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TECHNICAL MANUAL

THE GAS MASK

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THE GAS MASK

Prepared under direction of the Chief of the Chemical Warfare Service

SECTION I

GENERAL

1. Purpose.—This manual is published for the information and guidance of the using arms and services and all personnel charged with the issue, alteration, repair, and testing of gas masks in the field.

2. Scope.—This manual explains the designations or numbering systems for the principal components of the gas mask. In order that confusion in storage records and inspections may be avoided, tables giving the main distinguishing characteristics of the various components are furnished. The several special masks or respirators, canisters, and like equipment are also described. Field repair and

*This pamphlet supersedes TR 1120-35, October 21, 1930.

testing equipment are listed, and directives for these repairs and testing procedures are provided.

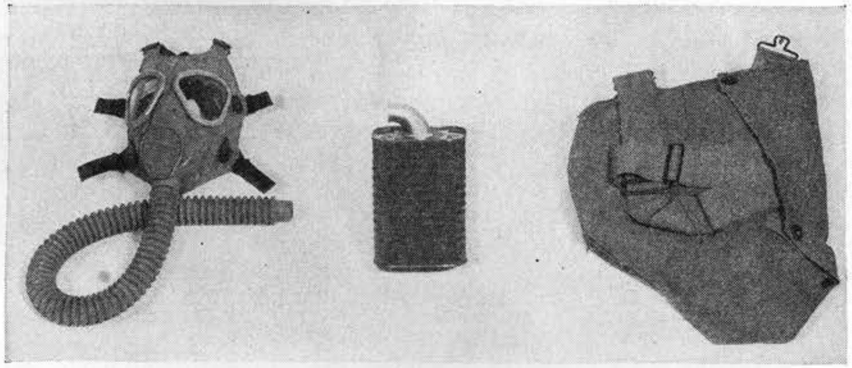
3. References.—See appendix I.

Section II

SERVICE GAS MASK

4. General.—*a. Definition.*—The military gas mask is an apparatus designed to purify the air which the soldier breathes. It also protects his eyes and face when he is in an atmosphere contaminated with toxic or irritating gases, vapors, or smokes.

b. Components.—The complete gas mask consists of three principal parts—the facepiece assembly, the canister, and the carrier (fig. 1).



① Facepiece assembly. ② Canister. ③ Carrier.
Figure 1.—Main components of military gas masks.

(1) The *facepiece assembly* generally consists of the facepiece, containing eyepieces, an outlet valve, a hose connection or angletube, and with a head harness attached. When a connecting hose forms part of the gas mask, it is included in the facepiece assembly.

(2) The *canister* has a hose connection which may or may not include an elbow nozzle, and also one or two inlet valves, depending on the type of canister. These inlet valves are found in all models except the model IX.

(3) The *carrier* is made of a canvas pouch or sack with various straps and buckles for slinging to body of wearer.

c. Principle of operation.—(1) The gas mask is an air filter. The path of the air flow in the service gas mask is as shown in figure 2. Air is drawn into the mask when the soldier inhales, and the mask is so constructed that this air must first pass through a canister containing a filtration system. This system comprises both mechanical and chemical filters, the former filtering out solid and liquid

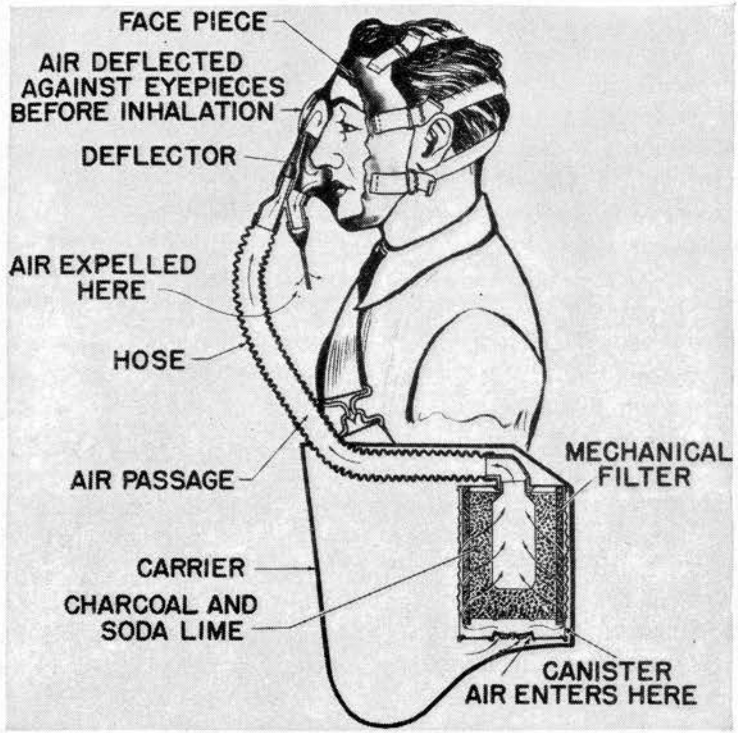


Figure 2.—Air flow system of gas mask.

particles (smoke and dust), and the latter absorbing and neutralizing toxic and irritating gases and vapors. The air after being purified by filtration is drawn to the soldier's face and after being inhaled and exhaled is expelled from the mask through an outlet valve.

(2) The facepiece fits snugly to the face so as to be gastight and is held in place by an elastic head harness. It is equipped with eyepieces of safety glass or other transparent material, and a deflector which deflects incoming air against the eyepieces so as to prevent

condensation of moisture on the lenses. In addition to this method of reducing dimming of the eyepieces, a soaplike substance, known as "antidim," is furnished with each mask—except the training mask—and which, when spread as a thin layer over the inner surfaces of the eyepieces, tends further to keep down eyepiece fogging. The facepiece is equipped with an outlet valve through which exhaled air is expelled and a metal tube which is connected to the canister by a corrugated rubber hose.

(3) The canister is a metal cylinder or oblong-shaped box containing a filter and chemicals comprising the filtration system. Ordinarily, it is equipped with an inlet valve which permits the entrance of incoming air and a nozzle for the exit of purified air. This inlet valve prevents exhaled air from passing through the canister. The nozzle of the canister usually is connected to the facepiece by the corrugated rubber hose tube through which the purified air passes to the wearer's face. The facepiece, hose, and canister are contained in a canvas carrier.

d. Limitations and use.—(1) The protection afforded by the gas mask is due primarily to the canister, the other components of the gas mask merely preventing air from entering the facepiece by any other route. There is at the present time no known toxic gas, vapor, or smoke against which adequate protection cannot be provided by means of a suitable canister.

(2) Special canisters can be made up with filtration systems that will eliminate any one or all of the known toxic gases or dusts from the air breathed. No canister, however, affords protection indefinitely. The life of the canister is dependent upon the total quantity of gas which it is capable of filtering out of the air. Thus, for very high concentrations, the life of the canister may be short, while in low concentrations, it may be a matter of many weeks or months before the canister becomes so saturated with gas that it fails to protect. Normal field gas conditions are such that a canister does not break down suddenly. Except in case of mechanical damage, any failure of the filters occurs very gradually and can be noticed by the wearer as it happens.

(3) The filtration system of the Army canister provides excellent protection against field concentrations of the chemical agents of warfare. Generally, field concentrations are relatively low. There are, however, toxic gases such as carbon monoxide and ammonia against which the Army canister will not protect, although adequate protection could be furnished if necessary. Neither will the Army

canister nor any canister type of gas mask protect in an atmosphere containing an insufficient amount of oxygen to support life, nor, for a certainty, in cases where concentrations of the toxics are extremely high, such as might be encountered in inclosed spaces, in chemical manufacturing plants, storage tanks, and the like. The service canister will protect against high concentrations of gas for only a short period of time. It is therefore assumed that protection for longer periods is assured only if the concentration of gas does not exceed one percent by volume. For such contingencies, which do not occur in the open air, hose masks or self-contained oxygen breathing apparatuses are required.

e. General principles of design.—Any complete description of the military gas mask must take into consideration the principles of design enumerated below. The mask must—

(1) Protect against all chemical warefare agents.
(2) Have a low breathing resistance.
(3) Be light in weight.
(4) Be comfortable.
(5) Be simple in design; easy to operate and repair.
(6) Not interfere greatly with vision.
(7) Be rugged enough to withstand field conditions.
(8) Be reasonably easy to manufacture in quantity.
(9) Not deteriorate in storage for at least several years.
(10) Have a service life in the field of at least several months.
(11) Be inexpensive.
(12) Be made of nonstrategic materials as far as possible.

Many of these requirements are opposed to each other. Thus, the requirements of maximum protection and light weight are opposed to each other since the amount of protection varies with the weight of chemicals used and the capacity of the filter. The greater the weight of chemicals and the size of the filter, the heavier the canister. Low breathing resistance depends upon a large surface area for the filter, but this increases the size and weight. A small, light canister would have less weight of chemicals with resultant lower protection, while a smaller filter area would cause greater breathing resistance. Therefore, the military mask is a compromise among the above twelve factors, of which the first three are the most important.

5. Numbering and identification systems.—*a. General.*—Many different types and models of each of the three components of the gas mask have been made in the past 20 years of development.

Many of these models were eliminated in the experimental stage, while others have been adopted, produced, and issued. Two different identification systems have been used to help in distinguishing these—one for experimental and development articles and another for the adopted production types. Although chiefly concerned with the latter, supply and using personnel in the field occasionally encounter experimental types under test, and it is for this reason that both systems are described.

b. Experimental types.—When in the course of experimentation and development the materials or design of a component are radically changed, the experiment is designated by a number prefixed by the letter E. When the model has been revised slightly without making a major change in design or materials, the letter R followed by a number representing the chronological revision is added. For example, a fully-molded rubber facepiece assembly is made with a rubber disk outlet valve and without hose and might be given the identification number E41R1. If a new model with a very slight change in the valve position is tried, the identification number would become E41R2. Since the complete gas mask consists of three components, it is customary to use the number of each experimental main component that goes to make up the mask in the identification number, so that in describing the mask as a whole, the facepiece assembly is identified first, the canister second, and the carrier third. The training mask in figure 8 had the numbers E41R40–E20R20 for the facepiece assembly and canister, training mask MI; and E41R38–E20R20 for the facepiece assembly and canister, training mask MIA1, before either had been adopted as standard for production and issue. It should be noted that the only differences are to be found in the facepiece assembly (type of valve), and that the MI carrier, formerly known as carrier E8R79, is the same for both masks.

c. Standard articles.—(1) When a mask component has been completely tested and is adopted as a standard for issue to the Army, it is given a new identification number. Instead of using the letter E, the letter M (signifying standardized model number) is used. Thus, the first standard service facepiece assembly is known as the MI. Revisions are designated by an A (signifying alteration) followed by the chronological number of the alteration. Hence, there have been two distinct alterations made or improvements added to the service facepiece, MI, which have not materially changed the design or materials. These two models are known as the MIA1 and MIA2.

(2) For complete designation of the adopted type of the entire gas

mask, it is necessary to identify all of the three main components: the facepiece assembly, the canister, and the carrier (as explained for the experimental types), bearing in mind that the letter M indicates adopted model and the letter A indicates adopted minor change. Thus, the present standard service gas mask, known as the MIA2–IXA1–IVA1, is the latest model of this type.

(3) Where more than one of the components are included in identifying the article, the letter M is not repeated. As an example, the experimental training gas mask, formerly designated as E41R40–E20R20–E8R79, later adopted as a standard article, is now designated as training gas mask MI–I–I. On articles standardized prior to September 1940, the M numbers are the Roman numerical system while the A numbers are Arabic; in the future all M numbers will also be Arabic. When in the Standard Nomenclature and Price List the letter R is included in the identification number, reconditioning of the original article is indicated.

