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HOME OFFICE
CIVIL DEFENCE

Manual of Basic Training

VOLUME II

BASIC
CHEMICAL WARFARE

PAMPHLET No. 1

LONDON: HIS MAJESTY'S STATIONERY OFFICE

1949

ONE SHILLING NET

GENERAL PREFACE

The series of Civil Defence handbooks and pamphlets is produced under the authority of the Home Secretary by the Civil Defence Department of the Home Office with the assistance of and in co-operation with the Secretary of State for Scotland and other Ministers concerned.

Measures for safeguarding the civil population against the effects of war which these publications describe, have become an essential part of the defensive organisation of this country. The need for them is not related to any belief that war is imminent. It is just as necessary that preparations for Civil Defence should be made in time of peace as it is that preparations should be made for the Armed Forces.

The publications cover, as far as is possible, measures which can be taken to mitigate the effects of all modern forms of attack. Any scheme of Civil Defence, if it is to be efficient, must be up-to-date and must take account of all the various weapons which might become available. The scale of bombing experienced in Great Britain during the 1939-45 war might be considerably exceeded in any future war, and types of weapons and tactics which were not experienced in this country might conceivably be used against it in the future. It does not follow that any one of the weapons, e.g. the atomic bomb, will necessarily be used, and it is most important that a proper balance is held between what is likely and what is possible.

The use of poison gas in war was forbidden by the Geneva Gas Protocol of 1925, to which this country and all the other countries of the Western Union were parties. At the outbreak of a war, His Majesty's Government would try to secure an undertaking from the enemy not to use poison gas. Nevertheless the risk of poison gas being used remains a possibility and cannot be disregarded any more than can certain further developments in other scientific fields.

The publications are designed to describe not only precautionary schemes which experience in the last war proved to be extremely effective in preventing avoidable injury and loss of life, or widespread dislocation of national industries, but also the training, both technical and tactical, which will be required of the personnel of the Civil Defence Services if they are to be ready effectively to play their part if war should ever break out. The publications aim at giving the best available information on methods of defence against all the various weapons. Information is not complete in respect of some of these weapons and the best methods of countering them, but as results of experimental work and other investigations mature, they will be revised and added to from time to time so that the Civil Defence Services may be kept up-to-date and their training may be on the most modern and experienced lines.

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INTRODUCTION

The purpose of this pamphlet is to set out in simple form the basic principles of personal and collective protection against Chemical Warfare.

The information it contains should enable every member of the Civil Defence Organisation to understand the properties and effects of War Gases, and to appreciate the risks which these entail.

The pamphlet should also be of interest to the general reader since the protection of the civil population must depend largely on the action of individuals themselves. A knowledge of the basic principles and of the correct way of applying any available measures of personal protection should enable members of the general public to look after themselves, and thus ensure an effective national defence against gas warfare.

The Germans did not use gas during the 1939-1945 war, but on its conclusion it was found that they held large stocks of both new and old war gases and some of these were ready for use in bombs and shells.

Though we cannot be certain why they did not use this weapon, it is fair to assume that the knowledge that the population of this country all possessed efficient respirators and were trained in their use, together with the possibility of retaliation, was an important deterrent.

It should, however, not be assumed that gas will not be encountered in future wars.

New gases have been discovered, and the fact that gas was not used during the last war might well increase the possibility of its future use, in the hope of achieving the surprise upon which the success of any gas attack largely depends.

Gas warfare is, therefore, still one of the risks that the civil population must be prepared to face and gas training and provision of protection must continue.

A number of unused paragraphs have been left at the end of each chapter to permit of any additions that may be considered necessary from time to time. This, it is hoped, will avoid the necessity of re-numbering paragraphs in Chapters which would otherwise have to be done.

CHAPTER I

I. WAR GASES

Gas is a chemical weapon relying on its poisonous effects and, like other weapons of war, its object is to kill or incapacitate. As its name implies it may be used as invisible vapour. It may be employed as minute solid particles or liquid droplets which are airborne and invisible ; or it may be used as liquid which evaporates to form invisible vapour—both liquid and vapour being dangerous.

War gases may be divided into two main categories :—

Non-persistent and persistent.

Non-persistent Gas

Non-persistent gases are those which will remain effective for only a short time, so that the locality in which they have been released quickly ceases to be dangerous. They are liberated in the form of airborne droplets of liquid, particles of a solid, or as a true gas. They are therefore at the mercy of the prevailing weather conditions and are quickly dispersed.

Persistent Gas

Persistent gases are liquids which evaporate slowly, giving off poisonous vapour and therefore "persist" or remain dangerous for some considerable time, unless something is done to destroy or neutralise the liquid.

2. CLASSIFICATION BY EFFECTS

The division of gases into the two main groups—non-persistent and persistent—is convenient because as soon as it has been determined to which category the gas belongs, it is possible to decide whether the area in which the gas has been liberated requires special treatment.

Gases may also be classified according to the effects upon the human body, and such a system of grouping is more satisfactory when considering the subject of personal protection.

This method of classification is by no means rigid, for some of the gases possess the characteristics of more than one group, but the principal war gases may be divided into five main groups. These groups, placed in what is now considered to be their order of importance are as follows :—

- (i) Nerve Gases
- (ii) Blister Gases
- (iii) Choking Gases
- (iv) Tear Gases
- (v) Nose Gases

For the purpose of personal protection it is important to know the general characteristics of these groups. In the sections which follow, therefore, the characteristics and effects of the above-mentioned gases are described in terms which are, as far as possible, applicable to each group as a whole. Those interested in the specific properties of individual gases will find particulars of the better known ones in the "Chart of War Gases" Appendix "A."

3. CHARACTERISTICS AND EFFECTS

The effects produced by any war gas depend on the amount of the gas and the length of time a person is exposed to it. The stronger the concentration, the greater will be the injury produced in a given time. It should not, however, be assumed that small quantities of gas will always cause injury.

(i) Nerve Gases

(a) Characteristics

The members of this group are persistent or semi-persistent liquids which give off invisible vapours. These vapours have practically no smell. They are absorbed only through the eyes and breathing passages and cannot be detected except by their effects.

The liquid can be absorbed through the skin and will penetrate clothing and may be absorbed by the skin underneath. Neither vapour nor liquid cause irritation or blistering.

(b) Effects

VAPOUR—Small doses absorbed in either vapour or droplet form cause contraction of the pupils of the eyes resulting in dimness of vision and difficulty in focussing on near objects. They also cause running of the nose, headache and tightness of the chest. These symptoms develop in 5—30 minutes, depending on the dose.

If larger doses are absorbed, the symptoms described above will be followed by death. These more serious symptoms develop in about 5 minutes to 6 hours depending again on the dose.

LIQUID—Splashes of liquid on the skin will be rapidly absorbed, even large splashes being absorbed in a few minutes. The symptoms are the same as those produced by exposure to vapour. If liquid Nerve gas is swallowed in contaminated food or water it will cause death.

There may be a delay between the initial symptoms and the onset of convulsions and possibly death, during which period it will be impossible to say whether or not a fatal dose has been received. Anyone, therefore, who shows the initial symptoms, contraction of the pupils, headache, etc., must be regarded as seriously ill and treated accordingly.

(c) Protection

The respirator, provided it fits properly and is in an efficient condition, will protect the eyes and breathing passages against Nerve gases, but will not, of course, prevent absorption of the liquid through the skin of other parts of the body.

(ii) Blister Gases

(a) Characteristics

The members of this group are liquids of varying degrees of persistence, giving off invisible vapour. They have great powers of penetration and there are few materials into which both liquid and vapour will not be absorbed.

Contact with the liquid will cause injury, as will exposure to the vapour, provided the period of exposure to the latter is sufficiently long.

Both liquid and vapour will attack any part of the body.

Some members of the group have pungent smells and irritant effects on the nose and eyes, and thus will give early warning of their presence.

Others have faint and indefinite smells which are unlikely to be recognised in air raid conditions.

(b) Effects

VAPOUR—Exposure of the eyes to vapour causes no immediate discomfort, but if prolonged, may result in closure of the eyes after some hours, with temporary blindness for one or two weeks.

Breathing of the vapour over long periods, may cause serious injury to breathing passages and lungs which may prove fatal.

Exposure of the skin to vapour causes no immediate discomfort or irritation. If the exposure is prolonged or the concentration of vapour is high, redness of the skin and severe irritation will develop in 2—24 hours. This redness may soon begin to show numerous small blisters which run together to form larger ones.

LIQUID—A small drop of liquid in the eye, unless treated immediately, will usually cause permanent blindness in that eye.

Liquid swallowed in contaminated food or water, and liquid in the form of minute airborne droplets which are inhaled, will both cause severe internal injury.

Liquid on the skin will be rapidly absorbed and may or may not cause a stinging sensation. Except for this, there will be no apparent effects until 15 minutes to about 2 hours afterwards, when redness and irritation of the skin will develop, and this will be followed by the formation of blisters within 1 to 8 hours.

(c) Protection

The respirator will protect the eyes, nose, breathing passages and lungs. Special clothing is required to protect other parts of the body.

(iii) Choking Gases

(a) Characteristics

The members of this group are true gases or liquids which evaporate quickly. They are therefore non-persistent or only slightly persistent.

Those which have been used in war have pronounced and offensive smells. When inhaled in large quantities they cause serious damage to the lungs which may prove fatal.

(b) Effects

Their effects are immediate and unmistakable. The initial symptoms are irritation of the nose and throat, causing coughing which may be violent. There is a feeling of tightness in the chest and a pain behind the breast bone. A certain amount of irritation of the eyes is common.

After exposure the initial symptoms may subside for a time, during which no ill effects are felt, but this may be followed by the appearance of the more serious symptoms. In consequence of this, no physical exertion should be undertaken in the 24 hours following exposure to Choking gases, if the initial symptoms have been severe.

(c) Protection

The respirator gives complete protection against Choking gases.

(iv) Tear Gases

(a) Characteristics

The gases in this group may take the form of invisible minute airborne solid particles, or invisible vapour from persistent liquids. They are effective even in low concentrations.

(b) Effects

The effects which are immediate, are smarting of the eyes and a profuse flow of tears. They cause no permanent injury to the eyes unless solid or liquid Tear gas enters the eye.

(c) Protection

The respirator gives complete protection.

(v) Nose Gases

(a) Characteristics

The gases in this group are solid arsenical compounds, which, when dispersed by heat or explosion, produce vast numbers of minute airborne particles. These are invisible and except when highly concentrated have no smell.

(b) Effects

When inhaled these gases are extremely effective even in very low concentrations, but the onset of symptoms is delayed for a few minutes.

They produce a burning pain at the back of the nose, in the throat and chest, a fullness of the head and a general feeling of discomfort. Sneezing, coughing, headache and aching of the gums are common.

The symptoms tend to increase after putting on a respirator or getting clear of the cloud, since the particles which have been inhaled remain in the nose, throat and chest. Though they cause much discomfort these symptoms pass off quickly leaving no ill effects.

(c) Protection

The respirator gives complete protection.

CHAPTER II

9. BEHAVIOUR OF GAS UNDER DIFFERENT CONDITIONS OF WEATHER AND GROUND

The effectiveness of gas may be considerably influenced by both the weather conditions at the time and the characteristics of the area in which it is released.

(i) Weather Conditions

The principal weather conditions affecting the behaviour of gas are wind, temperature and rain.

(a) Wind

Non-persistent gas will be carried along by the wind, being diluted and dispersed all the time. The stronger the wind, the more rapid will be this dilution and dispersal and hence the shorter the distance the gas will travel in effective concentration.

Persistent gas will evaporate more quickly under the influence of a strong, drying wind than in a calm, but there will be little increase in the danger from vapour on account of its more rapid dilution and dispersal.

(b) Temperature

In a high temperature and bright sunlight there is a tendency for upward air currents to develop, and in consequence non-persistent gas will be dispersed upwards and as it rises will also spread out sideways. Temperature chiefly affects persistent gas. In hot weather persistent gas evaporates more quickly than in cold and the vapour danger is correspondingly increased unless there is a strong wind blowing. In very cold weather some persistent gases may freeze and in this state they will give off little or no vapour until they begin to thaw. Contact with frozen blister gas, however, will still cause blistering of the skin. Persistent gases are more readily absorbed by some materials, e.g., tarmac road surfaces, when these have been warmed by the hot sun.

(c) Rain

Rain will have little effect on either non-persistent or persistent gases unless it is really heavy. Heavy rain tends to wash gas out of the air and may wash away liquid persistent gas on the surface to other places where, however, it may still be dangerous.

(ii) Ground Characteristics

In open country gas will drift with the wind, passing round or over obstacles such as hedges, small clumps of trees, etc.

