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GAS WARFARE

PART III.—METHODS OF TRAINING IN DEFENSIVE MEASURES

COMPILED AT THE
ARMY WAR COLLEGE
DECEMBER, 1917

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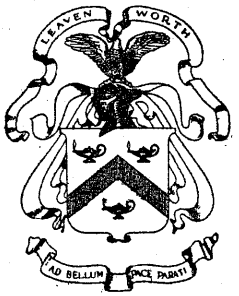
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WAR DEPARTMENT,
WASHINGTON, *December 5, 1917.*

The following pamphlet, entitled "Gas Warfare," is published for the information of all concerned.

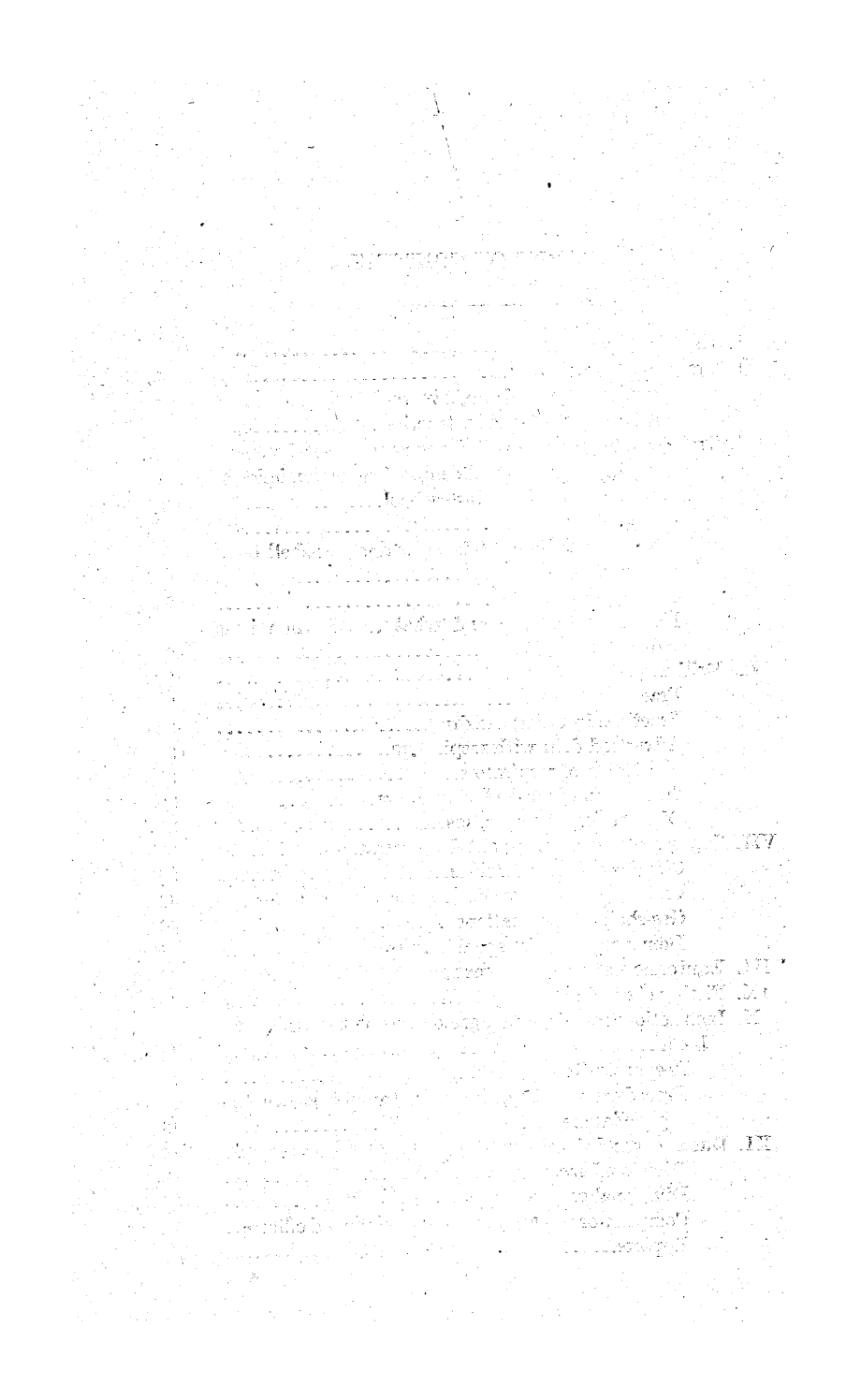
[A. G. O., No. 062.1.]

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Major General, Acting Chief of Staff.

OFFICIAL:
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DEFENSIVE MEASURES AGAINST GAS WARFARE.

I. INTRODUCTION.

1. It is a well-known fact that in the present war the employment of gas clouds and projectiles filled with gas is now a common feature of offense, and that the use of noxious gases by both sides is continually increasing in extent and deadliness. It is almost impossible, therefore, to overestimate the importance of the thorough training of troops in defense against gas.

2. On the other hand, the perfection of antigas appliances has kept pace with the developments in the offensive, and modern respirators are capable of dealing with high concentrations of all the gases in use or which are likely to be used. Defensive appliances against poison gases are at present ahead of offensive measures; consequently a soldier can be guaranteed perfect protection from gas if he keeps his respirator in good condition, knows how to use it properly, and is able to get it on in time. This puts defense against gas on an entirely different footing from defense against shells, bullets, etc. In gas warfare by far the greater number of casualties have been proved to be due to *inefficient training and slackness of discipline.*

3. *For destructive effects, gas must depend on surprise, on poor discipline, or on defective appliances.* Consequently gas casualties are preventible if the soldier is trained continually to exercise vigilance and is well drilled in the use and care of his respirator.

4. Gas is also used for harassing and for reducing the fighting efficiency of troops by forcing men to wear masks under difficult conditions. Troops must therefore be trained until they are accustomed to wear masks for considerable periods in all

circumstances and to carry out their ordinary work while protected against gas. This applies to all branches of the service, including such specialized work as that of telephone operators, ambulance drivers, bombers, etc.

5. The whole basis of gas defense lies, therefore—

(*a*) In frequent and thorough inspection, to insure all protective devices are in good working order.

(*b*) In thoroughly training men in their use under all conditions of war.

(*c*) In making sure that every man understands and rapidly complies with all orders on the subject of defense against gas.

These are all matters of training and maintenance of discipline. Training in gas defense can be divided into three categories, viz:

(*a*) Training instructors and specialists.

(*b*) Training regimental (etc.) officers and noncommissioned officers.

(*c*) Training the individual soldier.

II. TRAINING OF INSTRUCTORS.

6. Instructors in gas defense should have had a chemical training. This is particularly necessary if they are to act as gas officers at the front where their duties will not be confined to giving instruction. On the other hand, it is of the greatest importance that they be thoroughly trained soldiers and that they view the subject chiefly from the military standpoint. As explained above, the essence of gas defense is discipline, and it is toward this end that all instruction must be directed.

7. A suggested course for divisional gas officers and other special officers is contained in the following outline:

PROGRAMME IN GAS DEFENSE, TWELVE-DAY COURSE.

First day.

First hour: Lecture—Introductory, history of gas warfare.

Second hour: Practical—Enrolling, issue and provisional fitting of respirators.

Third hour: Lecture—Description of respirators.

Fourth hour: Practical—Demonstration of drill, preliminary drill, and inspection of respirators.

Fifth hour: Practical—Accurate fitting of respirator and removal of in lachrymator.

Sixth hour: Conference—Writing up notes and review of day's work.

Second day.

First hour: Lecture—Methods of gas offensive, cloud method in detail.

Second hour: Practical—Respirator drill, practices A, B, and F.

Third hour: Lecture—Methods of gas offensive, projectors, etc.

Fourth hour: Practical—Mutual instruction in practices A, B, and F.

Fifth hour: Lecture—Chemicals employed in attack and defense.

Sixth hour: Conference—Review.

Third day.

First hour: Lecture—Gas shells.

Second hour: Practical—Drill, practices C, D, E, and G.

Third hour: Lecture—Gas shells, trench mortar gas bombs.

Fourth hour: Practical—Drill.

Fifth hour: Practical—Breathing exercises (*a*) in the open, (*b*) in the gas chamber.

Sixth hour: Conference—Review, etc.

Fourth day.

First hour: Lecture—Protection against gas, evolution of protective appliances.

Second hour: Practical—Mutual instruction in respirator drill.

Third hour: Lecture—Gas alarms, Strombos horn, etc.

Fourth hour: Practical—Examination of faulty respirators and report upon same.

Fifth hour: Practical—Gas chamber, (*a*) with respirator adjusted, (*b*) adjusting from "alert" position to completion.

Sixth hour: Practical—Respirator drill and march by night.

Fifth day.

First hour: Lecture—Protected dugouts, clearing of trenches and dugouts.

Second hour: Practical—Use of fans and fires, dispersal of gas.

Third hour: Practical—Practice in entering protected dugouts.

Fourth hour: Practical—Mutual instruction in respirator drill.

Fifth hour: Practical—Wind observation and practical writing of wind reports.

Sixth hour: Conference—Review, etc.

Sixth day.

First hour: Lecture—Effects of gas on arms, ammunition, and equipment.

Second hour: Practical—Standard tests of respirator drill.

Third hour: Lecture—Standing orders, action before, during, and after a gas attack.

Fourth hour: Practical—Gas-cloud demonstration to bodies of men (e. g., one company).

Fifth hour: Lecture—Gas-defense organization and duties of divisional gas officer.

Sixth hour: Conference—Review, etc.

Seventh day.

First hour: Lecture—Recent gas attacks and lessons.

Second hour: Practical—Detecting faulty canisters of respirators and fitting new ones.

Third hour: Lecture—Smoke, its production and tactical uses.

Fourth hour: Practical—Respirator drill, games.

Fifth hour: Practical—Drill in antigas trench duties.

Sixth hour: Lecture—Horse respirators, practical demonstration.

Eighth day.

First hour: Lecture—Physiological effects of gases and treatment, first aid.

Second hour: Practical—Advanced drills, specialists, Artillery, machine guns, signals, etc.