6. Distinguishing characteristics of various types of gas masks.—Since the organization of the Chemical Warfare Service, continuous research has been conducted on the task of providing the best possible protection against chemical warfare agents. The problem is a most difficult one as explained in paragraph 4*e*, but much progress has been made in securing the maximum amount of protection and comfort combined with the easiest method of production. As a result there is a succession of models of facepieces, canisters, and carriers, each of which is a logical development based upon previous experiences. In some cases many of each of these components have been made and issued to troops or stored for emergency. Unless there is a way of identifying the parts of the gas mask, much confusion of records may result. Maintenance personnel must be able to recognize these various models since the repairs to be made vary with each one. Tables I, II, and III give the characteristics of the various types for these purposes. Figures 5 to 10, inclusive, 15, 17, and 19 illustrate the descriptions in these tables.

TABLE I.—*Characteristics of gas mask facepiece assemblies*

Name	Model number	Figure number	Standardization category	Distinguishing characteristics					
				Eyepieces	Outlet valve	Hose	Facepiece materials	Size	Head harness
Service	MI	5	Limited standard	Safety glass lens, eyepieces crimped on to rubber.	MI with valve guard	27-inch stockinette covered corrugated rubber.	Stockinette covered rubber, sewed chin seam type.	1-4	MI—six-strap head harness. Pentagonal cloth headpad with four buckles on sides and bottom of pad. No buckles on two top straps.
Service	MIA1	6	Standard in size 1 only.	Safety glass lens screwed on eyepieces.	do	do	do	1-4	MII—six-strap head harness. Pentagonal cloth headpad with six buckles on facepiece.
Service	MIA2	7	Standard	do	do	do	do	Universal	MII.
Diaphragm	MI	5	Limited standard	Safety glass lenses crimped on eyepieces.	MII with valve guard. Valve at bottom inserted at angle to hose stem.	do	do	1-4	MI or MII.
Diaphragm	MIA1	6	do	Safety glass lenses screwed on eyepieces.	do	do	do	1-4	MII.
Diaphragm	MII	7	do	do	MII without valve guard. Valve up and in front of diaphragm.	do	do	Universal	MII.
Diaphragm	M3	8	Standard	Transparent plastic, curved lenses, crimped on eyepieces.	MVI spearhead	27-inch rubber hose. Y tube around the outlet valve.	Fully molded rubber faceblank without a chin seam.	do	MII.
Training	MI	9	do	Transparent plastic, curved lenses, crimped on eyepieces. (Same as diaphragm, M3.)	MIV (circular button known to the trade as the Acushnet valve). Metal valve guardring or annular type.	No hose (snout type mask).	do	do	M4—no headpad or crosspiece. Buckles on facepiece.
Training	MIA1	9	do	do	MV (adaptation of the MI, known to the trade as the Connell valve). Plastic valve guard.	do	do	do	M4.
Optical	MI	17	do	Optical plate glass, sized to correspond to optical instrument eyepieces, interpupillary adjustment device.	MVI spearhead	Two hoses leading from ends of canister to each side of the facepiece.	do	do	M3—rosette-shaped spring head harness. Rubber headpad. Supports canister on back of wearer's head.
Noncombatant	MI	20	do	Plastic sheet assembled in the faceblank.	MVII at side. Adaptation of the MIV. Plastic valve seat.	No hose (facepiece assembled directly to canister).	Impermeable fabric faceblank, adhesive treated chin seam.	1—large adult; 2—small adult; 3—child.	Similar to training mask. Adult, M4. Child, M4.

TABLE II.—*Characteristics of gas mask service canisters (fig. 15)*

Name	Model number	Standardization category	Distinguishing characteristics						
			Color	Type of body	Dimensions	Breathing resistance: Minimum	Breathing resistance: Maximum	Valve: Type—Size—Position	Remarks
Service	MI	Obsolete	Blue	Rectangular corrugated body with rain shield at top. Straight nozzle, elbow inside of hose.	7" x 4⅝" x 3"			Two small button type inlet valves in the top, under the rain shield.	Irritant smoke protection below standard. This canister should be turned in if found. Use with MII carrier.
Service	MII	Limited standard	Blue with olive drab top (rain shield).	do	7" x 4⅝" x 3"	45	92	do	Irritant smoke protection below standard. Use with MII carrier.
Service	MIIR	Limited standard (emergency reserve).	Olive drab—two blue stripes 3" x 1" on side.	Rectangular corrugated body. Long nozzle elbow attached.	7" x 4⅝" x 3"	45	92	Single valve in bottom.	Irritant smoke protection below standard. The model number marking is embossed in the top of the canister.
Service	MIII	Limited standard	Olive drab	Rectangular corrugated body. Nozzle elbow attached.	7" x 4⅝" x 3"	45	92	Two small valves under rain-shield in top.	Use with MII carrier.
Service	MIIIR	Limited standard (emergency reserve).	do	Rectangular corrugated body. Nozzle elbow attached. Longer nozzle than MIV.	7" x 4⅝" x 3"	45	92	Valve in bottom	The model number marking is embossed in the top of the canister.
Service	MIV	Limited standard	do	Rectangular corrugated body. Nozzle elbow attached.	7" x 4⅝" x 3"	40	82	Valve in bottom, 1½" diameter	The model number marking is not embossed in the top of the canister.
Service	MVIII	do	do	do	7" x 4⅝" x 3"	35	77	Valve in bottom, 2" diameter	The model number marking is embossed in the top of the canister.
Service	MIX	do	do	Rectangular smooth body. Nozzle elbow attached.	6½" x 4⅝" x 3"	35	77	No valve. Circular opening in bottom, 1⅜" diameter	Double seamed—top and bottom. Use with MIV or MIVA1 carrier.
Service	MIXA1	Standard	do	Rectangular corrugated body. Nozzle elbow attached.	6½" x 4⅝" x 3"	35	55	Valve in bottom, 2" diameter	Do.
Training	MI	do	Gray	Cylindrical smooth body. Straight hose nozzle.	5⅜" x 3"	50	65	Valve in bottom, 2" diameter	Used on training mask MI and also on noncombatant mask. (The latter type canister has no nozzle.)
Optical	MI	do	Olive drab	Cylindrical. Nozzles on both ends.	5½" x 2 15/16"	60	90	Inlet is a slit along the side of the canister; valve in each nozzle.	Aluminum body.

TABLE III.—*Characteristics of gas mask carriers*

Name	Model number	Standardization	Shape	Remarks
Service	MII	Limited standard	Irregular hexagonal side satchel type. Curve at hose position.	Suitable for canisters MI MII, and MIII where the inlet valves are in the top of the canister.
Service	MIII	do	Irregular hexagonal side satchel type. Rivet at the inlet valve position. Curve at the hose position.	Suitable for canisters MIIR, MIIIR, MIV, MVIII, MIX, and MIXA1 and the special canisters where the inlet valve is in the bottom of the canister. Tuck at the canister inlet valve position to permit the access of air.
Service	MIIIA1	Substitute standard.	Irregular hexagonal broken straight lines in place of the uniform curve at hose position, otherwise similar to the MIII above.	Suitable for the same canisters as the MIII. Longer and larger flap than the MIII.
Service	MIV	Standard	Same as the MIIIA1, except for the decrease in the size and addition of a loop on which the stud of the lower snap fastener is fixed.	Suitable for use with canisters MIX and MIXA1.
Service	MIVA1	do	Same as the MIV except for the length of the waist strap which is 4 inches longer.	Reinforced section inside the carrier body. Suitable for use with the same canisters as the MIV.
Optical	M5	Standard optical	Rectangular box 7½" x 6½" x 9".	For use only with the optical gas mask.
Training	MI	Standard	Frustrum of a cone	For use with training masks, MI and MIA1.

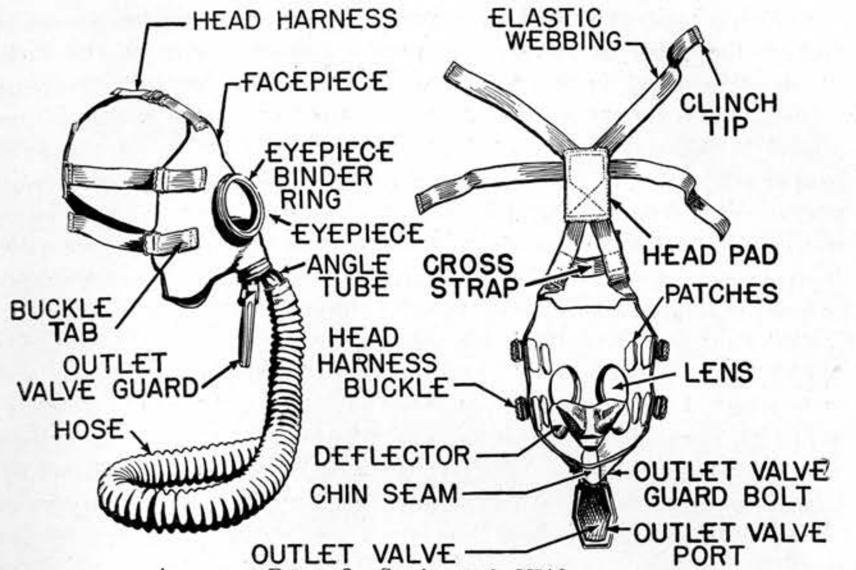


FIGURE 3.—Service mask, MIA2.

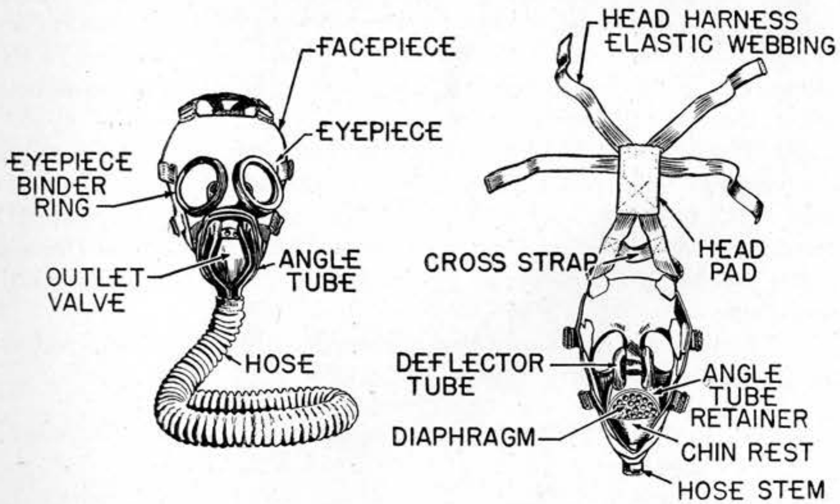


FIGURE 4.—Diaphragm mask, MII.

7. Description and nomenclature of service and diaphragm facepiece parts.—The parts and minor components of the MIA2 service facepiece assembly are illustrated in figure 3; the parts of the MII diaphragm facepiece assembly in figure 4. A discussion of the more important parts of these and other facepieces follows:

a. Facepiece.—(1) Most service and diaphragm facepieces are made from a flat piece of stockinette-covered rubber known as the face-blank. However, facepieces could be made from leather, synthetic rubber, or impregnated cloth. This blank is of such a shape that when it is folded double, a single seam (the chin seam) will produce the proper shape to fit the face and leave a round hole in the lower front portion in which the angletube may be inserted. The eyepiece holes in the faceblank are elliptical in shape so that when the eyepieces are inserted, the tension on the rubber will cause the mask to fit snugly across the forehead and the eyepieces to bulge forward.

