-Connecting Cable

26. A faulty cable may be suspected if any one of the following symptoms be observed :-

(a) If radioactivity is known to exist outside the post and no significant deflection of the meter needle is observed. This assumes that the "operation" switch is in the "on" position, the meter has been allowed to stabilise and that the check procedures detailed in para. 10 have been satisfactorily carried out.

(b) If a forward deflection of the meter needle is observed when it is definitely known that no radioactivity exists outside the post. This assumes that the "operation" switch is in the "on" position, the meter has been allowed to stabilise and also that the various check procedures detailed in para. 10 have been satisfactorily carried out, in particular that concerned with "set zero".

Repair

27. In any other circumstances where the instrument fails to operate or is in need of repair, it should be returned to group headquarters.

Equipment Stored at Posts

28. A routine inspection at intervals of not less than six months, should be carried out on the telescopic rods, cable clamp assemblies and rod clamps.which are stored in underground posts.

29. The following details should be noted during the inspection :-

(a) Ensure that the telescopic rod and cable clamp assembly are complete.

(b) Look for signs of damage or corrosion on all metal parts. Deposits of dust or dirt should be wiped off, using a clean cloth.

(c) Extend and collapse the telescopic rod to prove that the two parts are not corroded together.

(d) Ensure that the wing screws on the cable clamp assembly can be turned over their complete length. A small quantity of grease should be applied to the threads of the wing screws, if required.

(e) Inspect the rod clamp for signs of rust and, if necessary, apply grease to the screw threads.