Gas released in a built-up area will drift before the wind following the direction of the streets. Where the wind is at an angle to the line of a street some of the gas will travel down side streets. Thus a fairly wide area in a general downwind direction from the point of release of the gas will be dangerous. There will be a tendency for non-persistent gases or the vapour of persistent gases to form pockets in hollows or



Fig. 1

sheltered places where there is little air movement. Dangerous concentrations may therefore remain in such places for some time after the main volume of the gas has been carried away by the wind (see Fig. 1). The fact that war gases themselves are heavier than air will not prevent dangerous concentrations from piling up against and passing over the top of any but the tallest buildings if they cannot find an easier way

round them. Porous surfaces will more readily absorb liquid gas than hard surfaces. The gas thus absorbed being less effected conditions will remain dangerous for a long period.

(iii) Summary

Gas will be most dangerous in mild weather with a light wind to drift it considerable distances in high concentration. Both non-persistent and persistent gases are likely to be more dangerous in built-up areas than in open country.

CHAPTER III

13. GAS ATTACK

If gas is used in attacks on the civilian population of this country, the gases most likely to be used are those of the Nerve, Blister and Choking groups. The possibility of a tear gas with a pronounced smell being used in conjunction with a blister gas to mask the latter's presence should not, however, be overlooked. Effective attacks could be made by aircraft dropping bombs or releasing liquid gases in the form of spray.

(i) Bombs

Bombs filled with Nerve and Blister Gases may be of large, medium or small capacity.

The fuzes used in large and medium type bombs may be such as to burst the bomb case on impact or to burst the bomb case at a pre-determined height above the ground.

With an impact fuze a part of the filling will be liberated in the form of small droplets and vapour, which will drift away with the wind.

The high explosive burster, which is initiated by the fuze, may be powerful enough just to open the bomb and splash its contents around the point of burst heavily contaminating everything in the vicinity. This contamination will continue to give off dangerous vapour which will drift downwind.

On the other hand the burster may be such as to open the bomb and disrupt the filling thus dispersing the liquid in a mixture of much smaller droplets and vapour which will drift with the wind, leaving little or no liquid contamination.

With the air burst fuze practically the whole of the liquid contents of the bomb will fall like rain over a limited area beneath. Drops of Nerve or Blister gas falling on exposed skin or entering the eyes are extremely dangerous and drops of liquid blister gas on clothing may cause injury by blisters unless the clothing is removed soon enough.

Bombs filled with Choking Gas

Large capacity bombs only will be used with this type of filling and will be fuzed to open on impact.

When such a bomb with a choking gas bursts, a very highly concentrated cloud of gas forms immediately in the vicinity. This will drift with the wind, being gradually diluted and dispersed as it travels. In weather conditions favourable to the use of gas the concentration may be sufficiently high over the first few hundred yards of its travel to kill unprotected persons in its path. For a further few hundred yards it is likely to remain sufficiently concentrated to cause serious injury to unprotected persons.

(ii) Spray

Persistent liquid gases of the Nerve and Blister groups could be released from containers in aircraft. The liquid would split up into small drops and fall like a short, sharp shower of rain over a fairly wide area. This method of attack is not considered to be effective

enough against towns and cities to make it worth while and is more suited to attacks on troops in the field.

Whether from low flying or high flying aircraft the principal danger from Spray attacks lies in the possibility of large numbers of people in the open being injured by drops of the gas falling on their exposed skin and clothing. There will be little danger from Blister gas vapour and Blister gas contamination of the ground is unlikely to be heavy enough to call for special decontamination action. If, however, Nerve gas is dropped by this method the vapour danger will be considerable.

CHAPTER IV

17. RECOGNITION OF THE PRESENCE OF WAR GAS

In the past all members of the Civil Defence Services were taught to take certain steps to detect war gas and to recognise its type.

The Public, too, were encouraged to learn enough about simple methods of detection to enable them, at least, to realize the presence of war gas.

The recommended methods were well suited to the conditions which then prevailed. All known war gases could be readily detected by one, or a combination of, the tests advocated and, if these were properly carried out, there was no danger to the individual using them.

With the arrival of nerve gases as possible agents in gas warfare, however, these conditions have changed. Owing to the very insidious, rapid, and dangerous effects of these gases and, except in the liquid form, the absence of any means of recognising their presence until the initial symptoms (see Chapter I—Nerve Gases (*b*) Effects) show they have already attacked the body, protection can only be ensured by putting on the respirator immediately an enemy air attack takes place in the vicinity or the "gas warning" is given and, by keeping it on until the "gas clear" signal is given. *To use the sense of smell would be dangerous and should not be attempted.*

For members of the C.D. Services and for ordinary individuals this prohibition reduces the means of recognising the presence of war gases and identifying their type to what can be done while wearing the respirator, i.e., to what can be seen, what can be heard, what can be felt on exposed parts of the body and to chemical indicators.

It may be possible to see faint vapoury clouds of some non-persistent gases such as those of the "choking" group or the "nose" group but this is unlikely except near the source of the gas.

It will be possible, also, to see wet patches and splashes of liquid persistent gas except in wet weather when they may not be obvious.

Such liquid might be Nerve, Blister or Tear Gas.

As regards hearing, there may be a noticeable difference between the sharp crack of the explosion of an H.E. bomb and the duller sound of a gas bomb, which has a small bursting charge and contains a large quantity of gas, whether the latter bursts on the ground or in the air.

A loud, sharp explosion cannot, however, always be assumed to be an H.E. bomb because the large-capacity gas bomb, designed to produce a highly concentrated cloud of minute droplets and vapour, may sound much the same, but any suggestive indications may be useful if considered in conjunction with other observations.

With the eyes, nose and lungs protected by the respirator, recognition of the presence of gas by the sense of feeling will be confined to the appreciation of wetness on exposed parts of the body from liquid of the persistent Nerve, Blister and Tear Gases.

18. CHEMICAL DETECTORS

(i) Detector Paint

A special paint known as Detector Paint was issued during the last war to the Civil Defence services for detecting the presence of liquid gases, but this is now being superseded by Detector Powder.

Detector paint may still be used by the military and is usually greenish-yellow or brown in colour. When liquid Nerve or Blister gases come into contact with it, the paint changes to a reddish colour. This colour change may not be easy to see if the liquid itself is of dark colour or the paint is dirty. Certain other liquids, among them Tear gas, will also produce a reddish reaction.

Detector paint had two principal uses :—

(a) Spray Detectors

A board about 18" square painted with detector paint and set in the open at a slight slope, so that drops of liquid would tend to run and leave the red reaction easier to see.

(b) Ground Detectors

Strips of paper painted with detector paint and fixed over the end of a stick such as a broom handle were used to test suspicious patches or splashes of liquid on the ground.

(ii) Detector Powder

A special Detector Powder has been developed which can be used to detect the presence of liquid gases and identify them. The powder is the colour of white pepper, and will be supplied in canisters with perforated ends so that it can be sprinkled on to any suspicious liquid. It gives different reactions with liquid Mustard gas it changes to scarlet—and with liquid Nerve gas to a yellow-orange colour. By sprinkling, it can be brought into contact with liquid droplets on any type of surface, rough or smooth, without risk of droplets in cracks and crevices escaping detection.

(iii) Pocket Vapour Detector

Apparatus known as the Pocket Vapour Detector is available for detecting the presence of *blister gas vapour* and for assessing the degree of danger arising from such concentrations.

Such detectors will be issued to the Civil Defence services at a later date.

Though the detection of gas has become more difficult, the giving of gas warnings will still be a responsibility of the Civil Defence Services, and all members of the public too must be continually on the look-out for unusual sounds of bursting bombs ; for symptoms in themselves and others ; for splashes of liquid ; suspicious smoke or other visible signs for which there is no natural explanation, and if there are any indications of the possible presence of gas, the respirator must be put on immediately, if it is not already being worn.

CHAPTER V

24. PERSONAL PROTECTION — I RESPIRATORS

War gases attack by way of the eyes, nose and mouth and, in some cases, through the skin of any part of the body. Protection against gas is obtained, therefore, by preventing gas from gaining access to vulnerable parts of the body. In the case of the individual this can be done by wearing a respirator and, when necessary, special clothing, described in a later chapter.

The respirator in its simplest form consists of a covering for the eyes, nose and mouth with a canister attached, through which all air breathed in by the wearer must pass. This canister, known as the container, is filled with material which will remove all traces of war gas from air breathed through it, and is fitted with a non-return valve to prevent the moist used air passing out through it and causing damage to its contents.

25. PROTECTION AFFORDED

The respirators described in this chapter will give protection against all war gases in concentrations a great deal stronger than any likely to be met in the open and will remain effective even if worn repeatedly during successive gas attacks. It must be remembered, however, that they have not been designed to protect against some of the gases which may be met in industrial processes or in every day life. For instance, they will not protect against the deadly carbon monoxide gas, present in coal gas and the exhaust fumes of motor cars.

26. TYPES OF RESPIRATOR

Different kinds of respirator were produced to meet the special requirements of different types of wearers having regard to the risks they might have been called upon to face and the nature of their duties whilst exposed to gas. The three principal types were :—

Civilian types for the general public who were not expected to remain for long periods or undertake strenuous work in gas affected atmospheres.

They comprised the Civilian Respirator, the Small Child's Respirator, the Anti-gas Helmet for babies, the Helmet Respirator and the Hospital Respirator.

The Civilian Duty Respirator. A more robust type for those who had to remain at their posts and carry on with their normal duties whether gas was present or not.

The Service Respirator. A more elaborate type for those who might have been called upon to remain for long periods and to work hard in high concentrations of gas.

The wearer of any respirator must inevitably experience some slight resistance to breathing and be handicapped to a certain extent in his normal activities. Every effort has been made to reduce those drawbacks to a minimum by giving the clearest and widest field of view possible and, where necessary, fitting an outlet valve to allow easy escape of the air which is breathed out.

Sidestraps exerting a pull in line with the axis of the container.

T buckle not too far down at back of the head.

Eye panel well clear of nose.

Eyes about the middle of the eye panel

Snug fit under the chin.



Fig. 2

The Civilian Respirator being worn.

(i) The Civilian Respirator

This consists of a mask of thin sheet rubber with a large window of non-inflammable transparent material. The container fits into the facepiece and is secured by means of a stout rubber band. The rubber of the mask, being thin and flexible, makes a gas-tight contact with the skin of the face all round. The mask with container attached is held in place by three webbing bands which pass through a T-shaped buckle at the back of the head (see Figs. 2 and 3).

When the wearer breathes in, air is drawn through the container where all traces of war gas are removed. When he breathes out the valve at the inner end of the container closes to prevent his moist

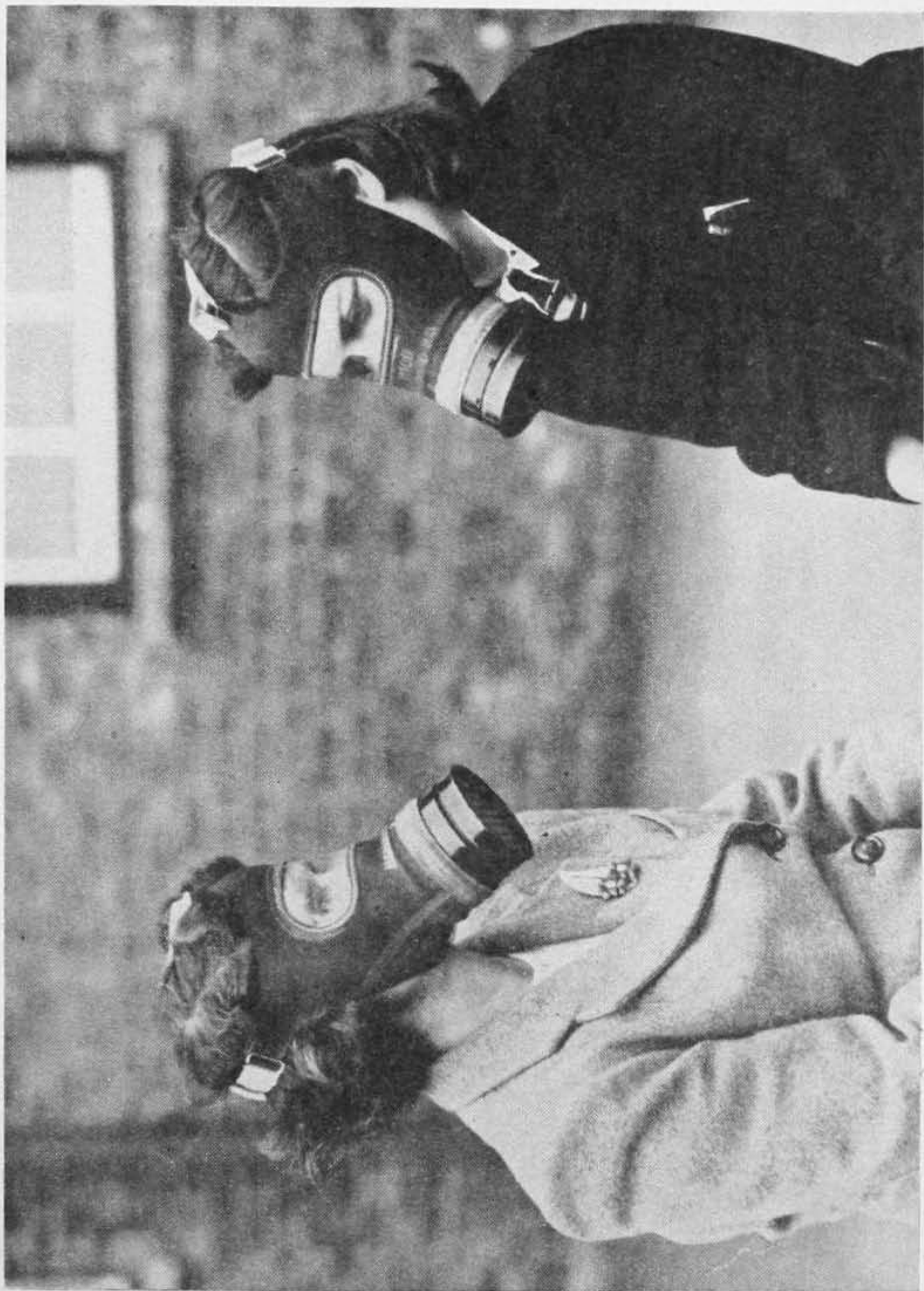


Fig. 3. Woman and child wearing Civilian Respirators

breath from going out through the container and it escapes from the facepiece past his cheeks.