(2) There are five types of service facepieces: the MI (fig. 5); MIA1 (fig. 6); MIA2 (fig. 7); M2 (fig. 9); and M2A1 (fig. 9); and four types of diaphragm facepieces: the MI (fig. 5); MIA1 (fig. 6); MII (fig. 7); and M3 (fig. 10). The M2 and M2A1 service facepieces are the same as the MI and MIA1 training facepieces (figs. 8 and 9). The diaphragm facepiece has a larger opening in it than the service mask so as to accommodate the larger angletube occasioned by the diaphragm. The diaphragm MI and MIA1 models correspond to the service MI and MIA1, and the diaphragm MII to the service MIA2, except in the angletube assembly. The M3 has a fully-molded rubber facepiece and corresponds to the service M2A1. In addition to the differences in the eyepieces and the diaphragm assembly explained below, there is a difference in size.

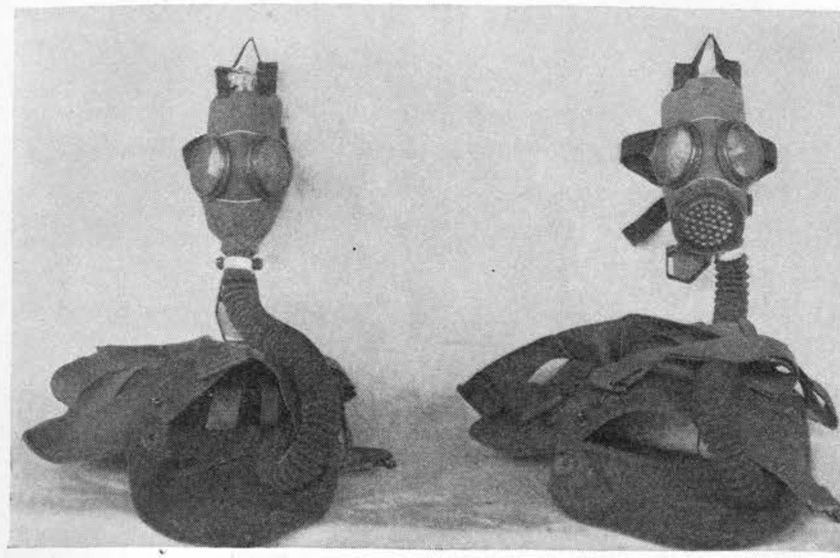
(3) The MI and MIA1 were made in four sizes, number one being the smallest. The number was placed near the center of the upper edge of the facepiece. The MIA2, the M2 and M2A1 service, and MII diaphragm are made only in the universal size. The letters US and U are placed on the forehead of these; the letter U signifying universal size.

(4) Experience has shown that the various sizes will fit the following percentage of men:

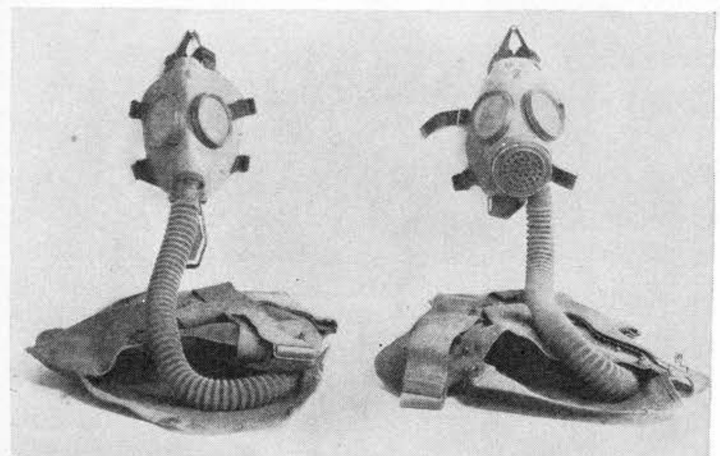
Size:	*Percent*
One	Five.
Two	Fifty.
Three	Thirty-five.
Four	Ten.

Where the universal size mask is used, a small number of small sizes are found necessary. The size range is about as follows:

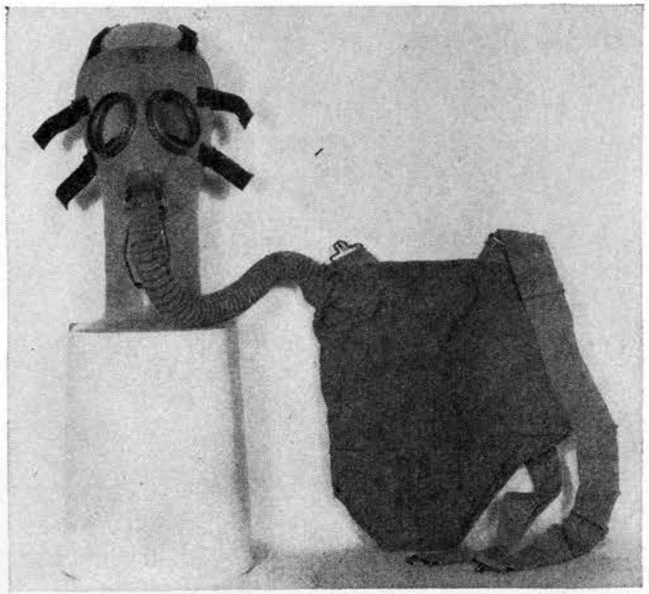
Size:	*Percent*
Small	Five.
Universal	Ninety-five.



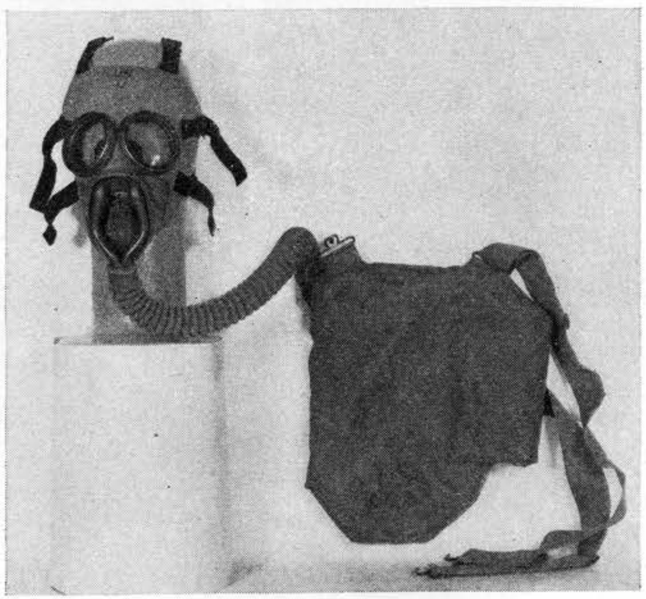
① Service. ② Diaphragm.
FIGURE 5.—Mask with facepiece MI.



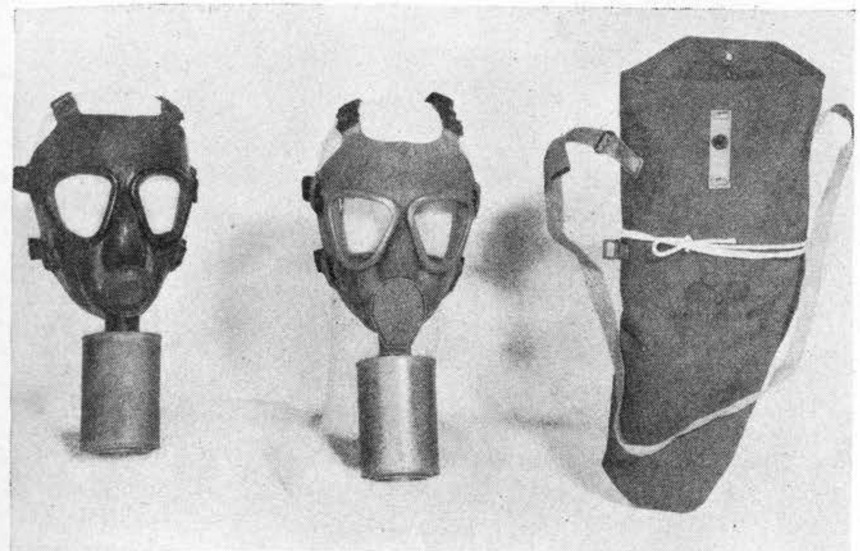
① Service. ② Diaphragm.
FIGURE 6.—Mask with facepiece MIA1.



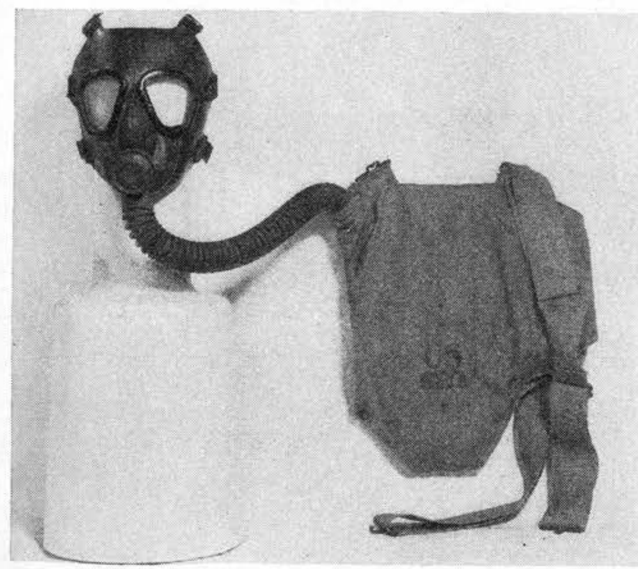
① Mask with service facepiece MIA2.



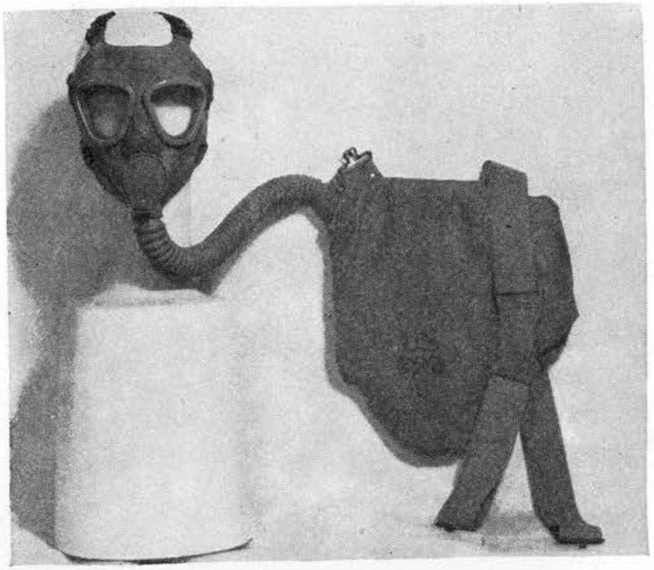
② Mask with diaphragm facepiece MII.
FIGURE 7.



① MI or M2. ② MIA1 or M2A1. ③ Carrier (all).
FIGURE 8.—Training mask and carrier.



① Mask with service facepiece M2.
FIGURE 9.



② Mask with service facepiece M2A1.
FIGURE 9—Continued.