30. If any serious fault is observed during the inspection a report should be submitted to group headquarters.

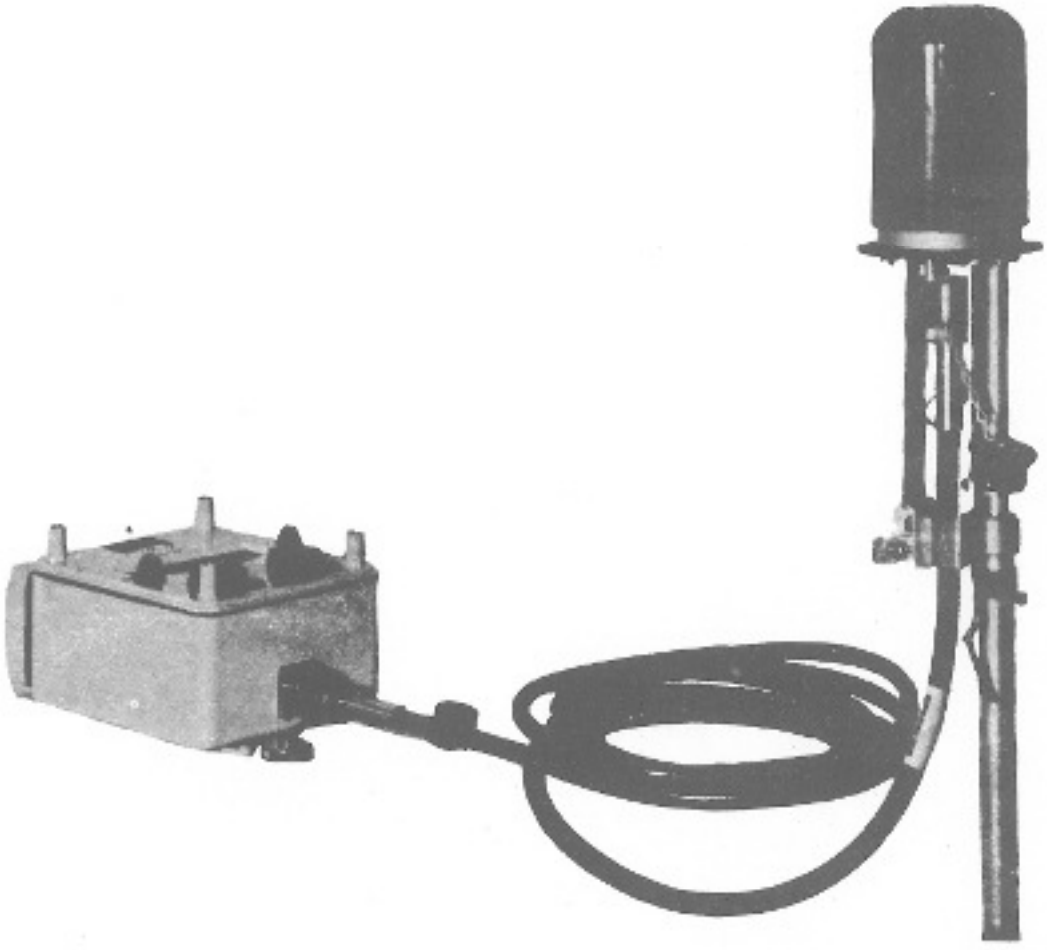


Fig. 13. The complete instrument assembled.

The contamination meter is intended primarily for use at group headquarters, where the problem of dealing with entry and exit of the large number of people comprising an operations room crew is concerned and decontamination facilities are envisaged. It is not likely that the contamination meter will be used operationally at posts but it has its uses in post training; therefore a description of its composition and function will be of interest to post observers also.

The Contamination Meter

THE ROYAL OBSERVER CORPS has recently been issued with a number of Contamination Meters which are designed to detect the presence of radioactive contamination on the skin, clothing, equipment, food, etc.

The chief danger of such contamination is that if radioactive dust is allowed to remain on the skin or on the clothing close to the skin it may result in skin burns or radiation sickness ; there is also the additional risk that some of this dust might later be taken into the body by breathing or swallowing, or through wounds or abrasions and thus cause radioactive poisoning.

The instrument must obviously be extremely sensitive in order to detect even very small amounts of contamination which might be present and accordingly measures from 0 to 10 milli-roentgens per hour.

The two units which together comprise the instrument are housed for carrying purposes in a haversack. These two units are the probe unit, consisting of a Geiger-Muller tube, a valve and other components, and the indicating unit, which contains the majority of the circuit components, the power supply unit, indicating meter and controls. The probe unit and indicating unit are interconnected for operating by a six-foot flexible connector which can also be stored in the haversack when not in use. Both units are hermetically sealed, only the interior of the power supply compartment being accessible to the operator. All plugs and sockets are of the sealed type and, in fact, the only difference between the two types of meter available—known properly as the Meter, Contamination No. 1 and the Meter, Contamination No. 1 Mk. 2—is that the No. 1 Mk. 2 equipment has moulded rubber plugs, sockets and connector, whereas the plugs and sockets of the No. 1 equipment are metal-cased.

POWER SUPPLY. Three types of power supply unit are available as separate alternatives for insertion into the power supply compartment. These are :—

1. Battery Holder No. 1, housing two 150V batteries.

2. Power Unit, Vibrator No. 1, operating from four 1.35V cells.

3. Power Unit, Mains No. 1, operating from A.C. mains, 100–120V or 200–250V, 40–60 C/S.

The two power units are hermetically sealed. The equipment when contained in the haversack measures 10 in. in length, 7 in. in width and is 11 in. high. The weight, complete with power supply unit, is about 17 lb.