Civilian Respirators were made in three sizes, large, medium and small.

A stout cardboard carton was issued with each respirator to contain it when not in use. (*See Figs. 4 and 5.*)

(ii) The Small Child's Respirator

This respirator was designed for children sufficiently developed to wear a respirator but not big enough to be satisfactorily fitted with the

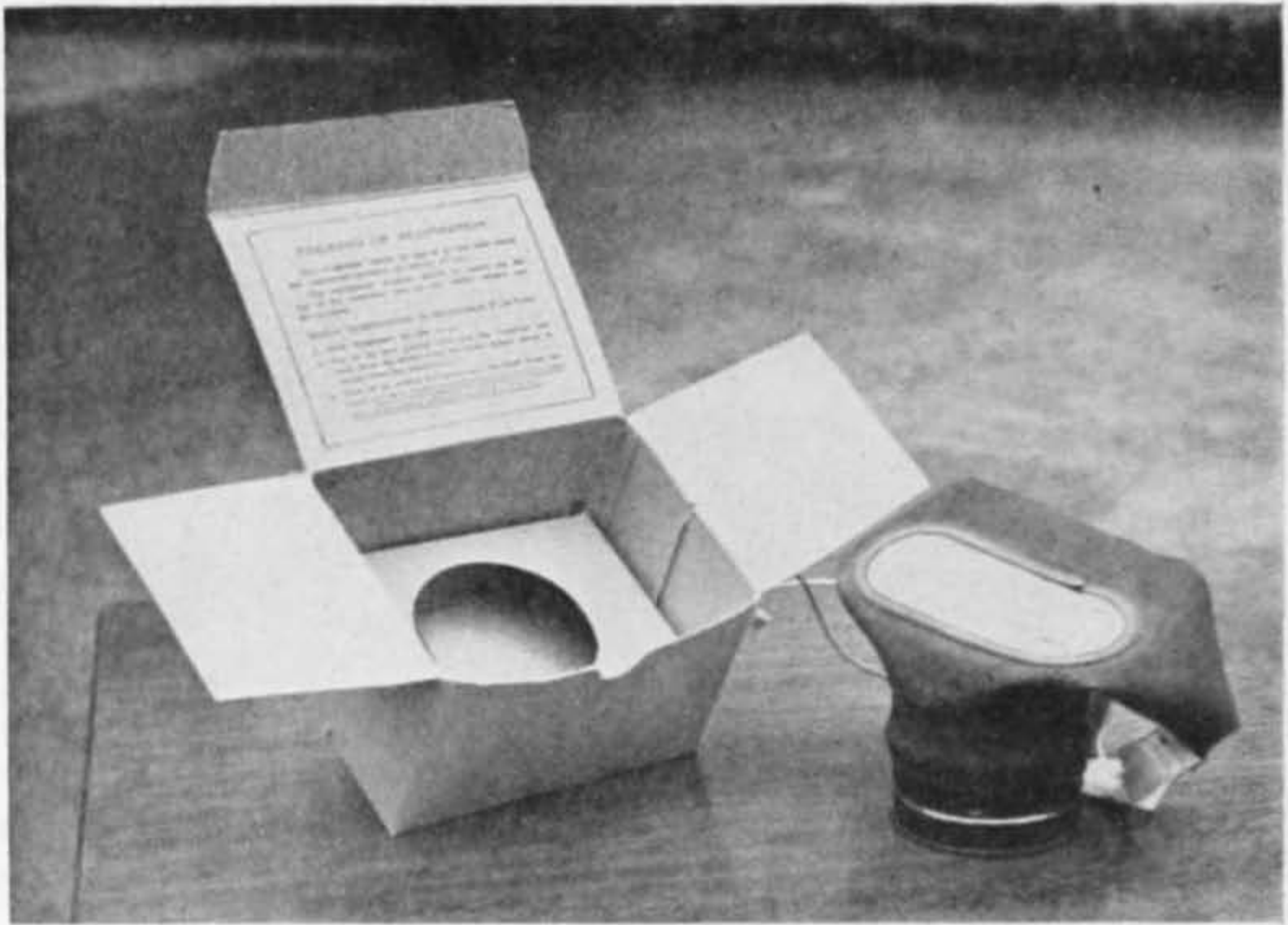


Fig. 4.
Civilian Respirator with its carton.

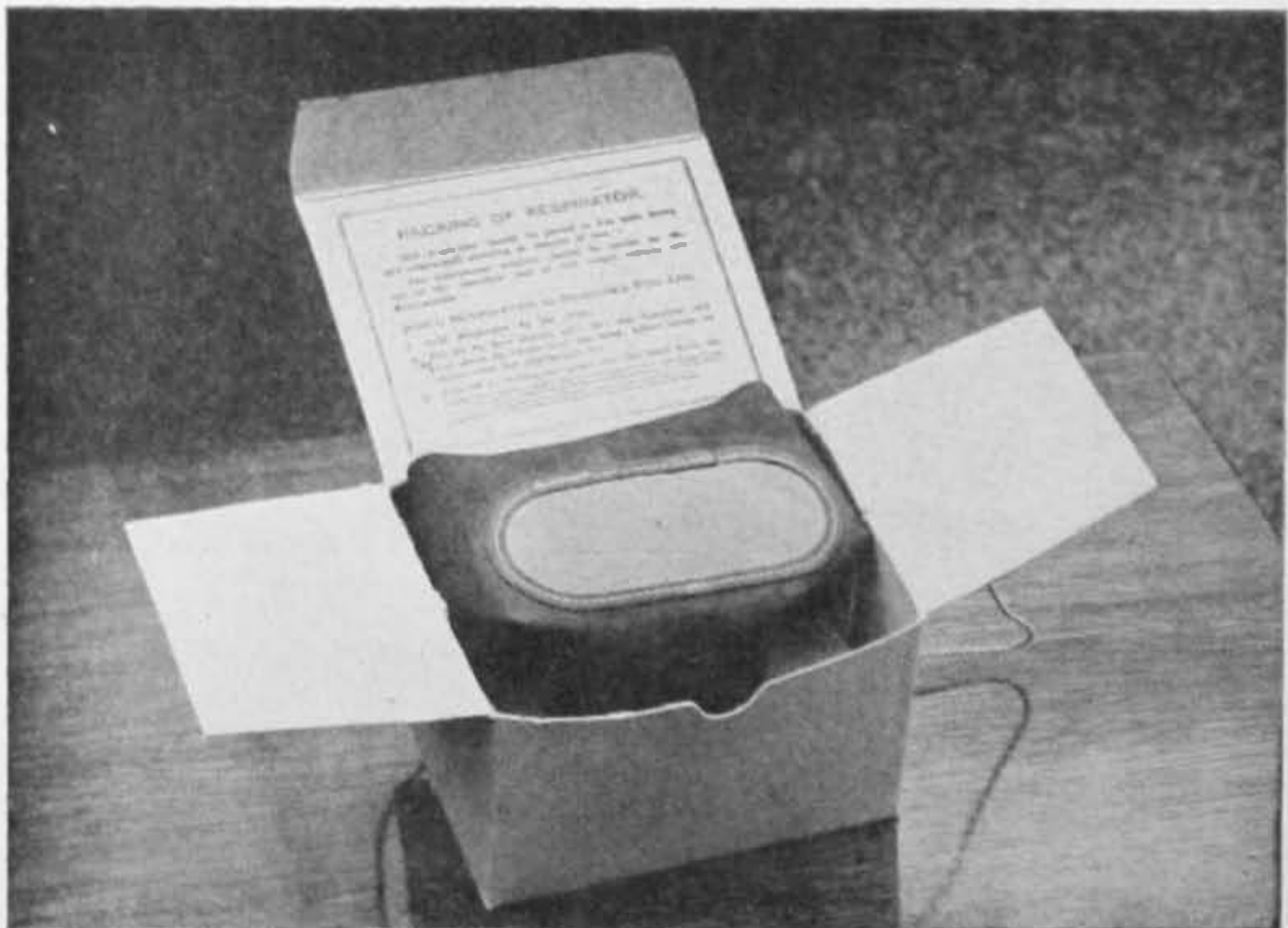


Fig. 5.
Showing the correct way of packing the respirator in its carton.

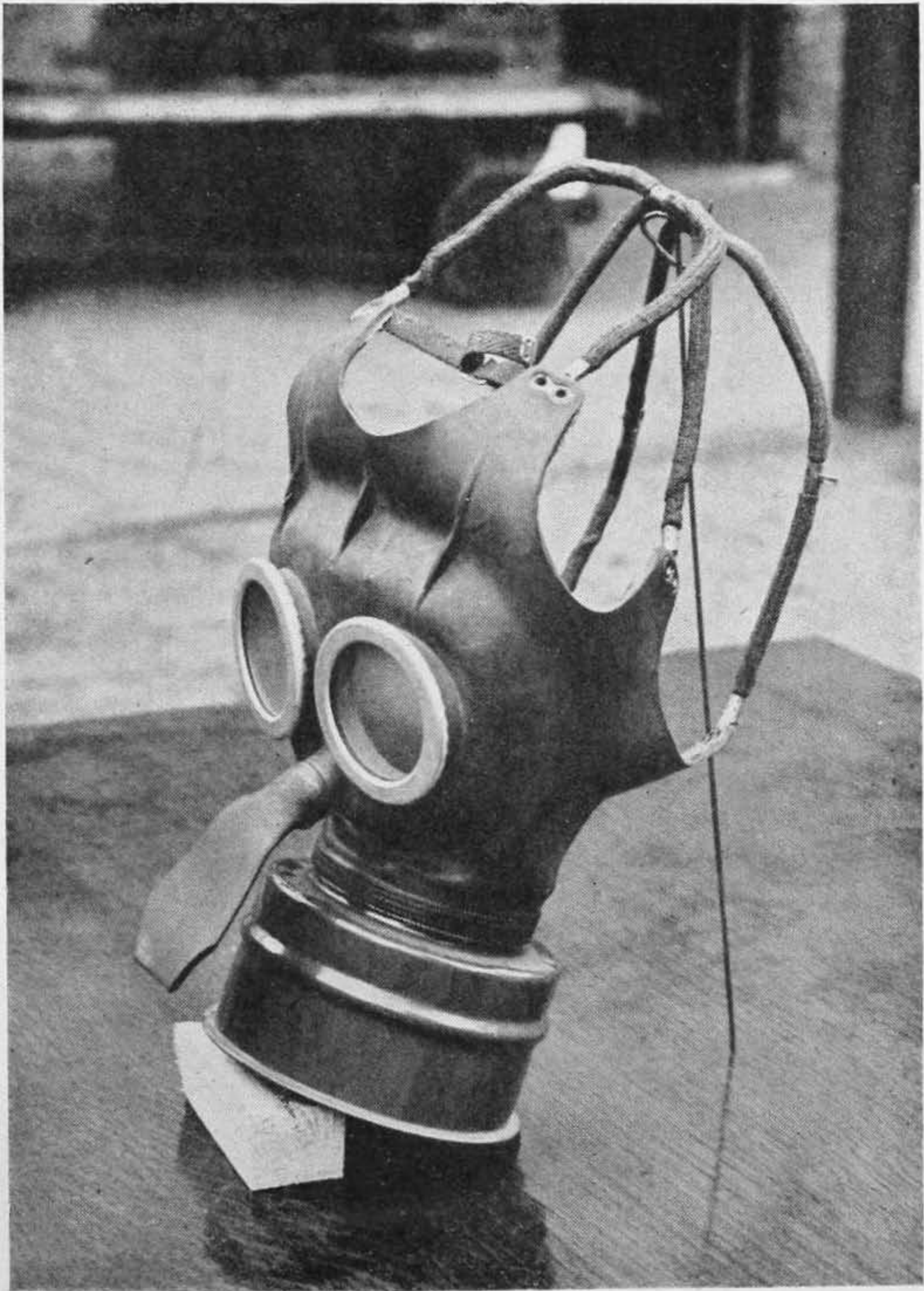


Fig. 6.
The Small Child's Respirator.

small size Civilian Respirator. As a rough guide it was suitable for children between the ages of about 18 months and 4 to 4½ years. Some Children below the age of 4 years were fitted with the small size Civilian Respirator.