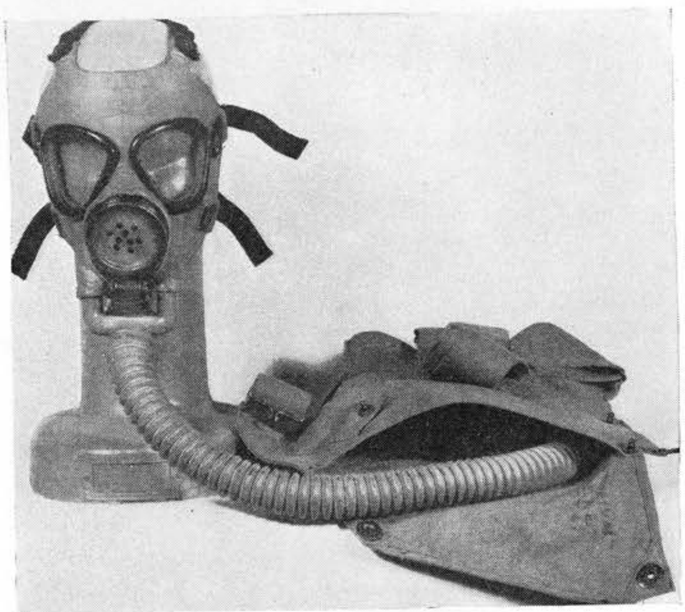


FIGURE 10.—Mask with diaphragm facepiece M3.

(5) The training facepieces are made of fully molded rubber and contain no chin seam. They are made only in a universal size and bear the letters US and U on the forehead. There are two models, the MI and MIA1. These are alike except for the outlet valves which are shaped as illustrated in figure 8. In training facepieces to be procured in the future, the MI and MIA1 will be designated M2 and M2A1, respectively, since they will be the same as the service M2 and M2A1. No change will be made in the nomenclature of training masks in the hands of troops at present.

(6) The noncombatant facepiece (fig. 21) is made of laminated impermeable fabric.

(7) The optical facepiece (fig. 19) is made of fully molded rubber and contains no chin seam. It is made only in a universal size and is so marked. It is called the optical gas mask M1–1–5. This mask has a diaphragm and two 11-inch lengths of hose connecting the facepiece to the head canister.

(8) The diaphragm facepiece M3 (fig. 10) is made of fully molded rubber and contains no chin seam. The eyepieces are similar to those of the training mask. It is made only in the universal size.

b. Eyepieces.—(1) The eyepieces of the service and diaphragm masks having stockinette-covered facepieces, consist in part of metal frames which are crimped on to the faceblank. Shatterproof laminated glass lenses are held in place in these frames and are made gas-tight by washers, and in the service MIA1 and MIA2, and diaphragm MIA1 and MII, are fastened on by a screw-type binder ring. Thus, these lenses may be replaced in the field. The lenses of the service MI and diaphragm MI facepieces are retained by a crimped-on frame and therefore may not be changed in the field.

(2) In the training mask (fig. 8), the service M2 and M2A1 (fig. 9), and diaphragm M3 (fig. 10), the eyepieces are made of a triangularly shaped transparent plastic material, and are curved so as to increase the field of vision and to permit a minimum of reflected light. Left and right lenses are identical. The eyepiece holes have molded recesses into which the lenses fit. The holes are smaller than the lenses so that when they are in place, the resultant tension insures an airtight fit. A metal eye ring is crimped on over the lens to hold it in place.

(3) In the noncombatant mask (fig. 21) the eyepieces are made of a transparent plastic and are sewn in place.

(4) The eyepieces of the optical mask are of high grade plane glass. They are small and are designed for use with binocular type optical instruments. A thumbscrew device adjusts the distance be-

tween the lenses so as to vary the interpupillary distance to fit the face and eyes of the individual wearer.

c. Angletube.—(1) The angletube of the service facepiece MI, MIA1, and MIA2 connects the facepiece with the rubber hose which in turn is connected to the canister. It is made of an aluminum alloy and contains two separate tubes for air passages. Incoming air enters the facepiece through one of these while the exhaled air leaves by the other. The front passage is connected to the hose on the outside and to the deflector on the inside of the facepiece. The other passage, through which exhaled air is expelled, is connected on the outside to the outlet valve, while on the inside it is open to receive exhaled air. These connections of the angletube to the facepiece, hose, deflector, and the outlet valve are made by the use of rubber cement, steel binding wire, and adhesive tape.

(2) The angletube assemblies for the MI and MIA1 diaphragm facepieces (figs. 5 and 6) are the same and are made of an aluminum alloy. The inlet tube is connected to the side of the angletube near the outlet valve, and branches on the inside to deliver the incoming air to each eyepiece.

(3) The angletube assembly for the MII diaphragm facepiece (fig. 7) is illustrated by the sectional view in figure 11. The inlet tube splits near the bottom of the assembly to form two branches of a **Y** which pass into the facepiece and thence to the lower edges of the eyepieces. The outlet valve points upward and is protected from injury by the branches of the inlet tube. The diaphragm is placed in rear of the outlet valve. The assembly is made of copper.

(4) The angletube assembly for the M3 diaphragm facepiece contains no air inlet tube (figs. 10 and 12). The corrugated hoses are connected to the facepiece by means of a metal **Y** tube. The outlet valve is placed below the diaphragm and is bent back between the chin and the **Y** tube.

(5) The angletube assembly for the M1 optical facepiece also contains no air inlet tube (fig. 19). The inlet tubes are molded into the facepiece and are connected to the canister by corrugated hoses. The outlet valve of this facepiece is also below the diaphragm and is bent back. It has a metal valve guard.

d. Deflector.—(1) The deflector of the service facepiece MI, MIA1, and MIA2 is a butterfly-shaped piece of rubber which causes air entering the facepiece to pass up and across the inner surfaces of the eyepieces, thus causing evaporation of moisture which tends to condense on the lenses. (This is known as the "Tissot effect.") It is fastened to the angletube with rubber cement and a wire loop (fig. 69),

and is cemented to the facepiece just below the eyepieces. The deflector also acts as a brace to prevent the facepiece from collapsing against the face.

(2) The deflector of the diaphragm facepiece is made of metal and is soldered to the angletube. It performs the same function as

FIGURE 11.—MII diaphragm angletube, sectional view.

the rubber deflector of the service facepiece, except that it does not reinforce the facepiece.

(3) The training, optical, M2 and M2A1 service and M3 diaphragm facepieces have integrally molded deflectors. The inlet tubes are molded into the rubber and are so constructed that the entering air is deflected on to the eyepieces as it leaves the tubes.

(4) The noncombatant facepiece has no deflector and does not make use of the Tissot effect.

e. Outlet valve.—Outlet valves are made of rubber. They are designed to open readily to let exhaled air pass out of the facepiece with least possible resistance, yet close at once without leakage when the wearer inhales. In the MI, MIA1, and MIA2 service and MI and MIA1 diaphragm facepieces, the valve is protected by a metal guard which points downward. These valves also help to drain the face-

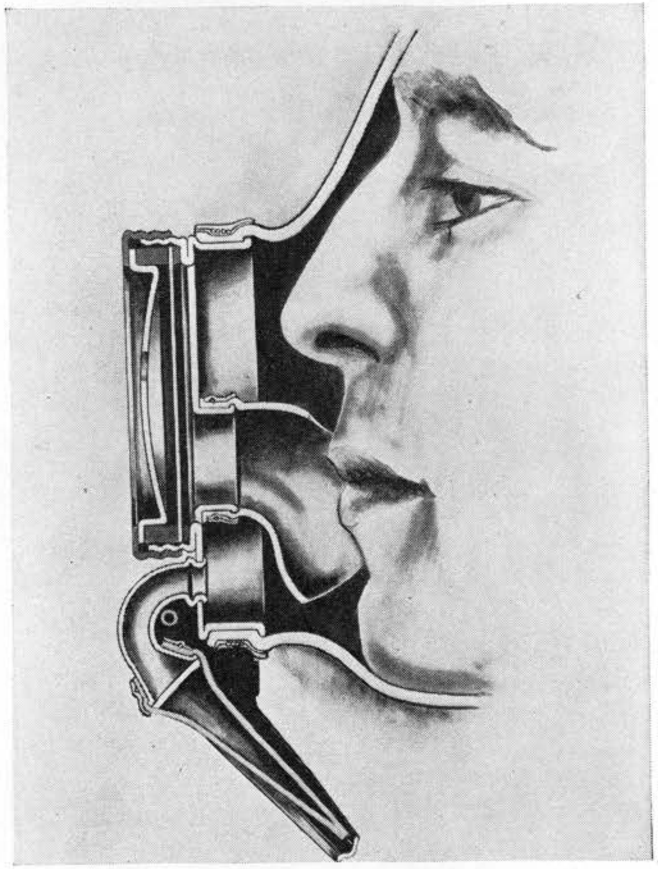


FIGURE 12.—M1 optical gas mask or M3 diaphragm gas mask, sectional view.

piece. In the MII diaphragm facepiece, the valve points upward and is placed between the inlet tubes and in front of the angletube where it needs no guard. The MI and M2 training facepieces (fig. 8), the M2 service facepiece, and the noncombatant facepiece (fig. 21) have a button-shaped valve which is called the MIV (also known as the Acushnet valve). The MIA1 and M2A1 training facepieces (fig. 8)

and the M2A1 service facepiece have a valve which is a modification of and functions similar to those on the older type service facepieces. It is called MV (also known as the Connell valve) and has a plastic valve guard. The optical mask (fig. 19) and the diaphragm facepiece M3 (fig. 10) have pear-shaped valves, and are otherwise similar to the service masks, but are protected by metal guards bent to slope under the chin and to the rear.

f. Head harness.—(1) In the service and diaphragm masks, the head harness, which holds the facepiece firmly in place on the head, consists of six elastic tapes each attached at one end to buckles which in turn are attached to the edge of the facepiece. The other end is attached to a pentagonal piece of cloth-covered felt called the headpad. In some cases, this headpad may be a rectangularly shaped piece of canvas. Since the buckles are attached to the facepiece, the entire head harness may be readily replaced, if necessary, in the field.

(2) The training and noncombatant head harnesses are similar to those of the service and diaphragm masks, but the elastic webbing straps are sewed together in a triangle instead of being attached to a piece of cloth or felt. Nevertheless, this triangle is also called a headpad. The optical mask has a rosette-shaped head harness made of six loops of coiled wire arranged so as to support the head canister, and with web tapes attaching springs to buckles on the facepiece. In this case, the headpad is circular. It is made of molded rubber shaped to fit the contours of the head and also to receive the coiled wire loops. It has a recess in the rear center for attaching a metal clip. The clip in turn supports the canister.

g. Hose.—(1) The hose of the service and diaphragm masks is a tube made of corrugated rubber and is 27 inches long. It connects the canister to the facepiece. Early models were stockinette covered.

(2) The training mask has no hose. The canister is connected to the facepiece by a short tube which is integrally molded into the facepiece. The noncombatant mask has the canister connected directly to the facepiece with no nozzle between. The optical mask has two 11-inch lengths of hose which connect to opposite ends of the head canister. These are corrugated and have a molded rubber elbow (90°) where the hose connects to each end of the head canister.

h. Diaphragm assembly.—(1) The diaphragm, which facilitates voice transmission, consists of a thin disk made of plastic or resinous material and is protected by a perforated metal guard. There are three types of diaphragms; the first is used in the diaphragm facepieces MI and MIA1 (figs. 5 and 6); the second in the MII diaphragm (fig. 7); and the third in the M3 diaphragm (fig. 10) and the M1 optical facepiece (fig. 19).

(2) In the diaphragm facepieces MI, MIA1, and MII, the angle-tube assembly is modified to permit the insertion of the diaphragm. Otherwise, these facepieces are similar to the service facepieces MI, MIA1, and MIA2, respectively (figs. 5, 6, and 7).

(3) The diaphragm assembly of the diaphragm facepiece MII is made to include the outlet valve. There is a fabric chin rest sewed into the facepiece to prevent the wearer's nose, chin, and mouth from coming in contact with the diaphragm assembly.