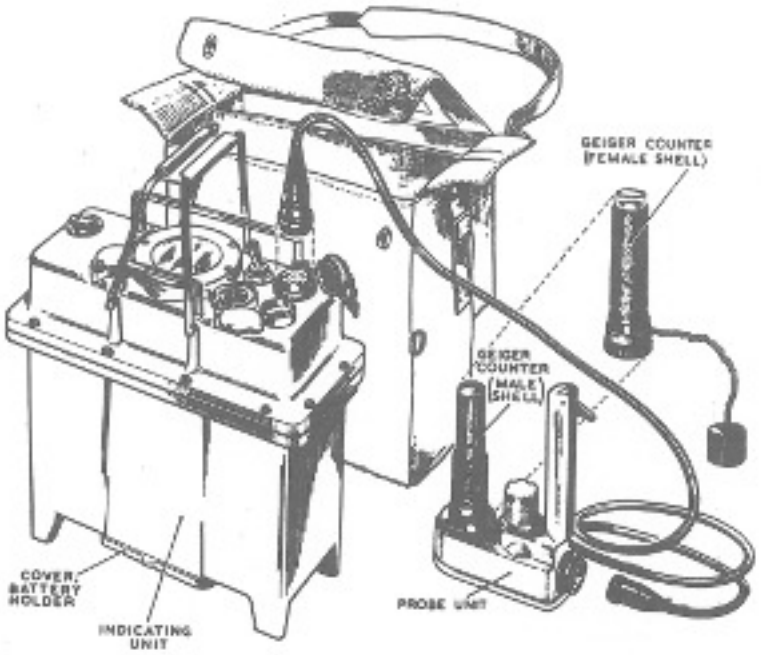


Fig. 1. *The two units comprising the Contamination Meter: on the left, the indicating unit, and on the right, the probe unit.*

CONTROLS. On the top of the indicating unit are a number of controls : these are as follows :—

Headphone Socket. A socket of moulded rubber for connecting headphones to give audible indication of contamination. Headphones will not be used by the R.O.C.

On-Off Switch. For switching on the power supply to the instrument.

Meter. A dial indicating in milli-roentgens per hour (mr/hr) the radiological dose-rate being detected by the probe unit. The meter is also used to indicate the state of the power supply when the test switch is operated. The scale is roughly logarithmic and reads up to 10 mr/hr. In addition it has three coloured segments—green (up to 1.3 mr/hr), amber (1.3 mr/hr to 4 mr/hr) and red (over 4 mr/hr).

Test Switch. A spring-loaded switch, which returns automatically to the "off" position. Used for checking the state of the power supplies.

Connector Plug. This joins the socket of the connector to the probe unit. A chained cover is fitted, which should be replaced when the socket is removed.

Pre-set Control "A". An eleven position switch used for setting the voltage applied to the Geiger-Muller tube. This is only to be altered in specially equipped workshops and is not to be touched by R.O.C. personnel. A slide-cover over is fitted to this control.

Pre-set Control "B". A three-position switch (also protected by a slide-over cover), which is used for adjusting the power supply voltage to the instrument. This control should only be altered if operation of the test switch produces a reading on the meter outside the "Test" region.

Humidity Indicator. An indicator which changes from blue to pink when there is dampness present inside the indicating unit. This also incorporates the dessicator unit which is replaceable, but only in properly equipped workshops.

FITTING THE SUPPLY UNIT. To prepare the instrument for use, the appropriate supply unit miust be fitted as follows :—

Battery Holder No. 1. Insert the battery holder complete with batteries into the power supply compartment on the underside of the indicating unit, ensuring that the locating pin on the base of the indicating unit enters the locating hole in the flange of the battery holder, and the four pins inside the power supply compartment enter the sockets on the batteries. Turn the two clamps until the battery holder can be pushed fully home, then turn them again to hold the battery holder in position.

Power Unit, Vibrator No. 1. To fit the four 1.35 cells, in this unit, loosen the two captive screws of the tray marked "Batteries" and withdraw the tray. Turn the two clamping strips carefully to their longitudinal positions in the tray. Insert the four 1.35 volts as marked on the tray—the brass endcap is the + terminal. Whilst holding down the cells, carefully turn the clamping strips to hold them in position. Replace the tray into the vibrator unit and tighten its captive fixing screws. Insert the vibrator unit complete into the power supply compartment of the indicating unit in the same way as the battery holder is inserted and clamped in position.