Third hour: Lecture—Flame projector (Flammenwerfer), demonstration.

Fourth hour: Practical—Qualifying examination in standard tests.

Fifth hour: Lecture and demonstration, chemical hand grenades and bombs.

Sixth hour: Conference—Review, etc.

Ninth day.

First hour: Lecture—Duties of gas noncommissioned officers.

Second hour: Practical—Gas-shell demonstration to bodies of men (e. g., one company).

Third hour: Lecture—Field operations, explanation of night attack.

Fourth hour: Practical—Gas-cloud attack and antigas precautions in trenches.

Fifth and sixth hours: Practical—Night field operations.

Tenth day.

First hour: Conference—Note books handed in; conference on operations.

Second hour: Practical—Mutual instruction in respirator drill.

Third hour: Lecture—Principles of training and hints to instructors.

Fourth and fifth hours: Practical—Advanced drill in respirator with specialists.

Sixth hour: Lecture—Carbon monoxide poisoning and oxygen inhalator.

Eleventh day.

First hour: Examination—Practical in respirator drill, etc.

Second hour: Examination—Lecturing, officers.

Third hour: Examination—Oral, noncommissioned officers.

Fourth, fifth, and sixth hours: Examination—Written, officers and noncommissioned officers.

Twelfth day.

First hour: Practical—Disinfection and handing in of stores, etc.

Second and third hours: Lecture and conference—Recapitulation.

HINTS ON GAS-DEFENSE INSTRUCTION.

8. The following paragraphs are intended to state some general principles which should guide instructors in antigas measures:

A. THE FINAL OBJECT OF INSTRUCTION IS THAT TROOPS SHALL BE ABLE IN ALL CIRCUMSTANCES OF WAR TO PROTECT THEMSELVES AS COMPLETELY AS POSSIBLE AND AS QUICKLY AS POSSIBLE AGAINST GAS.

9. To achieve this object two things are necessary within the Army:

1. Full knowledge of the scientific principles underlying the offensive and defensive in gas warfare and of the special tactics relating to it.

2. Discipline and practical proficiency in the use of antigas appliances.

For *all concerned* proficiency in the use of antigas appliances is the first and literally the vital consideration; whatever else may be sacrificed in training, this must be achieved.

For the *rank and file* proficiency in the use of appliances is the only thing in which they need be expert.

Drill is therefore the main element in the instruction of the rank and file.

10. *Officers* should bear in mind that the existence of specialist officers and specialist noncommissioned officers in their unit does not absolve them from the duty of qualifying in the highest degree possible as instructors of all serving under them. For this purpose they should receive special instruction much beyond that required for men.

B. INSPIRING CONFIDENCE IN THE MEANS OF DEFENSE.

11. A fundamental difficulty in antigas instruction arises from the mystery associated with the materials used. The very word "gas" is not understood; even what are called educated men often do not know that air is a mixture of gases. Most people think that all gases will burn. When the word "chemical" is used in addition the mystery is increased. Everyone knows that a solid or liquid projectile, if heavier than air, will fall; few know this about gases. Gases are credited with all sorts of impossible qualities of movement and death dealing. There is,

in fact, an intensity not only of ignorance but of what is almost superstition attached to the material of gas warfare that is found in connection with no other branch of military training.

The consequence of all this is that there is a question of *morale* to be reckoned with in antigas training so pronounced as to put this branch of training in a category by itself. The alarm and distrust that exist in the recruit with regard to gas can hardly be known to those who have not been engaged in instructional work.

12. It is therefore of primary importance in antigas training that all ranks shall be given confidence in the means of defense. This can not be done by drill or by assertion. It can only be done effectively through the personal experience of the soldier himself. An indispensable part of training is therefore exposure to gas. Whilst it is essential to create confidence, it is equally so to check recklessness. Exposure to gas must therefore be done in circumstances where negligence incurs real danger to life.

13. It is obvious that to give men the right attitude toward gas the personality of the instructor is very important. He should have both confidence and caution and be watchful to check both timidity and recklessness.

C. Teaching the Common Sense of the Operations.

14. It might be concluded from the foregoing that the needs of antigas training for the rank and file would be met by drill followed by exposure to gas. *This is by no means the case.*

In antigas training, if not in all training, every man has a need, if not a right, to know something at least of the common sense of the operations in which he is being drilled.

If an order appeals to the intelligence it gains in force, and real knowledge of appliances inspires confidence.

It becomes necessary, therefore, to give a clear idea of the conditions under which a respirator protects or ceases to protect; how gas travels; where gas accumulates; how it is removed, etc.

But here again it is most important to show rather than merely tell. No antigas training can be regarded as satisfactory in which men have not seen gas issuing from a cylinder, gas lying in trenches, and gas being removed by fan and fire. Operations with gas—especially night attacks, with all the usual

dispositions—should be regarded as of equal importance to field training with other instruments of war.

All this means that a fair allowance of time is necessary.

D. Qualifications of Instructors.

15. A full comprehension of the basis of gas defense is only possible to those who have an adequate knowledge of natural science. It is, however, obviously more important that an instructor should have—

(1) The ability to teach and maintain discipline.

(2) A knowledge of the actual conditions imposed by warfare in the field.

If these qualifications can be found combined in one instructor so much the better, but in no case should the more soldierly portion be absent. Innumerable examples have shown how satisfactory an understanding of the basis of gas defense can be acquired by a capable officer or noncommissioned officer with little or no previous formal knowledge of science.

16. *Amount to be taught.*—A real danger attached to all instruction lies in the tendency to try to teach too much, both of theory and detail. In antigas instruction the danger is especially acute. It should be remembered that theory, which is very simple to the man who knows, may be very difficult and confusing even to an intelligent novice. He must not be expected to absorb on a first hearing what has become established by long familiarity in the mind of the teacher. Theory teaching should, therefore, be in the simplest outlines and simplest terms and should be applied continually to actualities.

17. Simplicity of language is most important, and the use of scientific terms should be reduced to a minimum. This applies to the highest teachings as well as to the lowest, for it must be borne in mind that unusual language arrests attention and is passed on, often in a distorted form, from one level to another, especially by people who are not practiced teachers. The use of expressions like "minimum effective concentration" easily becomes a kind of fetish.

18. It is far more important that a limited number of things should be taught simply and thoroughly than that a large number—relevant and important though they may all be—should be taught superficially. Great attention is therefore necessary to the due suppression of detail. Detail in teaching the com-

ponent parts of a box respirator is important, but in such a case as a gas detector the teaching of detail is entirely mischievous.

19. *Method of teaching.*—It is also to be borne in mind that mere telling or lecturing is a poor way of teaching. Lecturing may interest, but it instructs very little. The wise teacher will place the subject before his class and lead them as far as possible to think it out with his help. He will encourage questions at every stage and be impatient only of interruptions that are frivolous.

Lecturing is best adapted for narrative purposes and for appealing to the emotions, when fine language, a large audience, and a spacious auditorium may have a useful dramatic influence. As a substitute for the real teaching that is possible with groups of 20 or 30, lecturing to 100 people must be regarded as an evil, even if sometimes a necessary evil. A lecture by some one on his recent experiences in war is wholly admirable, but a set lecture on the internal structure of a Vermorel sprayer is not to be endured.

20. *Illustrations.*—It is very important that where principles are being described they should be illustrated by actual things.

The handling of things is vastly more instructive than elaborate descriptions or drawings. It is much better that a future instructor under training should draw the parts of his own respirator and attach his own description of it than that he should copy a diagram and take down a lecturer's description.

Drawing is a useful auxiliary to teaching, but a clear distinction should be made between pictures and diagrams. A picture is not usually an explanation, whereas a diagram always should be.

Pictures are useful where the thing pictured is not accessible, and occasionally where it is. A moving-picture film of a gas attack would be valuable, but can easily be overrated, and a film of a whole battle would not compare in value to personal experience of a mimic gas attack in a small trench system.

Diagrams are of great value if made by the person under instruction from an actual object. They are also valuable if used by the teacher, but with him they are best when built up on a blackboard as simply as possible while he is teaching, and preferably with the object in front of him.

21. It should be remembered that in order of interest to a class are (i) things, (ii) pictures, (iii) words.

If an object is displayed it monopolizes attention till it is fully "taken in;" if a picture is displayed it is usually copied openly or furtively. During this time listening ceases, or becomes subconscious. This makes it all the more desirable not to use elaborate diagrams or to suspend a whole series at once before a class.

22. In conducting a class it would be well, though it is often impracticable, for the numbers to be kept to 20 or 30. It is then possible to keep an eye on individuals, to ply them with questions, and to discover and rectify their misunderstandings as the teaching progresses.

Attention should be given to the physical comfort of those under instruction. Men can not listen long if they are standing or are crowded. They should all be in front of the instructor. He should speak clearly and make sure that he is heard. Any kind of fidgeting on his part will distract attention.

23. *Notes.*—The value of notes depends on whether they are a mere imperfect version of descriptions easily accessible in textbooks or are the outline of something not so accessible.

The fuller the notes taken the more the listener's attention is diverted from understanding to recording. In the extreme case of dictation the listener has usually no time to think at all. A full understanding is therefore by no means to be inferred from a full notebook; it may be exactly the reverse.

Notes would be better replaced by correct printed or manifolded accounts of any subject about which explicit information really needs recording and retaining.

24. It need hardly be added that the worst form of teaching is where an instructor, No. 2, merely tries to recite (often doing it inaccurately) the very words of his own instructor, No. 1, on subjects he (No. 2) had failed to understand thoroughly. No competent instructor will affect knowledge which he does not really possess, though, of course, there is no virtue in making a parade of ignorance.

25. *Examinations.*—The testing of knowledge by examination presents many difficulties. Written examinations alone may be very misleading, even as to knowledge, and useless as to practical proficiency. Oral examinations are valuable if conducted not too peremptorily. Practical examinations occupy much time.

In antigas training a competent instructor will attain the most reliable judgment of individual efficiency by contact with

those whom he is instructing. The impression so gained may be tested and confirmed or modified by examinations, written, oral, and practical, but it should be given due weight in assessing marks. Elaborate "systems" of apportioning marks are apt to put the examiner in chains and annul his better judgment.