(4) The diaphragm assemblies of the M3 diaphragm facepiece and the M1 optical facepiece are similar and have no connection with the air inlet tubes as is the case with all others. The outlet valve and guard assembly of these facepieces is an integral part of the diaphragm assembly.

i. Antidim.—(1) A small can containing a piece of cloth wrapped around a stick of soap-like compound called antidim (fig. 13) is

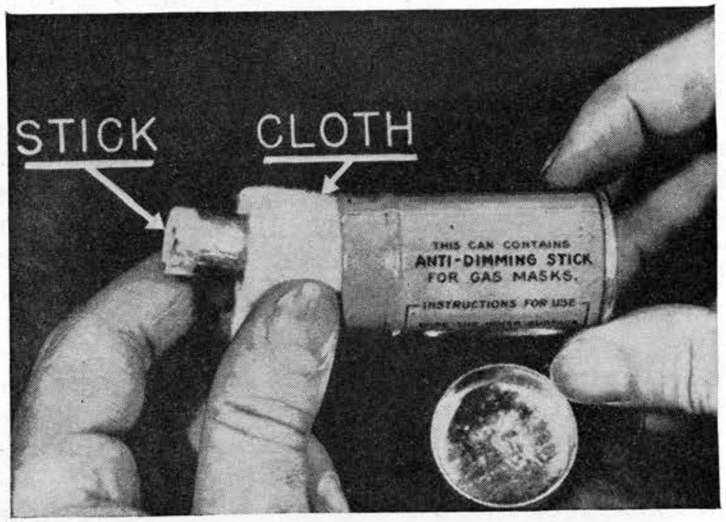


FIGURE 13.—Antidim.

furnished with each service and diaphragm mask. It is held in the carrier by a loop of fabric sewed on the lower canister strap. If used as directed, this antidim will greatly reduce fogging of the eyepieces. Antidim should be used *after* each time the mask is worn. To apply, clean the eyepieces, rub the stick gently on both sides of the lenses, leaving a small amount of the antidim on the eyepieces. Spread it evenly over the surface with the fingers. Then polish both sides of the eyepieces with the cloth until the antidim is evenly distributed on the surface of the lenses. If properly ap-

plied so as to leave a coating, the eyepieces will have a uniformly even surface upon which there will be little obscuring effect of the exhaled breath.

(2) Antidim does not prevent the condensation of moisture upon the lenses. The antifogging effect is obtained in quite a different way. Water does not easily wet or spread over glass. The tiny droplets of moisture condense upon the lenses and instead of spreading remain as drops, each having a surface which reflects light. Light rays which penetrate the water droplets are refracted unevenly and at many different angles. These reflected and refracted rays interfere with one another, thus causing the fogging effect. Antidim reduces the surface tension of the condensed droplets of water, causing them to form a thin, even film through which light passes with less distortion and much less interference than when the moisture is in multitudinous droplets. Thus, clearer vision is obtained.

(3) Antidim is not supplied with the training masks, but it can be used on plastic lenses in the same manner as on glass eyepieces. In lieu of antidim, a good grade white toilet soap may be used. It should be spread with a soft cloth such as a handkerchief. Care must be taken when antidim is applied to plastic lenses lest the surface be scratched.

8. Description and nomenclature of canisters and canister parts.—*a. General.*—The very earliest of military gas masks had no canister; instead, the air was passed through layers of treated cloth. These filters were improved by introducing a box of chemicals in place of the cloth. The safety and protection furnished by the gas mask was very greatly increased thereby because of the increase in surface and the greater quantity of the chemicals. Modern developments of the canister have been along the lines of producing greater effectiveness in particulate (or smoke) filtration, and in increasing the efficiency of the absorbents by means of various added chemicals.

b. Parts.—The canister includes three main parts (fig. 14): a container made of metal and provided with an air inlet and outlet; a filter which removes solid and liquid particles by mechanical filtration; and a chemical filling which removes gases by adsorption, neutralization, or both. The canister must conform to the general requirements for gas masks which are given in paragraph 4*e*. This greatly limits the materials which may be used.

(1) *Container.*—The container is the box into which the mechanical filter and chemicals are placed. It may be made of lithographed or enameled sheet iron, galvanized iron, aluminum, tin plate, or some other metal. Tin plate is most generally used. The MI to MVIII

and the MIXA1 canisters are rectangular in shape with rounded vertical edges and having corrugated sides; the ends are smooth. The MIX canister is rectangular and has smooth sides and ends. The training and noncombatant canisters are cylindrical and smooth. The optical canister is cylindrical and corrugated.

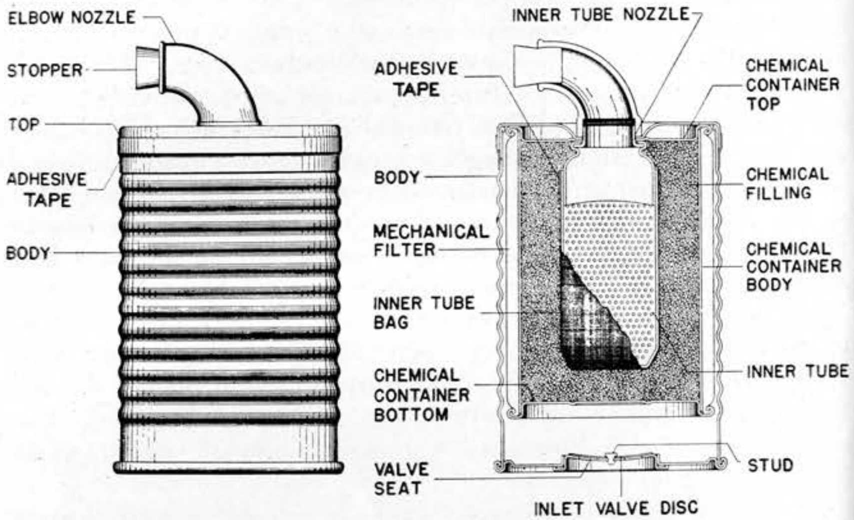


FIGURE 14.—Gas mask canister, cross-sectional view.

(2) *Mechanical filter.*—(*a*) The interstices of the mechanical filter must be fine enough to stop the extremely small, solid, and liquid particles in which irritant gases and smokes occur. Most of these particles cannot be seen under an ordinary high-power microscope since they are of minute (colloidal) dimensions. Even under the ultra-microscope, they are visible only as points of reflected light. On the other hand, the filter must not be so dense as to cause a high resistance to the flow of air through it and thus cause increased breathing resistance. A filter which fulfills these requirements has been developed.

(*b*) The materials used are fragile, and great care must be exercised in handling and repairing gas mask canisters to the end that these filters are not damaged. For this reason the canister will not be opened for repairs in the field except by special authorization as described in paragraph 36*d*.

(3) *Absorptive and neutralizing chemicals.*—(*a*) *General requirements.*—The chemicals used for absorption must—

1. Be very minutely porous so as to provide a huge surface area for adsorption in as small a space as possible.

2. Not react with each other, nor corrode the container.

3. Not be greatly affected by humidity.

4. Remove the gases very rapidly since the air moves through the canister at such a velocity as to be in contact with the chemicals for only a fraction of a second.

5. Have a high capacity, since the canister should last several months when in use.

6. Be easily and cheaply manufactured from domestic raw materials.

7. Not cause a high resistance to breathing.

8. Resist crushing and abrasion.

(*b*) *Activated charcoal.*

1. Of all the materials tested for the requirements listed in (*a*) above, the only one which approximately fulfills all the requirements is activated charcoal made from a very dense material and in the form of finely divided granules. During the World War, cocoanut shell was found to be the best raw material, but various nut shells, fruit seeds, etc., were also used. Since then, methods of activation have been greatly improved, and now domestic raw materials can be used instead of cocoanut shell.

2. Charcoal is made from wood and wood-like materials which consist of cellulose and other components. In charcoal manufacture, the cellulose is heated and thus converted to carbon, water is given off, and other constituents are also evolved. The residue is called primary charcoal. If the primary charcoal is then subjected to treatment with heat and steam or to some superheated vapors or gases in the absence or in limited amounts of air, more of the constituents are driven off leaving purer carbon. This activated charcoal is full of tiny spaces which were formerly occupied by some other constituents of the original material and now gives an extremely great surface to a small amount of charcoal.

3. Charcoal may also be processed in part by chemical action, as for example, by the peculiar charring action of zinc chloride, concentrated sulphuric acid, or phosphoric acid.

4. When air containing a gas or gases used in warfare is passed through activated charcoal, the molecules of the gas are held physically on the surface of the pores of the charcoal while the purified air flows through. This process is called adsorption and may be considered comparable to the action of a magnet in attracting and holding iron filings on its surface. The heavier the gas, the more easily it is adsorbed.

5. One of the characteristics of chemical warfare agents is that any such substance must be capable of producing the desired effect in very small quantities or doses. Casualty-producing chemical warfare agents are therefore chosen for their high toxicity and relatively great effect in low or minute concentrations.

6. The chemicals used in the gas mask canister, especially the charcoal, must therefore be able to seize and securely retain exceedingly small quantities of the chemical warfare agent. Also, these canister chemicals must be able to retain relatively large quantities of the toxic substances. Modern gas mask charcoal is chosen for these specific qualities. However, the total weight of toxic substances adsorbed and the tenacity with which they are held will vary with the vapor density of the gas and the temperature. Thus, it is easier to adsorb and retain mustard gas vapor which has a high vapor density than some other lighter substance as, for example, hydrocyanic acid gas, or even phosgene. At very high temperatures, these lighter gases will be retained with difficulty, or if previously adsorbed by the charcoal, may slowly be released again.

(*c*) *Neutralizing chemicals.*

1. There are several chemical substances which will react with and neutralize those gases or vapors not readily adsorbed or not easily retained by the activated charcoal. These may act on the gas in any or all of several ways as, for example, by decomposition, oxidation, catalysis, or by direct chemical combination. A number of these substances are described under special canisters in section IV. The principal neutralizing chemical in the service, optical, and training canisters is soda lime, several different mixtures of which have been developed so that the exact composition may vary.

2. Those gases which are not easily or firmly held by the charcoal or are given off by it come in contact with the soda lime. This latter substance may combine directly with the gas as in the case of phosgene, or may decompose the gas to form harmless substances which in turn may combine with the sodium and calcium hydroxides in the mixture.

The soda lime reacts more rapidly at higher temperatures. Thus, there is an advantage in having a combination of charcoal and soda lime, in that while a rise in temperature decreases the adsorptive capacity of the charcoal, it increases the chemical activity of the soda lime, and the two effects tend to balance each other.

(*d*) *Removal of specific chemical agents.*—The following table shows which components of the canister absorb or neutralize the various known war gases:

Symbol	Types of agents	Neutralizing component
DM	Adamsite	Filter.
CA	Brombenzylcyanide	Charcoal.
CN	Chloracetophenone	Charcoal and filter.
CNB	Chloracetophenone solution	Do.
CNS	do	Do.
Cl	Chlorine	Charcoal-soda lime.
PS	Chlorpicrin	Charcoal.
CC	Cyanogen chloride	Do.
DP	Diphosgene	Charcoal-soda lime.
DA	Diphenylchlorarsine	Filter.
ED	Ethyldichlorarsine	Charcoal-soda lime.
M-1	Lewisite	Do.
HS	Mustard gas	Charcoal.
CG	Phosgene	Charcoal-soda lime.

c. Limitations of service canister.—The service canister does not protect against carbon monoxide or ammonia or does it supply oxygen.

