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HANDBOOK No. 6

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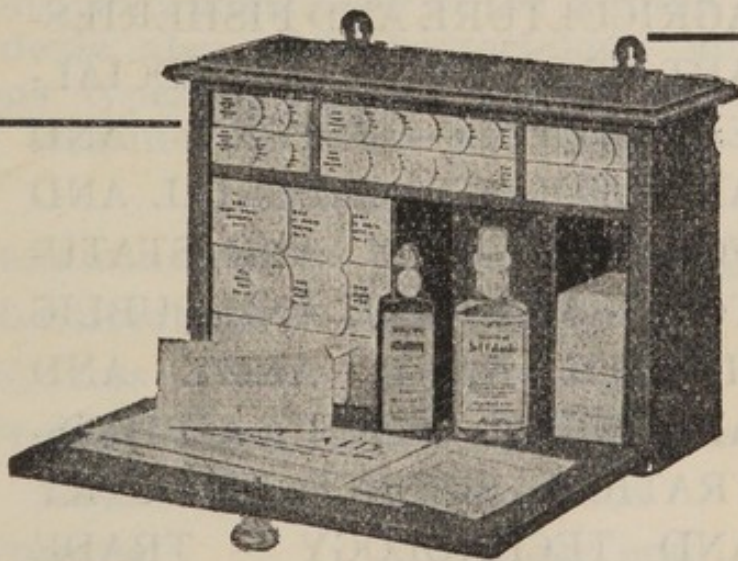


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No. 8.—The Duties of Air Raid Wardens (*1st edition*) (price 2d. : 2½d. post free).

(A handbook for Air Raid Wardens.)

In addition to these Handbooks, there is published a series of A.R.P. Memoranda dealing with various aspects of the organization to be provided by local authorities for public air raid precautions services.

GENERAL PREFACE.

The series of Air Raid Precautions Handbooks (of which a list is given on the opposite page) is produced, under the authority of the Secretary of State, by the Air Raid Precautions Department of the Home Office with the assistance of other Government Departments concerned.

The measures for safeguarding the civil population against the effects of air attack which these Handbooks describe have become a necessary part of the defensive organization of any country which is open to air attack. The need for them is not related to any belief that war is imminent. It arises from the fact that the risk of attack from the air, however remote it may be, is a risk that cannot be ignored and because preparations to minimize the consequences of attack from the air cannot be improvized on the spur of the moment, but must be made, if they are to be effective, in time of peace.

For the purpose of the measures now to be taken, it must be assumed that the scale of attack would greatly exceed anything which was experienced in the last war, and would involve the use of high explosive and incendiary bombs.

The use of poison gas in war is forbidden by the Geneva Gas Protocol of 1925, to which this country and all the most important countries of western Europe are parties, and the Government would use every endeavour on an outbreak of war 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.

The Handbooks are designed to describe a scheme of precautions which it is hoped would prove effective in preventing avoidable injury and loss of life, or widespread dislocation of national activities. The Handbooks will aim at giving the best available information on methods of passive defence against air attack, and will be revised from time to time in the light of future developments.

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INTRODUCTION.

This Handbook is intended primarily for factory occupiers, for occupiers of large commercial premises such as big shops, and for other employers of labour, on whom would rest in time of emergency a responsibility for the protection of their employees while at work and the safeguarding of their property.

Local authorities all over the country are engaged in the preparation of schemes for minimizing the effects of air attacks. The public services which are being organized by the local authorities for this purpose will be available for everybody in the country. But these arrangements, however, effective they may be, will not suffice to meet every requirement. They will need to be supplemented by the individual efforts of householders and of employers of labour.

In undertakings employing considerable numbers of workers it is hoped that it may be possible to work out what will amount to a miniature self-contained air raid precautions scheme embracing as many as practicable of the various services which might be required. As a general guide it is suggested that establishments employing 100 or more workers should adopt this principle.

All these factories and most commercial undertakings will already have some first aid arrangements, and very often their own fire arrangements, which will provide a convenient nucleus for their air raid precautions organization. In most cases, however, existing facilities would probably need to be increased.

It is of great importance that all employers should work in close co-operation with the local authority in whose area their establishments are situated. Not only will employers be dependent on local authorities for hospital arrangements and perhaps for other services; but in certain circumstances they might be in a position to give assistance to local authorities in case of need.

The importance of doing everything possible to safeguard the lives of employees does not need to be stressed; and any measures which can be taken to enable production—especially for vital national services—to be maintained will be of the utmost value to the country.

Suggestions which could be usefully included in revised editions of this handbook will be welcomed by the Air Raid Precautions Department.

CHAPTER I.

THE NATURE OF AIR ATTACKS.

The main sources of danger in an air raid are high explosive bombs, incendiary bombs and gas bombs or gas spray.

High Explosive Bombs.

High explosive bombs may be expected to weigh from 250 to 3,000 lb. They can be designed to burst on contact with a hard surface or to penetrate a considerable distance before bursting. The latter type of bomb would penetrate an ordinary building before exploding, though contact with a steel or stone structure may serve to deflect the path of the bomb or to explode it prematurely, and reinforced concrete of exceptional thickness may cause the bomb to explode before penetration.

Damage is mainly caused by the blast of the explosion and by the fragmentation of the shell of the bomb which results.

Incendiary Bombs.

This type of bomb is usually small and light, weighing anything from 2 lb. to 50 or 60 lb. It is filled with six incendiary compounds which is ignited when the bomb strikes a hard surface. The case of the bomb may be itself composed of inflammable materials, such as magnesium. Since these bombs contain within themselves the necessary elements for combustion they cannot be readily smothered.

A small incendiary bomb will normally pierce the ordinary type of roof, and will ignite on the floor of the top storey. Reinforced concrete, 5 inches thick, may be expected to keep out incendiary bombs of 2 lb. weight.

Incendiary bombs would be particularly dangerous against factories or stores containing inflammable or explosive material; and, being light, could be used in considerable numbers.

Gas Bombs or Gas Spray.

The weight of a gas bomb varies, and it may be anything up to 250 lb. or even larger. The poison gas content would normally account for more than half the weight of the bomb.

Gases may be divided into two main types (i) non-persistent and (ii) persistent.

Non-persistent gases when liberated are rapidly diluted by admixture with the air, and the period for which they continue to be dangerous is dependent upon the atmospheric conditions. Examples of such gases are chlorine, phosgene, and the poisonous smokes derived from various arsenical compounds.

Persistent gases (for example, mustard gas) usually consist of a contaminating liquid which will continue to give off poisonous vapour for many hours or even weeks, unless counter-measures are taken. Different materials vary in the ease with which they will absorb these gases, and therefore the decontamination measures have to be suited to the type of material contaminated. Contact with contaminated material will be dangerous unless neutralizing action is taken or the gas disappears naturally.*

Gas attacks may be made by means of bombs or spray. If the former are used, the gas will be liberated where the bomb explodes, whereas the gas discharged by spray will descend in the form of a fine shower of liquid, which may travel with the wind some distance before reaching the ground.

In providing protective measures against air attack, one of the objects is to prevent the gas, in liquid or vapour form, from penetrating into the building or shelter which it is desired to protect; and this is usually achieved by making the shelter air-tight.

Machine-gun fire.

This danger is not likely to arise frequently, but the measures taken to secure protection against high explosive bombs would be equally effective against this form of attack.

* A more detailed account of the gases used in aerial warfare is contained in A.R.P. Handbook No. 1, *Personal Protection against Gas*.

CHAPTER II.

GENERAL ORGANIZATION.

The Need for Preparation.

Air attacks can be delivered with great suddenness and it would be impossible to improvise the necessary precautionary measures at short notice. It is essential that a survey of the various measures to be adopted should be made at the present time, and that all necessary preliminary arrangements should be made to enable these measures to be put into force without delay.

Adaptation of Measures to Particular Circumstances.

The arrangements must be such as will stand the test of a time of emergency and crisis. The details will vary with each undertaking, according to the character of the buildings occupied, the location of the buildings, the class of work carried on, the nature of the materials handled, and the age and sex of the workers employed, as well as their number in proportion to the occupied area. The requirements of a steel works for instance will be very different from those of a cotton mill or a departmental store. Again, a good deal will depend on whether all business can be stopped until the danger is past, or whether there are processes which would have to be kept going.

The aim of this Handbook is to give general guidance which will be of use to all classes of undertakings; but it must rest with those who are responsible to select the means of protection which are applicable to their own case and to frame a complete scheme in which emphasis is laid on the measures most appropriate to their particular needs. This will best be done, indeed can only be done with success, if a responsible member or officer of the firm sets himself to visualize the kind of difficulties which might arise, and the steps which would have to be taken to cope with them.

Headings of a Scheme.

The headings suggested for an air raid precautions scheme for a factory or other undertakings are shown in Appendix A, and the material for insertion under each of the headings is dealt with in detail in the chapters which follow.

It is important that the scheme should distinguish clearly between the action to be taken:—

I.—(a) Now.

(b) As opportunity affords.

- II.—(a) When an emergency appears imminent.
 (b) When an air raid warning is received.
 (c) During an air raid.
 (d) When information is received that the raid has passed.

The scheme should cover, in as complete detail as possible, the action to be taken at these various stages. For example, notices giving instructions to workpeople on the action to be taken when an air raid is expected should be prepared now and stored, and the workers, especially those in key positions or required for air raid precautions duties, should be sufficiently familiar with the arrangements to know what to do.

Furthermore, equipment which is not likely to be readily available in an emergency should be obtained now if possible and stored, and its place of storage noted in the scheme: while exact details of further equipment which might be required in the emergency should be listed and a note made of the sources from which it might be obtained. If possible definite arrangements should be made to ensure that such equipment can be obtained quickly and without fail. This is important in view of the heavy demands which might be expected.

When a scheme has been worked out, the various tasks should be allotted and a list of the persons so designated should be prepared and kept up to date. Young men under 25 years of age might wish to enlist in time of war and should not, for preference, be chosen for air raid precautions services.

Personnel earmarked for first aid and decontamination work should be given the necessary training. This training can be arranged either with the local authorities or with the St. John Ambulance Brigade, St. Andrews Ambulance Association or British Red Cross Society. It is hoped that later it will be possible for a limited number of officials of large industrial and commercial undertakings to receive training as instructors at a Civilian Anti-Gas School.

It would no doubt be necessary in many cases for certain key workers to remain on duty while an air raid was in progress. Definite instructions should be prepared for such key personnel and the question of their protection must be considered.

The importance of collaborating closely with the local authorities has already been emphasized. The field of responsibility of the local authority and the employer should be carefully defined. For example, an undertaking possessing suitable transport should, if possible, accept the responsibility of removing casualties from the works to public

hospitals. In order to assist the managements of factories a table showing the air raid precautions services which are being organized by the local authorities is given in Appendix B.

It is again emphasized that, while public facilities will be available to factory occupiers and employees, there will be great need for all large undertakings to be as self-contained as possible in their arrangements.

Controlling Organization.

Each undertaking should decide, in the light of its particular circumstances, the type of controlling organization which could best be adopted for its air raid precautions services. It might well be thought desirable that the member or officer of the firm who had been appointed to supervise the preparation of the necessary plans in time of peace should also be made responsible for the execution of the plans in the event of war.

Maintenance of Production.

It is very important, in working out the scheme of air raid precautions, to ensure that, so far as may be practicable without incurring avoidable risks, it will involve the least possible check on production, especially where a factory might be engaged on war or other important work.

CHAPTER III.

PROTECTION OF EMPLOYEES.

The first task will be to consider how best to provide protection for workers and others who may be on the premises if an air raid occurs.

Since it would normally be impracticable to provide effective protection against direct hits by high explosive bombs, the arrangements to be made should be designed to ensure protection against blast, splinters and gas. In many cases it may be impossible to make large factory or business premises completely safe against gas and splinters and it will be necessary to select suitable places which can be adapted as shelters, to which workers and others could go on receipt of an air raid warning.

It may be noted that a special study is being made, under the aegis of the Air Raid Precautions Department, of possible measures for the protection of buildings from the effect of bombs. In due course the information collected will be embodied in a separate Air Raid Precautions Handbook on *Structural Precautions against Bombs and Gas*.

General Principles of Protection.

Individual Protection.

The Government are arranging to accumulate supplies of respirators which would be issued in time of war to the civil population in areas exposed to air attack. This will cover the general requirements of factories and other undertakings.

Persons engaged on air raid precautions duties will, however, need additional protection since they may have to remain in or go out into heavy concentrations of gas. In addition, there may be certain key workers who would have to remain on duty and who could not be provided with gasproof accommodation. These men also would require additional protection. It is recommended that all employers should make provision for such protective equipment as may be required in these cases. This would consist of a respirator of the standard of the Civilian Duty respirator* and also, in certain cases, of protective clothing.

Further information about respirators and protective clothing is contained in Appendix C.

* Formerly known as the Special Service respirator.

Collective protection.

The provision of collective protection is one of the most important problems with which employers will be faced, and in making the various detailed arrangements for this purpose, there are one or two essential principles which should be borne in mind.

It is of the greatest importance to avoid, as far as possible, any large congregation of persons. In selecting places for shelters, not more than fifty people should be congregated in any one place, unless special arrangements are made for dividing the shelter into compartments on the lines indicated on page 16.

The protection provided should include gasproofing and protection against blast and splinters. General standards of protection are set out in Appendix D. In addition, as has been stated, all employees should be in possession of respirators. They should keep their respirators always by them, ready to put on at a moment's notice.

Methods of Providing Collective Protection.

Collective protection may be provided in any of the following ways :—

- (1) by the use as shelters of suitable accommodation in existing buildings;
- (2) by trenches or other outside shelters;
- (3) by galleries (of the type used in mines) where these exist already or where they can be constructed more easily than special shelters or trenches;
- (4) by dispersal;
- (5) by a combination of any of the above.

The first point to consider is what facilities for collective protection may exist in the factory or its surroundings, and which of the methods suggested above would be most suitable. In some cases it may be found that the facilities available on or near the premises are inadequate to provide for the whole of the employees. In this event it may be advisable to arrange that, on receipt of an air raid warning, a specified number of the employees should disperse to their homes. In coming to this decision it is very important, however, to remember that the length of warning received will probably not exceed ten minutes and that it is highly undesirable that large numbers of persons should be caught in the streets or in public transport vehicles when the raid begins. As far as possible, therefore, only workers who live sufficiently near the works for them to reach home in about five minutes should leave for home, unless, of course,

it is found entirely impossible to provide any protection at all in the works. In such a situation, which may conceivably occur in the case of industrial establishments in urban areas, the local authority should be consulted with a view to determining what is best to be done in the circumstances for the safety of the workers, and particularly as to the possibility of finding suitable accommodation for them close at hand. In the arrangements made, the importance of getting people back to work after a raid, especially in work of an essential character, should not be overlooked.

The same principles will also apply to selecting shelters within the boundaries of the establishment; that is to say, if the area covered by the buildings and grounds is extensive, the shelters for the workers should be planned so as to enable employees to reach them as quickly as possible. In large works it would seem desirable to consider in advance the methods by which workers are to be directed to their shelters—for example, by the use of sign boards, which might be in distinctive colours.

As a general rule accommodation below ground level is best, provided that adequate protection against gas can be secured. If there is risk of flooding, alternative accommodation should be available.

If suitable accommodation below ground level is not available, then the ground floor should be chosen. It is, however, of the greatest importance, in deciding whether protection should be provided indoors or not, to take account of the construction of the building. If it is of very light construction and therefore liable to heavy damage it may be preferable to arrange for shelter out-of-doors. A factory which has a great deal of glass in windows or sky-lights might also be dangerous unless steps could be taken to guard against the danger of large quantities of glass falling upon persons in the building.

The following general rules should be adopted in selecting the positions for shelters, always bearing in mind that any place chosen should be capable of affording protection against splinters and blast and should be capable of being gasproofed.