It consists of a thin, flexible moulded rubber facepiece with separate eye-pieces of non-inflammable transparent material and an outlet valve. A container is screwed into a metal mount on the front of the facepiece (See Fig. 6). This container, though smaller, gives the same degree of

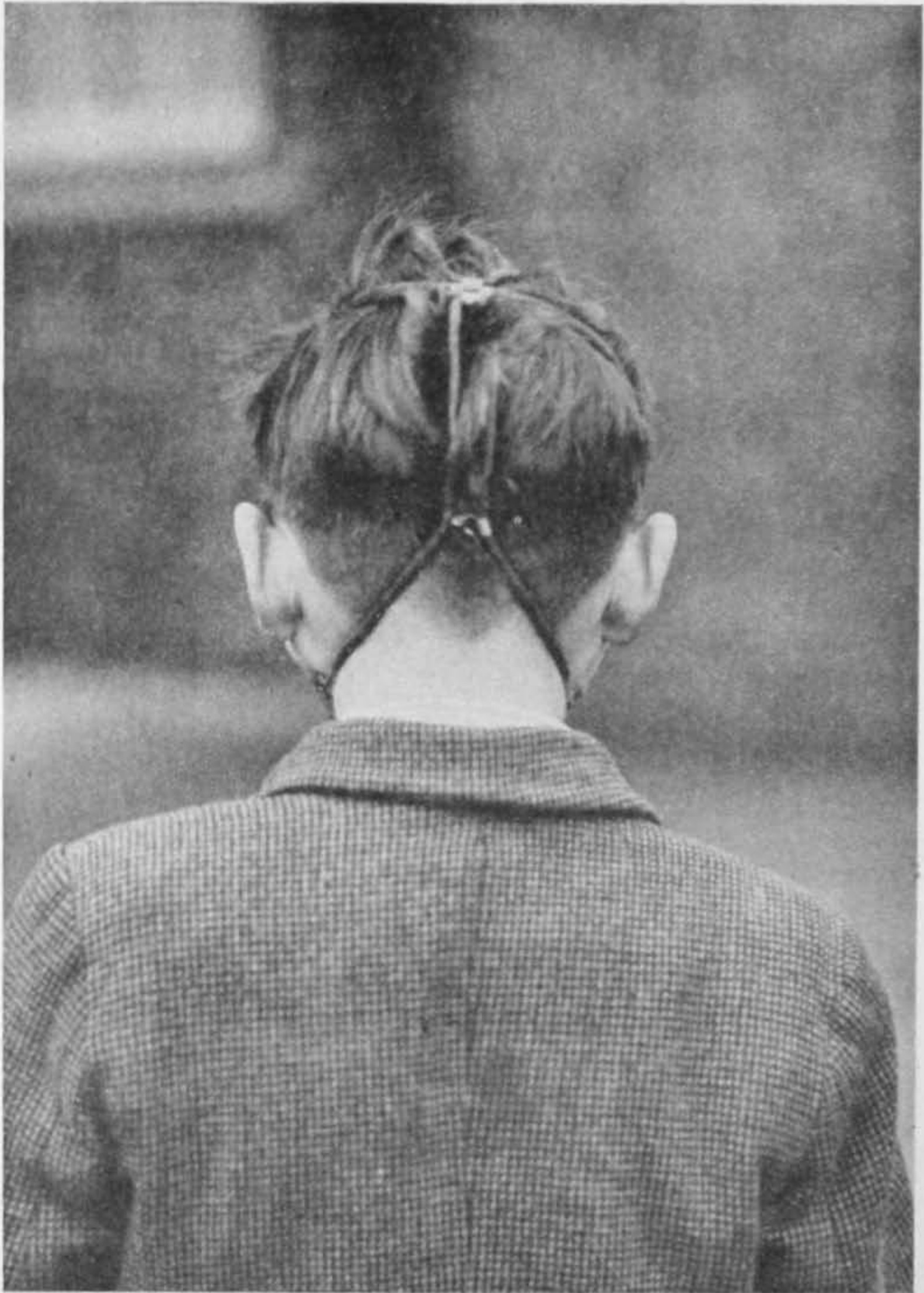


Fig. 7.

Back view of Small Child's Respirator showing bottom two springs of head harness hooked together

protection as that fitted to respirators for adults. The respirator is held in place by a head-harness formed of coiled springs enclosed in cotton braid. The head-harness is not adjustable but the tension and flexibility of the springs is such that the facepiece is held in firm but comfortable contact with the face. A hook and eye attachment to the two lower springs of the head-harness enable them to be hooked together at the back of the neck which prevents easy removal of the respirator by the



Fig. 8.—The Baby's Anti-Gas Helmet.

child itself (*see Fig. 7*). A stout cardboard carton with a sling was supplied with the respirator to contain it when not in use.

(iii) The Baby's Anti-Gas Helmet

This was designed for children too small to wear the Small Child's respirator. It consists of a hood of impervious fabric, with a large window to cover the head, shoulders and arms of the baby and is tied by means of a draw tape round the waist. The hood is supported by a light metal frame with a back which can be adjusted in length to suit all sizes of babies and children up to the age of five years. (*See Fig. 8.*)

Eyes slightly above the centre of the eyepieces indicating that the respirator is a bit too small. It is the largest size made.



Protuberance for telephone microphone.

Strap of helmet on the point of the chin.

Fig. 9

Civilian Duty Respirator being worn.

Air is pumped into the hood through a container by means of a rubber bellows worked by the parent or person in charge of the baby. All the time the bellows is working a continuous flow of pure air passes into the hood near the top and out through the baby's clothes at the waist. The outgoing air prevents any gas getting in.

For details of special respirators of the civilian type see Appendix "B."

(iv) Civilian Duty Respirator

This is similar in design to the Civilian Respirator but the facepiece is made of thick rubber moulded to fit closely to the face and an outlet valve is fitted. Separate eyepieces of strong plain glass are fitted into metal rims. The eyepiece discs are removable for replacement in the event of damage or for special treatment should the respirator become contaminated by a persistent liquid gas. The straps or bands of the head-harness to hold the facepiece in place may all be elastic; in later patterns the two which pass over the top of the head may be of non-elastic webbing. All the straps are adjustable for length. (See Fig. 9.)

Eyes in the centre of the eyepieces. →

Connecting tube slack, allowing free movement of the head without disturbing the fit of the facepiece. →

← Chin strap of helmet on the point of the chin.

← Flap of the haversack open to allow free access of air to the container.

← Haversack well up on the chest.



Fig. 10.
Service Respirator being worn.

The respirator—made in two sizes only, normal and small—is carried in a canvas haversack with a webbing sling which is worn over the right shoulder.

(v) The Service Respirator

In order to give adequate protection to those in the Civil Defence Services whose duties may compel them to do strenuous work in high concentration of gas for long periods, the Service Respirator is fitted with a larger and heavier container than those fitted to respirators already described. It cannot therefore be directly attached to the facepiece, but is carried in a haversack on the chest and connected to the facepiece by a flexible corrugated rubber tube. Apart from the very high degree of protection it provides, the Service Respirator gives the wearer the greatest possible freedom of movement and comfort. (See Fig. 10.)

The facepiece is of moulded rubber, sometimes covered with stockinet. It has separate eyepieces of splinterless glass, which, in later patterns, are removable for decontamination purposes. A metal mount,

fixed in the front of the facepiece and known as the valve holder, carries the outlet valve of special design to reduce to a minimum the resistance to breathing out and to allow clear and audible speech. The head-harness to hold the facepiece in place is similar in design to that of the Civilian Duty Respirator.

The corrugated rubber tube connecting the container to the facepiece is secured at one end to the neck of the container and at the other to the bottom of the valve holder. When the wearer breathes in, air is drawn through the container, where all traces of war gas are removed, passes through the small metal valve in the neck of the container, and enters the facepiece at the bottom of the valve holder. Here the air stream divides and passes through channels formed in the wall of the facepiece on either side of the valve holder to an inlet between the eyepieces. This arrangement ensures that the cool, dry air entering the facepiece flows across the inside of the eyepieces and helps to prevent dimming due to condensation. As the wearer stops breathing in, the small metal inlet valve in the neck of the container shuts and locks a column of clean fresh air in the connecting tube. As he breathes out his breath passes freely through the outlet valve.

The respirator is carried in a waterproof canvas haversack with separate compartments for facepiece, container and other small articles of equipment. The haversack has a canvas sling and a length of whipcord attached. It may be carried in the "Slung" position, i.e., with the sling over the right shoulder and the haversack on the left hip, or in the "Alert" position, i.e., with the haversack well up on the chest and held there by means of the sling and whipcord.

The Service Respirator was made in a variety of sizes and fittings—Large, Normal and Small, Extra Small and Extra Large. Specially moulded facepieces were designed for people with abnormally hollow cheeks and temples and were issued to those who wore spectacles.

27. THE FITTING OF RESPIRATORS

Unless respirators of the ordinary type are properly fitted they cannot be expected to give full protection and may be unnecessarily uncomfortable. The facepiece must make unbroken gas-tight contact all round the face and the correct size must be chosen for each individual.

Respirators when issued will be fitted by people trained to do this and once this has been done the owner must on no account alter the adjustment of the head-harness. Any such alteration may disturb the gas-tight fit.

For additional information on fitting see Appendix "B."

28. USING THE RESPIRATOR

The proper way of putting on or taking off a respirator of any of the normal types—Civilian, Civilian Duty and Service, should be learnt by the wearer and practiced until he can do it quickly and almost automatically without getting flurried. There are certain movements to be done in a certain sequence as in many other operations, for example, making a telephone call, or starting up a car and driving it away. Detailed instructions are issued with the Small Child's respirators and the Helmet types. These should be studied by those responsible and the methods of using these types should be practiced.

Once the use of gas by an enemy has been established or an official announcement advising the carrying of respirators has been made, they should be carried everywhere and be ready to put on at any time, day or night. If the gas alarm is heard or gas is detected or there is any cause for suspicion that gas may be present, whether the alarm has been given or not, owners of respirators should stop breathing and not go on again until the respirator has been properly adjusted on the face. They should then blow out hard to expel any gas inside the facepiece and continue to breathe normally. This applies to any normal type of respirator. It should also be remembered that hats, helmets or any other form of headdress must be taken off before the respirator can be put on.

29. REMOVING THE RESPIRATOR

When respirators have been put on as protection against gas they must on no account be taken off until tests by specially trained personnel have shown that the atmosphere is clear of gas and the " Gas Clear " signal has been sounded. *The test for gas by lifting the side of the face-piece and sniffing, as carried out by individuals during the last war may be dangerous in the presence of any of the new gases of the Nerve group.*

30. RESPIRATOR DRILL

The movements involved in putting on and taking off the different types of respirators and the proper sequence in which they must be performed are set out in the form of drills in Appendix C. These drills should, wherever possible, be taught and demonstrated by an Instructor in the first instance, but should be easy enough to follow without the help of an Instructor if necessary.

31. TREATMENT TO PREVENT DIMMING OF THE EYEPICES

When a respirator is being worn there is a tendency for the moisture in the wearer's breath to condense on the inside of the window or eyepieces and so make it difficult to see clearly. To prevent this an Anti-dimming compound is available with full instructions for its use.

32. THE CARE OF RESPIRATORS

Respirators when issued to the General Public and to members of the Civil Defence Services remain the property of the Crown. People to whom they are issued will be held responsible for their loss or damage if due to carelessness.