(1) *Carbon monoxide.*—Carbon monoxide is odorless and colorless, and a person subjected to a sufficient concentration of it will lose consciousness without warning. It is lighter than air however, and therefore high concentrations are likely to be found only in inclosed spaces. Carbon monoxide may be present in burning buildings since it is one of the products of combustion. Therefore, the Army canister must not be used in fire fighting. There is an all-purpose canister which is suitable for protection against carbon monoxide, as explained in paragraph 18*b*. Carbon monoxide may also be encountered in automobile exhaust gas, illuminating gas, blast furnace gas, mine-explosion gas, and gases resulting from the burning of smokeless powder propellants, such as might be found in pillboxes, casemates, and inclosed turrets. Ventilation removes the carbon monoxide.

(2) *Ammonia gas.*—Ammonia gas may be encountered in accidents or fires around refrigeration plants. The service canister must not be used for protection when such an accident occurs.

(3) *Oxygen deficiency.*—(*a*) Canisters will not supply or manufacture oxygen and therefore must not be used where the air is deficient in oxygen. In a mine after an explosion, in the hold of a ship, in an oil or gasoline tank, etc., this deficiency may occur. In such cases, a hose mask or a self-contained oxygen apparatus, such as described in paragraphs 14 and 15, should be used.

(*b*) The service canister is designed to protect only against low concentrations of war gases not greater than approximately one percent by volume. Higher concentrations are unlikely to occur in the field, except when a shell bursts in an inclosed space or very close to the victim. In such a case, a man, although he is wearing his mask, should hold his breath if momentary penetration occurs. The extremely high concentrations are transitory in the open as wind sweeps gases away. Such high concentrations may also result when one is changing a valve or repairing a leak on a chemical cylinder.

d. Types of canisters in use.—(1) Nine types of service canisters have been issued since World War I: the MI, MII, MIIR, MIII, MIIIR, MIV, MVIII, MIX, and MIXA1 (fig. 15). (For description

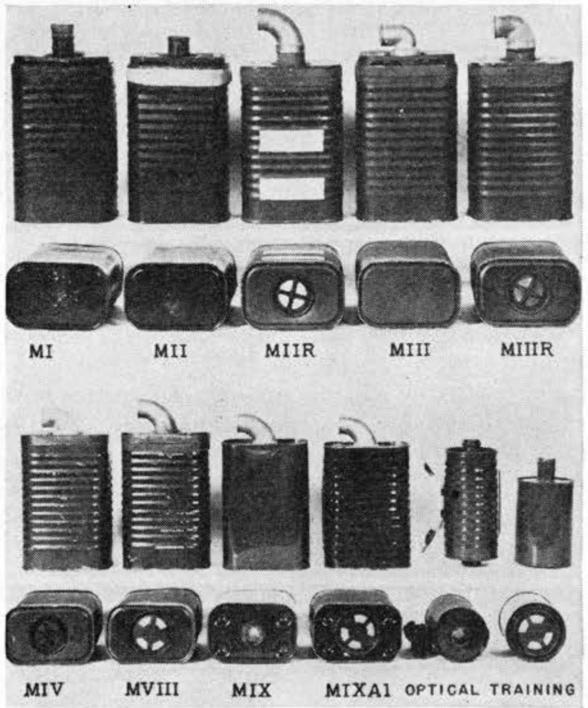


FIGURE 15.—Gas mask canisters.

see table II.) There are also special canisters, and canisters for the optical mask, noncombatant mask, and the training masks. All the service canisters are fundamentally the same; each has a mechanical and chemical filter, but improvements have been made in every case. All the canisters since and including the MIII give practically complete protection against war gases at concentrations likely to be encountered in the field. The MI is obsolete as its protection against smokes is considered too low, although it is substantially higher than that of the better World War I canisters; the MII and MIIR are better but provide rather low protection. The training canister gives adequate protection against war gases, but since it is smaller than the service canisters it will not last as long under the same conditions of use.

(2) Assuming proper care and use, the life of any canister depends upon these factors:

Concentration of gas $= c$
Rapidity of breathing $= b$
Time of contact $= t$

Thus, life or $l = c \times b \times t$, and a change in any one will result in a corresponding change in the life because the canister is designed to hold or neutralize a definite weight of absorbed chemical agent.

(3) The military canister if correctly cared for rarely breaks down suddenly. It usually fails very gradually, and its user can detect evidences of failure through minor physiological effects and warning signs such as odor, slight headache, and lacrimation. These effects generally can be noticed long before the mask completely fails.

(4) Table II gives the chief characteristics of the various canisters for identification purposes, while their pictures are shown in figure 15. A cross section of a service canister is shown in figure 14.

(5) (*a*) The Army service canister consists of a corrugated sheet metal can or outer container, 7 by $4\frac{5}{8}$ by 3 inches in the MI to MVIII, and $6\frac{1}{2}$ by $4\frac{5}{8}$ by 3 inches in the MIX and MIXA1. (The MIX is not corrugated.) At the bottom of the outer container (except in the case of the MI, MII, MIII, and MIX) is an inlet valve consisting of a rubber disk attached to a metal valve seat. The MIX canister has no inlet valve. In the MI, MII, and MIII canisters there are two inlet valves in the top of the canister. These are covered by a rain shield and may be used in the MII carrier. In the MIIR and MIIIR models, the canister bodies have been changed to the "valve in bottom" type. All canisters with the valve in the bottom are used with MIII or MIV type of carriers (see table III). The interior construction of the MIIR and MIIIR is the same as the original models.

(*b*) The inlet valve (or valves) opens only when the wearer inhales and thus prevents the exhaled breath from passing out through the canister. If permitted to do so the carbon dioxide of the exhaled breath will react with and cause deterioration of the soda lime.

(*c*) At the top of the canister is an elbow nozzle (except on the MI and MII where the nozzle is straight) which connects to the hose leading to the facepiece. A metal elbow is furnished with the MII canister. It is about 1 inch long on one end and $1\frac{1}{2}$ inches long on the other. In assembling the canister to the hose, the long end of the elbow is inserted into the nozzle and the hose is forced over the short end. The elbow prevents kinking of the hose.

(*d*) Inside the can is a filter which catches solid particles of smokes and some liquid particles. Within the filter is a perforated metal container which contains the chemicals, a mixture of activated charcoal, and soda lime. These adsorb and neutralize the gases which have passed through the filter. There is another smaller perforated metal inner tube which is covered with a muslin inner tube bag to prevent the chemicals from working through the perforations. The inner tube opens directly on the outlet nozzle.

(6) The training canister is a cylindrically shaped smooth can $5\frac{3}{8}$ inches long and 3 inches in diameter. Its internal structure is similar to that of the service canister. A canister similar to the training canister but without a nozzle is used with the noncombatant mask. The optical canister is also a cylindrically shaped can $5\frac{5}{8}$ inches long and 3 inches in diameter, and with a long slit in the side for an air inlet and two nozzles, one at each end. There is a valve in each nozzle which serves the same purpose as the inlet valve on the service canister.

9. Description and nomenclature of carrier.—*a.* The service carrier is an irregularly shaped satchel made of olive-drab canvas provided with adjustable shoulder and waist straps made of 2-inch cotton webbing (fig. 16). It is carried on the left side under the arm so that one strap is over the right shoulder and the other around the waist. The carrier opens to the front when in the slung position, and the opening is covered by a flap which is closed with two snap fasteners. Inside the carrier are two straps to hold the canister in place. The upper one is sewed to the left side and fastened to the right side of the carrier by means of a snap fastener. The lower one is sewed at both ends, and has sewed to it a loop which holds the antidim can. Five service carriers, the MII, MIII, MIIIA1, MIV, and MIVA1, have been made and are illustrated in figure 17. (For description see table III.) The rectangular shaped MI car-

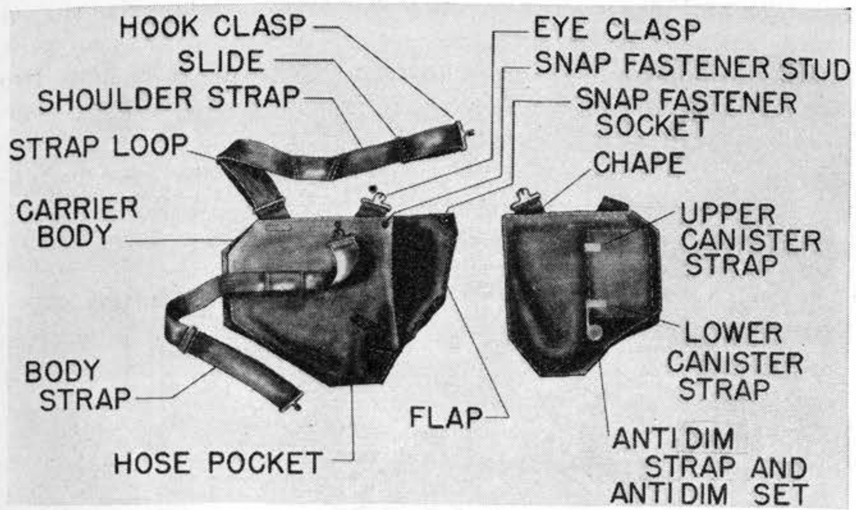


FIGURE 16.—Nomenclature of gas mask carrier MIVA1.

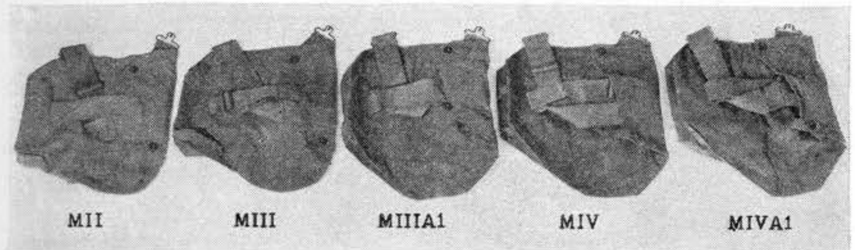


FIGURE 17.—Service carriers.

rier is obsolete. All others are in use though the MII is no longer issued. They are fundamentally the same but each is an improvement over the previous one.

b. As explained in table III, the MII carrier, which has no tuck in the bottom, is used with canisters MI, MII, and MIII, since these canisters have the inlet valves in the top. All other service canisters have the air inlet in the bottom; therefore, the other carriers all have a tuck below the air inlet of the canister to permit unrestricted air passage. The MIII has this tuck and a rivet at the inlet valve position. In the MIIIA1 the uniform curve at the hose position is replaced by broken straight lines. The MIV carrier is smaller than the MIIIA1, the flap has been reshaped, and a loop is added on which the post of lower snap fastener is fixed. The MIVA1 carrier is the same as the MIV except that the waist strap is 4 inches longer.

c. The optical gas mask carrier (fig. 18) is a rectangular shaped canvas satchel. It has an adjustable shoulder strap but no waist strap. The opening is at the top and is covered by three flaps, two

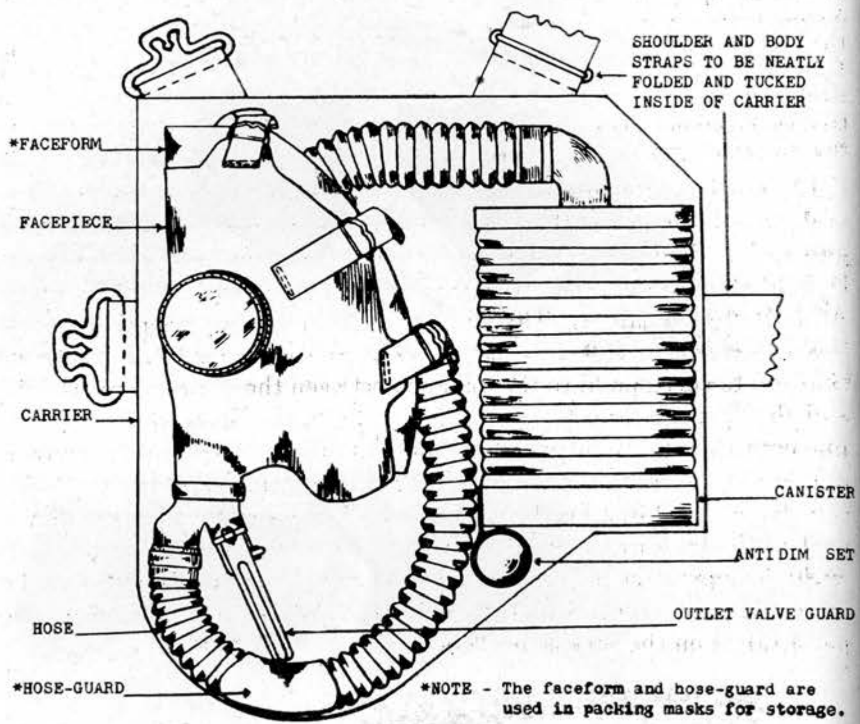


FIGURE 18.—Placement of gas mask in carrier.

being extensions of the sides which fasten together in the center, and the third being an elongation of the back side which comes over the side flaps and fastens in two places on the front of the carrier.

d. The training gas mask carrier is shaped like an inverted frustum of a cone. It has an adjustable shoulder strap made of ¾-inch cotton webbing and a waist cord made of cotton shelter tent rope. The opening of this carrier is at the top and is covered with a flap which is an elongation of the inner side of the carrier. This flap is closed with one snap fastener. The facepiece and canister are completely removed for adjustment to the face. The noncombatant gas mask carrier is similar to the training mask carrier except that it is shorter and has no waist cord.