III. TRAINING OFFICERS AND SELECTED NONCOMMISSIONED OFFICERS.

26. Previous to the training of the mass of troops in gas-defense measures it is necessary to instruct all available officers and noncommissioned officers. Courses for this purpose are in no way similar to the courses intended for training divisional gas officers or other special officers, but should be so organized that they are of a very practical and personal nature, capable of being readily reproduced in units by nonspecialist officers and noncommissioned officers.

27. In order that subsequent training in units may be given the greatest support and be taken up with vigor it is particularly important that the senior officers of a regiment should attend such a course as soon as possible. The following officers and noncommissioned officers should therefore attend in the order named—

(i) The commanding officer or second in command and one officer to act subsequently as regimental gas officer; all battalion and company commanders; all first sergeants.

(ii) Other officers (including medical officers) and noncommissioned officers as soon as can be arranged.

The course for these officers should be so arranged that theory is avoided and great stress laid on drill, practical demonstrations, and suggestions for the training of large bodies of men. Every officer and noncommissioned officer attending the course must be able to pass the same tests as are insisted on in the case of the men.

In general, the training should consist of instruction—

(*a*) In the various forms of gas attack.

(*b*) With respirators and other protective appliances.

(*c*) In tactical measures before, during, and after a gas attack.

28. The following is a typical outline of a course for such officers:

FOUR-DAY COURSE FOR OFFICERS AND NONCOMMISSIONED OFFICERS AT A GAS-DEFENSE SCHOOL.

First day.

First hour: Lecture—Introductory, history of gas warfare.

Second hour: Practical—Issue of respirators, preliminary drill.

Third hour: Lecture—Description, inspection, and demonstration of drill with respirators.

Fourth hour: Practical—Inspection of respirators and drill, practices A, B, and F.

Fifth hour: Lecture—Methods of gas offensive, the cloud method.

Sixth hour: Practical—Accurate fitting of respirators and removal in lachrymator.

Second day.

First hour: Lecture—Gas shells.

Second hour: Practical—Respirator drill, practices C, D, E, and G.

Third hour: Practical—Drill in breath holding.

Fourth hour: Practical—Mutual instruction in respirator drill, all practices.

Fifth hour: Lecture—Gas alarms.

Sixth hour: Practical—Drills in breath holding in gas chamber; recognition of various gases used in war.

Third day.

First hour: Lecture—Dispersal of gas and protection of dugouts.

Second hour: Practical—Use of fires, fans, blanket doorways, etc.

Third hour: Lecture—Procedure before, during, and after a gas attack.

Fourth hour: Practical—Respirator drill, all practices.

Fifth hour: Practical—Testing respirators in various gases; adjustment in gas.

Sixth hour: Practical—Night march in respirators with gas-shell attack.

Fourth day.

First hour: Hand in notebooks. Lecture and demonstration—Wind observations and use of smoke.

Second and third hours: Practical—Demonstration of cloud and shell attack with trench duties.

Fourth hour: Practical—Standard tests.

Fifth and sixth hours: Examination.

IV. TRAINING OF TROOPS.

29. The training of troops must be as practical as possible. Lectures should not be given except for the purpose of stimulating interest and should be in the form of short talks by the officer or noncommissioned officer in charge of the instruction. These talks should include as much demonstration as possible, and in no case should last longer than half an hour.

30. The most important feature of the training is drill and familiarization with the respirator. *Within twelve miles of the firing line the soldier is never parted from his respirator and may have to use it at any time.* His training in its use must therefore be regarded as of importance second only to the handling of arms, *and instruction in gas defense must be started as early in the recruit's training as possible.* The best time to begin this training is immediately after he has been familiarized with the fundamentals of the school of the soldier and the school of the squad. After that, gas-defense training must be continuous and universal, and must be combined with all other forms of training, so that the soldier developes confidence in the respirator, discipline in its use, and the ability to combine gas-defense measures with his other military duties.

31. In the final stages of the antigas training of troops the assistance of the gas-defense school can be of great use. This cooperation will permit the arrangement of simulated gas attacks, using such accessories as gas cylinders, gas hand grenades, smoke materials, alarm arrangements, etc. Special lectures can also be given, respirators fitted, men "passed through gas," and so on. The divisional gas officer can also assist in the inspection of appliances and antigas training in units.

32. The time allotted for antigas training should be the maximum time available and should not be less than two hours per week, one hour of which may be devoted to combined training.

V. PRINCIPLES OF TRAINING IN DEFENSE AGAINST GAS-SHELL BOMBARDMENTS.

GENERAL.

33. *What to expect.*—Every man should know what to expect, and should be told to regard as gas shells all those which burst with a small detonation, and to remember that gas shell is difficult to detect when fired with high-explosive shell, as it usually is.

34. *Gas alarm.*—Every man must be practiced in spreading the alarm by shouting "Gas shell" as soon as he has adjusted his respirator. Warning must be conveyed to troops to the leeward of the area bombarded. Sentries should be posted to warn men to put on their respirators before entering affected areas. Arrangements must be made to warn men who are asleep immediately a gas bombardment begins.

35. *Wearing respirators.*—Respirators must be adjusted properly during gas-shell bombardments, and must not be removed after the bombardment is over except on the order of an officer. If removing respirators is left to the judgment of individual men casualties are bound to occur.

36. *Respirator drill.*—It is important that men should be practiced in adjusting the small-box respirator while wearing steel helmets, by going through the necessary motions, even when not wearing the steel helmet. Practice in prolonged wearing is necessary, as many instances have occurred of men having to wear the respirator for five to eight hours. Men must also be practiced in moving in the dark and in speaking while wearing the respirator.

37. *Realistic training.*—It is important that the actual training should be made realistic and combined with ordinary work, e. g., a party engaged on night operations might suddenly be given the alarm "**GAS SHELL**," whereupon the correct action should be taken and respirators worn for an hour without interrupting the operations.

Night practices are essential, because gas shelling nearly always occurs at night. Specialists and men of all arms must be able to perform their duties in the dark while wearing their respirators.

38. *Gas-proof dugouts.*—All ranks must be acquainted with the proper method of adjusting the blankets at the entrances

to gas-proof dugouts. The adjustment of the blankets should be practiced in the dark when wearing respirators.

The value of gas-proof dugouts and cellars has been clearly demonstrated. This should be borne in mind in view of the inflammation of the skin produced by mustard gas. Billets and dugouts into which gas has entered must not be occupied until they have been completely cleared of gas by fires or fans.

HOW TO DETECT GAS AND WHAT TO DO WHEN IT IS DETECTED.

39. With the present wide use of gas in artillery shells, trench mortar bombs, cloud gas waves, and even hand grenades, it is a very difficult matter to be sure there is no gas around.

Everywhere within the reach of artillery, front line, communication trenches, batteries, billets, or, in fact, wherever a body of men are likely to be found, gas-shell bombardment is to be expected and guarded against. Salvos of gas shells are sent over in the hope of catching bodies of men unprepared or unwarned. Such a bombardment is apt to be heavy, especially at first, in order to develop a strong concentration of gas. Not only will gas shells be sent but also frequently a large proportion of high-explosive shells in an attempt to conceal the former or to detract attention.

40. Both in the case of gas artillery shells and gas trench mortar bombs, the sound of the burst is very small and they are therefore sometimes considered as "duds" (high-explosive shells that fail to burst).

When a gas shell explodes most of the liquid gas turns into vapor, sometimes in the form of a white cloud. However, this is not true of all kinds of gas.

41. If a gas shell bursts 20 yards or less to windward of a body of men they have no time to wait for any alarm, and unless each acts for himself he will be killed. *Each must hold his breath and get his respirator or mask on as quickly as possible.* In doing so follow the methods described in Practice B or Practice C. Whenever putting on a mask do so according to the methods given in the practices, because these have been worked out with great pains to save loss of time.

42. *Mustard gas (dichlorethyl sulphide.*—The slight smell of mustard gas and the absence of any immediate effect on the eyes and lungs make it necessary that precautions against gas shells should be taken when any shells are observed to burst with only a slight explosion, even if no gas be smelled or recognized.

43. Cloud gas is usually, if not invariably, chlorine or chlorine mixed with phosgene. Both have a very distinct irritating odor like that given by chloride of lime, well known as a disinfectant. Both are irritating to the throat and cause coughing. There is no difficulty in recognizing them, but *one full breath of a phosgene cloud will kill a man*, therefore *hold your breath while putting on your respirator or mask.* The responsibility for recognizing cloud gas rests with the sentries in the front-line trenches. The actual gas cloud is preceded a few seconds by a hissing sound like the escape of steam; this noise, however, can not always he heard on account of artillery or machine-gun fire. In the daytime these gas clouds are visible at quite a distance and readily recognized, but as they are now used only at night and often when there is fog it is seldom that they can be seen more than five seconds away.

SUMMARY.

There are three things to do:

First. Hold your breath and give the alarm.

Second. Keep on holding your breath until your respirator is fully and accurately adjusted.

Third. Give the alarm for all your comrades.

VI. DRILL WITH RESPIRATORS.

44. The following drills are designed to teach officers and men to quickly adjust their respirators and masks. The drills must be so thoroughly mastered that one will protect himself instantly upon hearing the gas alarm.

45. At the beginning of each drill the recruit should first be taught how to wear the respirator correctly, i. e., at the left side with the sling passing over the right shoulder and the snap fasteners of the satchel toward the body. (See fig. 1.)

PRACTICE A.—ADJUSTMENT OF THE RESPIRATOR IN THE "ALERT POSITION."

46. At the command **GAS ALERT**, pass the left arm back through the sling and bring the satchel to the front of the body. With the right hand grasp the metal hook (or leather tab) at the left of the satchel, with the left hand reach behind the neck for the metal eyelet (or brass stud) on the sling, pull down and fasten the two together. Undo the snap fasteners, but replace the flap to keep the respirator from the wet.



FIG. 1.

Complete the adjustment by taking the cord from the right-hand compartment, passing it through the ring on the right of the satchel, then round the waist, and secure it to the ring on the left of the satchel. (See fig. 2.)

NOTE.—Explain the reasons for the adjustment and the replacement of the flap. When first detailed this practice may be divided into two parts, the completion of the adjustment being detailed separately.