A respirator can only be relied upon to give complete protection against war gas if it fits perfectly and is kept in good condition. Damage and loss of efficiency may result from a number of avoidable causes. The following general instructions regarding the care of respirators should be studied and carried out by all to whom a respirator has been issued :—

(i) Respirators must always be put on and taken off by the methods described in Appendix C. The use of any other methods may result in damage leading to loss of gas-tightness.

(ii) Avoid any action which might cause damage to the container, for instance, dropping the respirator on a hard surface or allowing it to bump against the side of a door. Denting of the container may result in loss of efficiency and increased resistance to breathing.

(iii) Keep respirators dry. Moisture is liable to cause deterioration of all parts. Moisture entering the container makes breathing more difficult and sets up internal rusting which may lead to perforations and leaks. Always dry all parts of the respirator, including the inside of the facepiece, after use and before packing it away in its carrier.

(iv) When not in use, keep the respirator properly folded in its carrier, so that it is not exposed to strong light, and place it in a cool, dry place. Strong sunlight and heat cause cracking and perishing of the rubber parts.

(v) Take the respirator out of its carrier periodically to air it and to allow it to resume its natural shape. When a facepiece has been folded for a long time it is liable to become creased and this may cause leaks.

(vi) Never hang a respirator by its head-harness. This causes stretching and loss of elasticity in the elastic straps and in the rubber of the facepiece of the Civilian Respirator.

33. SPECIAL PRECAUTIONS WITH CERTAIN TYPES

The transparent window is the most vulnerable part of the Civilian Respirator. Great care is needed to prevent folding, creasing, denting and scratching of this window. The respirator should always be packed in its carton in such a way that the window lies flat and at full length on top of the container. (See Fig. 5 on page 36).

The outlet valve of the Civilian Duty Respirator and those Civilian respirators so fitted is liable to be torn if the respirator is carelessly handled. Care is necessary, particularly in taking the respirator out of its carrier, to avoid this.

CHAPTER VI

41. PERSONAL PROTECTION—II ANTI-GAS CLOTHING

Though properly fitting respirators will adequately protect the eyes, the covered part of the face, the breathing passages and lungs from all forms of war gases, the rest of the body is vulnerable to liquid nerve gas and to either the liquid or the vapour of blister gases.

Ordinary clothing when contaminated, will be penetrated and can act only as a delaying agent. Moreover, unless promptly removed, it becomes a danger not only to the wearer, since it keeps the gas in close contact with his skin, but to others with whom he may come in contact.

Special anti-gas clothing and other protective equipment was therefore designed for men and women in the Civil Defence Services who might have needed them in the course of their duties.

The materials found most suitable for making these outfits are the oil-dressed fabric called "oilskin," and rubber. Both these are penetrated only slowly by the liquid gases and afford protection for periods which depend on the thickness of the materials. This duration of protection, is, however, long enough for the spells of duty normally required and longer, in fact, than they can be safely worn when performing manual work, as, being non-porous, they keep in the heat and perspiration of the body and so cause fatigue and exhaustion, particularly in hot weather.

42. TYPES OF OUTFIT

There are two types of oilskin clothing, the "heavy" and the "light." They differ only in the thickness, weight and strength of the material used.

Owing to its greater handicap the "heavy" suit is used only when the work to be carried out involves considerable risk of damage to the material by tearing and scratching. Rescue work is in this category and the men in this service therefore use the heavy outfit. All others normally have outfits of the light material.

A suit of oilskin of either kind consists of a jacket and trousers, but to protect those parts of the body still uncovered, the complete anti-gas outfit also includes boots and gloves of rubber or oilskin, canvas overmittens to preserve the oilskin gloves, and an oilskin curtain to be worn on the helmet to protect the neck from liquid contamination (See Figs. 11 and 12). These articles are in addition to the respirator and steel helmet.

There is an oilskin hood to protect those parts of the face, head and neck left uncovered by the respirator. When worn in addition to the rest of the anti-gas outfit it imposes great strain on the wearer and should be restricted to occasions when work has to be carried out in high concentrations of blister gas vapour as liable to be found in enclosed places.

The heavy outfit should be worn over special underclothing and socks only, but the light outfit can be worn over ordinary clothing or uniform.



Fig. 11.
The Heavy Anti-Gas Outfit.

43. DRESSING

In order to get the maximum protection and comfort whilst at work, the anti-gas outfit should be put on in a definite fashion and order, as follows :—

- (1) Attend to wants of nature
- (2) Remove own clothing, underclothing and socks
- (3) Put on official underclothing and socks



Fig. 12.

The Light Anti-Gas Outfit.

NOTE.—The webbing belt is not standard equipment but is useful in preventing "ballooning" of the coat in windy weather.

- (4) Put on trousers
- (5) Put on boots
- (6) Put on Jacket
- (7) Adjust respirator in "Alert" position
- (8) ~~Put on eye shield if required~~
- 9 (9) Put on gloves and over-mittens if worn
- 9 (10) Put on helmet with anti-gas curtain attached.

44. UNDESSING

When work is over the anti-gas clothing may be contaminated and must be carefully removed to avoid danger to the wearer, and carefully stored to prevent danger to others, till it is decontaminated.

Undressing, therefore, must be a drill. At the conclusion of the work the party should return to a Cleansing Station where a suitable protected Undresser, if available, will remove all outer clothing out-of-doors in an open shed to avoid creating a vapour danger.

Each article as it is removed, is placed in a metal bin with a lid, separate bins being provided for different types of articles.

With the advent of Nerve gas, and the importance of preventing contamination of the skin, it is inadvisable for an individual (who has been exposed to the risk of contamination) to attempt his own undressing out of full protective clothing.

Should there be no " Depot Undresser " at the Cleansing Station the men will undress each other. To assist the last man the depot attendant e.g. boilerman, storekeeper etc., wearing a respirator in the gas position, oilskin apron, rubber gloves and rubber knee boots will act as Undresser.

The Undresser wearing the equipment described above can readily undress himself without undue risk.

The order of undressing is as follows :—

- (1) Remove over-mittens.
- (2) Remove gloves.
- (3) Untie whipcord of haversack, pass the sling over the head, remove the container from the haversack and pass it to the man being undressed to hold.
- (4) Turn the helmet curtain up over the top of the helmet, and remove the helmet by lifting it up and bringing it forward and downwards over the facepiece, the man being undressed passing the connecting tube and container between the chin-strap and helmet.
- (5) Remove jacket.
- (6) Lower trousers, man sits on form.
- (7) Partly remove each boot in turn.
- (8) Remove both boots, man keeps feet off floor.
- (9) Remove trousers, man swings round and stands up on clean side.

The man enters the Cleansing Station still wearing his respirator where he removes it and the remainder of his clothing. He then carries out the proper cleansing procedure, dresses in clean clothing and leaves by another route.

The hood in particular should not be worn unless essential and when worn should be put on at the last moment and removed at the first opportunity.

Decisions on these points must be made by the officer-in-charge on the spot who should have the pocket vapour detector to help him. In the case of liquid, good training of the individual should enable him to avoid contamination in many cases.



CHAPTER VII

51. COLLECTIVE PROTECTION

Every individual can rely on his respirator for his own protection against war gas, and this is his primary defence, but the protection which is afforded against vapour, by buildings in sound condition, is of considerable value and against liquid and spray is complete.

Provided the doors and windows of the buildings are close fitting and are kept shut, only a very small quantity of gas in vapour form will find its way in from outside. More elaborate precautions can be taken by sealing up the doors, windows and any other openings of a room so that no gas can enter, but in this case neither can the air in the room be renewed and in consequence, the heat and moisture given off by the occupants; the products breathed out by them and the gradual using up of oxygen—which is essential to life—make conditions unbearable. Such a room can, therefore, only be used for a limited period which will vary according to the number of occupants.

While a raid is in progress members of the public should seek refuge in a shelter or indoors. Doors and windows should be kept closed during the attack and ordinary ventilation systems should be shut down. When a gas warning is given, respirators should be put on as, if the building is damaged by explosion, e.g. windows broken, the respirator will be the only protection against gas.

If therefore, members of the public take shelter indoors immediately on a gas alert and remain there until the gas clear signal has been given, the risk of becoming a gas casualty will be considerably reduced.

CHAPTER VIII

55. GENERAL ANTI-GAS PRECAUTIONS

To untrained and unprotected persons, gas could probably cause more casualties than most other weapons because of its stealthy approach and more widespread effects. The risks of injury by gas, however, are far easier for the individual to avoid than those by any other weapon, provided he makes proper use of the protective equipment available.

(i) Keeping under cover

Except when their duty demands that they should be in the open, ~~people should keep~~ people should keep under cover during "Alerts." The protection thus

(ii) Precautions when out of doors

Once it has been established that the enemy is using or proposes to use gas, people who must remain in the open and those who are out of doors when the "Alert" sounds must take every precaution to protect their eyes from drops of liquid gas from air burst bombs. Steel helmets, hats or caps will give good protection to the eyes provided people resist the temptation to look upwards. As little bare skin as possible should be left exposed to drops of liquid gas from air burst or splashes from ground burst bombs. The coat collar should be turned up to protect the back of the neck and if an overcoat or raincoat is being carried, it should be put on with the collar turned up. Gloves should be worn or, if not available, the hands should be kept thrust into the pockets.

Should the "Gas Alarm" be heard or bombs be heard bursting on the ground or in the air Respirators must be put on immediately. In these circumstances *all* outer clothing which may have been splashed by liquid gas must be removed before entering any building and left hanging up to air in a well ventilated out-building or shed. Respirators must not be taken off, even if the "Gas Clear" signal has been given, until all possibly contaminated outer clothing has been removed and hung up to air. The vapour from contaminated clothing may have serious effects if inhaled. When the outer clothing and finally the respirators have been removed the personal preventive cleansing procedure described in Chapter IX must be carried out with as little delay as possible.

(iii) Use of the Respirator

Once it has been established that an enemy is using gas, there must be no hesitation on the part of anybody in using any protective equipment that has been made available. Many of the gases that might be used do not advertise their presence. Nobody should hesitate, through fear of appearing ridiculous, to put on a respirator at the slightest suspicion that gas may be present, or if other people are seen to be wearing theirs. Once respirators have been put on they must not be removed until the "Gas Clear" signal is given.

(iv) Keeping Upwind of the Source of Gas

As Non-persistent gases, which include the vapour given off by persistent liquid gases, drift with the wind, everybody should, as far as

their duties allow, try to keep upwind of any sources of gas such as the places where gas bombs have burst or areas where gas spray has fallen. If overtaken by gas in the street the quickest way to get clear of the gas is to move at right angles to the direction of the wind. For this reason it is a good plan to note the direction of the wind in the vicinity at all times. (See diagram on Page 14.)

(v) Avoiding Contamination

Nobody should needlessly walk in liquid gas on the ground even when wearing suitable footwear as this will tend to spread the contamination and render elaborate decontamination of their footwear necessary. There will, of course, be occasions when walking through liquid contamination may be necessary, for example when the Leader of a Decontamination party is making a thorough reconnaissance of the area in which a blister gas bomb has burst. Members of the Civil Defence Services, whose duties demand that they should enter and work in an area contaminated by liquid gas, and members of the General Public who may have to be led through such an area, while being evacuated from buildings rendered temporarily uninhabitable by gas must be careful to avoid, as far as possible, touching, handling or brushing against anything which may have been splashed with liquid and treading on earth or debris on the ground which may be heavily contaminated. Should it be necessary to handle contaminated material e.g., in order to reach a casualty, the hands should be protected by anti-gas gloves, if available, ~~or if not, by smearing them liberally with anti-gas ointment.~~ Any stout material wrapped round the hands to prevent contact between the bare skin and the contaminated material will give a certain amount of temporary protection in an emergency.

People who have walked through a contaminated area should remove their boots or shoes. They must be left outside until they have been properly decontaminated.

Clothing which has been contaminated by liquid gas must be removed as soon as possible otherwise the contamination will penetrate to the skin and cause injury. As in the case of boots, contaminated clothing must not be taken inside any building. The outer clothing, at least, must be taken off and left outside. It will not be safe to wear again until it has been collected and put through the process of decontamination appropriate to its degree of contamination.

It is important that everybody should know and understand what can be done in the way of First Aid and Preventive Cleansing for people who have been affected by gas. Chapter IX should be studied and such preparations, for carrying out the treatments described therein as lie within the scope of the ordinary householder, should be made.

CHAPTER IX

59. FIRST AID AND PREVENTIVE CLEANSING

Speed of action is the key-note of First Aid in gas contamination of any part of the body.

The method of First Aid employed will vary in detail according to the type of gas and the way in which it attacks the body but the first and immediate object is to prevent or lessen injury by getting rid of all traces of the gas as quickly and effectively as possible.