Power Unit, Mains No. 1. Check the voltage of the main power supply and that it is an A.C. source having a frequency between 40 and 60 cycles per second. Adjust the mains tap switch on the mains unit to the appropriate setting, using the screwdriver provided in the haversack. Insert the mains unit into the power supply compartment of the indicating unit in the same way as the battery holder is inserted and clamped into position. Connect to the mains power supply source and switch on.

SETTING UP. To set up the instrument :—

1. Remove the indicating unit, probe unit and connector from the haversack.

2. Remove the chained cover of the plug on the indicator unit.

3. Connect the probe unit to the indicating unit using the six-foot connector provided. On instruments having moulded rubber plugs and sockets, the rubber pips on each part must be aligned before insertion. On instruments having metal cased plugs and sockets, screw home the clamping rings on the connector.

4. Replace the indicating unit into the haversack if the instrument is to be operated whilst being carried.

5. If the Geiger-Muller tube is not already fitted, remove it from its packing, and insert it with its keyway correctly located in the two-pin socket on the probe unit, ensuring that the flexible skirt of the tube is secured under the flange of the socket.

6. Test the power supply by pressing the test switch to the "On" position and, whilst the switch is still pressed, check that the meter pointer comes to rest within the region marked "Test" on the dial. If there is no reading at all, check that the plug and socket connections of the connector are firmly made, and, if the mains power unit is being used, check that the supply is switched on. If there is a reading, but the pointer is outside the "Test" region on the dial, slide the cover off the pre-set control "B" and adjust it with the screwdriver provided. If meter indications cannot be brought up to the "Test" region and a battery holder or vibrator unit is being used, change the batteries.

FUNCTIONAL CHECK. A functional check can be made by setting the "On-Off" switch to the "On" position, and, with the probe unit well removed from any known radio-active source observing slight "kicks" of the meter pointer. These "kicks" are known as "background count" and, being due to normal natural radio-activity, give an indication that the instrument is functioning. If a small radio-active source, such as a luminous-faced watch is brought nearer to the probe unit, the reading should increase. If the meter pointer does not move, the voltage applied to the G.M. tube may be incorrectly set on the pre-set control "A", and the instrument should be considered unserviceable.

OPERATIONAL USE. The contamination meter, as has been stated, is a very sensitive instrument and will give a false reading of the suspected contamination if the probe unit is used without shielding in an area of general contamination. While it is being used, the probe unit must be placed

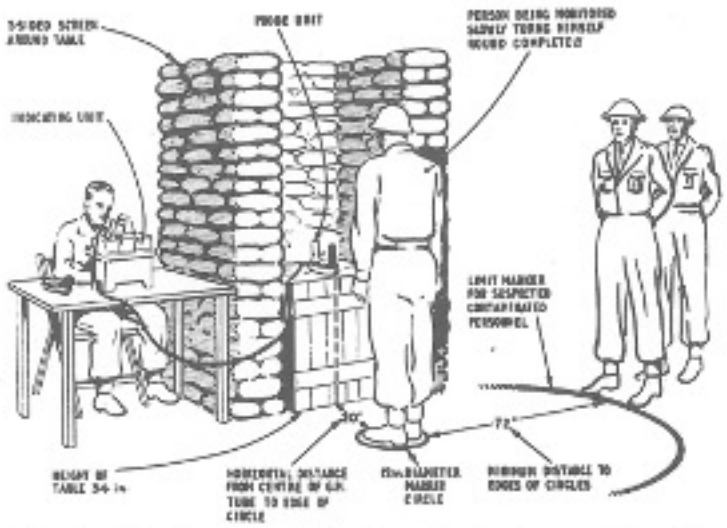


Fig. 3. *Operational use of the Contamination Meter. The shelter around the probe unit is of sandbags or some equally effective protection.*

in a position so that it is adequately shielded from all radioactive sources other than that under investigation.

Before commencing to use the instrument the probe unit should be placed in its operating position and the "background count" should be noted. The suspect person, clothing, food, etc., should then be placed about 20 inches from the probe unit. Other suspect material should not be closer to the probe unit than six feet. The extent of contamination is assessed by deducting the "background count" from the reading indicated on the meter.