Indoor Shelters.

It is better to have a number of small shelters than to attempt to congregate a large number of people in one shelter. As indicated above, fifty persons per shelter, or per compartment of a shelter, should be regarded as the maximum number in normal circumstances, though it is realised that it may at times be necessary to exceed this number.

In determining the number of shelters required, 75 square feet of surface area (walls, ceiling and floor) per head should be allowed. If a filtration unit is installed the accommodation of a shelter can be increased. (For further details see page 49).

The walls and roof of the shelter should be of sound construction and should be capable of being made gasproof.

The fewer the openings, such as windows and doors, the better, and the easier it will be to afford protection against splinters and gas. In a shelter of any considerable size it is desirable that two exits should be provided.

No shelter should be located below heavy machinery, water tanks, or below any structure which might collapse and demolish it, unless the roof is of sufficiently strong construction.

No shelter should be near stores of inflammable material. Proximity to boilers or to numbers of hot pipes should also be avoided, as high temperatures in a shelter are undesirable.

If the shelter has windows it is preferable that they should face another building or a wall, or else soft ground, since there will then be less danger from flying splinters and blast.

There is also advantage in having shelters on the side of the building not exposed to the prevailing wind, which may tend to blow gas through cracks which have not been properly sealed.

An internal corridor may form a good shelter if it can be closed at both ends for protection against gas.

If underground accommodation is available and suitable, additional supports may have to be inserted to ensure that the roof would not collapse if the structure above were wrecked. Particular attention should be paid to the means of exit in case of any such damage occurring, and extra supports are strongly advised round the doors to prevent the exits becoming blocked. It is for this reason that any accommodation of this kind should, if possible, have alternative exits.

If the shelter is on the ground floor or above ground level, additional protection against splinters and blast will be required, and the floor should be capable of bearing the weight of any protective material, such as sandbags, which may have to be built up as a protection. Windows and doors should be protected and also the walls if they are of brickwork less than $13\frac{1}{2}$ inches thick. Sandbags should be

stored for this purpose and a scheme worked out which would enable the bags to be quickly placed into position after being filled with earth, coal dust, gravel or sand. Boxes of earth are an excellent substitute for sandbags.

If, owing to limited facilities, more than fifty persons have to be sheltered in one place, the shelter should be broken up with splinterproof partitions of concrete, sandbags or boxes of earth in order to localize the effect of any explosion.

Details of the adaptation of shelters in existing buildings so as to render them splinterproof and gasproof are set out in Appendix E, and the construction of sandbag walling is described in Appendix F.

A summary of the equipment required for a shelter is given in Appendix G. It is very important that those in a shelter should be given some means of quiet recreation, and special arrangements should be made for this.

Outdoor Shelters.

If, for any reason, indoor shelters are impracticable, it may be necessary to arrange for the construction of trenches in open ground.

Any spaces intended for this purpose should be kept clear or in a state in which the trenches can be very quickly prepared, and steps should be taken to ensure that the necessary tools for digging the trenches are available. If possible, trenches should not be dug in very soft or wet ground, or in ground that is liable to flooding.

Details of suitable types of trenches are included in Appendix H.

Trenches provide good protection against anything except a direct hit. They can be reasonably quickly prepared and, if necessary, can be made reasonably gasproof. Provided the ground is available it may often be safer to use trenches in preference to indifferent accommodation indoors.

Galleries (of the type used in mines) are an alternative form of outdoor protection, when conditions are suitable. The methods of constructing galleries are outlined in Appendix I.

Preparation of Shelters.

Once the sites for shelters have been selected they should be examined in order to see what protective measures are required; what can reasonably be undertaken now; and what would be necessary to complete them should an emergency appear imminent.

The extent of the work to be carried out now must depend on local conditions and facilities. It is of primary importance, however, that plans should be prepared in detail and the necessary materials either accumulated or earmarked in such a way that they can be available when required, and all arrangements made to enable shelters to be constructed at comparatively short notice.

Summary of Action to be Taken.

Now.

- (a) Preparation of part of scheme relating to protection of personnel.
 - (i) Choice of sites of shelters.
 - (ii) Survey of structural alterations required in each shelter.
 - (iii) Survey of equipment required.
 - (iv) Survey of Civilian Duty respirators required.
- (b) Execution of structural alterations where necessary.
- (c) Purchase of equipment, where necessary.
- (d) Purchase of Civilian Duty respirators required and arrangements for storage.

Emergency.

- (a) Purchase of equipment outstanding.
- (b) Preparation of shelters for occupation.
- (c) Final instructions to employees.

CHAPTER IV.

PROTECTION OF PROPERTY AND MATERIAL.

General.

A survey should be made of the more vital parts of the plant to see what can be done to afford local protection against damage by blast and splinters, especially for machinery which is essential to the continued working of the factory. Particular attention should be given to steam boilers and to surface pipes of essential water and gas supplies and to the switchboards and cables of electricity supplies. The piercing of supply pipes, besides causing dislocation to the factory, might involve the flooding of shelters or explosions.

The storage of highly inflammable material, such as petrol or benzine in tanks, should receive special consideration on account of the grave risk of fire. Where this is not already done, plant containing inflammable spirit stores should be mounded so as to prevent burning spirit spreading over a large area. Where there is a large storage on a top floor of a building it may be an advantage to provide a drain pipe to a sump outside to prevent spirit flowing from floor to floor.

Telephone switchboards and other places essential to communication and control will require protection, also any place earmarked for use as a first aid post or for some other air raid precautionary purpose.

In most cases sandbags will afford the most simple and effective means of protection; but, as already indicated, wooden boxes filled with earth are an excellent substitute.

Where practicable, duplicates of vital key machinery and special fittings should be obtained, if not already available, and stored as an additional form of protection. These duplicates should preferably not all be stored in one place, and should be away from the main buildings.

Any large area of glass should be protected, by wire netting or otherwise, to prevent scattering of glass if it should be shattered by an explosion.

If premises become contaminated by gas, decontamination will be necessary before work can restart. Any steps which can be taken to gasproof important parts of the factory will be valuable and may help to reduce interference with production.

As already indicated, incendiary bombs may be expected to pierce light roofs and burn on the floor of the top storey. It is most important, therefore, to take all possible steps to reduce the risk of fire, partly by having adequate arrangements to extinguish fires quickly (*see* Chapter VIII), and also by reducing, as far as is practicable, any stocks of inflammable materials on the top storey.

Supplies of Essential Services.

The question of how work could be carried on if supplies of water, electricity and gas from public or private sources were interrupted by damage to producing stations or service mains should be carefully considered.

Where private generating plant is being replaced by supply from public mains, the private plant should, if possible, be retained in working condition.

In view of the fire risk, reserves of water or alternative sources of supply should be arranged wherever practicable.

Repair Work.

Arrangements should be made for augmenting at short notice the existing facilities for dealing with damage to machinery and property. Where repair work is done by outside labour, steps should be taken to ensure that assistance would be forthcoming in an emergency despite largely increased demands on the resources of outside contractors.

Summary of Action to be Taken.

Now.

(a) Survey of premises to see what parts require protection and gasproofing, and preparation of detailed plans.

(b) Where practicable, provision and storing of duplicates for vital parts of plant.

(c) Provision of alternative sources of supply for vital services.

(d) Arrangements for augmentation of repair service.

Emergency.

Putting into effect of plans for protection and gasproofing of premises and for augmentation of repair service.

CHAPTER V.

WARNING SYSTEM AND EMERGENCY COMMUNICATIONS.

Warning System.

The Government have prepared a scheme for observing the movements of hostile aircraft and for issuing warnings of approaching attacks. It should be assumed that warning might be received from 7 to 10 minutes before the arrival of the hostile aircraft.

A factory will normally be expected to rely on the warning issued to the public in the vicinity of the works. The exact form of this warning signal will be settled in each district by the local authority. The management should make the necessary arrangements to ensure that, on receipt of an air raid warning, it is conveyed to the workpeople. It will often be desirable to plan means for conveying the warning to the selected personnel who have to take some preliminary action, before it is issued generally. Time is of the essence of this matter, and when warning of an air raid is received, not a second should be lost in taking the action required.

On the departure of the raiders, a further signal would be given: and arrangements would be needed for conveying this signal to all in the works, whether in shelters or elsewhere.

It will be necessary to arrange for a distinctive signal, known to all in the premises, to indicate when poison gas is present during or after a raid. If gas is present, those in shelters should remain under cover, even after the raiders have passed, until conditions are reported to be safe.

Emergency Communications.

In time of war, no assurance can be given that the telephone will remain in operation. It may be damaged or the lines may become overloaded.

Arrangements should accordingly be made for emergency methods of communication, e.g., runners, cyclists, etc., between different parts of the undertaking or between the undertaking and vital places outside.

Summary of Action to be taken.

Now.

(a) Preparation of plan for conveyance of warnings to key personnel and to workpeople generally.

(b) Preparation of plan for emergency methods of communication.

Emergency.

Execution of plans.

CHAPTER VI.

LIGHTING RESTRICTIONS.

It is expected that the restrictions on lighting imposed in time of war would need to be more drastic than those enforced during the last war. The purpose of these restrictions is not merely to prevent conspicuous buildings being picked out by night from the air as targets for attack; but also to deprive enemy airmen of an easy means of checking their position. The restriction on lighting in a factory is, therefore, not merely a protection for the works, but may also be a protection for the whole neighbourhood.

The occupier of a factory or business premises should be prepared for a degree of restriction which would prohibit the use of any lights visible from outside. There would have to be exceptions to this in the case of certain factories engaged in essential work which are dependent on unscreened lighting; but no exemption would be granted until the occupier had satisfied the authorities that he had, as a permanent measure for the duration of the war, extinguished or obscured lighting so far as practicable; and it would be a condition of the exemption that visible lights must be extinguished on the receipt of an air raid warning. Accordingly, the more dependent a factory is on visible lights, the greater would be the dislocation of work on the threat of air raids.

All illuminated advertisements would be absolutely prohibited and all external lights, save in so far as they were expressly authorized by the police, would have to be extinguished. Arrangements should accordingly be made for having roads and pathways marked by white posts or stones or by whitewash in time of war, for the convenience of those who have to use them after dark.

In the case of internal lights the question should be investigated how far complete invisibility from outside can be secured by the darkening of windows and skylights. In time of war, all windows, skylights and glazed doors would have to be rendered opaque at night, either by the use of paint covering the whole window, by the fitting of blinds, or by a combination of both methods. If dark blinds are not fitted now, full measurements of the blinds or screens required should be taken and recorded as part of the air raid precautions scheme of the factory. As material may run short when the need arises the occupier would be well advised to obtain the necessary blinds and screens now. Blinds under skylights, if sufficiently strong, would serve to prevent the fall of glass in the event of a skylight being shattered by the explosion of a bomb.

If new blinds are required their type should be considered in conjunction with the gasproofing arrangements referred to in Chapter III.

Consideration should also be given to the practicability of carrying on work with lamps of lower power or so shaded as to throw light only on the bench or machine as the case may be.

All these measures should be taken where the occupier of the factory has reason to believe that in time of war it might be necessary for the factory to be at work during the hours of darkness.

In the case of special industrial processes which cannot be effectively screened, such as blast furnaces, colliery by-product plant, potteries and metal works with open furnaces, steps should be taken to ascertain how quickly operations can be damped down. The information should be given to the Chief Officer of Police for the district. It will then be a matter for consideration whether in time of war night work can be permitted having regard to the question whether sufficient warning of impending air raids may be expected.

It is important that such steps as are practicable should be taken to make less easy the identification of objectives by day, as well as by night. Accordingly arrangements should be made so that, on the outbreak of war, it would be possible to remove or screen any signs on the roofs of buildings which might give any indication of the identity of the premises.

Summary of Action to be Taken.

Now.

- (a) Measurement of blinds and screens required.
- (b) Assessment of requirements of low powered lamps and shades.
- (c) Storage, where practicable, of stocks of these requirements.

Emergency.

- (a) Fitting of blinds and screens.
- (b) Fitting of low-powered lamps and shades.
- (c) Removal or screening of all large roof signs.

CHAPTER VII.

FIRST AID.

The extent of the preparations which it may be possible to make for dealing with casualties must vary in accordance with the facilities of the undertaking concerned. Cases of serious injury will normally have to be sent to hospital by ambulance, but every effort should be made to give first aid for minor or even major injuries and to deal with cases of gas contamination within the premises.

Each undertaking must decide in the light of its particular conditions on the best organisation of its casualty service.

First aid post.

A first aid post will be required where first aid can be given to wounded persons. When there is an ambulance room it will normally serve for this purpose; though it may have to be extended to cope with the number of casualties to be expected if the undertaking were bombed. In very small works first aid facilities may be provided in the shelters, in lieu of a first aid post. In works where a large number of persons are employed or which cover a wide area, more than one first aid post may be necessary.

Cleansing centre.

A cleansing centre will be needed to deal with cases of contamination by poison gas. Where practicable, the cleansing centre should be close to, or better still part of, the first aid post, since contaminated persons may be suffering from injuries and require first aid. The equipment of a cleansing centre should consist of baths, preferably shower baths, with supplies of warm water, bins with close fitting lids for contaminated clothing, and a supply of fresh clothing for persons whose clothing has become contaminated. The arrangements should have regard to the fact that it is essential that contaminated persons should be cleansed at the earliest possible moment. The risk of injury increases with every minute during which cleansing is deferred. Accordingly every factory or shop should aim at having a cleansing centre, and large premises should have more than one.

The cleansing centre will also serve the needs of key workers wearing protective clothing who have been exposed to gas and who are coming off duty.

In a *small* combined first aid post and cleansing centre, one trained person will be required to take charge, one semi-trained to act as undresser for contaminated cases, two trained persons to give first aid, and two semi-trained or untrained persons for general duties.

Separate accommodation and staff should be provided for men and women.

The layout of first aid posts and cleansing centres is outlined in Appendix K. The important principle to observe is that contaminated persons or material must not come into contact with uncontaminated or cleansed persons.

First aid parties.

First aid parties, each consisting of three men, will be required to give immediate attention to casualties and to convey stretcher cases to ambulances or to a first aid post.

The question of equipment is dealt with in Appendix J. Normally, the material provided under the Workmen's Compensation Act requirements will afford sufficient peace-time cover for emergency requirements. The distribution of this material (e.g., between first aid posts and first aid parties) will be a matter for decision in the light of the particular circumstances of each undertaking.

Additional first aid parties should be organised if communications between different parts of the works are difficult or are likely to be difficult under air raid conditions. In undertakings covering a wide area, the personnel engaged in first aid parties should be increased and should work in parties of four.

A factory or shop with (say) 250 employees should have at least two first aid parties and the number of parties required must depend on the prescribed area of each works: but as a rough guide it is suggested that an additional party should be provided for every 250 employees or fractions thereof. This relates to the requirements at any one time, and if more than one shift is likely to be worked further parties will be required.

First aid parties may be stationed in shelters, or at a first aid post, if communications between the post and the shelters are good. Any trained personnel who are not working in parties should be distributed among the shelters.

Trained personnel for first aid services.

To meet the needs of the various first aid services outlined above, it is suggested that at least one out of every 20 workpeople should be trained in first aid and anti-gas precautions. In very large undertakings a somewhat smaller proportion will probably serve. Training should be organised

in collaboration with the St. John Ambulance Brigade and the British Red Cross Society, and in Scotland with the St. Andrew's Ambulance Association and the Scottish Branch of the British Red Cross Society.

Ambulance transport.

If suitable transport is available, arrangements should be made to take serious cases to hospitals. A proportion of the vehicles should be reserved for the transport of cases contaminated by gas as well as injured. The vehicles so reserved must be of a type which can easily be decontaminated by washing after use.

Summary of Action to be Taken.

Now.