FIG. 2.

ADJUSTMENT IN "ALERT POSITION" (ALTERNATIVE METHOD).

47. Pass the left arm back through the sling, bring the satchel to the front of the body and undo the snap fasteners. Support the respirator with the right hand at a convenient height on the chest and with the left hand pull the sling down on the back to form a "V." Hold the sling in this position with the thumb

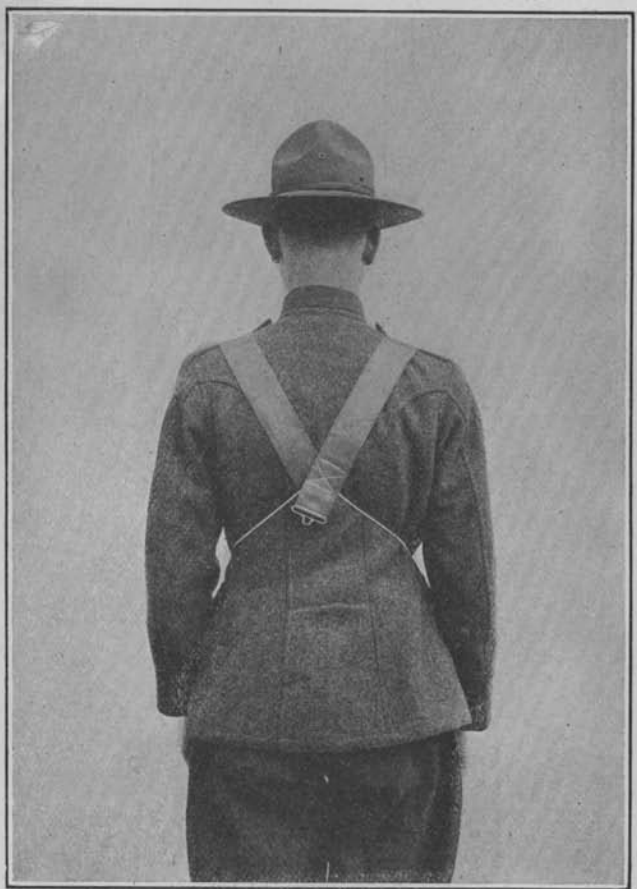


FIG. 3.

and the first finger of the left hand and with the right hand remove the cord from the satchel, passing it round the body through the " V " of the sling. Hold the respirator in its position on the chest with the right forearm and fasten the cord to the ring on the left of the satchel. (See fig. 3.)

NOTE.—This method is very comfortable for troops wearing skeleton equipment, as, for example, in the trenches, and will be used at the discretion of the commanding officer.

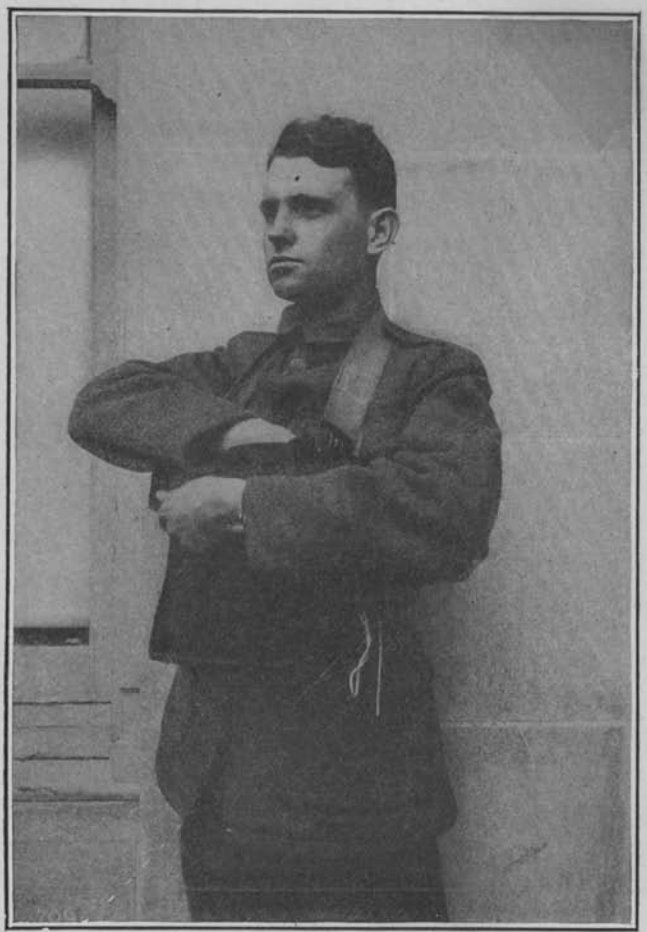


FIG. 4.

PRACTICE B.—COMPLETE ADJUSTMENT OF RESPIRATOR.

1. BY THE NUMBERS.

48. At the command **GAS**, knock off the headdress, place the rifle between the legs, open the satchel flap, seize the mask with the right hand, the elbow tube being in the palm of the

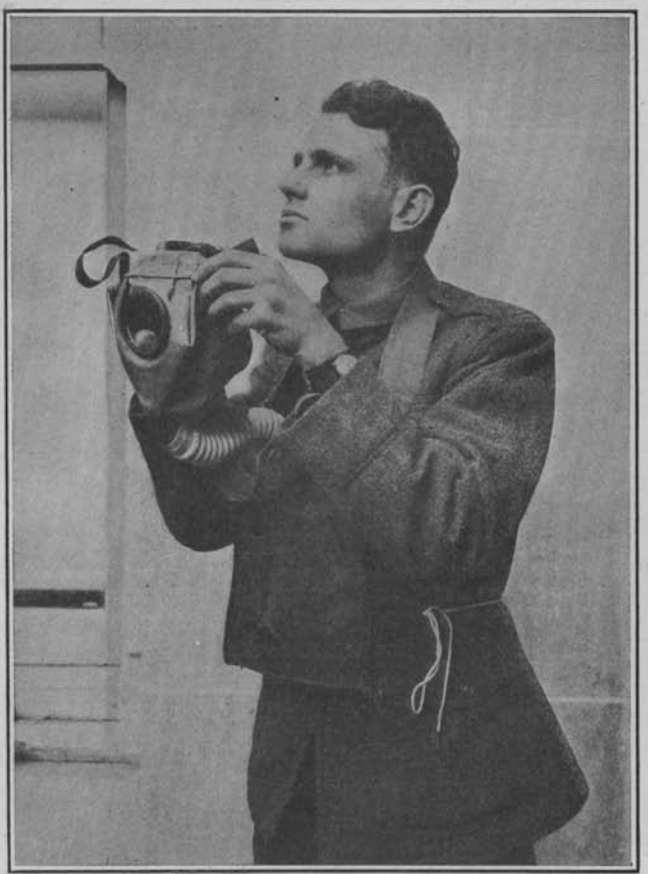


FIG. 5.

hand, the thumb and first finger grasping the wire frame of the nose clip. (See fig. 4.)

NOTE.—Always go through the movement of knocking off the headdress, even when practicing.

(TWO) Bring the mask smartly out of the satchel and hold it in both hands in front of the face with all fingers outside around the binding and the two thumbs inside, pointing inward and up-



FIG. 6.

ward under the elastic. At the same time *throw the chin well forward* ready to enter the mask opposite the nose clip. (See fig. 5.)

(THREE) Bring the mask forward, digging the chin into it, and with the same motion bring the elastic bands over the crown of the head to the full extent of the retaining tape, using the thumbs.

(FOUR) Seize the elbow tube outside the mask, thumb on the right, fingers on the left—all pointing toward the face. Push the rubber mouthpiece well into the mouth and pull it forward until the rim of the mouthpiece lies between the teeth and the lips and the two rubber grips are held by the teeth.

(FIVE) Adjust the nose clip to nose, using the thumb and the first three fingers of the right hand. Run the fingers around the mask on either side of the face to make sure that the edges are not folded over. Correct any faults in adjustment. Come smartly to attention. (See fig. 6.)

NOTE.—At the completion of this exercise the instructor inspects each man and corrects any faults of adjustment. It is very important to see that the mask fits the face properly and that the length of the sling in the alert position is such that the man can move his head about freely without exerting traction on the rubber tube.

2. RAPID ADJUSTMENT.

49. At the command **GAS,** the breath will be held until the mask is finally in position. All of the above movements will be gone through in order.

NOTE.—Speed must be developed, but not at the expense of accuracy.

When he has obtained complete adjustment each man must be instructed to take one pace forward and come to attention. This and similar methods cause emulation and increase the speed of the class as a whole.

All men must be drilled until they can make a perfect adjustment in six seconds.

3. REMOVAL OF RESPIRATOR.

50. At the command **TAKE OFF MASKS,** insert the fingers of the left hand under the mask at the chin, bend the head forward, at the same time removing the mask with an *upward* motion of the left hand. (This movement must be done without undue strain on the mask or elastics.) Wipe the face piece and mouthpiece. Fold the face piece in one fold, as in closing a book; gather the elastics around to one side and replace the mask in the left compartment, taking care that the outlet valve is not crumpled. (See figs. 7 and 7A.)

NOTE.—When sufficiently practiced, men must be instructed on every occasion to carry out Practice "G" on permission being given to remove masks.

PRACTICE C.—COMPLETE ADJUSTMENT OF RESPIRATOR FROM THE "SLUNG" POSITION.

51. At the command **GAS,** open the satchel flap and adjust the mask as in Practice B, allowing the satchel to hang by the rubber tube. Then proceed to complete adjustment in "Alert" position as in Practice A. The breath must be held during this practice, but after the mask is adjusted breathing can be resumed and the satchel fastened in the "Alert" position. Complete protection must be obtained in seven seconds. The final adjustment is then made.

NOTE.—The reason for this practice must be explained to the class.