SECTION III

SPECIAL RESPIRATORS

10. Optical gas mask M1-1-5.—The optical gas mask (fig. 19) is designed for use with optical instruments, such as range finders, gun sights, field glasses, periscopes, etc., where the instruments must be held close to the eyes. It has small eyepieces made of plane glass. An adjustable bridge, called the eyepiece adjustment assembly, across the nose connects the two eyepieces so that the space between may be changed to correspond to the distance between the wearer's eye pupils, and thus permits him to focus and use binocular instruments requiring both eyes to be adjusted to the instrument eyepieces. There is a diaphragm in the mask to facilitate speech transmission. The canister is fitted to a head harness and when in use rests on the lower part of the back of the head so as to prevent interference by the hose with the operation of optical instruments. It is made only in the universal size. This mask is described in detail in appropriate paragraphs on the service mask.

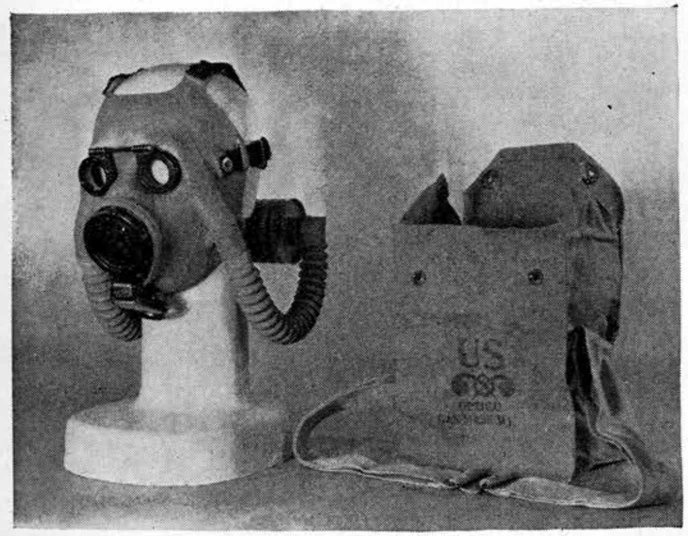
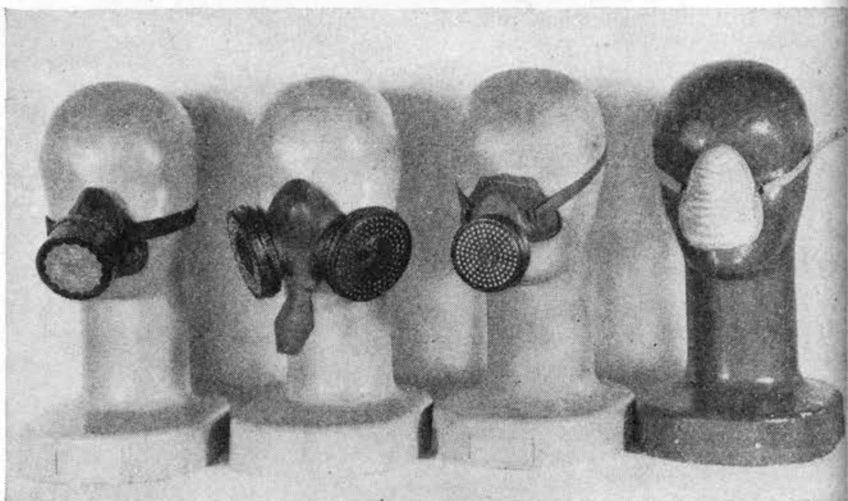


FIGURE 19.—Optical gas mask M1-1-5.

11. Aviators' gas mask.—The aviators' gas mask, which is in the development stage and has not been standardized, has a fully molded rubber facepiece with eyepieces similar to those in the training mask. It contains a diaphragm to aid in speech transmission. It is so constructed that by means of a 3-way valve the wearer can breathe oxygen from his oxygen tank, air that has been filtered through a canister, or unfiltered air. Thus, he can choose his air supply at will. It is made only in the universal size.

12. Dust respirators.—*a.* Commercial type dust respirators have been adopted for protection of certain classes of military personnel such as vehicle drivers. These respirators are light, comfortable, half-masks with effective dust filters. In most models there is an inlet and outlet valve; in some models there is no inlet valve. They cover only the lower portion of the face, and if protection for the eyes is desired, goggles must be worn. Several of the models in present use are shown in figure 20. Nomenclature and numbers shown in figure 20 are assigned by the manufacturer and have no military significance.

b. A respirator similar to the American Optical Company R-9100 has been standardized as the model 1. This respirator includes both an inlet and an outlet valve. The filters for the respirators other than the R-9100 shown in figure 20 are replaceable and are expendable.



① American Optical Company R-1000.
② Mine Safety Appliance Company Comfo.
③ Wilson Company No. 5.
④ American Optical Company R-9100.

FIGURE 20.—Dust respirators, commercial types.

***Caution.**—Troops wearing these respirators must always bear in mind that they do not protect against gas.*

13. Paint respirators.—*a.* Paints, particularly the newer types of synthetics and lacquers, contain certain noxious constituents. Men engaged in paint spraying are subjected to the fumes of the volatile portions of these paints. Although spraying is usually done under a hood connected to an exhaust fan, some of the fumes almost always escape into the room. Since the human body can stand small amounts of these substances, only partial protection is necessary. The paint respirator covers the wearer's nose and mouth. It contains several layers of felt to stop pigment and liquid particles, and activated charcoal to catch some of the fumes. The eyes are not protected.

b. Protection from paint fumes should be provided in military establishments where spray painting of vehicles and other equipment is required and no special ventilation is provided. Paint respirators to be used by the United States Army are of commercial type approved by the United States Bureau of Mines and are procured and issued by the Quartermaster Corps.

14. Hose mask.—*a.* When the concentration of oxygen is below the 16 to 17 percent required to sustain life, or the concentration of a gas is too great for the special canisters provided for it, either a hose mask or a self-contained oxygen breathing apparatus is required. The former consists of a facepiece similar to the service, diaphragm, or training types, attached to a length of hose. With it the wearer may enter tanks, tank cars, ships' holds, sewers, etc., in safety. About 25 feet or more of hose are attached to the mask and the inlet is placed in an uncontaminated source of air. A hand or motor-driven blower may be provided for longer lengths of connecting hose. The hose mask is simple, rugged, and costs little to maintain. The hose mask gives full protection to the lungs against all gases if the open end of the hose is in an uncontaminated atmosphere. On the other hand, it restricts the movements of the wearer and requires either a pump tender or an assistant who watches from the outside of the inclosure.

b. Hose masks are not made by the United States Army but may be obtained commercially. However, hose masks may be improvised by attaching a long length of hose to any military facepiece, if necessary. Obviously, their military use is limited.

15. Oxygen breathing apparatus.—*a.* Whenever concentrations of gas are so high as to render the standard gas mask or any of the special canisters useless, or when there is a deficiency of oxygen and the hose mask is not suitable for use, the self-contained oxygen breathing apparatus is required. This mask supplies an artificial oxygen atmosphere and gives full protection to the wearer's lungs in any atmosphere containing any gas or a lack of oxygen. It consists of a facepiece (or mouthpiece), one or more tanks of oxygen, a pressure control apparatus, and a regenerator which removes the carbon dioxide in the exhaled air before the air is rebreathed. The tanks are usually carried on the back. The disadvantages of the apparatus are that fresh tanks of oxygen are needed from time to time and the apparatus may get out of order.

b. This apparatus is used extensively in mine rescue work where carbon monoxide and methane gases or oxygen deficient atmospheres are encountered, and in fighting certain kinds of fires. The Navy "escape" lung and the high altitude aviator's masks are modifications of the oxygen breathing apparatus.

c. The self-contained oxygen breathing apparatus is not made by the United States Army but may be obtained commercially. Obviously, its military use is limited.

16. Noncombatant gas mask.—The noncombatant gas mask (fig. 21) is an inexpensive but efficient mask for civilian employees and others who are not required to engage in any great activity during

FIGURE 21.—Noncombatant gas mask MI-I-I.

gas attacks. The canister, which is attached directly onto the front of the facepiece, is not replaceable. Except for the omission of the canister nozzle, the noncombatant canister is the same as is used in the training mask. The eyepieces are made of a transparent plastic material and are sewed in place. The facepiece is made of rubberized fabric and is sewed and glued together at a chin seam. There is no deflector. A button or rubber disk type outlet valve which is the same as the MIV outlet valve on the MI training mask is inserted in the left side of the facepiece. These masks come in three sizes: large adult, small adult, and child.

SECTION IV

SPECIAL CANISTERS

17. General.—*a.* The following special canisters are used by the Army:

	Color painted
All-purpose	Red
Acid vapor	White
Hydrocyanic acid	Yellow with white top
Oil vapor	Black
Ammonia	Green

All the special canisters shown in figure 22 and described below (table IV and pars. 18 to 22, incl.), are designed for assembly with the standard service facepiece assemblies, MI, MIA1, MIA2, M2, or M2A1, or the standard diaphragm facepiece assemblies, MI, MIA1, MII. It is also possible to use these canisters with the standard training facepiece MI or MIA1, providing the standard 27-inch hose is employed. These canisters are to be used with carriers MIII and MIIIA1. The outer containers of all special canisters are made of tin plate with rounded corners and edges and are about 7 by 4⅝ by 3 inches. Each has an inlet valve in the bottom and each is connected to the hose by means of a canister nozzle or nozzle elbow. In order to recognize them readily, each type is painted a different color.

b. The test conditions used to determine the protection afforded are severe. Concentrations used in testing are rarely encountered more than momentarily in service in well-ventilated places. The flow of 32 liters of air per unit as is required by the test is equivalent to the breathing of a man performing hard work or walking at a rate of 3½ miles per hour.

1. All-purpose—red.
2. Hydrocyanic acid—yellow with white top.
3. Acid vapor—white.
4. Oil vapor—black.
5. Ammonia—green.

FIGURE 22.—Special canisters.