- (a) Training of personnel in first aid and anti-gas measures.
- (b) Earmarking of first aid posts and of cleansing centres and making detailed plans of any structural alterations required.
- (c) Organisation of first aid parties.
- (d) Arrangements for transport of serious cases to hospital.

Emergency.

- (a) Equipment of first aid parties.
- (b) Establishment of first aid posts and cleansing centres.
- (c) Ambulance arrangements.

See also.

A.R.P. Handbook No. 1. ("Personal Protection against Gas")—a handbook for members of air raid precautions services.

A.R.P. Handbook No. 2. ("First Aid for Gas Casualties")—a handbook designed for services giving first aid to air raid casualties.

A.R.P. Handbook No. 3. ("Medical Treatment of Gas Casualties")—a handbook for doctors and nurses (in preparation).

A.R.P. Memorandum No. 1. ("Organisation of Air Raid Casualties Services")—a memorandum on the organisation of air raid medical services by local authorities.

CHAPTER VIII.

FIRE PRECAUTIONS.

Fire precautions in factories, important at all times, are rendered immensely more important when war risks have to be taken into account, for these introduce new factors and call for special precautions which do not enter into the problem in peace time. This arises in a number of ways. For instance :—

(1) The risk of outbreaks of fire occurring in factories is greatly increased. The most serious risk is, of course, the possibility of attack by incendiary bombs from the air. There may also be a risk of incendiarism; and the risk of fires being caused accidentally is generally greater than under normal conditions of work.

(2) A new and fundamentally important factor is the possibility of numerous outbreaks of fire occurring in a locality at one and the same time. In peace time this does not occur, or occurs so rarely that it can safely be left out of account in building up local fire brigade resources; but in the event of air attack the outbreak of numerous fires is only to be expected, and it may well happen that all available resources of the public fire brigades in a district which is attacked will be insufficient to enable the brigade to deal with all the fires which break out.

(3) Further, in the event of attacks from the air, the normal water supply may be interfered with by reason of water mains being damaged or the pressure in the mains being reduced by the volume of water drawn off to deal with fires. Roads also may be damaged and the arrival of fire brigade assistance thereby delayed.

For these reasons it is incumbent upon all who are responsible for factories and other industrial establishments to review their fire precautions with the object of guarding against these risks, so far as that is possible, and, in particular, to make the premises much more self-sufficient in all matters of fire protection, including the provision of emergency water supplies, than is necessary in peace time.

The measures to be taken for this purpose amount to a full overhaul of the fire precautions, with these war risks especially in view, with the following objects :—

(1) Reducing the fire risk by cutting down to a minimum the amount of inflammable material which

might be set alight by bombs. (Special attention should be paid to top floors and empty spaces under roofs.)

(2) Organising regular fire practices with the staff.

(3) Reviewing the fire-fighting arrangements and the fire appliances provided, and supplementing them as may be necessary to meet the emergency risks.

(4) Organising and training fire parties with regular fire drills. It has been proved over and over again that the haphazard efforts of unorganised employees, however well meant, can never be expected to control fire as well as action by a trained body of men, familiar with the fire protection arrangements and layout of the premises and accustomed by drill and practice to handle the appliances provided.

(5) Providing, wherever possible, supplementary water supplies for fire extinction purposes.

(6) Providing appliances to enable fire parties to remove incendiary bombs from points where there is inflammable material, and sand and means of applying it to hold such bombs in check. (Water must not be thrown on incendiary bombs.)

Many general fire precautions in factories are dealt with in the Pamphlet "Fire Protection in Factories" (Safety Pamphlet No. 13) issued by the Home Office in 1928,[†] and published by H.M. Stationery Office.* The special emergency measures above referred to are dealt with in more detail in the paragraphs which follow.

Calling the Fire Brigade.

In spite of what has been said as to the possibility of the public fire brigades being unable to assist in an emergency, it is a sound rule always to call the Fire Brigade *as soon as any fire is discovered.*

If the premises are large or there are any special risks, it is also sound practice to concert measures beforehand with the officers of the local fire brigade or brigades, so that they may become acquainted with the premises and any special risks there may be, and to settle in advance what reinforcing brigades should be called in if the local brigade should be unable to cope with a fire without assistance.

The brigade or brigades to be called in case of fire, with telephone number, should be clearly indicated in Fire Notices at suitable points on the premises, and especially at every telephone. (See also the Safety Pamphlet.)

* This Pamphlet is under revision.

Reducing the Fire Risk.

Emergency measures for reducing the fire risk are mainly a matter of intensifying the precautions which ought to be in force at all times. There are many forms of carelessness which are common causes of fires, such as, unnecessary accumulation of rubbish: improper storage of materials liable to spontaneous combustion: bad electrical wiring and connections: overheating flues: faulty shafting bearings: naked flames near inflammable materials: smoking where smoking is prohibited: dropping cigarettes or matches in waste paper baskets or amongst inflammable materials.

In war time, there is special need for vigilance, and, in addition, for specific measures to minimize the risk of incendiary bombs falling amongst inflammable materials and setting the factory alight. Wherever there is inflammable material which can be reached by a bomb there is potential risk: wherever there is none, a bomb may generally be allowed to burn out harmlessly. Anything that can be done to do away with inflammable material or to put it where it is not likely to be reached by a bomb increases the safety of the factory. Special attention should be paid to top floors and roof spaces, which should be cleared of all inflammable material wherever possible.

Fire Practices.

The organization of Fire Practices for all members of the staff is another ordinary fire precaution which becomes specially important as a safeguard against war risks. (See also the Safety Pamphlet.)

Fire Parties and Fire Appliances.

A good deal of information on the subject of fire parties and the appliances to be provided for their use is given in the Safety Pamphlet, but for the reasons which have been indicated, the setting up of a complete organization of fire parties, with appropriate appliances, becomes a matter of primary importance as a precaution against war risks.

Those chosen to form fire parties should be steady, reliable, possessed of common sense and able to direct men and women in an emergency.

It is essential not only to organize fire parties, but also to drill them regularly with the appliances they would have to use in case of fire.

Separate fire parties will be required for each shift, and, in war time, the risk when work is not going on may be as great as when it is. Fire parties would therefore need to

be on duty throughout the twenty-four hours, and when the factory was not fully occupied, it would be particularly important to have every part regularly and frequently patrolled.

The size and number of the fire parties which should be provided naturally depend on a number of considerations, such as :—

- (1) the area the premises cover, and the number of floors;
- (2) the class and mode of construction of the buildings;
- (3) the character of the material manufactured, handled or stored.

In Appendix L particulars are given of typical fire parties and the equipment which is recommended. The smallest party which is recommended consists of three men, with the "first aid"* equipment which is indicated.

Alternatively, in premises where there is much inflammable material, the fire parties may be organized in parties of six, with appliances as indicated.

Experience has shown that women and girls are capable of undertaking this duty efficiently, if well trained.

Fire parties of three or six should be well distributed through the factory, with their appliances ready to hand, so as to ensure that a fire can be attacked promptly before it can get firm hold and spread.

In addition, it will be necessary, in any but the smallest factories, to reinforce these fire parties by organizing, as a works brigade, one or more fire parties, of, say, twelve persons each, with major appliances, light or heavy. Major appliances include light portable pumps, trailer pumps and motor pumps. Such appliances should be located in a convenient position for covering all parts of the factory and preferably near to a water supply. The number of fire parties and appliances required will depend on the size and character of the premises, the water supplies available, and on whether hydrants are installed and so forth; but in this connection the possibility of the factory mains being damaged in case of air attack should be borne in mind. Particulars of the appliances suitable for these parties are also given in Appendix L.

* The expression "first aid" is used, as in the Safety Pamphlet, to signify appliances which are operated by hand and are therefore of use only for dealing with fires in their early stages; but, if brought into use promptly and operated efficiently, they can be of the utmost service in preventing small fires developing into large ones.

Dealing with Incendiary Bombs.

It is difficult to extinguish incendiary bombs while they are burning, but a great deal can be done to check them and limit the spread of the fires which they cause.

Supplies of silver sand or ordinary dry builders' sand should be provided, preferably in specially prepared containers,* with long handled scoops. If an incendiary bomb falls where it cannot safely be allowed to burn out, and it can be approached near enough, as much sand as possible should be thrown over it.

Alternatively, it may be possible to pick up the bomb itself in a long handled scoop or shovel and remove it where it can do no harm.

On no account should water be thrown on to a burning incendiary bomb, as an explosion may result.

When approaching a burning incendiary bomb, efficient dark glasses must be worn. Those used in acetylene welding will be suitable.

A light asbestos shield will also be useful for protection against the great heat which may be generated. Efficient shields can be purchased, but a simple form of shield can be made, easily and cheaply, from a sheet of asbestos on a light metal frame about 2 feet 6 inches square, with straps for the arms and rather like a Roman shield.

Water Supplies.

Water is the medium which must be relied upon for extinguishing most fires, including those caused by incendiary bombs, though water must not be applied to the bombs themselves.

If a fire can be dealt with in its earliest stage, only a small quantity of water will be required; but, if the fire gains headway, a much larger quantity may be necessary, particularly in a factory containing inflammable materials.

For reasons which have been indicated, reserve supplies of water should be provided, wherever possible, including some or all of the following, according to requirements:—

- (a) Water in buckets or pitchers, water in tanks or other receptacles conveniently placed for use in "first aid" appliances; and reinforcing "first aid" appliances.†

* The Redhill container is recommended. It is a container which has been designed by the Home Office and can be obtained from any manufacturer of fire appliances. It holds up to 50 lb. of sand and has been devised to enable the sand to be thrown evenly and effectively on the seat of the fire. It serves well for removing an incendiary bomb, as the bottom will not burn through for some considerable time. If special containers are not available, sand buckets will serve instead. The Redhill container includes in its design a scoop which can be fitted with a long handle.

† See Safety Pamphlet No. 13, section headed "Reinforcing first-aid appliances."

(b) Reserve supplies in larger quantity, which may take the form of pressure supplies independent of the public mains, underground tanks, ponds, streams or other such sources made accessible to fire engines, etc., etc., according to the circumstances of the particular establishment concerned.

Storage of water at a height above ground level has many advantages, as the necessary pressure to deal with fires can be obtained by gravity, if the storage reserve is sufficiently high, but overhead tanks are liable to be vulnerable in case of air raids. Underground tanks are therefore preferable for this purpose. Alternatively, it may be possible to flood a basement or cellar.

Where several factories are in close proximity, a single reserve supply may serve them all, provided sufficient quantities of water and hose are available.

Where internal hydrants are installed and a reserve supply is available for use with power fire pumps, valves should be provided so that, if the mains should be broken or all the water is drawn off for fighting fires elsewhere, the inlet from the public supplies can be closed, and water under pressure delivered directly into the pipes supplying the factory hydrants.

Alternatively, if suitable valves are installed, the factory pump could be used for boosting up the pressure available from the public mains, to give more efficient streams from the internal hydrants.

Hydraulic Reels.

When there is an internal supply of water under pressure of not less than, say, 15 lbs. per square inch, hydraulic reels may be of great service in dealing with fire in their early stages, and can be installed without great expense. They should be provided with sufficient 1 inch rubber hose to cover the area to be protected and fitted with a $\frac{1}{4}$ inch or $\frac{5}{16}$ inch nozzle.

Alternatively, lengths of rubber garden hose, about 1 inch diameter, with nozzles and suitable connections so that they can be attached to ordinary water taps, may be very useful as first aid fire extinguishing appliances or for filling buckets or hand pumps near the seat of a fire.

Rescue Work.

Provision should also be made for the rescue of persons who may be trapped in damaged or wrecked buildings. The nature of the arrangements to be made will depend on the size and construction of the buildings.

In large undertakings, several rescue squads, each consisting of six or eight men, should be organized. Normally, however, this work can be performed by the fire parties, who, in any event, would have to do the rescue work when the buildings were on fire.

A list of suitable rescue equipment is set forth in Appendix M.

Summary of action to be taken.

Now.

(a) Review of fire-fighting arrangements and fire appliances provided, and supplementing them as necessary to meet emergency risks.

(b) Organisation and training of fire parties and, where necessary, works brigades, with regular fire drills.

(c) Organisation of regular fire practices for the staff.

(d) Provision of supplementary water supplies for fire extinction purposes.

(e) Removal, wherever practicable, of non-essential inflammable material (especially from top floors).

(f) Organisation and training of rescue squads.

(g) Preparation of plans for co-operation in time of emergency with local fire brigades and neighbouring factories.

Emergency.

(a) Complete (where necessary) equipment of parties.

(b) Assign final fire stations, ensuring that parties are on duty day and night.

See also.

Safety pamphlet No. 13. ("Fire Protection in Factories")—issued by the Factory Department, Home Office, and now under revision. (Price 6d. net, 7d. post free.)

A.R.P. Memorandum No. 2. ("Rescue Parties and Clearance of Débris")—a memorandum on the organization of rescue and demolition parties by local authorities.

CHAPTER IX.

DECONTAMINATION OF MATERIALS.

Decontamination of Materials.

So far as their resources permit, the occupiers of industrial premises should make the necessary arrangements for the decontamination of buildings, plant, equipment and materials. The decontamination squads organized by the local authority may be fully occupied with the decontamination of streets and other public places and of small private premises, and may not be available. What is required is the training of a number of men accustomed to hard manual labour in the work of decontamination, and the collection of the equipment and material required by them.

It is suggested that an undertaking employing less than 1,000 operatives should have at least one squad: and an undertaking employing over 1,000 operatives at least two squads. If the undertaking covers a wide area, the number of squads should be increased. A squad should normally consist of a foreman and five men.

In estimating the number of squads required, regard should be had to the fact that, where persistent gas was used, repair work and the re-admittance of persons to a contaminated area could not proceed until the necessary measures of decontamination had been carried out. A squad of six men would take about two hours to decontaminate the area directly contaminated by a 50 lb. gas bomb, consisting partly of ground surface and partly of the fronts of buildings.

Decontamination is heavy work and the members of squads should be of good physique. They will require a very thorough training in their duties, especially in carrying out decontamination measures while wearing the full protective clothing. In order that the work may be carried out quickly and efficiently, the squad must work together as a team and the members should learn how to perform their individual duties and to avoid exposing themselves unnecessarily to contamination. It is suggested that the occupier should get into touch with the local authority with a view to the training being organised in conjunction with the local authority decontamination squads.

In time of war, the squads must be available at all times, whether they work in the factory or are off duty.

A list of equipment for a decontamination squad is set out in Appendix N. Whoever is responsible for decontamination should, however, carefully review the requirements of the undertaking in respect of equipment after reading A.R.P. Handbook No. 4, *Decontamination of Materials*.

Decontamination out-of-doors requires the copious use of water and accordingly where an undertaking has a wide area in the open which might be bombed, a survey should be made of available hydrants or of the facilities for carting water to different parts. Hose, condemned for fire brigade purposes, would be quite satisfactory for decontamination work, as it need not be used with high pressures of water.

The question how best to ensure adequate supplies of bleaching powder in time of war is under examination. The mere accumulation of stocks is not sufficient, as the material deteriorates in course of time. It would be of assistance if users of bleaching powder would carry stocks which would be turned over and if the use of bleaching powder in time of peace could be extended where practicable.

The squads should be provided with a place where their tools, etc., can be stored.

If the undertaking has vehicles which may become contaminated, arrangements should be made for their decontamination. What is required is a large yard, with a concrete or other impermeable surface on which the vehicles can stand while they are decontaminated. The process of decontamination would involve a copious use of water and a water supply should be available and ample drains for carrying away the contaminated water.

Gas Detection.

It will be most important, after premises have been struck by bombs, that the presence of gas, if it has been used, should be detected without delay.

In the services organised by local authorities, gas detection officers will be employed. Their chief duty will be to indicate the presence of gas and to warn those concerned so that action may be taken to deal with the situation.

Except in very large works, where the training of a gas detector may be desirable, those duties can normally be performed in factory premises by members of the decontamination squads.

Summary of Action to be Taken.