In order to do this, clothing which has been contaminated by liquid or vapour must be promptly removed and affected skin rapidly cleansed. It is obvious that the affected individual must first be protected from further exposure by putting on a respirator and by removal to a place free from the gas. In the following paragraphs the war gases are taken in the order in which they appear in Chapter I with the appropriate First Aid in each case.

(i) Nerve Gas

VAPOUR. Put on respirator, and if possible, get out of the gas area and change clothing, keeping respirator on until this is done.

LIQUID. Owing to the rapidity with which liquid Nerve gas is absorbed by the skin, it is essential that any visible liquid should be dabbed off with a handkerchief, rag or other swab as quickly as possible—it must not be wiped off as this may spread contamination. Care must be taken to dispose of whatever material is used as a swab, so that it will not endanger others. The affected individual, with a respirator on, must be removed to a place free from the gas and all contaminated clothing immediately taken off and contaminated skin areas scrubbed thoroughly with soap and water. If any injury has occurred in the contaminated area of the body leaving the skin broken, the wound must be scrubbed with soap and water before any other contaminated part is treated.

Onset of Symptoms

Immediately the initial symptoms of dimness of vision, running of the nose, and tightness of the chest appear, the case must be treated as seriously ill and kept lying down because it is impossible at this stage to say whether or not the more dangerous symptoms of twitching and convulsions will eventually appear. Early medical supervision is essential.

Contaminated Food

In the event of contaminated food being swallowed, vomiting should be produced at the earliest possible moment either by tickling the throat or giving a large quantity of salt and water to drink.

(ii) Blister Gas

VAPOUR. Put on respirator and get out of gas atmosphere. As soon as possible contaminated clothing should be removed and at least the skin which has been exposed, and if practicable the whole body, thoroughly washed with soap and water, preferably warm.

LIQUID.

Eyes. If liquid gas has entered the eyes they must be washed out at once with plenty of water (or salt and water if available). A good stream of water from a water bottle or other vessel should be directed for at least one minute into each eye. Should only one eye be affected, care must be taken not to contaminate the sound eye when washing out the injured one.

Skin. Visible liquid must be immediately removed from the skin in the same way as in Nerve Gas contamination, followed by the application of bleach cream well rubbed into the contaminated areas with the fingers. Bleach cream must be washed off with water after two minutes. If bleach cream is not available, the affected part should be thoroughly washed with soap and water or an alkaline solution, such as washing soda. Only if it is known without doubt that the liquid is Blister Gas should anti-gas ointment be used.

Anti-gas ointment or bleach cream should not be applied to the skin when reddening has developed. Blisters should not be opened.

(iii) Choking Gas

People who have breathed in Choking Gas may sometimes be able to carry on their work with only mild discomfort or slight cough and tightness of the chest, and yet after an hour or more may suddenly get worse and collapse with severe lung symptoms. Anyone who shows signs of having breathed in Choking Gas, or who is suspected of having done so, should therefore be removed as soon as possible to a place free from the gas. He should be made to lie flat on the back and be kept warm until seen by a doctor. Early medical treatment may save his life. Contaminated clothing must be removed. Artificial respiration must not be attempted.

(iv) Tear Gas

In the majority of cases the symptoms will rapidly subside when the respirator has been adjusted. If they persist the individual affected should be moved to a place free from gas and the eyes bathed with warm water or salt solution (one teaspoonful to a pint of warm water).

If actual liquid enters the eyes they should be treated on the lines laid down for Blister Gas.

If the skin is irritated it should be washed with soapy water.

Liquid contaminated clothing will have to be removed.

(v) Nose Gas

No special first aid treatment is necessary as a rule. Symptoms will usually subside fairly soon if the respirator is put on promptly.

Sometimes the symptoms may be delayed and may not be felt until a few minutes after the respirator has been put on. Any tendency to remove the respirator in such a case must be checked while in the presence of the gas.

An exceptionally severe case may need removal to fresh air where treatment in the form of a gargle and washing out the nose may be given.

* *Anti-gas ointment* contains a substance which counteracts the poison. Bleach cream is a mixture of tropical bleaching powder and water. It is made by adding the bleach to the water in small quantities while stirring until the mixture has the consistency of thick cream.

CHAPTER X

63. PRINCIPLES OF DECONTAMINATION

If bombs filled with persistent liquid gases are dropped there will be an appreciable amount of liquid on the ground in and around the craters and everything within a limited area will be splashed with liquid, the amount depending on the distance from the crater. Each bomb will produce an area of "contamination" varying in extent with the size of the bomb.

This contamination will be dangerous in two ways—from the liquid and the vapour.

The liquid may be picked up on shoes or boots; smeared on to clothing by brushing against contaminated objects; or may get on to the hands by handling anything on which there is liquid gas. As the liquid gases of the Nerve and Blister groups have great powers of penetration, casualties are likely to occur from any of the above causes.

The danger does not arise from the liquid only. The vapour which comes off the liquid is also damaging to unprotected people who remain exposed to it. This vapour danger will remain all the time there is free liquid on the ground, on walls of buildings and other objects. In the case of contamination inside buildings, it may still persist from liquid which has soaked in, even after the free liquid has dried up on the surface.

The continued presence of contaminated areas in a town or city cannot be allowed and urgent action is required to deal with the two-fold danger—in other words, they must be "decontaminated." An area or an object of any sort is said to be decontaminated when it has been rendered safe for all normal uses, but this does not necessarily mean that all traces of gas have been destroyed or removed. An open area in a town or city, for instance, would be considered to be decontaminated when the streets are safe for wheeled or pedestrian traffic; when there is no danger from brushing against or handling anything in it and when there is no appreciable danger from vapour. There may still be a certain amount of liquid which has soaked into road surfaces, pavements, walls of buildings and other objects, but it will not be picked up on boots, clothing or hands and any vapour from it will be coming off so slowly and be so rapidly dispersed that it will not constitute a danger.

Decontamination work will be carried out by specially trained parties, but some knowledge of the principles of decontamination should be useful to everybody.

64. DECONTAMINATION METHODS

Contamination may be REMOVED, DESTROYED, SEALED, or it may be left to the action of the weather in certain cases.

(i) Removal

Free liquid on the ground or other surfaces can be removed by washing it away with water from a hose. This merely moves the contamination from one place to another but this method should only be adopted in cases where it can do no harm especially bearing in mind its

final destination. The removal by hosing should be assisted by scrubbing. The method is laborious and, moreover, will only deal with liquid on the surface. Unless it is undertaken within a very short time of the contamination occurring, some further treatment of the liquid which has soaked in will be needed.

Free liquid can also be removed by mopping it up. Rags or cotton waste may be used for this purpose, but it must be remembered that they will become contaminated and must be safely disposed of after use. Moistening the rags or cotton waste with a suitable solvent of the gas will render this method more effective. In the case of contamination on hard and impervious surfaces such as glass or clean metal, careful and thorough mopping up by "the solvent" method may be all the decontamination necessary.

Free liquid on a flat horizontal surface can be mopped up by sprinkling dry earth, sand, sawdust, ashes or other similar materials over it and allowing time for the liquid to be soaked up. The mopping material is then shovelled up and, being contaminated, must be buried or otherwise disposed of safely. This method, although seldom sufficient by itself, is often a useful preliminary to further treatment.

(ii) Destruction

Liquid contamination can be destroyed by applying a chemical which will react with it and change it into a harmless substance. In the case of blister gases the most useful chemical for this purpose is chloride of lime, commonly known as bleach. The bleach may be applied dry in the form of powder in which case it will react violently and the mixture may burst into flames. The decontamination will be rapid and effective. Where a fire is undesirable the bleach may be mixed with sand or earth or made into a cream or paste with water.

Dry bleach is ineffective with Nerve gases and a bleach cream or other alkaline solution should be used.

Liquid Blister and Nerve gases which have soaked into clothing and other similar materials can be destroyed by boiling the contaminated articles if they will stand it. Certain precautions must be taken by the specially trained people, who will undertake this work, to safeguard themselves and to avoid damaging the fabrics. This decontamination process should not therefore be attempted at home.

(iii) Sealing

Contamination can be covered up so that no one can come into contact with it and no vapour can escape from it. On a horizontal surface an even seal of three inches of earth, sand or ashes, must be spread over the whole contaminated area. This is a laborious method and will only be effective so long as the seal remains undisturbed. Painting the Blister gas contamination on a vertical surface with bleach cream will not only destroy any free liquid but also seal that which has soaked in.

(iv) Weathering

In certain circumstances it may be possible to leave decontaminating action to the sun, wind and rain, but the affected area must be roped off to prevent access to it, until there is no further danger from contact with the liquid and insufficient vapour is coming off to constitute a danger. This method may take a considerable time. Weathering is also adopted for dealing with clothing which is contaminated with small droplets only or vapour.

CHAPTER XI

69. OTHER DANGEROUS GASES

A list and description of the gases most likely to be used as offensive agents in war have been given in Chapter I.

There are, however, a number of other dangerous gases which might be encountered in war or peace, either deliberately used by an enemy or occurring accidentally. Some knowledge of these is highly desirable and the more important are considered here.

(i) Prussic Acid

This is a colourless, very volatile, liquid with a smell of bitter almonds.

When inhaled in high concentrations the vapour can cause rapid death by paralysing the respiratory centre in the brain and thereby stopping breathing.

Luckily, however, the vapour is somewhat lighter than air and is rapidly diluted in the open to harmless strength. Prussic acid can also be absorbed through the skin, but the danger is slight unless the contamination is heavy or evaporation is retarded by a covering of clothing.

Shells filled with prussic acid, used in the open field in the 1914-1918 war, proved useless, but in enclosed spaces, such as tanks, an effective and deadly concentration might be rapidly built up. The Japanese had a prussic-acid bomb designed for this purpose.

The respirator gives protection against concentrations likely to occur in the open.

Treatment must be immediate and consists of rapid removal of the victim to fresh air and artificial respiration. Free liquid must be removed at once from the skin, and clothing which has been contaminated should be taken off and hung in the open air until it no longer smells of gas.

(ii) Arseniuretted Hydrogen (Arsine)

This is a colourless, inflammable, gas. In high concentration it smells like acetylene but in lower concentrations has no appreciable smell. It does not cause any irritation of eyes, breathing passages, lungs or skin, so for the detection of its presence, white test papers which turn yellow are used.

It is produced when dilute acids act on compounds of arsenic with metals, or in certain cases the reaction may be produced by water alone.

It might possibly be used as a non-persistent gas in bombs, or as the heavy dark grey powder of calcium arsenide which would give off the gas over long periods on contact with moisture in the air or on the ground.

When breathed it attacks and destroys the red blood cells and also damages the liver and kidneys from its arsenic content. The symptoms vary from headache, discomfort and breathlessness, in mild cases, to weakness, giddiness and collapse in severe cases. Jaundice may develop later. In high concentrations it can cause death.

The respirator gives protection.

Severe symptoms are usually delayed in their appearance and first aid should consist of rest, warmth and non-alcoholic drinks. Early medical attention is necessary.

(iii) Carbon Monoxide

This gas is formed whenever any material containing carbon burns with an insufficient supply of air and so is found frequently in everyday life as well as wartime. It is therefore very important to understand its dangers.

It is a colourless, odourless, non-irritant gas and so cannot be recognized by the senses.

It is inflammable and burns with a blue flame so often seen flickering over a smouldering fire. In the open it is not dangerous as it is rapidly diluted by mixing with the air but if it is produced in, or obtains entry into, enclosed places, it is a great and very insidious danger as it may not be recognized in time to retreat to safety.

In peacetime, it is most commonly found in dangerous amounts in coal gas, in the exhaust from internal combustion engines, in the after damp of colliery explosions, and in coke stoves and smouldering fires, big or small.

In wartime, not only are the peace time hazards increased by fractured gas mains, large fires, etc., but there is the added risk from the considerable amount of carbon monoxide which is contained in the gases formed when any kind of H.E. explodes and which may enter enclosed spaces being used as shelters or living rooms, from underground, or under-water bursts, or from an explosion within a building or ship.

In the great fire at Hamburg in July 1943, many thousands of people sheltering in cellars were killed by carbon monoxide.

Carbon monoxide produces its poisonous effect, when breathed, by combining with the red colouring matter of the blood and lessening the amount of oxygen it can carry around the body. One of the first indications of the presence of the gas may be loss of power of the limbs preventing retreat to safety, later unconsciousness may follow and perhaps death.

The victim should be promptly removed to fresh air, kept warm and at rest. Oxygen should be given if available and, if breathing threatens to fail, artificial respiration employed.

The ordinary war gas respirator affords **NO PROTECTION** against carbon monoxide. When working in an enclosed space where this gas is present, a self-contained breathing apparatus or one which draws fresh air from the open by means of a tube should be used.