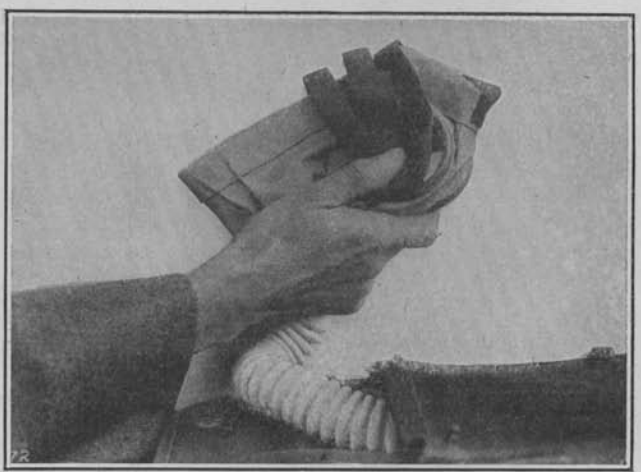


FIG. 7.

PRACTICE D.—CLEANING EYEPIECES.

(See fig. 8.)

52. At the command **CLEAN RIGHT (OR LEFT) EYEPIECE,** grasp the right eyepiece between the thumb and first finger of the left hand. Push the first finger of the right hand gently into the fold of the mask behind the right eyepiece and clean with a gentle rotatory motion.

The left eyepiece will be cleaned in a similar way.

NOTE.—The eyepieces of the respirator should be cleaned once weekly, or after each time the respirator has been worn.

DIRECTIONS FOR USE OF ANTIDIMMING OUTFIT.

53. Remove moisture and dust from respirators, apply a little of the paste from the tube to the cleaned surface, rub it in with the fingers, then polish gently with the flannelette until the eyepiece is clear.

Do not use the mask material for polishing.

PRACTICE E.—GIVING ORDERS.

NOTE.—It must be explained that long messages or orders must be broken up into short phrases, so that each part can be shouted out with plenty of breath. The squad is then extended to four paces and messages passed along under supervision.



FIG. 7A.

54. Take a long breath and, *without removing the nose clip*, remove the mouthpiece sideways from the mouth by turning the elbow tube to one side. Then shout the message and immediately replace the mouthpiece before taking a breath.

PRACTICE F.—CLEARING GAS OUT OF MASK.

NOTE.—Explain how a little gas may be present in the mask when it is first put on.

55. At the command **EMPTY MASKS**, press the face piece close to the face with the fingers and palms of both hands, thus forcing out foul air around the sides. At the command **FILL**



FIG. 8.

MASKS, fill the face piece again from the lungs by blowing around the mouthpiece.

Carry this out three times, thus removing the last trace of noxious gas.

NOTE.—When sufficiently practiced, men should be instructed to carry out this practice on every occasion after adjusting the face piece.

PRACTICE G.—TESTING FOR GAS.

56. At the command **TEST FOR GAS**, empty mask as in Practice F. With the forefinger of the right hand lift the face piece slightly from the right cheek, then loosen the nose clip with the left hand and smell gently. Do not take a breath.

If gas is smelled, replace the nose clip and mask and go through Practice F.

If no gas is smelled, remove the mask gradually, face piece first, leaving nose clip and mouthpiece adjusted; then take off the nose clip and gradually breathe through the nose. Finally, remove the mouthpiece.

If, after wearing for a long time, the pressure of the nose clip becomes unbearable, it may be relieved for a few moments by taking off the pressure without removing the clip.

57. As soon as each man has been supplied with his *service respirator*, he must wipe his mask dry and apply antidimming composition to the eyepieces after each drill before replacing it in the satchel.

58. No record will be made on the entry card for periods of breathing through the respirator in drill. Men must be taught to make the entry automatically after wearing the respirator in the gas chamber, under gas-shell attacks or cloud-gas attacks, but it will be assumed as regards drill that the respirator is used for the maximum time permissible.

PRACTICES IN BREATH HOLDING.

59. It should be explained to the squad that the object of the drills is to train all ranks to *refrain from drawing in breath* for certain periods of time or while moving certain distances, rather than to hold the lungs filled with air during the exercise.

There is no objection to releasing breath gradually from the lungs, which, in any case, should not be filled to full capacity.

60. In the following exercises, therefore, for the words "Holding the breath," etc., the sense "Refrain from taking in fresh breath" should be understood.

Practice 1.—The squad will be formed in single rank. On a whistle or other signal, breath will be held until a second signal is given 15, 30, 40, 50, or 60 seconds after the first.

As each man fails to "hold his breath" any longer, he will take one pace forward.

The practice will be carried out with, and then without, warning, preceding the first signal.

Practice 2.—The squad is formed facing the wind. The instructor moves 15, 30, 40, 50, or 60 paces into the wind. He then drops a stone or similar object to represent a gas shell. Immediately the men hold their breaths and march or double time to windward of the object before breathing afresh.

If any man is unable to hold his breath until he has moved the required distance, he will halt immediately.

Practice 3.—Respirators, or other objects to represent them, are laid out on the ground in a line. The squad is formed at varying distances from and facing away from the respirators. On a given signal the men will hold their breaths, about face, double time to their respirators, and pick them up.

Practices 1 and 2 may be carried out competitively in a slightly modified form, as follows:

Practice 4.—On a given signal the squad hold their breaths, taking one pace forward when unable to continue. The instructor calls out the number of seconds as each man comes out of the line.

Practice 5.—On a given signal the squad marches or double times into the wind, halting when unable to proceed farther without breathing afresh.

When all have halted the instructor paces out the distances, calling out the number of paces as he reaches the position of each man.

Practice 6.—Men will be marched in small detachments into the gas chamber containing chlorine at a low concentration, say, 1–50,000, and instructed to hold their breath for 10 seconds and then leave.

Practice 7.—Under similar conditions men will be instructed to hold their breath as long as possible or until compelled to leave the chamber.

The above drills should be continued until every man can hold his breath for at least 30 seconds and while marching at least 50 paces.

NOTE.—Squads should be given a few minutes's rest between practices.

ADVANCED DRILL WITH RESPIRATORS.

61. The respirator is first adjusted. Using the ordinary commands, drills are carried out in handling arms and in move-

ments appropriate to the particular branch of the service under instruction.

Infantry.—The drill should include physical and rifle exercises, marching over rough ground, and marching at double time for at least 200 yards.

Training in rifle exercises (including actual firing on the range), bombing, use of the automatic rifle, etc., must also be practiced while wearing gas masks.

Officers must particularly be instructed in giving orders, both in writing and word of mouth, using the telephones, etc.

Artillery.—Gun practice and battery control must be carried out frequently. Gun layers, fuse setters, etc., must be particularly well trained in performing their duties while wearing gas masks.

Officers will practice using the telephone and megaphone.

Signal service.—Telephone operators must be specially practiced in using their instruments when wearing respirators. Talking and "buzzing" should both be practiced.

Linemen must be well practiced in carrying on their work while wearing respirators.

Mounted branches, motorcyclists, etc.—Mounted branches of the service and all horse and mechanical transport personnel must be practiced in riding and driving while wearing gas masks.

NOTE.—*The above exercises must be carried out by night as well as by day.*

INSPECTION OF RESPIRATORS.

62. The importance of frequent and thorough inspection of respirators can not be overemphasized.

During gas-defense training respirators should be carefully inspected before each drill. *A soldier must be made to feel an individual responsibility for his respirator, taught to inspect it for himself, and to report any faults at once.*

63. For instructional purposes or as a drill the inspection will be carried out as follows:

The unit being in proper formation, the command is given:

PREPARE FOR INSPECTION OF MASKS.

Pass the left arm back through the sling, bring the satchel to the front of the body, and then unbutton the flap.

INSPECTION OF MASKS BY NUMBERS.

(ONE) Examine the satchel and sling to see that the metal hook and metal eyelet (or leather tab and brass stud) and the metal rings at each side are securely fastened in their proper positions. Then remove the canister and hold under the left arm, and examine the interior of the satchel to see that the wire platform, record card with repair plaster, and antidimming compound are present, and that the whipcord is in good condition and free from knots.

(TWO) Examine the canister for rust spots and holes and for weak places by pressing lightly with the fingers. See that the inlet valve at the bottom of the canister is in good working order; that the flexible tube is properly fastened to the canister and to the metal tube, and is free from obvious defects.

(THREE) See that the metal elbow tube is properly connected with the mouthpiece and outlet valve. Examine the outlet valve to see that it is in good condition and working properly. The mouthpiece should be flexible and the metal bushing present.

NOTE.—In cold weather the saliva on the outlet valve will freeze. This can be prevented by two drops of glycerine or heavy thick oil. However, as both tend to injure the rubber they should be used only in very cold weather.

(FOUR) Examine the face piece. It should have no holes nor tears and should be securely fastened between the flanges of the metal elbow tube. Make sure that the nose clip and eyepieces, elastics, and tape are in good condition and securely attached to the face piece, and that the outer fold of the face piece is firmly cemented down.

NOTE.—The instructor should explain to the recruit the proper methods for inspecting the several parts of the respirator and the reasons for so doing. The outlet valve may be tested by closing the inlet valve with the hand so as to prevent passage of air, and at the same time attempting to draw air in through the mouthpiece, which should not be possible. This also proves the absence of leaks in the tube or canister.

The inlet valve may be tested by pressing the outlet valve with the fingers and alternatively breathing in and out; the valve should vibrate back and forth and no air should pass out.

64. At the completion of the inspection men with faulty respirators will be instructed to fall out. Respirators which are unfit for use must be repaired or exchanged.

DISINFECTION OF RESPIRATORS.

65. Whenever respirators are to be exchanged and worn by other men they should be disinfected immediately after use, as follows:

MATERIALS REQUIRED.

Two per cent lysol or cresol (immaterial which is used).
One test-tube brush per respirator.
Two small pieces of cloth.
One small tin to hold disinfectant.

DIRECTIONS.

(1) Hold the mask in the hand, saturate one of the pieces of rag with disinfectant, and sponge the whole of the inside of the mask, including the nose clips.

(2) Dip the test-tube brush in the disinfectant and insert into opening of the mouthpiece. Push as far as possible with rotatory movement, and brush back and forth repeatedly; 15 seconds active brushing suffices.

(3) Dip mouthpiece up to mask in disinfectant. Do not shake off the excess after removal from solution.

(4) Hold the outlet valve between the forefinger and thumb, across the breadth, and press slightly so as to open valve and dip as deeply as possible into disinfectant. Do not shake off excess.