Now.

- (a) Organisation and training of decontamination squads.
- (b) Collection of equipment and material required.
- (c) Any special arrangements for vehicle decontamination.
- (d) Investigation into methods of ensuring an adequate supply of water at any part of the premises.

Emergency.

(a) Complete (where necessary) equipment of decontamination squads.

(b) Obtaining supplies of bleaching powder and other perishable material required for decontamination.

See also.

A.R.P. Handbook No. 4 ("Decontamination of Materials")—a manual of practical instruction in the decontamination of streets, buildings, materials, vehicles and plant.

A.R.P. Memorandum No. 3 ("Organisation for Decontamination of Materials")—a memorandum for local authorities.

APPENDIX A.

Headings of a Scheme.

1. *General Organisation.*

- (a) Controlling authority in peace and war.
- (b) Instructions to (i) workers generally, (ii) key men and (iii) air raid precautionary services.
- (c) Co-operation with local authority.

2. *Protection of Workers.*

- (a) Shelters for workers, and adaptations and equipment required.
- (b) Instructions to workers.
- (c) Protection of key men who must remain on duty.
- (d) Respirators and other forms of individual protection.

3. *Protection of buildings, machinery and plant.*

- (a) Protection of vital parts.
- (b) Transference of inflammable and dangerous stores.
- (c) Protection of essential supplies, such as water, gas and electricity.
- (d) Alternative sources of essential supplies.

4. *Communication of air raid warnings.*5. *Concealment of lights.*

- (a) Screening of windows at night.
- (b) Shading of lights.
- (c) Extinction of external lights.
- (d) Removal of external signs, visible by day.

6. *Emergency Communications.*7. *Medical Arrangements.*

- (a) First aid posts and cleansing centres and their equipment.
- (b) First aid parties and their equipment.
- (c) Ambulances.
- (d) Training of personnel required.

8. *Fire fighting.*

- (a) Arrangements with public fire brigades.
- (b) Works brigades or works fire parties: and their equipment.
- (c) Fire practices for staff.
- (d) Removal of inflammable stores.
- (e) Water supplies.

9. *Rescue Work.*10. *Decontamination of Materials.*

- (a) Decontamination squads and their equipment.
- (b) Depot for squads.
- (c) Depot for vehicle decontamination.
- (d) Materials for decontamination.

11. *Gas detection.*12. *Repair of damage to buildings and plant.*

- (a) Augmentation of repair squads and equipment.
- (b) Spares of vital parts and their storage.

As indicated on pages 9 and 10, the scheme should distinguish between the action to be taken.

I.—(a) Now.

(b) As opportunity affords.

II.—(a) When an emergency appears imminent.

(b) When an air raid warning is received.

(c) During an air raid.

(d) When information is received that the raid has passed.

APPENDIX B.

Local Authority Schemes.

A local authority's scheme is expected to make provision for the following precautionary services, in so far as they fall within the local authority's jurisdiction :—

- (1) *Treatment of Casualties.*
 - (i) Mobile first aid parties.
 - (ii) First aid posts.
 - (iii) Casualty clearing stations.
 - (iv) Base hospitals.
 - (v) Ambulance service.
 - (vi) Laundry service for decontamination of clothing.
 - (vii) Clerical organisation for records.
- (2) *Rescue Work and Demolition of Unsafe Buildings.*
- (3) *Decontamination of Materials.*
- (4) *Augmentation of resources for repair of roads, sewers, etc.*
- (5) *Air Raid Wardens.*
- (6) *Fire Fighting Organisation.*
- (7) *Gas Detection.*
- (8) *Emergency Communications.*
- (9) *Protection of the Public* (i.e., for persons caught in the streets during raids).
- (10) *Protection of public undertakings* which are under the control of the local authority.

The scheme should also give executive effect, within the jurisdiction of the local authority, to the following measures which will be organised on a national basis.

- (11) *Lighting Restrictions.*
- (12) *Air Raid Warnings.*

In a County Borough, the Council will be responsible for all these services.

In the area of an Administrative County the County Council will be directly responsible for certain services and will be responsible for co-ordinating the measures taken by borough and district councils in respect of other services.

As regards the organisation of services, the principle adopted has been that each authority should undertake those services which are related to the authority's normal functions.

In Scotland the appropriate authorities are County and Town Councils, co-ordination being effected in general by means of a Joint Committee consisting of representatives drawn from the County Councils and the Town Councils within the County.

APPENDIX C.

Respirators and Protective Clothing.

Respirators.

The Government has designed a respirator, known as the *Civilian Duty* respirator;* which is intended to afford protection to persons who may be called upon to carry on their normal duties in the presence of poison gas.

The Home Office has obtained from the Patent Office a certification mark in respect of anti-gas respirators. It is proposed to grant licences to manufacturers to affix the mark to respirators, made under Government inspection, which are identical with the *Civilian Duty* respirator or which give an equally good performance against poison gases.

In this way, employers should be able, within a reasonable period, to purchase for such of their employees as may require them respirators of the *Civilian Duty* class. Employees engaged in air raid precautionary services, or who must remain at their work during air raids, should be so equipped.

The *Service* respirator (which is the type used by the Defence Services) will be used by those who must enter and remain for prolonged periods in heavy concentrations of gas; such as policemen, firemen, and members of public decontamination squads.

In addition, the Government has designed a *Civilian* respirator suitable for the requirements of the general public which will be issued free in time of war to all persons in areas exposed to attack.

All the above respirators are designed to protect the wearer's face, eyes and lungs from any poison gas at present known, which is capable of being used under war conditions. The length of time for which protection is given naturally varies with each type of respirator, and according to the strength of the gas encountered. The container in which the filtering apparatus is located can be easily and quickly changed in all three types of respirators.

These respirators do not protect against carbon monoxide or coal gas. They should not be used as respirators in industrial processes.

Protective Clothing.

Members of decontamination squads must be equipped with protective clothing. Enquiry is being made into the best forms of protective clothing, and information on this subject will be issued as soon as possible.

* Formerly called the *Special Service* respirator.

APPENDIX D.

General Standards of Protection.

Investigations are being conducted into the strength and thicknesses of material likely to afford protection against blast and splinters from high explosive bombs, and on the best methods of constructing air raid shelters. Technical advice will be made available in A.R.P. Handbook No. 5, *Structural Precautions against Bombs and Gas*. The following notes are, therefore, of a provisional character. They are based on the information available at the present time.

As has been stated above, the construction or adaptation on any extensive scale of shelters which would be proof against direct hits by high explosive bombs would involve great expense. It is, however, practicable to secure protection against blast and splinters from a bomb which falls some distance away.

The effect of blast varies widely according to the nearness of the explosion, the size and charge-weight of the bomb, the nature of the building and the degree to which the explosion is confined. In general it may be said that within 50 feet of the explosion, a building must be of substantial construction if it is to withstand the blast of a medium or heavy-weight bomb.

Provided that a building is of reasonably substantial construction and that the space in front of the building is not confined (for example, by the presence of high buildings on all sides in close proximity), the use of protective systems against splinters, in accordance with the data indicated below, will also contribute to a substantial reduction in the blast effects from the bombs.

The following thicknesses of material will afford protection against splinters from bombs up to 500 lb., which explode not less than 50 feet away.

Material.	Thickness.	Remarks.
Mild Steel Plate ..	1½ ins.	Special steels may give increased resistance.
Stock bricks in cement mortar.	{ 13½ ins. solid 15½ ins. hollow	2 ins. cavity.
Unreinforced concrete (not weaker than 6-1 mixture).		
Reinforced concrete	12 ins.	Normal structural reinforcement.

Material.	Thickness.	Remarks.
Reinforced concrete	10 ins.	Specially reinforced to resist the punching shear effect of the splinters which induces tensile stresses between the front and rear faces of the concrete wall. Rectangular links (connecting front and back reinforcement) of $\frac{1}{4}$ in. diameter rods at 12 ins. centres is a suggested arrangement which has been tested successfully.
Sand or earth or coal dust revetments.	2 ft. 6 ins.	This should be the minimum thickness, for example, at the top of a traverse or revetment.
Coal (in lumps) . . . Shingle (or ballast) revetments, contained between wood or C.G.I. sheeting.	2 ft. 6 ins. 2 ft.	A sandwich of shingle between sheeting.
Shingle revetments contained between steel plates. Front steel plate $\frac{1}{4}$ in. thick, back plate $\frac{1}{2}$ in. thick.	10 ins.	

APPENDIX E.

Adaptation of Shelters in Existing Buildings.

Protection against High Explosive Bombs.

The choice of a room or section of an existing building will vary with the nature of the building, but where possible an effort should be made to select a room the walls of which approximate as nearly as possible to the thicknesses indicated in Appendix D as affording protection against splinters; these would also afford a considerable measure of protection against blast.

Any shelter which is to accommodate a considerable number of people should have an emergency exit of some kind as well as the regular entrance.

Where the walls, etc., of a shelter above ground level are not of the necessary thickness, they should be reinforced, e.g., by sandbags or wooden boxes filled with earth to a height of about five feet above internal floor level.

Windows and doors should be protected by the construction of traverses of material of the necessary thickness.

The roof of a shelter below ground level or on the ground or first floor should be strong enough to withstand debris falling on top of it. If it is not strong enough, it should be shored up.

Gasproofing of shelters.

The object is to seal up cracks and crevices through which gas may find entrance into the room and the protection will be increased if doors and windows are kept closed throughout the building so as to avoid draughts.

The following notes indicate various methods by which the different parts of a shelter may be sealed up.

Air Lock at Entrance.

At the regular entrance to the shelter an "air lock" should be constructed, being a compartment with a door to the outside and a door to the shelter through which a person entering the shelter must pass. By having one or other of these doors always closed, the direct passage of air from the outside into the shelter can be prevented.

One method of constructing an air lock is to set up two blanket screens across the entrance passage, so that a person can enter the space between the screens and adjust the fitting of the blankets before passing into the shelter. The screens should be at least 4 ft. apart, and preferably anything up to 10 ft. apart in a shelter accommodating a large number. The best arrangement is for these blankets to rest on inclined frames, otherwise a close fit is impossible. The blanket should have light wood slats fastened across it, say two feet apart, to keep it hanging flat. (See Fig. 1.)

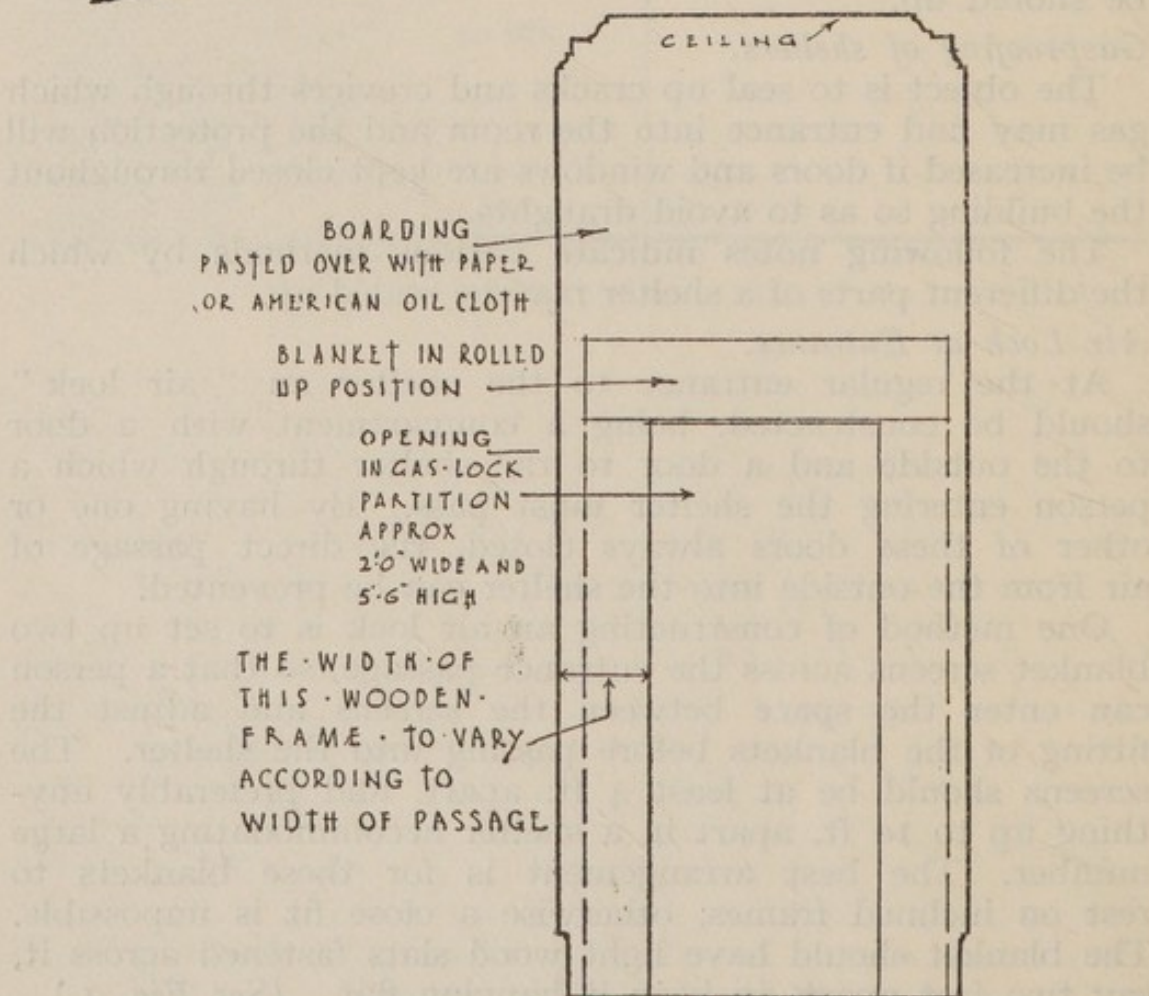
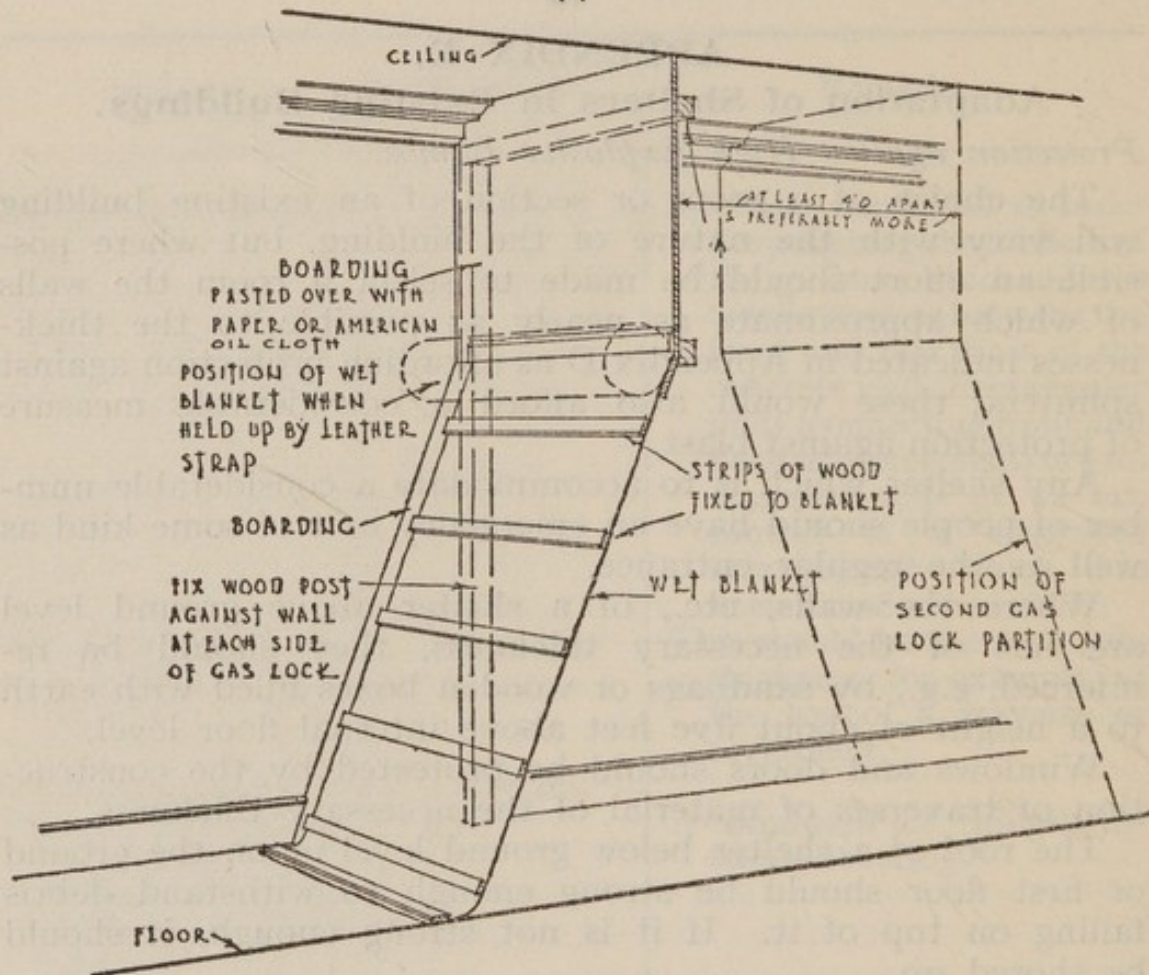


Fig. 1.—Air Lock constructed with Blanket Screens.
Sketch (above) and Elevation (below).