70. GASES ENCOUNTERED IN FIRE-FIGHTING

Fire-fighters, particularly in enclosed spaces, are liable to risks from the formation of dangerous gases, as well as from deficiency of oxygen.

Carbon dioxide and carbon monoxide will always be present in greater or lesser amounts, depending on the rate of combustion, while other harmful gases, may be given off by the burning materials.

It must also be remembered that certain chemicals contained in fire extinguishers, such as carbon tetrachloride and methyl-bromide, may themselves be dangerous when used in quantity in confined spaces.

The ordinary war gas respirator will **NOT** stop all these gases, neither can it provide oxygen when this is lacking.

CHART OF GASES

APPENDIX "A"

TYPE	GENERAL DESCRIPTION	EFFECTS	FIRST AID
NERVE GASES CHOKING GASES PHOSGENE	Persistent or Semi-Persistent Non-Persistent. Almost in- visible vapour. May be seen as a white cloud near point of burst. Corrodes metals. Smells of musty hay or de- caying vegetation.	(i) VAPOUR (or fine spray) Coughing and watering of eyes. Pain in chest. Lung damage develops later—often after a lapse of some hours.	VAPOUR Complete rest and warm- ing.
TEAR GASES B.B.C.	Very Persistent brown liquid. Gives off invisible vapour with faint smell.	Immediate stinging of eyes and profuse watering. Spasm of the lids. Liquid in the eyes can cause severe damage.	When Respirator is put on or casualty removed to fresh air recovery is usually rapid without treatment. Liquid contaminated clothing should be removed. If liquid gets in eye it must be washed out with water at once.
NOSE GASES D.A. D.M. D.C.	Solid colourless or bright yellow compounds of arsenic. When heated gives off volumes of minute particles generally invisible except near source. Non-Persistent. No smell.	Slight delay in effects but within 5 minutes, sneezing, burning sensation in nose, mouth, throat and chest, later perhaps vomiting in severe cases.	Remove from gas atmosphere. Effects may increase for the first few minutes in fresh air, or when Respirator is put on but will get less as the small amount of gas breathed before detection works itself off.

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CHART OF GASES

APPENDIX "A"

TYPE	GENERAL DESCRIPTION	EFFECTS	FIRST AID
NERVE GASES	Persistent or Semi-Persistent colourless liquid. Gives off invisible vapour. No appreciable smell. Liquid rapidly absorbed by eyes, wounds and skin and readily penetrates clothing.	<p>(i) VAPOUR (or fine spray)</p> <p>(a) Small doses cause in 5—30 minutes contraction of pupils with dimness of vision and loss of focusing power, running of nose, headache, lightness of chest.</p> <p>(b) Larger doses cause in 5 mins.—6 hrs. the same symptoms as above but followed by twitching of limbs, convulsions and death. There may be a delay between the onset of the initial symptoms (a) and the twitching, convulsions and death.</p> <p>(ii) LIQUID In eyes, wounds and in contact with skin produces the same symptoms as in (a) and (b) above.</p>	<p>VAPOUR Put on Respirator. Remove from Gas. Take off outer clothing. Complete rest as soon as first symptoms appear. Turn over to doctor.</p> <p>LIQUID Visible liquid must be immediately dabbed—not wiped—off the skin with a swab of any material handy, treating any wounded areas first. Then remove clothing and scrub the skin with soap and water, again dealing with wounds first. If any symptoms appear transfer to medical supervision immediately.</p> <p>In the event of contaminated food being swallowed, vomiting should be produced at the earliest possible moment either by tickling the throat or giving a large quantity of salt and water to drink.</p>
BLISTER GASES MUSTARD GAS	Very Persistent heavy oily liquid, dark brown to straw colour. Gives off invisible vapour. Smells like garlic, onions, horseradish or mustard. Smell may be faint. Like any oil, readily soaks into clothing and most other materials. It freezes before water.	<p>(i) VAPOUR <i>Eyes</i>—irritation and swelling within 24 hours. <i>Skin</i>—redness, irritation, blisters, after 12 hours or longer. Damp parts specially affected. <i>Breathing passages</i>—loss of voice, brassy cough.</p> <p>(ii) LIQUID <i>Eyes</i>—no immediate pain; severe inflammation in 1—2 hrs. <i>Skin</i>—redness in 2 hrs, blister 12—24 hrs.</p>	<p>VAPOUR Put on Respirator. Remove from Gas. Change clothing and wash body all over.</p> <p>LIQUID (i) <i>Eyes</i>—wash out at once with plenty of water or salt solution if available.</p> <p>(ii) <i>Skin</i>—dab off any visible liquid on skin with a dry rag and with fingers rub in anti-gas ointment or apply bleach cream and wash off with water after two minutes. If anti-gas ointment or bleach cream are not available wash part affected with soap and water.</p> <p>(iii) <i>Clothes</i>—remove contaminated clothing, apply ointment or paste to affected skin or wash with soap and water.</p> <p>As for Mustard Gas.</p>
LEWISITE	Persistent heavy arsenical liquid usually brown in colour. Gives off invisible vapour. Smells strongly of geraniums. Very rapid penetration of skin. Quickly destroyed by water and any alkali.	<p>(i) VAPOUR Immediate and severe irritation to nose and eyes. Damage to eyes and lungs. Reddening of skin and blistering. (Less than by mustard vapour.)</p> <p>(ii) LIQUID <i>Eyes</i>—immediate pain and spasm. Grave effect. <i>Skin</i>—similar to effects of "Mustard" but blisters develop more rapidly.</p>	<p>Complete rest and warmth.</p>
CHOKING GASES PHOSGENE	Non-Persistent. Almost invisible vapour. May be seen as a white cloud near point of burst. Corrodes metals. Smells of musty hay or decaying vegetation.	Coughing and watering of eyes. Pain in chest. Lung damage develops later—often after a lapse of some hours.	Complete rest and warmth.
TEAR GASES B.B.C.	Very Persistent brown liquid. Gives off invisible vapour with faint smell.	Immediate stinging of eyes and profuse watering. Spasm of the lids. Liquid in the eyes can cause severe damage.	When Respirator is put on or casualty removed to fresh air recovery is usually rapid without treatment. Liquid contaminated clothing should be removed. If liquid gets in eye it must be washed out with water at once.
NOSE GASES D.A. D.M. D.C.	Solid colourless or bright yellow compounds of arsenic. When heated gives off volumes of minute particles generally invisible except near source. Non-Persistent. No smell.	Slight delay in effects but within 5 minutes, sneezing, burning sensation in nose, mouth, throat and chest, later perhaps vomiting in severe cases.	Remove from gas atmosphere. Effects may increase for the first few minutes in fresh air, or when Respirator is put on but will get less as the small amount of gas breathed before detection works itself off.

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APPENDIX B

ADDITIONAL INFORMATION ABOUT RESPIRATORS

1. Modifications of the Civilian Respirator and Special Civilian Types

For people who found even the slight effort of expelling the air past the checks too great a strain, a Civilian Respirator was designed in which an outlet valve is mounted on the facepiece between the window and the container. This respirator was issued on production of a medical certificate approved by the local Medical Officer of Health to people who, through age, weak heart, asthma, hay fever, etc., had difficulty in breathing.

For people with very thin faces, pronounced hollows in the cheeks or temples and deep scars on their faces, on whom it is difficult to ensure a gas-tight fit, the facepiece can be fitted with pads of sponge rubber to fill up the hollows. These pads may only be fitted by an Instructor or Warden who has been specially trained and then only while the respirator is on the individual.

2. The Helmet Respirator

This has been designed for people who experience great difficulty in breathing (e.g. sufferers from acute asthma) and for people who breathe through a tube in the throat. It is also suitable for people who, as a result of injury or a surgical operation to the face or head, cannot be fitted with a normal type of respirator.

It consists of a loosely fitted hood of rubberised fabric with a flap at the back and front. The hood rests on the shoulders and the flaps are tied down by a cord which passes under the armpits. Two separate eyepieces are fitted. (See Fig. 13.) Air is supplied to the inside of the hood in the same way as in the Baby's Anti-Gas Helmet, the bellows being worked by the wearer. Previously it was only issued on production of a medical certificate as in the case of the Civilian Respirator with outlet valve.

3. The Hospital Respirator

This has been designed for bedridden patients whose condition makes the wearing of an ordinary respirator impossible. It is similar in principle to the Helmet Respirator but has a large window in place of the eyepiece so that the patient can be easily observed. It can only be worn by patients lying down or sitting up so that the skirt and flaps of the hood can be tucked under the bedclothes or other covering.

These respirators were supplied only to hospitals.

4. Vigorous Work in the Civilian Respirator

The Civilian Respirator is not designed for people who will normally have to undertake vigorous work while wearing it but there may be occasions when this is necessary in an emergency and it may be found that there is a tendency for the facepiece to slip forward off the chin. This tendency can be overcome by fitting a tape to support the weight of the container. A piece of wide tape, four feet long, should be passed once round the container immediately above the rubber band and knotted on the opposite side of the container to the eyepiece, leaving



Fig. 13.

Helmet Respirator being worn, showing wearer operating the bellows.

the ends of equal length. When the respirator has been put on in the usual way the ends of the tape are passed round to the back of the neck and tied in a bow. The tape should be drawn just tight enough to prevent any forward movement of the container, but not tight enough to cause any displacement of the facepiece. If, as is sometimes the case, there is also a tendency for the head-harness to slip upwards at the back

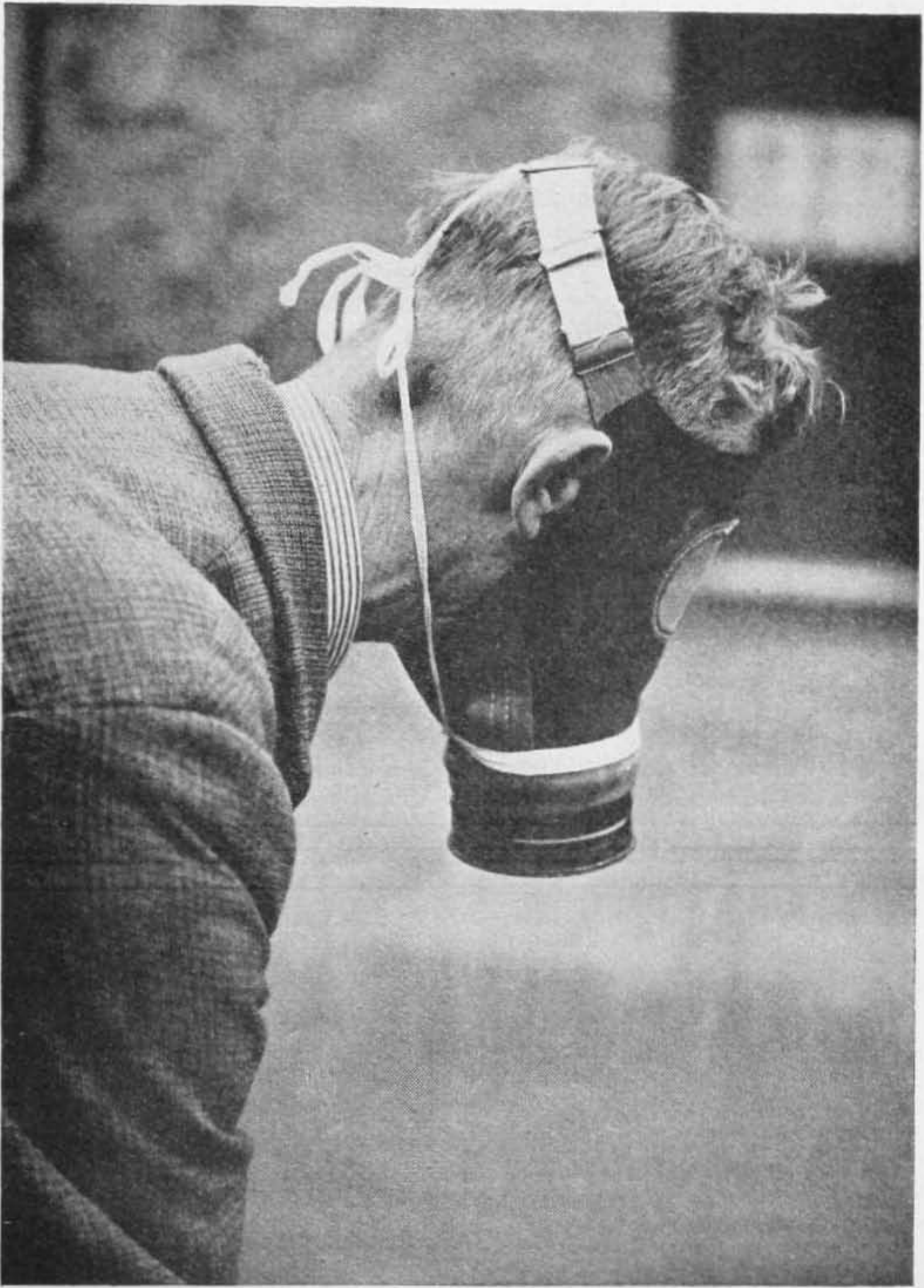


Fig. 14.