(5) Leave all parts moist with disinfectant for 15 minutes, then wipe inside of mask (but not mouthpiece) with dry rag (not handkerchief) and allow to dry, if possible, in air before returning to satchel.

VII. SUGGESTIONS FOR CARRYING OUT DEMONSTRATIONS.

66. The object of carrying out demonstrations with actual gas is to improve the quality of both individual and collective training. It can do this by—

(*a*) Demonstrating the efficiency of the mask.
(*b*) Representing actual conditions.
(*c*) Stimulation of interest.

In order to carry out an effective demonstration it must be thought out carefully beforehand. The following points must be especially considered:

(*a*) The most favorable ground must be chosen with regard to terrain, prevailing winds, proximity to buildings and thoroughfares, etc.

(*b*) The officer in charge of the operation must make arrangements for clearing the ground to leeward, and must decide how much gas he may employ and how long the bursts of gas may last. If there is any doubt about this, advice may easily be obtained from the divisional gas officer.

(*c*) Instructors should be carefully drilled in order that the operation may be carried out without confusion and misunderstanding.

67. The following suggestions may prove instructive:

CLOUD GAS DEMONSTRATIONS.

(A) FOR BATTALION, COMPANY, OR OTHER SIMILAR COMPLETE UNITS.

(1) The battalion is formed and a lecture is given lasting 15 minutes to 20 minutes, which ends with a description of what is to take place. Men are cautioned that if they feel any gas they are to hold their breath and fall out to the front.

(2) Four cylinders are placed about 15 to 20 yards interval and 30 to 40 yards distant from the front of the battalion. Ground is cleared to the leeward.

(3) All respirators are carefully inspected and then placed in "alert" position, company commanders reporting "All correct." Men with faulty respirators fall out.

(4) Three smoke bombs are burst at such distance to leeward of the battalion that the cloud will just reach its front in six seconds. This is to be the alarm signal, breath is to be held, and all respirators correctly adjusted. Then sufficient smoke cases are thrown to make the cloud thick and evenly dispersed over the battalion.

(5) When the smoke has cleared away a burst of gas lasting 10 seconds is commenced and the officer in charge observes the effect, and collects any men who have fallen out. A second cloud of the same duration is then sent over.

(6) It is of the utmost importance that the men who have fallen out should receive special attention and their respirators must be examined and tested if necessary.

68. Most men fall out owing to sudden panic, and if this is the case the names should be taken and extra training given them either by the unit or at the gas school.

(B) GAS ATTACK FOR ANY NUMBER OF MEN UP TO A COMPANY STRENGTH.

69. The most important points to note are:

Respirators are placed in "alert" position. The party is divided into two. One part acts as a working party to leeward of the trench. The officer or noncommissioned officer in charge is told to organize the working party and post a sentry over it. The other party mans the trench. The officer or noncommissioned officer to act as company commander, appoints the company gas noncommissioned officers, and sees that all sentries are posted. Ordinary trench routine is carried out as far as possible. Only the sentries are permitted to look over the trench. (One of the party may be told off secretly to act as a casualty.)

The instructors with three or four cylinders of gas and about eight smoke cases take up positions from 60 to 100 yards to windward of the trench. If possible, they should be screened from view by trench, breastwork, hedge, or canvas screen.

At a given signal each instructor lights one smoke case. In about 5 to 10 seconds all the gas cylinders are turned on full at once and are turned on and off in short bursts of gas until the smoke cases are burnt out. The party is under observation of the officer in charge, who may be in the trench with the class, or, better, in a position away from the trench where he can observe all that happens in the trench and at the same time shout or signal directions to the instructors.

When the class has cleared the trench and respirators have been removed, a second attack is suddenly commenced, starting with a sudden burst of gas from all cylinders and then reinforced with smoke.

Further attacks may be made if desired.

70. Afterwards the class is formed and faults are criticized. (Chief faults: Half-hearted alarm, forgetting to lower blankets of gas-proof dugouts, mistakes in treatment of casualties, not changing cylinders of Strombos horn when exhausted, clearing trenches and dugouts not correctly carried out, definite permission to take off masks not being given.)

The company gas noncommissioned officer should be expected to make a written report.

71. Special emphasis should be laid on the following points:

(1) The attack must be thoroughly organized; as many anti-gas fans, combustibles for clearing dugouts, Strombos horns, minor alarms, etc., being in the trench as can be used.

The responsibility of the company commanders or the company gas noncommissioned officers for testing for gas, clearing trenches, and warning sentries after one cloud has passed must be clearly explained.

(2) It is most important that when trenches have been cleared and masks removed that a *weak* wave of gas should be sent over *simultaneously* with smoke in order that the necessity for a good lookout should be thoroughly brought home.

(3) A criticism of the defense should always be made by the officer in charge.

CLOUD-GAS DEMONSTRATION FOR MACHINE GUNNERS.

(Taken from a demonstration at a gas school in France.)

72. Two guns firing and two packed up for transport, the detachments being on the road. Smoke and gas were let off. Alarm was given by shouting "Gas!" A runner was sent (wearing respirator) to bring up spare detachments, who came up at double time in respirators and got their guns into action.

GAS-SHELL DEMONSTRATIONS.

(A) FOR A BATTALION, COMPANY, OR SIMILAR COMPLETE UNIT OF INFANTRY.

73. The unit is formed and a lecture of 15 to 20 minutes on gas-shell bombardments is given. It should conclude with a description of the demonstration about to be held.

(*a*) The unit is marched, a company at a time, in column of squads along a given line and sufficient smoke bombs are burst to windward to cover the frontage.

Action taken, the company will halt. Every man will hold his breath, adjust his mask, then shout "Gas shells!" The local alarm should also be sounded. Masks are adjusted from the "slung" or the "alert" position. Men must then gather up any of their equipment which they have scattered and the company will move out of the bombarded area.

(*b*) Action taken in (*a*) will be repeated, only this time men will be warned that gas will be used as well as smoke, and bursts of gas from cylinders will commence simultaneously with burst of the smoke bombs.

(*c*) In order to show men that if isolated gas shells burst to windward of them, complete protection may be obtained while

in the cloud by holding the breath, the following may be carried out:

Mimic gas shells are exploded or a chlorine cylinder is turned on in short bursts at 40 yards to windward of a company.

The only action which men take is to hold their breath while in the cloud.

Instruction in smelling for gas without taking a breath must also be given in this way:

(*d*) Instruction on the above lines can be varied at will so as to accustom men to protect themselves from gas shells under all conditions. For example, an attack can be organized and the instructors should burst occasional mimic gas shells among the attacking waves, supports, etc. Each man must protect himself properly and then proceed with the work in hand.

Most gas-shell attacks occur at night. It is therefore necessary that these practices be carried out by night as well as by day.

(B) FOR ARTILLERY.

74. Batteries of all calibers must carry out gun drills and practice operations under conditions of gas-shell bombardment.

Gas-shell alarms, gas-proof telephone dugouts, and observation posts should be represented, and smoke, gas, and lachrymatory bombs used.

It is hardly necessary to indicate how this should be organized, but if it is carefully carried out it is a most effective form of demonstration.

DEMONSTRATIONS FOR SPECIAL UNITS, SIGNAL COMPANIES, BOMBERS, ETC.

75. The following demonstrations have been carried out in a gas school in France and indicate the organization of demonstrations for special units.

(1) Machine Gunners.

(A) DEMONSTRATION ON RANGE.

76. Four guns firing and spare crews standing near. Without warning, mimic gas shells, smoke and lachrymatory bombs were burst to windward. Alarm was given, "Gas shells," and the men were instructed to hold their breath, put on respirators, and then continue firing.

(B) DRILL IN GAS CHAMBER AT THE GAS SCHOOL.

77. Lachrymator was first used to test masks, and then a good concentration of chlorine was put in the chamber. Men carried out the usual drills with one gun in the gas.

NOTE.—In giving such a demonstration the officer in charge must give his orders clearly and men repeat them. The gun will not be much affected, but must be washed in soda after the tests.

(2) BOMBERS (PARTIES FROM BOMBING SCHOOL).

78. All men were first tested in the lachrymatory chamber. They were then taken to a point some distance from the practice trenches and were given detailed instructions by their officers for a properly organized bombing attack on the trenches.

Smoke was put up so as to obscure the trenches and ground in front of them, and lachrymatory bombs were burst in the trenches. The men put on their respirators and advanced to the attack—gas was discharged as they approached. A trip wire was arranged some 25 yards in front of the trench. Only dummy bombs were used.

(3) SIGNALLERS.

79. Besides laying lines through a smoke cloud while wearing respirators and connecting up the instruments in gas in two houses, these parties were made to transmit written messages on the ordinary form, and to find and repair cuts made in the wires. During these tests respirators were worn continuously for 40 minutes.

80. The following points might be mentioned in connection with arranging these practices:

(*a*) A competent officer should accompany each party to organize and criticize the work of the men.

(*b*) Everything should be ready so that delays are avoided and the interest of the men is kept up.

(*c*) Respirators should be tested in lachrymator if the men are to be exposed to much gas.

The above instructions indicate the lines on which demonstrations should be carried out, but they can obviously be varied at will.

VIII. EQUIPMENT OF DIVISIONAL GAS SCHOOLS.[1]

81. For a properly organized divisional gas school the following equipment is required:

(*a*) Buildings:

(1) Lecture room, large enough to contain 60 to 100 men (lantern, exhibits, and diagrams).

(2) One *well-equipped* office for instructional staff and clerk.

(3) Storeroom for gas cylinder and apparatus, workshop.

(4) Drill shed for use in bad weather.

(5) Gas chamber. (The type used at the cantonments of the United States Army is outlined in figure 9.)

(6) Lachrymator shed for fitting large numbers of men with service respirators.

(*b*) Special splinter-proof shed or dugout for storing explosives and combustibles.

(*c*) Demonstration trenches and dugouts.

These should be located according to the prevailing wind in the district. It will be seen that the typical demonstration trenches shown in figure 10 can be used when the wind is in any direction, since in this system the support trenches have been reversed, as shown by the position of the firing steps and traverses.

The dugouts should be protected by blankets according to standard methods.