If there is a door to the shelter, it can serve in place of one of the blanket screens, provided that it is made air-tight. This can be done by making the door draught-proof with felt or rubber. All keyholes and other cracks or crevices should of course be stopped up. Alternatively, two air-tight doors can serve as entrance and exit to an air lock.

Where there is no passage outside the entrance to the shelter a more primitive form of gas protection can be constructed with a blanket fixed over a door. The blanket should be fixed by strips of wood on the outside of the door, the fastening being stopped some 5 feet above the floor level on the side away from the hinges, and the bottom left loose at that corner so that it can be lifted up for people to get through. Twelve inches of blanket should be left trailing on the floor to prevent air getting underneath it. The blanket should be kept wet. (*See Fig. 2.*)

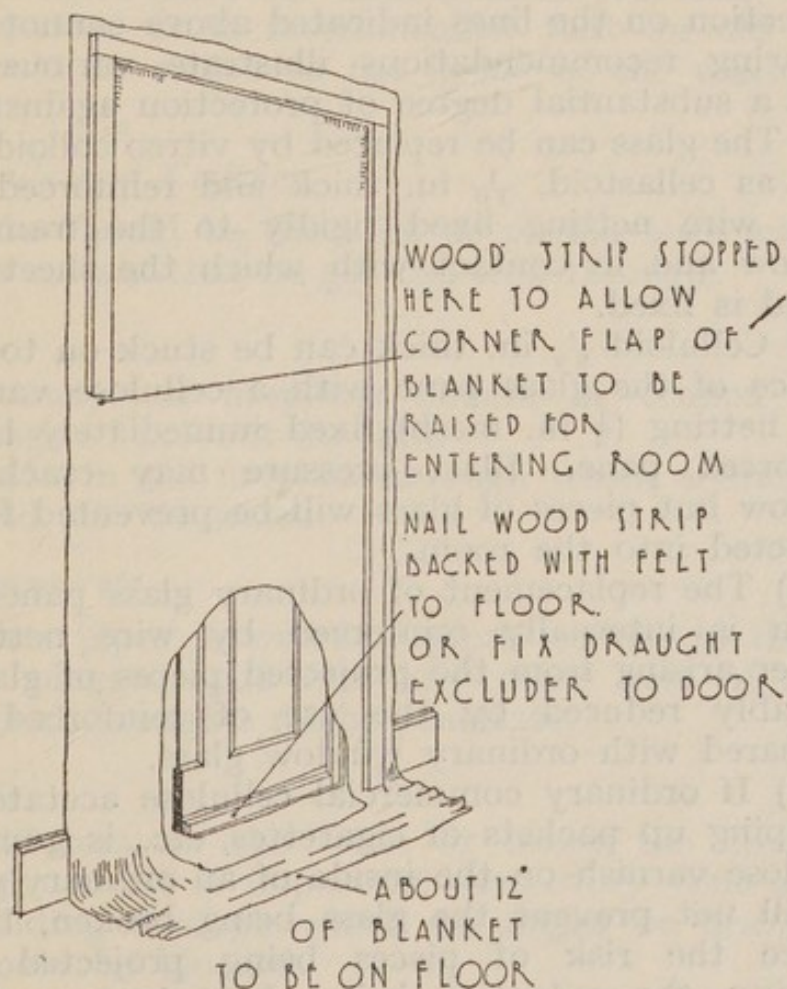


Fig. 2.—Gas Protected Door.

Windows.

The object of maintaining intact the glass or a substitute for glass in a window opening is, besides keeping out the effects of weather, etc., to prevent poison laden air entering the room or shelter.

The air pressure or blast due to the explosion of a high explosive bomb bursting some distance from a window composed of the ordinary type of glass may shatter the glass and project the broken pieces with considerable velocity into the building.

Protection from the effect of blast from a bomb bursting some distance away can be given to glass windows by constructing on the outside sandbag walls or earth traverses 2 ft. 6 ins. thick between shuttering which must entirely cover the window opening and which must touch the brickwork with an overlap of at least 12 ins. all round. Protection cannot be given by fixing steel or wooden shutters of practicable thickness on the outside of the window frame owing to the fact that the pressure pulse due to blast is conveyed through such shutters to the air behind them which, being compressed, will shatter the glass.

If protection on the lines indicated above cannot be given, the following recommendations illustrate various ways of obtaining a substantial degree of protection against blast:—

(i) The glass can be replaced by vitreo colloid material, such as cellastoid, $\frac{1}{10}$ in. thick and reinforced by $\frac{1}{2}$ in. mesh wire netting fixed rigidly to the frame of the window and in contact with which the sheet of vitreo colloid is fixed.

(ii) Celluloid $\frac{1}{64}$ in. thick can be stuck on to the inner surface of the glass pane with a cellulose varnish, and wire netting ($\frac{1}{2}$ in. mesh) fixed immediately behind the reinforced pane. Blast pressure may crack such a window but pieces of glass will be prevented from being projected into the room.

(iii) The replacement of ordinary glass panes by glass which is internally reinforced by wire netting. The danger arising from the projected pieces of glass is considerably reduced by the use of reinforced glass as compared with ordinary window glass.

(iv) If ordinary commercial cellulose acetate used for wrapping up packets of cigarettes, etc., is gummed by a cellulose varnish on the inside of an ordinary glass pane, it will not prevent the glass being broken, but it will reduce the risk of pieces being projected into the building, the reduction being dependent on the thickness, etc., of the cellulose acetate employed. If bits of

cellulose acetate are used in this way, great care should be taken to overlap them on the window pane, and if several thicknesses of cellulose acetate can be used, so much the better.

If neither sandbag walling covering the window on the outside nor vitreo colloid system referred to above can be used, some provision must be made to block up the window opening in the event of the window panes being fractured or driven in, as the poison laden air must be kept out of the building. For this purpose, it is recommended that a frame (either of iron or wood, but preferably the former because it will not lose its shape) should be kept handy which will fit accurately on the inside of the window, the inner surface of this frame being pressed against the window frame by means of thumbscrews fixed at suitable intervals. Between the movable frame and the window frame a rubber or felt strip would help to make the joint air-tight. In this movable frame are fixed two layers of blanket material reinforced with strong wire netting ($\frac{1}{2}$ in. mesh) on each side. If, therefore, the existing window is punctured, the blanket window could be quickly placed in position to keep out gas.

In cases where there are difficulties in providing the spare blanket window, it is recommended that an old piece of carpet should be nailed to the inside of the window frame instead.

Floors, Walls and Ceilings.

All cracks should be filled in, or pasted over with paper, unless it is certain that no gas can leak through.

Fireplaces.

The chimneys of fireplaces should be stuffed up with paper or rags to prevent draught.

Any cracks in the fireplace through which a draught may come should also be sealed.

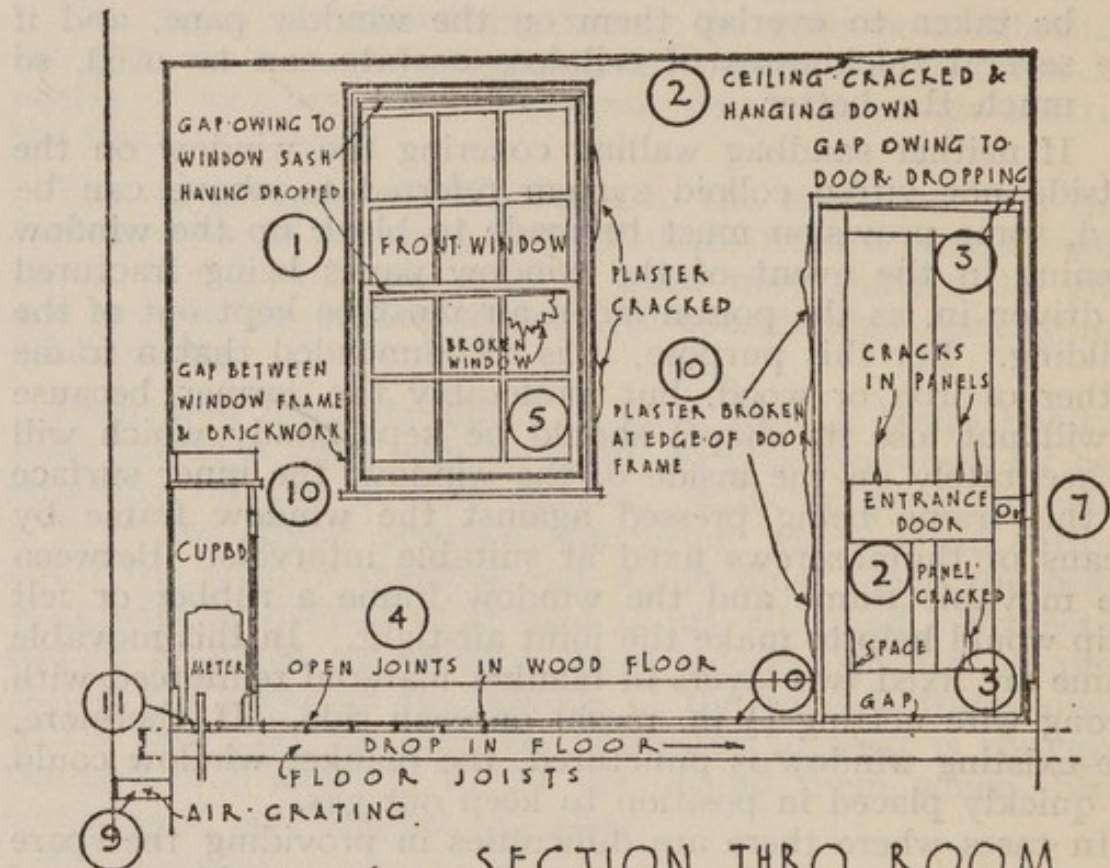
Pipes, Basins, etc.

Any waste pipes or overflow pipes leading to the outside should be plugged, and also any other hole of any kind through which draughts might penetrate.

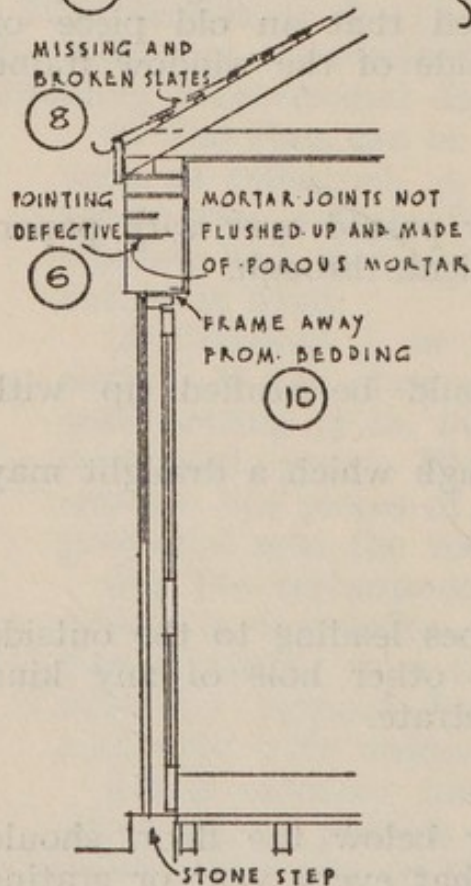
Ventilators.

All ventilators, in the room or below the floor, should be stopped up. It is important that every vent or grating in the building through which air might be drawn to the shelter should be blocked.

Fig. 3 shows typical structural defects which require attention in making premises gas-proof.



SECTION THRO ROOM



SECTION THRO ENTRANCE DOOR

REMEDIAL MEASURES

- ① REPLACE SASH AND WEDGE UP IN POSITION
- ② PASTE BROWN PAPER OVER CRACKS
- ③ COVER GAP WITH WOOD STRIP
- ④ IF NOT COVERED WITH LINO, PASTE BROWN PAPER OVER JOINTS
- ⑤ PASTE PAPER (OR CELLOPHANE) OVER BROKEN WINDOW
- ⑥ REPOINT DEFECTIVE JOINTS
- ⑦ PLUG UP KEYHOLE
- ⑧ REPLACE MISSING OR BROKEN SLATES
- ⑨ BLOCK UP GRATING
- ⑩ PACK UP SPACE BETWEEN FRAME AND PLASTER (OR SKIRTING AND FLOOR) WITH PAPER MUSH
- ⑪ STOP UP SPACE AROUND GAS AND WATER PIPES

Fig. 3.—Typical Structural Defects.

Ventilation and Accommodation.

To determine the number of people who can be accommodated in a gas-proof shelter which is unventilated, allow 75 square feet of surface area (floor, ceiling and walls) per person. On this basis shelters may be occupied for periods up to a maximum of six hours. An allowance of 100 square feet of surface area per person would provide for a stay of 12 hours : but this need not be provided for unless the accommodation is available.

If suitable arrangements can be made for drawing fresh air into a shelter the permissible number of occupants may be increased. Fresh air may be drawn in either through a mechanical ventilation plant or through a suitable filtration unit. In the former case the air intake should be situated well above the building and clear of adjacent roofs, so that contaminated air will not be drawn into the shelter. The intake should be at least 30 feet above the level of the ground or adjacent flat roofs. Even when a filtration unit is used the position of the air intake should be carefully selected. It should, in general, be well above the ground and so situated that it will not draw its air supply from an area where high concentrations of gas are likely to accumulate.

The air intake should be sited to reduce, as far as may be practicable, the possibility of its whole or partial destruction by air attack. With either the mechanical or filtration system of ventilation it is necessary to create a small positive air pressure within the shelter. By reason of this positive pressure it is not necessary for the gas-proofing to be as efficient as in the case of a closed shelter. As regards accommodation, it should be possible, with an adequate inflow of pure air, to pack people in closely. For comfort and safety, however, a minimum of six square feet of floor area per person should normally be allowed. Under emergency conditions where overcrowding may occur the allowance of floor space must never be reduced below $3\frac{1}{2}$ square feet per person. Information about suitable filtration units is being prepared and will be made available in due course.

If the air intake is so damaged or the gas-proofing of the shelter is otherwise destroyed occupants would have to put on their respirators.

APPENDIX F.

Construction of Sandbag Walling.