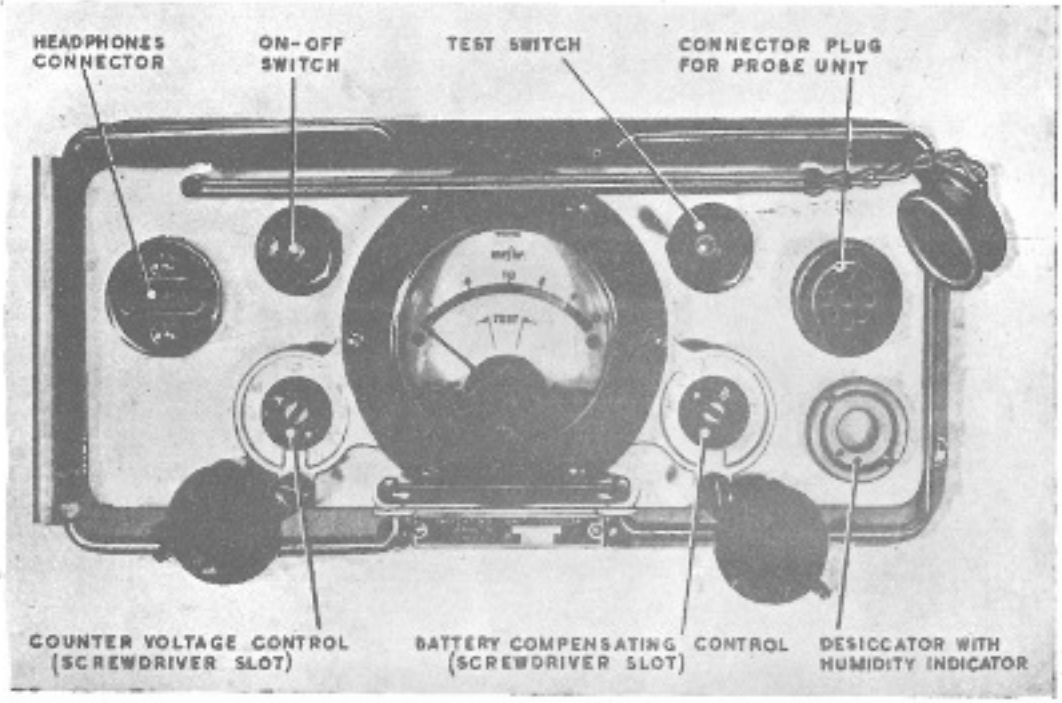


Fig. 2. *The dial and controls of the indicating unit.*

In the first 24 hours after a nuclear burst the reading should not exceed 4 mr/hr, for safety. That is, any reading in the red segment of the dial indicates danger.

After 24 and up to 100 hours the reading should not exceed 1.3 mr/hr for safety. Thus any reading in the red *or amber* segment indicates danger.

CARE AND MAINTENANCE. For satisfactory operation the instrument depends very largely upon the G-M tube, which must be handled with care and must on no account be subject to rough usage. The rest of the instrument is not so susceptible to damage but reasonable care must be taken when using it. For example, the flexible connector should not be subjected to too much strain.

Care should be taken to ensure that food, clothing, personnel, etc., which is suspected of being contaminated, does not come into direct contact with the instrument as the instrument itself might thus become contaminated.

When the humidity indicator in the indicating unit or in the power units turns pink, the complete unit must be returned to the workshops to check the hermetic sealing. In no circumstances is the humidity indicator to be removed from the unit nor are the hermetically sealed units to be opened by R.O.C. personnel.

Always make sure that the "On/Off" switch is returned to the "Off" position after use.

If the instrument is not required for use for a time, and if either a battery holder or vibrator unit is fitted, all batteries should be removed to prevent corrosion.

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