IX. FITTING OF RESPIRATORS.

82. Procedure to be adopted and instructions to be carried out by qualified instructors at the lachrymatory shed of the divisional gas school under the supervision of the divisional gas officer or his assistants:

(1) Each man will be supplied with a respirator of the size which it is anticipated will fit him.

(2) A few unusual sizes will be kept at the divisional gas school to replace those which are found to be ill fitting.

(3) On arrival at the school the men will be formed and will put on their respirators for a few minutes. The officer in charge will assure himself that the respirators fit, at least approximately. This is done by making the soldier take a deep

[1] Refers to training in America. In the American expeditionary forces the gas-defense schools are attached to corps headquarters.

breath, removing the mouthpiece and breathing out into the mask, the instructor in the meantime closing the outlet valve with thumb and finger. The mask balloons out, and bad fitting is determined by the easy escape of air at certain places around the edge.

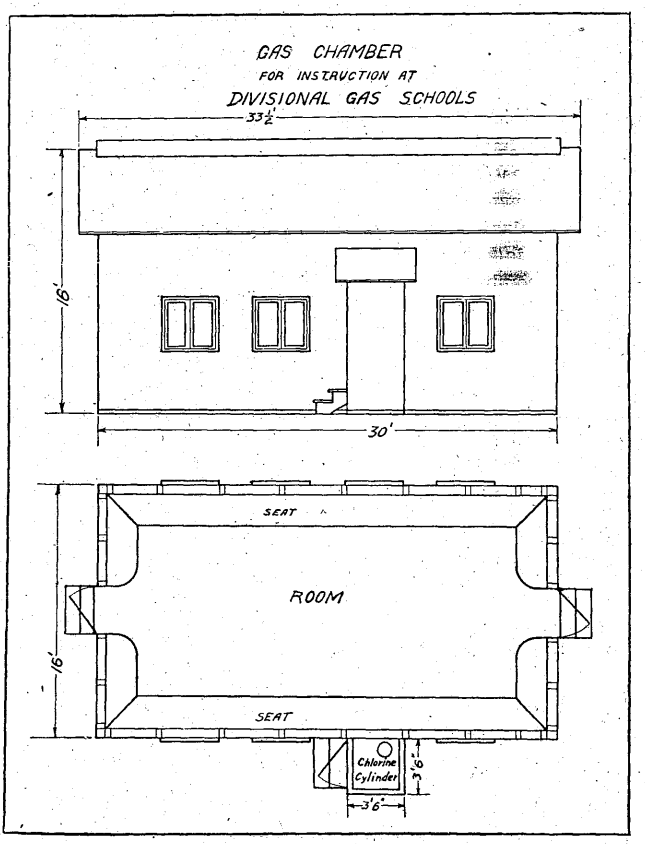


FIG. 9.

(4) The respirator will then be taken off and the further procedure to be adopted explained to the men as follows:

After readjusting their respirators—

(*a*) Men will file into the lachrymatory chamber, walk about, and talk.

(*b*) Any men who are lachrymated will file out and fall in as directed.

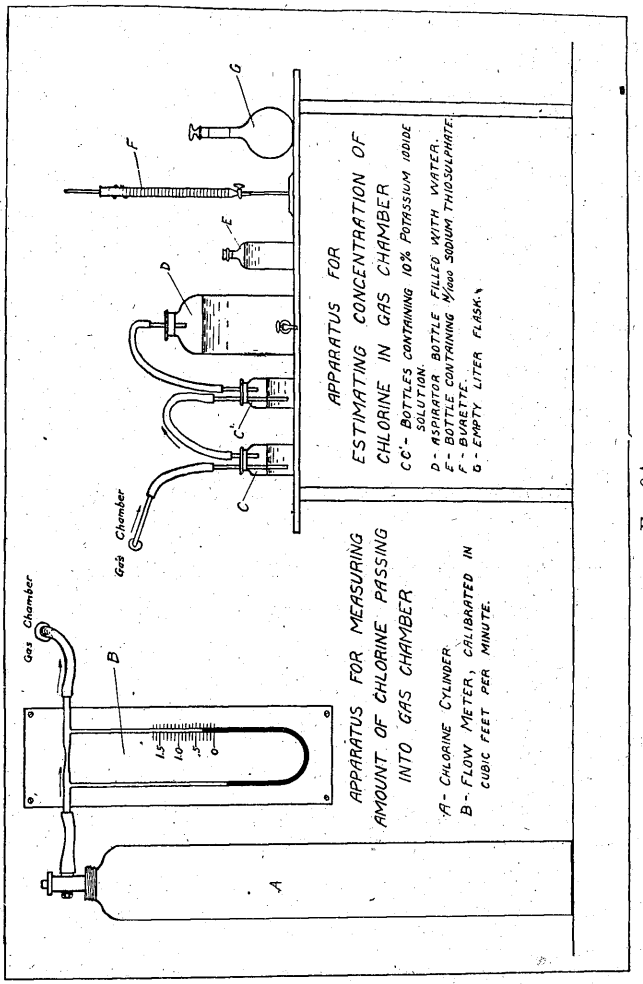


FIG. 9A.

(*c*) The remainder, after five minutes, will file out and fall in separately. Each man will remove his respirator only as the inspecting officer approaches him. The men will be examined

for pressure marks on their faces and signs of lachrymation. They will file up to a table and—

(*i*) Write their names with indelible pencil on the bottom right-hand corner of the fastener side of the satchel.

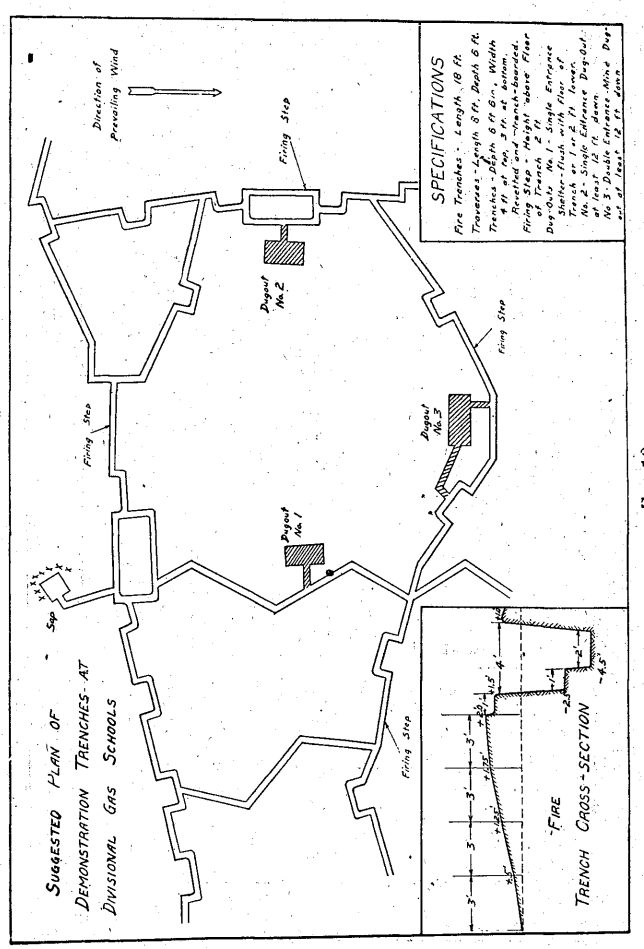


FIG. 10.

(*ii*) Have the size of the respirator, date of issue, and school stamp impressed on record card.

(*d*) All men who have been lachrymated or ill fitted will, as soon as they recover, be refitted and again passed through the chamber and procedure as in (*a*) and (*c*) gone through.

(*e*) The whole party will then be inspected by the officer in charge.

83. It must be carefully impressed on the men that it is most important for each man to retain the respirator with which he has been fitted. Badly fitting respirators, in which men have been lachrymated, must be exposed to the air until all traces of lachrymator have disappeared.

X. INSTRUCTIONS FOR DIVISIONAL GAS OFFICERS AT THE GAS CHAMBERS.

RESPONSIBILITY.

84. The divisional gas officer or his assistant in charge of the gas chamber will be responsible for discipline and the strict observance of the following instructions:

(1) *Cylinders.*—No officer or other rank will remove or loosen any part of a cylinder unless qualified to do so by attendance at a course of instruction at a divisional gas school.

Any officer or other rank manipulating a cylinder will invariably wear a respirator.

The valves of the cylinder will be on every occasion turned only by an officer or qualified instructor, and with a key or spanner authorized for that purpose.

(2) *Concentration of gas.*—The concentration should be about 1 in 5,000. The gas can be measured, approximately, by the means of the flow meter (see fig. 9A) and the concentration estimated by the following method: Aspirate 1 liter of the mixture of chlorine and air through the 10 per cent solution of potassium iodide, disconnect, add starch paste, and titrate with $\frac{N}{1000}$ sodium thiosulphate solution. It is unnecessary to carry out this estimation every time the chamber is used after experience has been gained.

(3) *First-aid remedies.*—The following should be kept near at hand:

(*a*) Ammonia solution in atomizer.

(*b*) Aromatic spirits of ammonia.

(*c*) Drinking water and cup.

PROCEDURE WHEN PASSING MEN THROUGH GAS IN THE GAS CHAMBER.

85. The battalion or regimental gas defense officer will march the men to the divisional gas chamber with rifles and packs and with respirators in the slung position.

Upon arrival at the gas chamber the men will be ordered to form in detachments of about 40.

The divisional gas officer or his assistant will then inspect the men in the fitting of their respirators and in the standard tests.

These men showing insufficient training will not be allowed to pass through the gas chamber, and a report upon them will be sent to the regimental commander.

When the inspection is completed the men of each detachment will remove packs, stack arms, and will file into the gas chamber.

One qualified instructor, including the battalion or regimental gas officer or his assistant, shall be present with each detachment of 20 men.

The divisional gas officer or his assistant will be on duty outside close to the chamber, with respirator, ready to render assistance should necessity arise.

The men will be moved about in the gas chamber and instructed to talk.

They will remain in the gas at a concentration of 1–5,000 for five minutes.

Should a man consider his respirator to be noneffectual, he should be instructed to leave the chamber at once, and the matter investigated.

Upon leaving the gas chamber men will form upon their equipment and be given permission to remove respirators. They will be examined in folding and returning the respirators to the satchel and then dismissed.