The Army pattern sandbag measures 33 ins. by 14 ins. empty. It is made of jute bagging and issued in bales of 250, weighing 96 lb. Each sandbag, therefore, weighs about 6 ozs.

Sandbags should be three-quarters filled with earth or sand so that when beaten with a shovel to a rectangular shape they measure about 20 ins. by 10 ins. by 5 ins. Hard ground, gravel, bricks, etc., must be broken small so that when the sandbag is filled with this material it can be shaken into a compact pliant mass. In this case, the sandbags must not, of course, be beaten.

A sandbag is said to be a "stretcher" when it is laid with its longer side parallel to the face of the wall, and a "header" when at right angles to the face.

The bond used in sandbagging is known as English bond, i.e., alternate courses of "headers" and "stretchers"; the first course should be "headers." "Headers" should be laid with chokes (tied ends) inside. If the bag has only one seam, this should also be turned towards the inside when laying "stretchers."

In building a wall, care should be taken to break vertical joints. (See Fig. 4.)

*SANDBAG WALL TO RESIST PENETRATION BY SPLINTERS.
8'0" HIGH, OR HIGHER AS NECESSARY.*

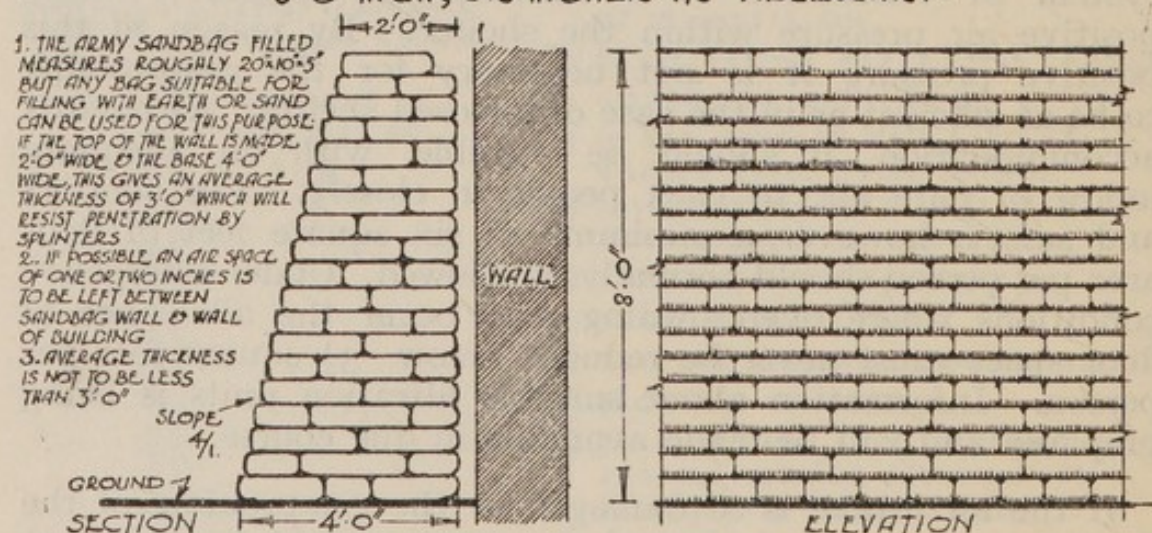


Fig. 4.—Sandbag Walling 8 ft. high.

The sandbag when filled contains a little over $\frac{1}{2}$ cu. ft. of earth.

A filling party should consist of three men—two holding and tying and one shovelling. Building parties should work in pairs. The size of the carrying party connecting the filling

and building parties depends, of course, on the distance bags have to be carried. Three men should fill and two men should lay 60 bags in one hour, so that the carrying party should be sufficient to deal with this number of bags.

Grain sacks or bags which may be available can be substituted for sandbags. They usually contain two bushels ($2\frac{1}{2}$ cu. ft.) of grain, so that if they are used instead of sandbags they should not be more than half filled, otherwise they are too heavy to handle.

It is not necessary to close up or tie up a sack if the mouth is carefully folded under it when it is being placed in position, as the weight of the sack will prevent loss of earth.

As a rough guide to the number of sandbags required, it may be mentioned that a sandbag wall, 8 feet high, constructed of Army pattern sandbags in the manner indicated in Fig. 4, would require 40 to 50 sandbags per foot run.

Storage of Sandbags.

Sandbags can be stored for considerable periods—say up to twenty years, provided the following precautions are observed :—

(i) The store must be absolutely dry. If damp is present, spontaneous combustion is likely to set in.

(ii) The bales should, if possible, be piled on grids a few inches above the floor and there should be a free passage of air around the piles of bales.

Alternatives to Sandbags.

If sandbags are not readily available, wooden boxes filled with earth will serve as well.

Failing wooden boxes an earthen rampart may be used.

APPENDIX G.

Equipment required for Air Raid Shelters.

1. A list of those who ought to use the shelter, so that a roll-call can be made.
2. Tables and chairs or benches.
3. Blankets, or other warm coverings.
4. Water in covered receptacles, for drinking, washing, etc.
5. Food in air-tight tins or jars.
6. Plates, cups, knives, forks, etc.
7. Means of occupying the time without exertion (books, playing cards, etc.).
8. Emergency lighting arrangements (emergency lighting or candles and matches or electric torches or hurricane lamps and matches).
9. Basins for washing and soap and towels.
10. Chemical closets or chamber pots, and toilet paper and screens for privacy.
11. First aid outfit.
12. Bucket or box of sand with a shovel, or a fire extinguisher.
13. Means of rendering shelter gas-proof again, if gas-proofing should be destroyed.

APPENDIX H.

Construction of Trenches.

Trenches should be 7 ft. deep and passage ways should be 2 ft. wide. The parts of a covered trench used as shelters should be wider than 2 ft.—the exact width depending on the form of shelter to be provided. Fig. 5 illustrates a trench shelter system in which accommodation could be found for a considerable number of people.

The trench should be revetted. One method is to use wooden frames with boarding, corrugated iron or any other suitable material behind. Where boarding is used, the following notes apply to the passage-ways:—the excavated width of passage-ways should be 2 ft. 10 ins. and revetting should be done with inch boarding with 4-inch by 2-in. uprights. The uprights should be driven 1 ft. 6 ins. into the ground, and held apart at the head by 4-in. by 2-in. spreaders. This gives a clear width of 2 ft.

The trench should be rendered as weather-proof and gas-proof as possible; this could be done by covering with 2 ft. of earth. If rubble is available, a layer of 9 ins. or 12 ins. of rubble should be placed on top of the earth. The earth should be supported on corrugated iron, resting on 6 in. by 3 in. rafters at 1 ft. 6 in. intervals, fitted on 6 in. by 2 in. wall plates. (See Fig. 6.)

Trench system should have at least two entrances. An air lock should be provided in the passage-way at each entrance. This may take the form of two gas curtains, with a shelf at the side of the trench on which the curtain is placed when not in use. The gas curtains should be at least 4 ft. apart, and preferably anything up to 10 ft. apart in a communal shelter.

Covered trenches may be provided either with seats in recesses cut off the passage trench or with bunks in chambers cut off the passage trench.

(a) *Seats in recesses for ten persons.*

A recess 15 ft. long and 1 ft. 6 ins. wide will accommodate 10 persons. The seat should be 1 ft. 3 ins. wide. The recesses should be dug on each side of the passage trench alternately. (See Fig. 7.)

(b) *Bunks in chamber for six persons.*

The inside measurements of the chamber should be 6 ft. 6 ins. by 4 ft. 6 ins. by 6 ft. 9 ins. deep. It should be revetted by 1½ in. boarding or other suitable material held in position by the uprights of the bunking. Bunking for six persons made of 3-in. by 3-in. timber, 3-in. by 1-in. wood fillets and expanded metal sheets, giving each bunk 6 ft. 6 ins. length and 2 ft. clear width.

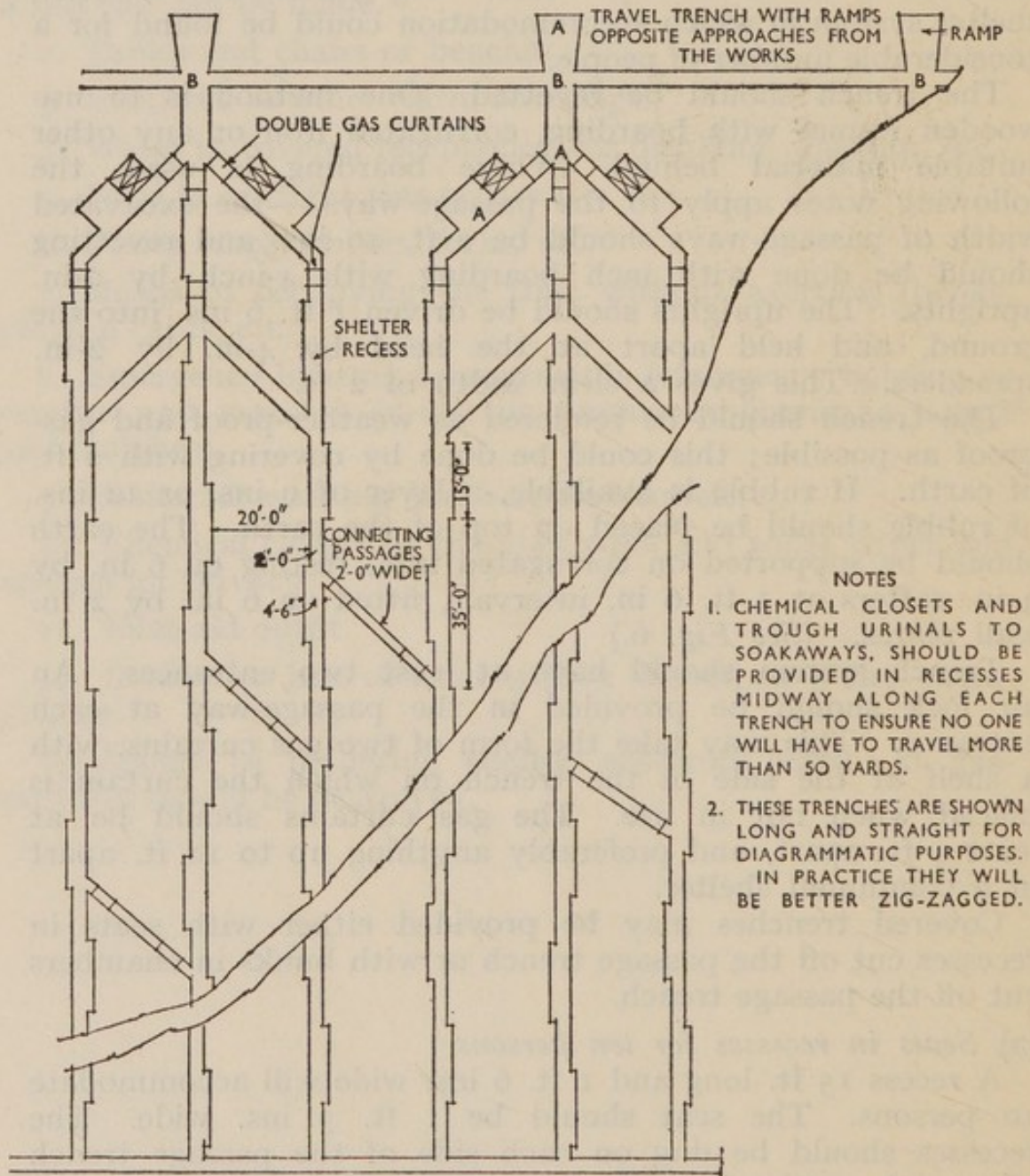


Fig. 5.—Trench Shelter System.

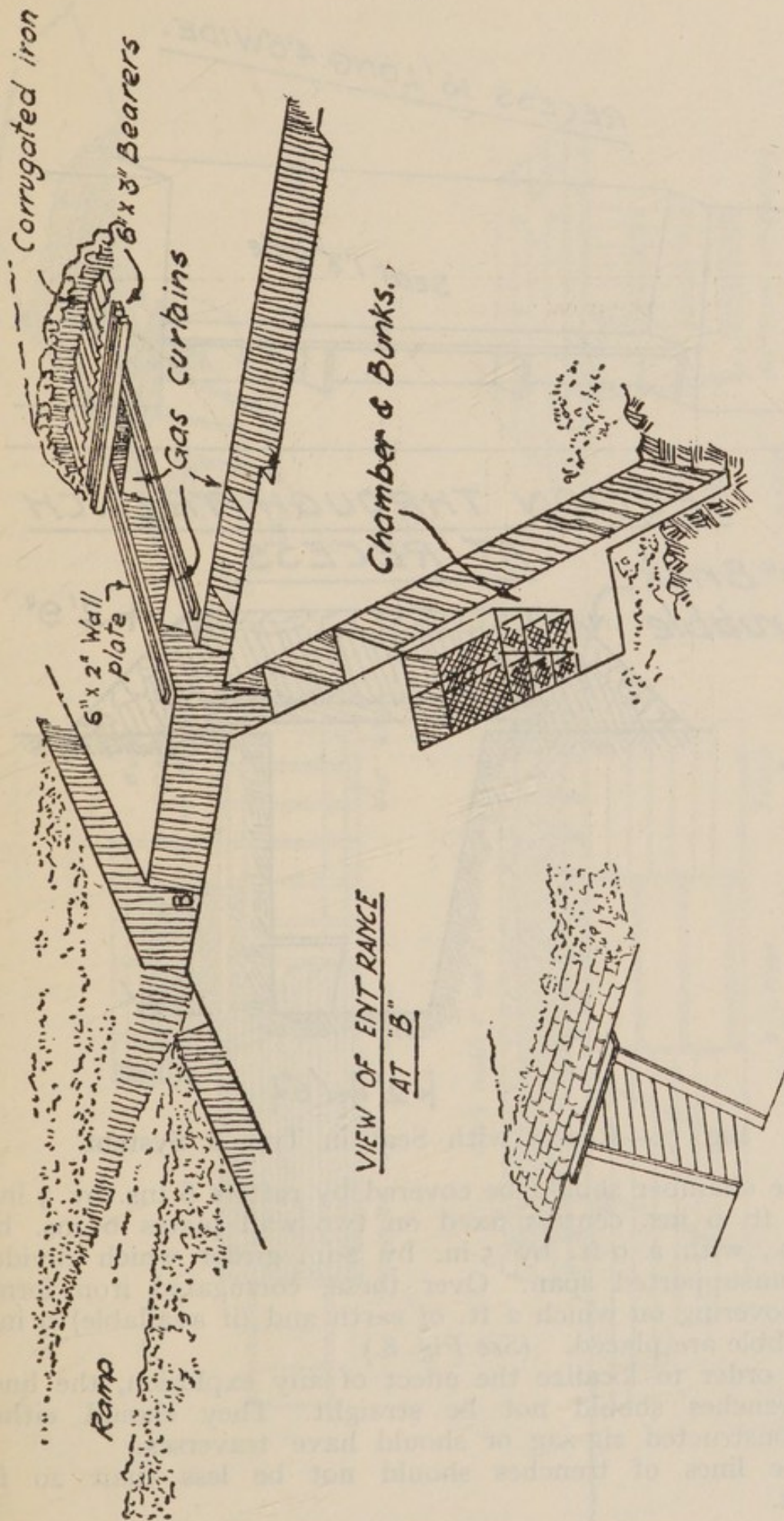
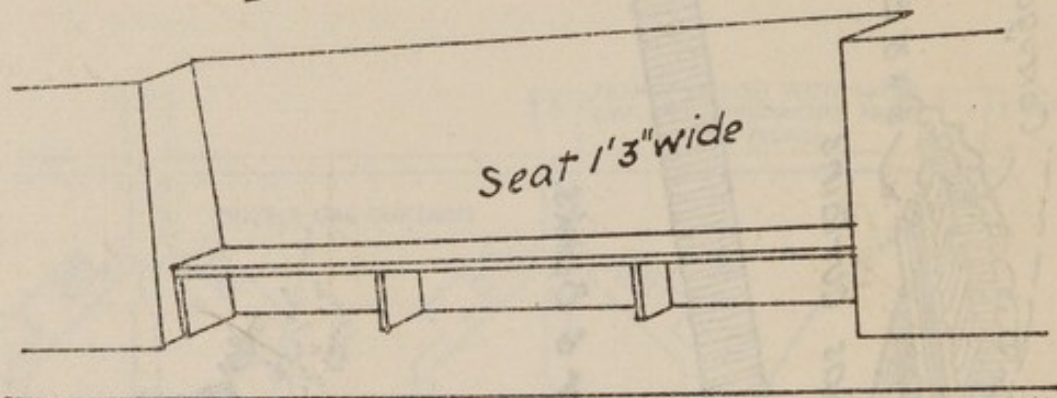


Fig. 6.—Ramp, Trench and Air Locks.