Civilian Respirator being worn, showing arrangement of tape to support weight of container and prevent the facepiece from slipping forward.

of the head, this can be overcome by attaching a loop of tape to the bottom slot in the T-buckle and passing the steadying tape of the container through the loop before tying it. (See Fig. 14.)

When the respirator is not in use the ends of the tape should be wound round the container and secured so that they will not become entangled with the head-harness while the respirator is being put on.

5. The Respirator Telephone

The speech of anyone wearing a Civilian Duty Respirator is muffled and indistinct and is particularly difficult to understand over a telephone. For telephone operators who must remain at their posts in rooms which cannot be made gas-proof a Respirator Telephone was designed. This is an ordinary Civilian Duty Respirator with a microphone attachment fitted into the protuberance moulded on the left cheek of the facepiece. The microphone is plugged into the switchboard and headphones are worn with the respirator.

6. The Fitting of Respirators

The aim in fitting respirators is to provide each person with the size of respirator which, while making a gas-tight fit on his face, will be as comfortable and as little handicap as possible. The key to a gas-tight fit is the chin—which must fit properly into the facepiece. The correct size is that which gives the wearer the best possible field of vision through the eyepieces or window when the facepiece has been pulled up on the face until it fits snugly under the chin. In a correctly fitted respirator the wearers eyes should be seen approximately at the centre of the eyepieces or window when looked at from the same level. The straps or bands of the head-harness in the Civilian Duty and Service Respirators are adjustable. The top two straps should be pulled up until the facepiece fits snugly under the chin and the others should be tightened just enough to hold the facepiece firmly on the face when the wearer moves his head about. If they are pulled too tight they may prevent the rubber of the facepiece from settling into hollows and thus introduce leaks ; they will certainly cause unnecessary discomfort.

7. The Use of Spectacles with Respirators

The advent of Nerve Gas and its rapid and dangerous effects, necessitates a very high standard of fitting of respirator face-pieces, and the wearing of spectacles (even if fitted with the official design of frames used during the war) introduces an unacceptable risk of leakage. Spectacles must *NOT*, therefore, be worn with the Civilian Respirator, Civilian Duty or the Service Respirator.

Wearers of Civilian Respirators who would be quite helpless without their spectacles can obtain sufficient aid for moving about in safety by wearing their spectacles **OUTSIDE** the facepiece. A piece of string or elastic should be fastened to the side members of the spectacles and passed over the back of the head to hold the spectacles in place.

8. Test for Gas-tightness and Test of Valves

When respirators are first issued and fitted they will be tested for gas-tightness and if possible their fit will be confirmed in a gas chamber or gas van. The effectiveness of the respirator depends on its gas-tightness and the proper working of the valves. The valves should, therefore, be tested every time the respirator is put on and the test of the valves will also show if the respirator is gas-tight. The wearer of the respirator is the only person who can tell with any certainty whether the valves are working correctly or not.

9. To test the Outlet Valve

In wear this valve should be shut except while breathing out, when it should open to allow the breath to escape freely. To test this, put

on the respirator and it will be obvious at once if the outlet valve is not opening properly because resistance to breathing out will be experienced and the breath will escape past the cheeks. Should it be found that the outlet valve is not opening properly hold the facepiece firmly against the face with the palms of the hands and blow out hard. This will often remedy this defect.

It is vitally important that the outlet valve should be tightly shut when the wearer is breathing in. In order to make certain of this and incidentally to test for gas-tightness generally, stop the normal passage of air into the facepiece and attempt to breathe in. Do this by nipping the connecting tube of the Service Respirator or, by holding a piece of smooth cardboard, or the palm of the hand if it is large enough, firmly against the outer end of the container of the Civilian Duty and Civilian Respirators. With the normal entry of air stopped it will be obvious to the wearer if any air comes into the facepiece either through the outlet valve or through any leak past the edges of the facepiece. Should the outlet valve be found to be leaking it may be due to a small piece of grit or dirt on the seating of the valve and this may often be removed by blowing out hard with the facepiece held firmly on to the face. Should it be found that air comes in through a leak at the edge of the facepiece make certain that it is on straight and try again. If the leak is still noticeable the head-harness needs adjusting and this should be done by a specially trained person.

10. To test the Inlet Valve

This valve should open when the wearer breathes in and remain shut at all other times to prevent moist used air going back into the container. To test this put the respirator on and it will be obvious at once if the inlet valve is not opening because the wearer will be unable to draw any air through it. To find out if it is closing properly stop up the normal exit of air from the facepiece and breathe out gently. Do this by holding the sides of the Civilian facepiece on the face with the palms of the hands; by nipping the outlet valve of the Civilian Duty Respirator; or by holding a pad firmly over the outside of the valve holder in the Service facepiece. If air is escaping when the wearer breathes out gently and is not felt passing the cheeks it can only be escaping through a faulty inlet valve or a leak in the connecting tube of the Service Respirator. In the Civilian and Civilian Duty Respirators taking the rubber inlet valve disc off its pin and turning it over before replacing it may sometimes remedy the defect. Nothing can be done about a faulty inlet valve in a Service Respirator and the respirator should be replaced at the first convenient opportunity.

A leaky outlet valve is dangerous in a gas affected atmosphere and the wearer should move out of the gas at once. A leaky inlet valve, on the other hand, is not dangerous because all the air being breathed is still purified in passing through the container. It will, however, cause discomfort and excessive fogging of the eyepieces if the respirator is worn for a long period.



APPENDIX C

RESPIRATOR DRILLS

1. Civilian Respirator

Immediately the presence of gas is noticed or suspected, or the Gas Alarm (Rattle) is heard, proceed as follows :—

(i) STOP BREATHING. Remove headgear and place it between the knees. Remove spectacles.

(ii) Take the respirator out of its carrier and hold it in front of the face with the thumbs under the side straps. (See Fig. 15.)

(iii) Thrust the chin well into the bottom of the facepiece, pull the straps over the head with the thumbs and place the T-buckle centrally at the back of the head. (See Fig. 16.)

(iv) Feel round the edges of the facepiece to see that no parts of it are folded inwards and make sure that the straps are not twisted. The respirator should now be giving full protection.

(v) Blow out to expel any gas from the facepiece and carry on breathing normally. Replace the headgear.

When the " Gas Clear " signal (handbell) is heard the respirator is taken off by placing a thumb under the T-buckle at the back of the head and pulling it forward over the head so that the respirator is lowered downwards from the face. (See Fig. 17.) NO OTHER METHOD OF REMOVING THE RESPIRATOR IS PERMISSIBLE AS IT MAY EVENTUALLY RESULT IN DAMAGE TO IT.

To Adjust a Civilian Respirator on another Person

There may be occasions when it is necessary to put the respirator on another person who is unable to do it for himself, for example, someone who is injured, or a child. It is done from behind and the injured person must either be sitting or lying, if an adult, but a child may be standing provided its head is below shoulder level of the person doing it. The method is as follows :—

(i) Turn the head-harness forward over the front of the facepiece. Hold the respirator in both hands with the fingers outside and the thumbs inside the facepiece on either side of the chin hollow.

(ii) Catch the chin hollow of the facepiece under the chin of the wearer and see that it fits snugly. Then slide the hands up the edge of the facepiece, catching the head-harness on the way, and draw the head-harness over the head into the correct position.

(iii) Adjust the straps of the head-harness to hold the facepiece in position.

2. Civilian Duty and Service Respirators

These respirators will be carried in the " Slung Position " normally, but during periods of alert they should be brought to the " Alert Position."

The Slung Position

Place the sling of the haversack over the head and slip the left arm through it so that the haversack rests on the left hip. The haversack is



Fig. 15.
Preparing to put on the Civilian Respirator.

kept closed and in the case of the Service Respirator, the press studs of the flap of the respirator compartment must be towards the body.

Alert Position

SERVICE RESPIRATOR

1. Swing the haversack to the front of the body and slip the left arm through the sling.



Fig. 16.

Thrusting the chin into the Civillian Respirator.

2. Undo the press studs of the respirator compartment.
3. Take out the whipcord and thread it through the D ring on the right of the haversack.

The latest type of haversack has no D's. The whipcord is secured to the haversack near the bottom right hand corner and when not in use is carried in a small pocket on the outside of the haversack.



Fig. 17.
Taking off the Civilian Respirator.

4. Lift the haversack well up on the chest and drop the sling down the back.

5. Pass the whipcord through the sling at the back and secure to the D on the left of the haversack with a slip knot, or by taking a turn round the quick release button where this is fitted in place of the D.

6. Fold over the flap of the haversack to cover the respirator.

CIVILIAN DUTY RESPIRATOR

Swing the haversack to the front of the body.

Open the haversack to the fullest extent (except when raining).

To put on the Respirator from the Alert Position

Immediately the presence of gas is noticed or suspected, or the Gas Alarm is heard, proceed as follows :—

1. STOP BREATHING.
2. Place the chin strap of the helmet under the chin and push the helmet to the back of the neck. Remove the ~~eyeshield~~ spectacles if worn.
3. Take hold of the respirator in the right hand with the Service Respirator by the valve holder, but with the Civilian Duty Respirator by the binding securing the container to the facepiece.
4. Pull it out of the haversack and turn it towards the face.
5. Place the thumbs inside the two lower elastics on each side and slide them wide apart.
6. Bring the facepiece up to the face and dig the chin well into it.
7. Pull the harness over the head with the thumbs and see that the pad is centrally placed at the back of the head. (See Fig. 18.)
8. Settle the facepiece comfortably on the face and see that the edges are not doubled inwards or the straps of the harness twisted. The respirator should now be giving full protection.
9. Blow out to expel any gas from the facepiece and resume breathing.
10. Bring the helmet forward on to the head and replace the chin strap on the point of the chin.

To put on the Respirator from the Slung Position

It is possible that a surprise gas attack might catch members of the Civil Defence Services carrying their respirators in the Slung position. In these circumstances they must put their respirators on as quickly as possible and, when fully protected, adjust the haversack in the Alert position. The Drill is as follows :—

1. STOP BREATHING.
2. Swing the haversack to the front of the body and, in the case of the Service Respirator, slip the left arm through the sling.
3. Proceed as in putting on the respirator from the Alert position. In putting on the Service Respirator it may be found easier to bend forwards.
4. After putting on the helmet and adjusting the chin strap, bring the haversack to the Alert position.

To take off the Facepiece

When the " Gas Clear " signal is heard, and not before, the facepiece of the Service Respirator or the Civilian Duty Respirator may be removed as follows :—

1. Prepare a fresh eyeshield.
2. Push the helmet to the back of the neck.
3. Insert two fingers of either hand between the chin and the



Fig. 18.
Putting on the Civilian Duty Respirator.

facepiece and remove with an upward and backward movement. (See Fig. 19.)

3. 4. With the Service Respirator let the facepiece hang by the connecting tube. With the Civilian Duty Respirator let it hang by one of the straps of the head-harness from the thumb of either hand.

4. 5. Put on the fresh eyeshield and replace the helmet.



Fig. 19.
Taking off the Civilian Duty Respirator.

To Replace in the Haversack

As soon as the facepiece of the Service Respirator or the Civilian Duty Respirator has been taken off it must be replaced in its haversack correctly so that it is ready for instant use when required again.

This is done as follows :—Hold the facepiece in the right hand with the fingers on one eyepiece and the thumb on the other and the valve holder or container lying in the palm of the hand with the inside of



Fig. 20.
Folding the Civilian Duty Respirator.

the facepiece upwards. Drop the pad and straps of the head-harness inside the facepiece. (See Fig. 20.) Squeeze the eyepieces together and push the facepiece or respirator into the haversack, forehead part first, with the harness buckles to the wearer's right. (See Fig. 21.) Fold over the flap of the Service Respirator haversack.

To adjust a Service or Civilian Duty Respirator on another Person

Should it be necessary to put a respirator on anyone unable to do it himself, it should be done as follows :—



Fig. 21.

Returning the Civilian Duty Respirator to its haversack.

- (1) Get behind him.
- (2) Take his respirator out of its haversack and hold it in both hands with the thumbs inside the two lower harness straps pointing upwards and the fingers outside the facepiece.
- (3) Catch the chin part of the facepiece under the chin and draw the head-harness over the head.
- (4) Straighten the facepiece and settle it comfortably on the face.

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