XI. DUTIES OF GAS-DEFENSE PERSONNEL WITH TROOPS IN THE FIELD.

86. The following duties are reprinted for instructional purposes and may be taken as typifying the practice followed for some time by divisions at the front.

DIVISIONAL GAS OFFICERS.

87. *Advisory.*—While officers commanding units are directly responsible that the precautions laid down in the various pamphlets and instructions on antigas precautions are taken, the

divisional gas officer must place his special knowledge at the disposal of commanding officers and advise them on all questions of defense against gas attacks. To enable him to do this effectually he must be in close and frequent touch with troops in the line. He will advise the general staff of the division on the antigas protective measures to be taken, and will bring to notice any alterations or improvements that he considers necessary.

88. *Operations.*—(*a*) To superintend the taking over of antigas trench stores. When divisions are moving into the line the divisional gas officer will be attached to the advanced headquarters of the division.

(*b*) On relief, outgoing and incoming divisional gas officers will render a certificate that antigas trench stores and maps have been handed over to and received by the incoming divisional gas officer.

(*c*) To arrange with the divisional general staff to be at once notified of any hostile gas attack or gas-shell bombardment. To investigate and render reports and samples.

(*d*) To examine captured appliances dealing with gas, smoke, flame, etc., and report on same.

(*e*) To supervise the production of smoke when required.

89. *Routine.*—(*a*) To visit the divisional front and divisional artillery when the division is in the line.

(*b*) To visit all units from time to time and supervise inspection of antigas appliances.

(*c*) To ascertain that all units keep gas defense equipment up to scale.

(*d*) To arrange for the inspection of the reserves of gas-defense equipment as required.

(*e*) To arrange for the examination of salvaged antigas appliances as required.

90. *Instruction.*—(*a*) To hold courses at the gas schools for both officers and noncommissioned officers.

(*b*) To lecture to units on gas, smoke, and gas shells.

(*c*) To train noncommissioned officers and men from each unit in the tactics of production of smoke as required.

(*d*) To arrange for the gas-defense instruction of all new drafts.

(*e*) To arrange for fitting and testing the antigas equipment of other troops (e. g., Army or corps troops) in the divisional area.

91. *Reports, weekly.*—(*a*) Report of instructional stores at the divisional gas school.

(*b*) Report of gas-defense stores in the divisional area. This should include *all* stores actually issued for use in the divisional area. All stores should be accounted for, whether actually in the line or not. Any kept at the gas school should be noted.

(*c*) *Report of gas alarms.* This should include:

(i) Map locations of Strombos horns with local name of position, number of cylinders and pressure, complement of tools, and protection and condition of horns.

(ii) Remarks should include number of empty cylinders returned, damage to horns, etc.

(iii) Statement as to supply and condition of minor alarms.

(*d*) *Divisional gas officer's general report.* This should include:

(i) An account of instruction given during the week (including number of reinforcements dealt with and the time spent in training them).

(ii) Visits paid to the front, and reports on the condition of gas-defense precautions and discipline, and efficiency in the use of antigas equipment.

(iii) Inspection of reserves of gas-defense appliances and salvage dumps of enemy material, etc.

(iv) Distribution of gas-testing apparatus.

(v) Trench and area map, whether up to date and correct. It should show—

(*a*) Exact locations of Strombos horns and sprayers.

(*b*) Number of vacuum bulbs and antigas fans per sector.

92. *Reports, monthly.*—(*a*) List of equipment of antigas school.

(*b*) Number of shortages in antigas equipment in the division. It should show the number of officers and other ranks not in possession of serviceable respirators.

(*c*) Nominal roll of all gas noncommissioned officers on duty with units in the division.

DIVISIONAL GAS NONCOMMISSIONED OFFICERS.

93. The duties of the noncommissioned officers when detached to regimental headquarters will be:

(1) To carry out the weekly inspection of antigas equipment of personnel attached to regimental headquarters and prepare a list of shortages.

(2) To keep a record showing number and position of all antigas trench stores in the regimental area or held by batteries, and prepare weekly reports to be forwarded to the divisional gas officer on the following:

(*a*) Gas-defense equipment and inspections, consolidated weekly reports.

(*b*) Strombos horns, as for divisional gas officer's weekly report.

(*c*) Other antigas trench stores—

(i) Vermorel sprayers, number and map location.

(ii) Chemicals, amount in stock.

(iii) Canvas trench fans, distribution and location.

(iv) Vacuum bulbs, distribution and location.

(v) Gas-proof dugouts, condition and location.

(vi) Number of wind vanes, gongs, and alarms in the regimental area.

(*d*) Changes in personnel of company, etc., gas noncommissioned officers.

(3) To inspect and test all antigas appliances before they are distributed.

(4) To visit all Strombos horns in the divisional area at least once a week and test the pressure of the compressed air in the cylinders.

(5) To keep a nominal roll of battery or battalion and company gas noncommissioned officers.

(6) To supervise the replacement of useless or damage containers of respirators.

(7) To keep in touch with company, etc., gas noncommissioned officers and assist them when necessary.

(8) To keep a supply of lachrymator for testing the fit of masks.

(9) To assist in training reenforcements.

(10) After a cloud-gas attack or gas-shell bombardment to obtain reports, samples, and specimens from battery or battalion and company gas noncommissioned officers to transmit to the divisional gas officer and to supplement inquiries made by them.

(11) To collect enemy antigas, smoke, or flame apparatus and forward to the divisional gas officer.

(12) To assist in salvage of antigas equipment.

(13) To assist in smoke production when required.

(14) On relief to visit all Strombos horn positions with relieving gas noncommissioned officers and check all antigas trench stores and locations, if possible, one or two days before relief.

Give or receive an acknowledgment that all is correct or otherwise.

(15) The divisional Artillery gas noncommissioned officers should assist at the inspection of at least two batteries per week and report on the gas-defense discipline and efficiency in use of gas-defense equipment to the battery commander and divisional gas officer.

COMPANY OR BATTERY GAS NONCOMMISSIONED OFFICER.

94. The duties of the company or battery gas noncommissioned officer will be:

(1) To assist officers at the inspection of respirators.

(2) To keep the following records and prepare weekly reports on the following:

(*a*) Number of inspections held during the week.

(*b*) Number of officers and other ranks in possession of serviceable respirators.

(*c*) Number of officers and other ranks not in possession of serviceable respirators.

(*d*) Number and location of all antigas trench stores and appliances in the company sector.

(3) To see that record books of respirators are entered up correctly.

(4) Under the company commander, to have charge of, and inspect daily, all antigas trench stores, as follows:

(*a*) Strombos horns, gongs, rails, rattles, etc., and see that sentries posted over them know their duties.

(*b*) Gas-proof shelters, assist in the erection of gas-proof doors and see that they are kept in a serviceable condition.

(*c*) Canvas trench fans, see that they are placed in proper positions and kept in good order.

(*d*) Stores of fuel for clearing dugouts, arrange to have a supply on hand.

(*e*) Vermorel sprayers, see that they are well protected and kept in working order.

(*f*) Gas sampling apparatus, have charge of vacuum bulbs and gas-testing tubes and take samples during a gas-cloud attack. Keep a stock of corked bottles and tins with well-fitting lids for collecting samples of earth and water after a gas-shell bombardment.

(5) To train men in the use of antigas appliances.

(6) To see that the men detailed to handle gas shells are wearing their respirators and know how to use them, and that proper precautions are taken at dumps of gas shells and grenades.

(7) To make wind observations every three hours, or more frequently if the wind is in or nearing a dangerous quarter, and report any change of wind to the company commander. Reliefs of gas noncommissioned officers for this purpose should be arranged when responsible.

(8) To make wind vanes and keep them in order and see that the "Wind dangerous" area is correctly marked on them.

(9) To salvage antigas equipment in area and hand it over to the proper authorities.

(10) To assist in smoke operations if required.

(11) On relief to accompany the advance party and take over antigas trench stores (by daylight if possible), and to obtain or give a receipt for them.

95. *The company or battery gas noncommissioned officer is not available for other duties if they interfere with the antigas duties laid down.*

The duties of gas noncommissioned officers of other units will be modified to suit their organization.

REPORTS.

96. In writing reports clearness, combined with conciseness must be aimed at and the various details tabulated as far as possible.

The following must be stated: Place (names of places should be in black capitals), date, time, signature, rank, and unit.

After a gas attack reports should be forwarded as soon as possible to the divisional gas officers, together with cloud-gas samples. Shell-gas samples, water, and earth impregnated with the liquid chemical or gas, gas-shell bases, and fragments.

97. I. WIND REPORT.

Place.....

Trench No..... Date.....

Time.	Direction of wind.	Speed (miles per hour).	Remarks.
a. m.....	.....	.....	.....
p. m.....	.....	.....	.....

Signature.....

Unit.....

98. II. REPORT ON GAS ATTACK.

	Gas cloud.	Gas shells.
Time commenced		
Time finished		
Section of line affected		
Color		
Color changes		
Sound of escaping gas		
Smell		
Effects on—		
(i) Men		
(ii) Animals		
(iii) Vegetation		
(iv) Arms and ammunition		
(v) Artillery		
(vi) Telephone dugouts		
(vii) Machine-gun emplacement		

Position of—

(i) Blind shells.

(ii) Shell fragments.

(iii) Shell bases.

Number of samples taken:

(i) Gas.

(ii) Shell liquids.

(iii) Earth.

General remarks:

(*a*) Alarms, satisfactory working or otherwise.

(*b*) Warning, how given, how much did men get?

(*c*) Removal of respirator, did order come through satisfactorily?

(*d*) Casualties, how caused; how far back were men gassed; did any die?

(*e*) Civilians, how were these affected?

Dated_____

Place_____

Signature_____

Unit_____

99. III. GAS NONCOMMISSIONED OFFICER'S REPORT ON GAS DEFENSE STORES IN TRENCHES.

REMARKS.

Appliances.	Number.	Position.	Condition.
Protected dugouts			
Strombos horns			
Cylinders			
Local alarms			
Kind			
Canvas trench fans			
Respirators			
Gas-sampling tubes			
Vermorel sprayers			

Place.....

Date.....

Unit.....

Signature.....