RECESS 16' LONG. 4'6" WIDE.



SECTION THROUGH TRENCH
AT RECESS.

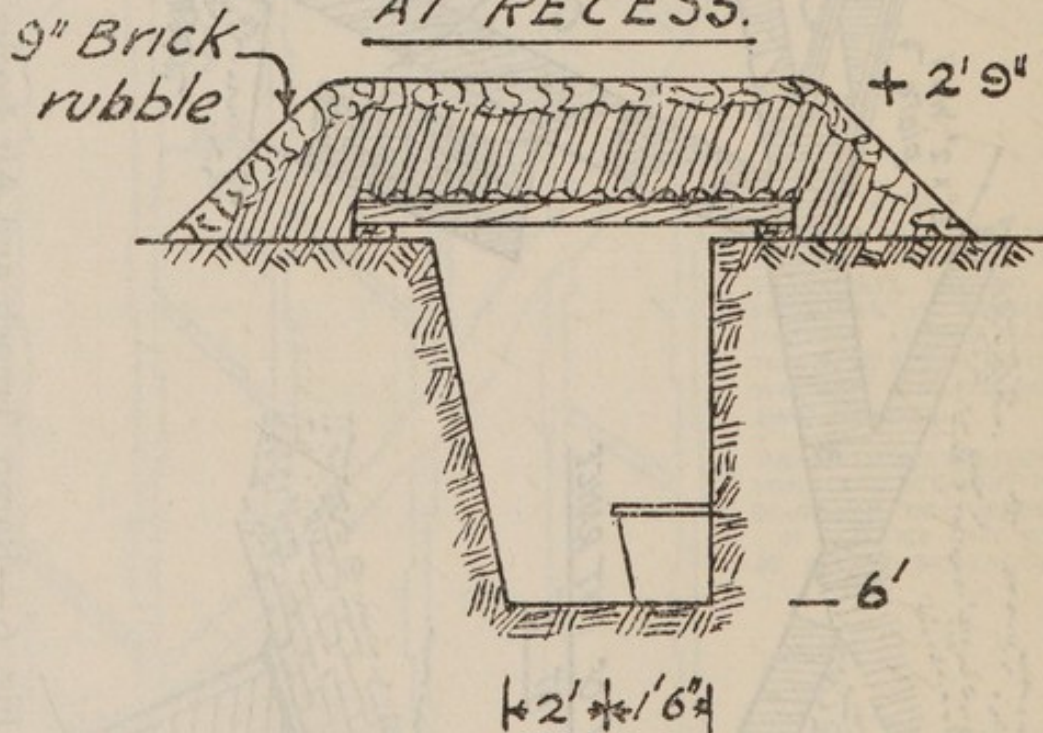


Fig. 7.—Recess with Seat in Trench System.

The chamber should be covered by rafters 6 ins. by 3 ins. at 1 ft. 6 ins. centres fixed on two wall plates 6 ins. by 2 ins., with a 9-ft. by 5-in. by 2-in. girder which divides the unsupported span. Over these, corrugated iron forms the covering on which 2 ft. of earth and (if available) 9 ins. of rubble are placed. (See Fig. 8.)

In order to localize the effect of any explosion, the lines of trenches should not be straight. They should either be constructed zig-zag or should have traverses.

The lines of trenches should not be less than 20 ft. apart.

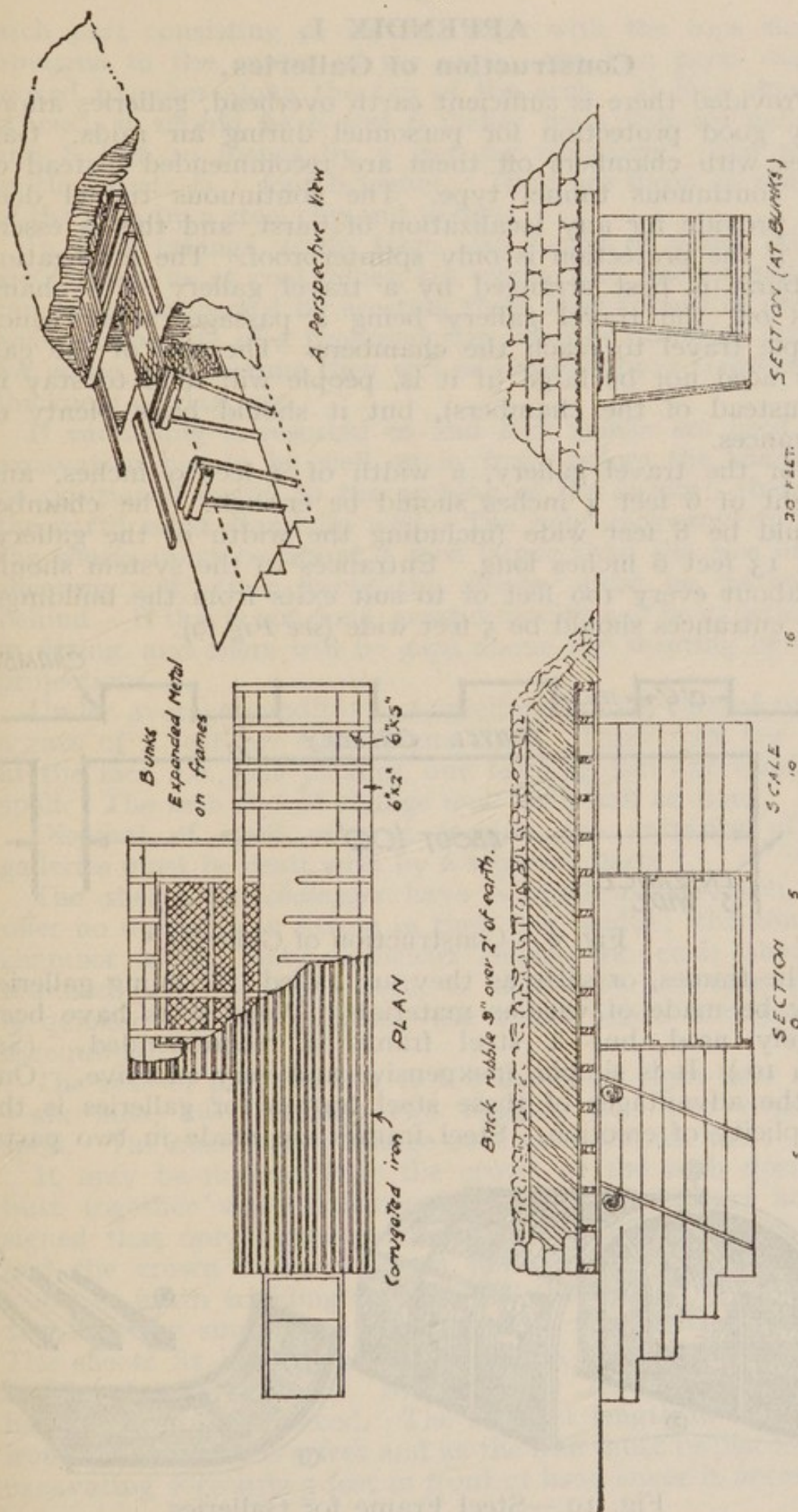


Fig. 8.—Chamber for Bunks.

APPENDIX I.

Construction of Galleries.

Provided there is sufficient earth overhead, galleries afford very good protection for personnel during air raids. Galleries with chambers off them are recommended instead of the continuous tunnel type. The continuous tunnel does not provide for any localization of burst, and this is essential if the protection is only splinterproof. The localization of burst is best arranged by a travel gallery with chambers off, the travel gallery being a passage, along which people travel to reach the chambers. The size of the gallery need not be large (if it is, people will tend to stay in it instead of the chambers), but it should have plenty of entrances.

For the travel gallery, a width of 2 feet 9 inches, and height of 6 feet 4 inches should be enough. The chamber should be 8 feet wide (including the width of the gallery) and 13 feet 6 inches long. Entrances to the system should be about every 100 feet or to suit exits from the buildings. The entrances should be 5 feet wide (see Fig. 9).

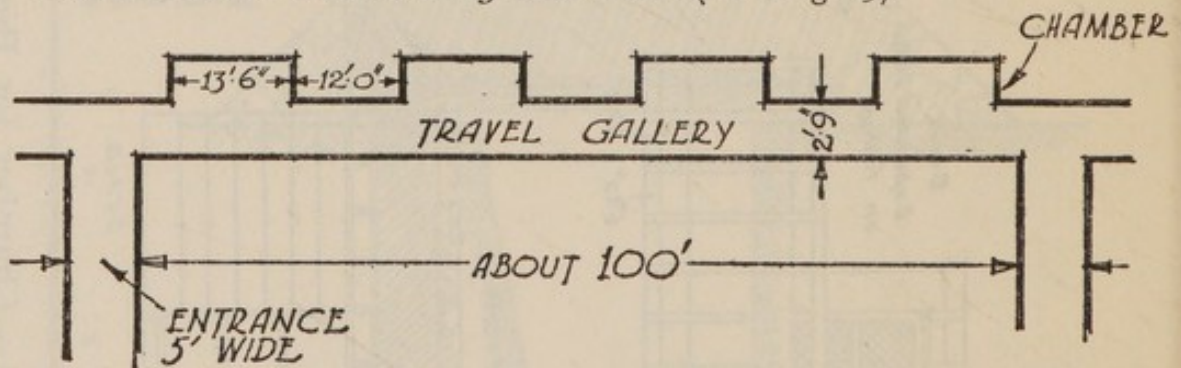


Fig. 9.—Construction of Galleries.*

The frames, or setts as they are called, for lining galleries may be made of various materials. Wood setts have been largely used, but a steel frame is recommended. (See Fig. 10.) It is simple, inexpensive and very effective. One of the advantages of these steel frames for galleries is the simplicity of erection. Steel frames are made in two parts,

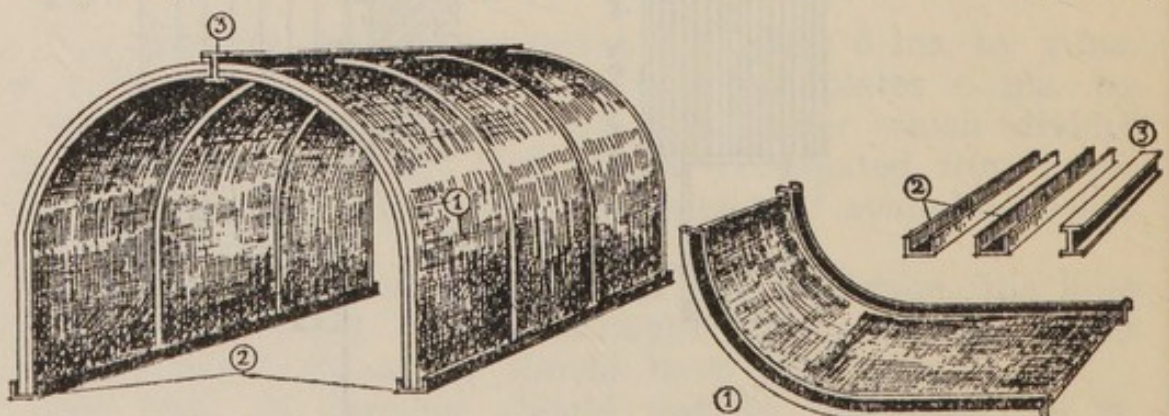


Fig. 10.—Steel Frame for Galleries.

* This diagram is not drawn to scale.

each part consisting of vertical sides with the tops sloping upwards to the centre of the arch; the two parts can be locked together along the top of the arch. If lock sheeting is used, it should be 6 feet 6 inches by 3 feet for galleries and 8 feet 10 inches by 9 feet for chambers. The width of the sheets is 1 foot 6 inches. They are fixed at the top of the arch by a steel clip and wedge.

In undertakings where large slag heaps of waste dumps are formed, as at coal mines, tin mines, etc., shelter galleries can easily be formed by erecting these steel frames at ground level on the site of a proposed slag heap or dumping ground for waste, and in time they will be covered by a considerable thickness of slag, etc.

If tunnelling is resorted to and lock sheets are used, the excavation has to be well on in front before the sheet can be positioned owing to the arching of the sheets; therefore the earth must stand up well. The hole excavated to take the sheets must be about 1 foot larger than the size of the sheeting and, after fixing the sheets, must be packed in behind. If this is not done, great difficulty will be experienced in fitting, and there will be gaps above the sheeting between projections.

Under average conditions, tunnelling can be carried out at a rate of 4 feet per eight hours shift. Three men per shift at the face, i.e., one picking, one bagging and one removing spoil. The men should change over each half an hour.

Disposal of spoil once it reaches the entrance of the galleries must be dealt with by a separate party.

The sheets for *chambers* have a much flatter arch, and offer no difficulty in fitting in their own width; therefore, in chamber work, only sufficient depth for each sheet is required, but if the earth is sound to excavate ahead is quicker. As for galleries, the 1 foot extra and packing is required.

The rate of progress is 1 foot 6 inches in eight-hour shifts—six men, two picking, two bagging and two removing spoil. The men should change over each half an hour.

It may be noticed that the crown of the arch does not butt together when constructed. These sheets are so designed that only under great pressure will the arch depress and the crown make a closed joint. In order to prevent water or earth trickling through the sheeting, it is advisable to cover the small gap with a timber fillet before packing. The sheets fit in 6 inches by 3 inches channel irons which are let in the ground. No necessity for using spreaders has yet been experienced. The shortest length in which the irons are available is 5 feet and as the iron must be placed first, excavating forwards 5 feet in front of head cover is necessary.

APPENDIX J.

Composition and Equipment of First Aid Parties.

It is suggested that a first aid party on duty should normally consist of three men, trained in first aid, apart from any ambulance crews that may be working with them. This number makes no allowance for casualties, and reserves of trained men should be available in addition.

Each member of the party on duty should be equipped with a respirator and protective clothing: and the party should have a stretcher (with oilskin cover in case of contaminated casualties), a blanket, and spare respirators for casualties.

The first aid equipment carried by first aid parties will depend on the particular circumstances of each works. For convenience of reference, the equipment suggested to local authorities for public first aid parties is set out below. Normally parties in undertakings will be working very much nearer first aid posts and will need less elaborate equipment.

Equipment Recommended for Local Authority First Aid Parties.

The suggested contents of the first aid pouch and surgical haversack, which should be of durable waterproof material, such as will withstand decontamination by approved methods, are :—

First aid pouch (one per man).

- 1 triangular bandage, unbleached calico, B.P.C., 38 in. × 54 in., wrapped.
- 1 white open wove bandage, B.P.C., 1 in. × 3 yds., wrapped.
- 1 white open wove bandage, B.P.C., 2 in. × 4 yds., wrapped.
- 1 $\frac{1}{2}$ oz. plain lint, B.P.C., wrapped and cartoned.
- 1 $\frac{1}{2}$ oz. absorbent cotton wool, B.P.C., interleaved, wrapped and cartoned.
- 1 pair surgical scissors, 5 in.
- 6 safety pins, nickel plated on brass, in metal container : size 3.
- 3 30 minim ampoules, 2 per cent. alcoholic solution of iodine, in card containers.
- 1 2 oz. stoppered bottle of sal volatile, in metal case.
- 1 2 oz. graduated medicine tumbler, in strong container.
- 1 piece strong cane, 6 in. long.
- Elastic plaster dressings, assorted sizes, for minor injuries.

Surgical haversack (one per party).

- 1 set wooden splints, with 3 metal pockets.
- 3 cotton webbing straps for securing splints.
- 1 lb. cotton wool, B.P.C.
- 2 triangular bandages, unbleached calico, B.P.C., 38 in. \times 54 in., wrapped singly.
- 3 elastic plaster dressings for finger injuries, wrapped singly.
- 6 elastic plaster dressings for small wounds, wrapped singly.
- 1 roll (3 yds.) of gauze, B.P.C.
- 4 large first aid dressings.*
- 4 white open weave bandages, B.P.C., 1 in. \times 3 yds., wrapped singly.
- 3 white open weave bandages, B.P.C., 2 in. \times 4 yds., wrapped singly.
- 3 white open weave bandages, B.P.C., 3 in. \times 4 yds., wrapped singly.
- 1 spool adhesive plaster, zinc oxide, B.P.C., $\frac{1}{2}$ in. \times 2 $\frac{1}{2}$ yds.
- 12 safety pins, nickel plated on brass, size 3, in suitable container.
- 1 2 oz. absorbent cotton wool, B.P.C., interleaved, wrapped and cartoned.
- 1 1 oz. boric lint, B.P.C., wrapped and cartoned.
- 1 pair surgical scissors, 5 in.
- 1 oz. 2 per cent. alcoholic solution of iodine, in capillary container.
- 1 2 oz. graduated medicine tumbler, in strong container.
- 1 tourniquet, St. John's, or similar type.
- 1 bottle smelling salts, or 6 ampoules aromatic ammonia, in container.

* Dressings should be of materials designated in the B.P.C., and of a grade or quality not lower than the standards prescribed therein. They should be sterilised as prescribed in the B.P.C. for surgical dressings (i.e., by steam heat and not chemically) and be so packed as to remain sterile.

APPENDIX K.

**Construction and Equipment of First Aid Post
and Cleansing Centre.***First Aid Post (uncontaminated cases).*

In the calculations which follow, a stretcher case is assumed to require 50 square feet, or 30 square feet when treatment is finished. A sitting case is assumed to require 15 square feet. A post of 200 square feet should serve for a factory employing from 250 to 500 workers.

Warm water is necessary in this room, together with some water-boiling apparatus for sterilising instruments; but running water is not essential if it is not already laid on. Shelving or cupboards would be needed for dressings and medicaments. It would be advisable to have curtains or screens available to screen off a small section of the room for gassed patients for whom the main treatment might be rest. A slop sink or lavatory should be accessible from this room for emptying pans, etc., of patients under treatment.

Separate accommodation and water closets should be available for patients awaiting treatment and for those who have been treated or are waiting for ambulances. A works which is dependent on outside ambulances will normally require more space for waiting cases than a works which is removing its own ambulance cases.

Cleansing Centre.

The sequence is undressing, cleansing and dressing: and the accommodation provided at each stage should be arranged in that order. The most convenient arrangement is for the accommodation provided to be interconnected. If a separate entrance and exit cannot be arranged in each room, it is desirable to erect temporary barriers to avoid the possibility of contact between those entering and those coming out. An essential point is that there should be a separate entrance for contaminated personnel leading straight to the undressing accommodation.

For undressing, what is required is suitable accommodation adjacent to the cleansing room, where contaminated persons can be undressed. If inside accommodation is used, it is useful to have an open shed outside where grossly contaminated articles of clothing can be discarded and the concentration of vapour in the undressing room thereby reduced. Forms should be provided for undressing: bins with close-fitting lids will be required for contaminated clothing: also one or two latrine buckets behind screens, if

no w.c. which could be specially reserved is available, because contaminated people cannot be allowed to use w.c.'s which might be used by others. The undressing accommodation, because of the presence of vapour, must be completely sealed off from the cleansing and dressing accommodation: and (unless all contaminated clothing is taken off in the open) the entrance to the cleansing room from the undressing accommodation must have an air lock.

In the washing room bleach and eye treatment may first have to be given, followed by washing. For the latter purpose it is suggested that the simplest procedure will be for each person to go under a shower to get wet, withdraw and soap himself, and then pass under another shower before drying. This scheme can most economically be met by two sets of showers with the washing space between. Drainage under the showers may have to be improvised. If the floor is of wood, it can be covered with lino, which should be turned up the walls at the skirtings for about a foot. If there is no fall for drainage, the water can be swept to an improvised drain, either in the floor or in the wall. Alternatively a low sloping platform can be built under the showers, with a drain underneath, and the surface covered with lino, or preferably with lead sheeting.

In the dressing room there should be a store of clothing, also a w.c. for the patients' use.

About 300 square feet (divided in equal proportions between the three rooms) might be allowed for the cleansing centre of a small factory.

Combined Post and Centre.

Fig. 11 shows the lay-out of a first aid post, which provides cleansing facilities. The area figures of the various parts are given in proper proportion. The post consists of:—

- (1) Undressing room for contaminated cases with open shed for removal of grossly contaminated clothing.
- (2) Washing room for contaminated cases.
- (3) First aid room for wounded cases, both uncontaminated cases and contaminated cases which have been cleansed.
- (4) Dressing and waiting room.

Where both sexes are employed, duplicate provision of all these facilities will be required.

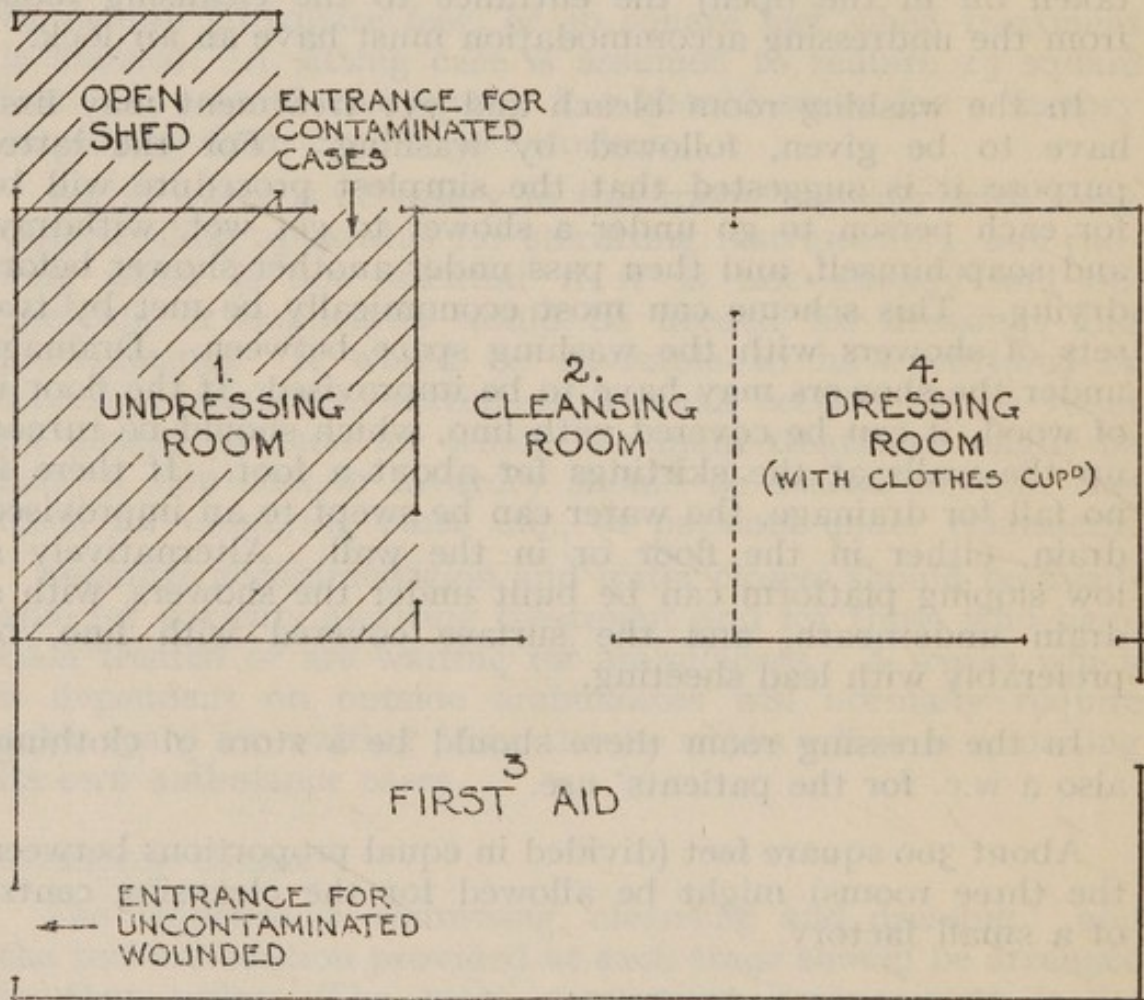


Fig. 11.—Combined First Aid Post and Cleansing Centre.

Note.—Poison gas vapour will tend to accumulate in the shaded part. Air locks should be provided at all external entrances and exits and also between Rooms 1 and 2.

APPENDIX L.

I. Equipment suitable for fire parties of three or six, with hand appliances.

	Party of	
	Three	Six
Mark II "Bantam" pump, with	1	2
Pitchers or Buckets (preferably the former)	2	4
or		
Chemical fire extinguishers (2 gal. London Fire Brigade pattern)	3	6
*Sand containers with long-handled shovels ..	2	4
Blankets, rolled and secured horse-shoe fashion	2	6
Crowbar	1	1
Hand axe	1	1
Rip saw in leather case	1	1
$\frac{1}{2}$ round file	1	1
Hurricane lamp	1	2
Long line (100 feet)	1	1
Corrugated iron sheets	3	6

II. Equipment suitable for fire parties consisting of, say, twelve persons, with major appliances.

	Number per party.
Mark V pump, or	1
Light portable motor fire pump, or	
Trailer pump, or	
Motor pump	
Hose in lengths of 75 feet or 100 feet. (Couplings as used by local Fire Brigade.)	500 feet or as required to enable two streams of water to be got to work in any part of the factory.
Branch pipes with suitable nozzles	2
Standpipes and turncocks' tools	2
Pitchers or Buckets	6

* See note on the Redhill sand container at foot of page 31.

	Number per party.
*Sand containers with long handled shovels ..	10
Felling axes	2
Hand axes	2
Crowbars	2
Rip saw in leather case	1
$\frac{1}{2}$ round file	1
Blankets in bundles of 6	12
Ladders, in suitable lengths	4
(Scaling ladders are specially suitable and can be obtained in 6 foot sections.)	
Hook ladder	1
Hurricane lamps	4
Long line (100 feet)	2
Corrugated iron sheets	12

NOTE.—If volatile liquids are stored on the premises, foam fire appliances should be available.

* See note on the Redhill sand container at foot of page 31.

APPENDIX M.

Equipment for Rescue Parties.

The following lists of rescue equipment are put forward for guidance. The "heavy" and "light" sets have been recommended to local authorities, and many large undertakings will be in possession of the equipment here indicated. The list entitled "extra light" has been devised for smaller undertakings :—

	"Heavy" set (for a party of 8 men).	"Light" set (for a party of 6 men).	"Extra light" set (for a party of 6 men).
Iron shod levers, 12 feet long ..	3	2	—
Iron shod levers, 10 feet long ..	—	—	2
Heavy block for fulcrums ..	2	2	1
Crowbars	4	3	2
Picks	4	3	2
Shovels	4	3	2
$\frac{1}{2}$ round files	2	2	2
Sledge hammer	1	1	1
Heavy axes	2	2	1
Light (timbermen's) axes ..	2	2	1
Two-handled cross cut saws ..	2	1	—
Hand saws	2	2	1
Wheelbarrows (iron)	2	1	—
40 feet lengths $1\frac{1}{2}$ inch Manilla lashing lines	3	3	2
Length (up to 100 feet) 3 inch Manilla rope	1	1	1
Length (up to 100 feet) 4 inch Manilla rope	1	—	—
Chain tackle (or set of rope blocks, 3 sheave and 2 sheave) ..	2	1	1
3 ton chain tackle	1	—	—
Single sheave snatch block ..	1	1	1
Hydraulic jacks with 10 ton lift	2	2	—
Hydraulic jacks with 20 ton lift	2	—	—
35 feet ladder (extending) ..	1	1*	1*
9 inch by 3 inch deals (about 12 feet long)	3	3	—
Length (up to 100 feet) wire rope, or several shorter lengths	1	—	—

* A smaller ladder may suffice, or sufficient scaling ladders in 6 ft. sections, which can also be used as bridges.

	" Heavy " set (for a party of 8 men).	" Light " set (for a party of 6 men).	" Extra light " set (for a party of 6 men).
Acetylene cutting apparatus, with oxygen and acetylene cylinders	I	—	—
Oil flood-light projectors or acetylene flares	4	I	I
Hand electric lamps	6	4	2
Hurricane lamps	6	4	2
Tarpaulins or stout canvas sheets (to protect trapped persons from falling debris until released)	2	2	—
" Fire devil " (or fire basket) for warming trapped persons in winter	I	I	—
Box of miscellaneous tools, spikes, timber dogs, etc. ..	I	I	I
Suitable timber and wedges for shoring up dangerous floors or walls	I	—	—

Transport.

For a " heavy " set, a lorry (preferably a garage break-down van).

For a " light " or " extra light " set, either a light lorry (preferably a garage break-down van) or a two-wheel cart capable of being dragged over debris (of the motor trailer type).

APPENDIX N.

Equipment for Decontamination Squads.

Each member of the squad will require two Service or Civilian Duty respirators (one in use and one in reserve), and two suits of full protective clothing. A squad should have a cleansing outfit consisting of basin, soap, nail brush and cotton wool. Some bleach vaseline ointment will also be required.

A squad should normally consist of 6 men, one being foreman.

The gear required by each decontamination squad in a small works is as follows:—

- 2 buckets of water.
- 2 buckets for mixing bleach paste.
- 2 whitewash brushes for applying bleach paste.
- 2 long-handled scrubbers or hard brushes.
- 1 shallow tray (about 30 in. by 18 in. by 3 in. deep) for bleach for the treatment of boots or tools contaminated during work.
- 2 bins (e.g. galvanised iron sanitary bins) for contaminated clothing.
- 1 bin for contaminated tools.
- Supply of bleaching powder and of paraffin.

In an undertaking covering a considerable area the following should also be provided:—

- 1 vehicle to carry the squad and equipment.
- 2 lengths of hose (60 feet to 100 feet).
- 1 standpipe and adaptor.
- 2 horticultural lime sprayers, for spraying bleach on walls.
- 2 spades.
- 2 picks.
- Rope and pickets for enclosing contaminated areas.
- Danger boards.



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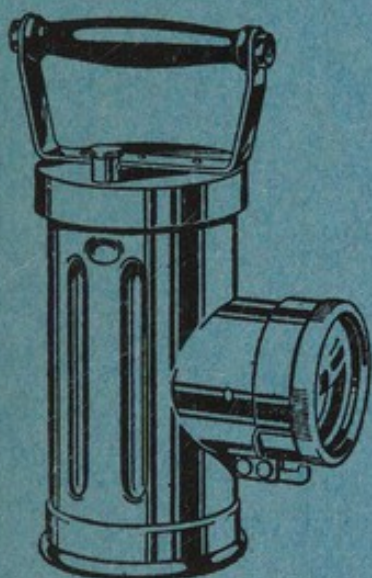
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