18. All-purpose canister.—*a. Description.*—(1) The all-purpose canister (fig. 22) is painted red. On one side of the canister is pasted a red label on which brief instructions for the use and storage of the mask are printed. Absorbent chemicals which have a high capacity for absorbing or restraining irrespirable gases and smokes are placed in the canister in layers. The first layer, which consists of 250 cc of activated charcoal, has a high capacity for organic vapors, such as acetone, alcohols, aniline, benzene, carbon bisulfide, carbon tetrachloride, chloroform, ether, ethylene dichloride, formaldehyde, gasoline and other petroleum distillates, and toluene.

(2) Above the charcoal is a cotton pad which filters out smokes, dusts, and mists. This, together with another cotton pad at the top, is sufficient to remove large particulate smokes, such as those arising

from burning materials like coal, wood, and paper. These filters do not, however, remove all military irritant smokes.

(3) Next above the filter is a layer of 175 cc of silica gel for the purpose of restraining ammonia. However, the silica gel has some absorptive power for restraining organic vapors and supplements the charcoal in this respect. Silica gel is a silicic acid preparation formed by precipitation from solution, dehydration, and granulation. Above the silica gel is a metal screen separator.

(4) Above the metal screen separator are placed 400 cc of caustic pumice for restraining acid gases and water vapor. Caustic pumice is a granular preparation of caustic soda and pumice. Among the numerous acid gases which are restrained by the caustic pumice may be mentioned—

Acetic acid.	Chlorine.
Formic acid.	Hydrochloric acid gas.
Hydrogen sulfide.	Oxides of nitrogen.
Hydrocyanic acid gas.	Phosgene.
Sulfur dioxide.	

(5) The caustic pumice also absorbs water vapor which must be restrained, because it inhibits the action of the material (hopcalite) next above it. A wire screen separator is placed on top of the caustic pumice.

(6) The hopcalite is a specially prepared mixture of manganese dioxide and copper oxide in granular form; 175 cc are included. Hopcalite acts as a catalyst to cause union of carbon monoxide with the oxygen in the air, thus forming the relatively harmless carbon dioxide. The hopcalite functions until moisture in the air finally penetrates to the hopcalite. As it is impossible for the wearer of a mask to tell when the carbon monoxide, which is tasteless and odorless, finally penetrates, and as water vapor is always present in the air drawn into the canister, a time limit of 2 hours' total use is put upon a canister.

(7) Above the hopcalite is a wire screen separator. Next are 150 cc of caustic pumice to prevent access of water vapor to the hopcalite from above.

(8) Lastly, there is another cotton pad filter between wire screens to serve as a smoke filter and also to prevent dusts from the absorbents being drawn into the facepiece. The absorbents are held firmly in place by means of a strong spring in the bottom which presses firmly against the stiff upper screen.

TABLE IV.—*Characteristics of special canisters*

Name	Model number	Standardization category	Distinguishing characteristics		Distinguishing characteristics—Continued			Remarks
			Color	Type of body	Dimensions	Maximum breathing resistance	Valve: Type—Size—Position	
All-purpose	MI	Standard	Red	Rectangular corrugated body	7" x 4⅝" x 3"	85	Valve in bottom	Protects against all gases usually found at fires; fits standard facepiece assemblies and MIII, MIIIA1, MIV, or MIVA1 carriers.
Acid vapor	MI	do	White	do	7" x 4⅝" x 3"	60	do	Protects against acid gases and acid vapors; fits standard facepiece assemblies and MIII, MIIIA1, MIV, or MIVA1 carriers.
HCN	MI	do	Yellow with white top.	do	7" x 4⅝" x 3"	55	do	Protects against usual concentrations used in fumigation (P. H. S.); fits standard facepiece assemblies and MIII, MIIIA1, MIV, or MIVA1 carriers.
Oil vapor	MI	do	Black	do	7" x 4⅝" x 3"	55	do	Protects against moderate concentrations of oil or organic liquid vapors; fits standard facepiece assemblies and MIII, MIIIA1, MIV, or MIVA1 carriers.
Ammonia	MI	do	Green	do	7" x 4⅝" x 3"	55	do	Protects against moderate concentrations of ammonia gas; fits standard facepiece assemblies and MIII, MIIIA1, MIV, or MIVA1 carriers.

b. Protection.—(1) The all-purpose canister will provide protection against concentrations of 1 percent by volume of any toxic gas or against a total concentration of 1 percent by volume of any combination of gases that may be met. When the gases finally break through the canister, the wearer can, in all cases except carbon monoxide, recognize their presence by their odor or taste. Because of the carbon monoxide, the time limit of 2 hours' total use is imposed. If carbon monoxide is absent, the mask may actually protect against other gases beyond the 2-hour limit. However, the canister must not be used for a total period of time to exceed 2 hours, whether carbon monoxide has previously been encountered or not.

(2) Specifications for the canister require that it shall restrain—

(*a*) Carbon monoxide (CO) in concentrations of 1 to 1.2 mg (milligrams) per liter (about 1,000 ppm (parts per million), or 0.1 percent by volume) in air flowing at the rate of 32 liters per minute and approximately saturated with water vapor at 25° C. Penetrations of not more than 0.02 mg CO per liter are permitted during the first 100 minutes, nor more than 0.1 mg per liter during the next 50 minutes; both are harmless amounts. The canister restrains higher concentrations of CO more readily than the low test concentration because of the greater heat of reaction between higher concentrations of CO with the oxygen (O_2) which increases the rate of reaction.

(*b*) Ammonia in a concentration of 7 mg per liter in air (about 10,000 ppm, or 1 percent flowing at the rate of 32 liters per minute for at least 15 minutes).

(*c*) Chlorpicrin for at least 15 minutes at a concentration of 50 mg per liter in air (2,500 ppm, or 0.25 percent) flowing at the rate of 32 liters per minute and of 50 percent relative humidity. The chlorpicrin is taken as representative of the entire class of organic vapors for this test.

(*d*) Phosgene for at least 25 minutes in a concentration of 20.25 mg per liter in air (5,000 ppm, or 0.5 percent) flowing 32 liters per minute and of 50 percent relative humidity. Phosgene is taken as representative of all the acid gases.

c. Special precaution.—Masks equipped with the all-purpose canister should not be worn longer than 2 hours. The label on the canister (fig. 22) includes a blank form for recording the periods of use and for keeping a running total of the time of usage. It is absolutely necessary to record each period of use immediately to insure the safety of subsequent users of the canister.

19. Acid vapor canister.—*a. Description.*—(1) The acid vapor canister (fig. 22) is painted white. On the outside of the canister is pasted a label on which brief instructions for the use and storage of the mask are printed. In the canister above the inlet valve is a perforated metal dome which supports the granular soda lime absorbent for the acid vapors and permits the passage of air into the filling which is 1,150 cc of soda lime.

(2) Soda lime has a high capacity for the acid vapors. It restrains all acid vapors, of which the following may be mentioned among the numerous volatile acid materials:

Acetic acid.	Hydrogen sulfide.
Chlorine.	Nitrogen peroxide.
Formic acid.	Phosgene.
Hydrogen chloride.	Sulfur dioxide.
Hydrogen cyanide.	

(3) The granules of soda lime are held in place by means or a spring which presses against a stiff screen and cotton pad on the upper surface of the soda lime. The cotton pad also prevents any leakage of the soda lime or its dust into the spring compartment, whence the dust, if present, might be carried into the facepiece.

b. Protection.—The acid vapor canister will provide protection for 40 minutes against 0.5 percent by volume of phosgene in air of 50 percent relative humidity flowing at the rate of 32 liters per minute, or it will restrain for 80 minutes hydrocyanic acid gas in concentration of 0.2 percent in air of the same relative humidity and same rate of flow. Phosgene and hydrocyanic acid gas are taken as representative of the entire class of acid vapors. While the canister will restrain up to 1 percent of acid vapor, its life is reduced accordingly. It is necessary for the wearer of the mask to know that the concentration of the acid vapor does not exceed 1 percent, because higher concentrations may quickly penetrate the mask.

c. Special precautions.—(1) The life of the acid vapor canister, when worn in ventilated places, is generally very much longer than indicated in *b* above because it is seldom that the wearer will be subjected to concentrations continuously as great as stated. When the canister approaches saturation, a slow but gradually increasing leakage of vapors will take place. The odor of most of these vapors will warn the wearer of the penetration and that he must have the canister replaced.

(2) If the feeling of irritation on the skin caused by some acid vapors (for example, sulfur dioxide) becomes acute, the concentration is excessive and may penetrate the canister. Under such conditions the wearer of the acid vapor mask should leave the contaminated atmosphere until the concentration is reduced by ventilation, water spray, or other means. Continued exposure, even though the mask does restrain the vapors, might result in blisters on the skin. Not all acid vapors are irritating to the skin, however; hydrogen cyanide may produce a feeling of warmth, probably due to superficial congestion, but at a concentration as high as 2 percent it does not irritate.

(3) The acid vapor canister affords no protection against organic vapors such as ether, benzene, aniline, gasoline, etc.; against carbon monoxide which may be encountered in fires in inclosed spaces or around leaking gas mains; or against ammonia gas which may be encountered in refrigeration plants.

(4) The special precautions relative to wearing this mask in concentrations of hydrocyanic acid gas as listed in paragraph 20*c* must be observed.

20. Hydrocyanic acid canister.—*a. Description.*—The HCN canister (fig. 22) is made to protect against concentrations of this gas and is painted yellow with a white top. On the outside of the canister is pasted a label upon which brief instructions for the use and storage of the mask are printed. Absorbent chemicals which have a high capacity for absorbing hydrocyanic acid and cyanogen chloride are placed in the canister in three layers. The first layer consists of 150 cc of charcoal impregnated with hexamethylenetetramine and rests on a perforated metal dome. Above this is a layer of 400 cc of caustic pumice. On top of the pumice is another layer of 600 cc of charcoal impregnated with hexamethylenetetramine. These absorbents are held in place by means of a spring which presses against a stiff screen and a cotton pad on the upper surface of the top layer of charcoal. This cotton pad prevents leakage of the charcoal into the spring compartment.

b. Protection.—(1) The HCN canister will provide protection for a man performing hard work against a mixed concentration of one-twentieth of 1 percent hydrocyanic acid and one-thirtieth of 1 percent of cyanogen chloride, by volume, for 3 to 5 hours. (This is approximately the concentration employed by the Public Health Service for ordinary fumigation.) When the canister begins to fail, the amount of gas penetrating during the succeeding half hour will be extremely minute, and the canister is so constructed that the cyanogen chloride, which is a tear gas, is the first to break through and thus serves as a warning that the canister is failing. The life of the canister will generally be much longer than stated above since it is very seldom that the wearer will be subjected to the full concentration of gases employed during fumigation. Fumigated compartments are usually ventilated before operators are required to enter.

(2) The HCN canister will also provide considerable protection against other acid gases such as chlorine, hydrochloric acid, and sulfur dioxide, and against organic vapors such as benzol, gasoline, and alcohol. The use of the HCN canister for protection against these gases is recommended, however, only if more suitable canisters are not available.

c. Special precautions.—(1) It should be remembered that the canister will break down in a rather short time when used in very high concentrations of hydrocyanic acid and cyanogen chloride. Therefore, it should not be used in a concentration exceeding 1 percent by volume. Concentrations as high as this ordinarily will not be encountered in fumigation work.

(2) It should also be remembered that a man may be overcome by the absorption of hydrocyanic acid gas through the skin; a concentration of 2 percent hydrocyanic acid gas being sufficient to thus overcome a man in about 10 minutes. Therefore, even if one wears a gas mask, exposure to concentrations of hydrocyanic acid gas of 1 percent by volume or greater should be made only in case of necessity and then for a period not longer than 1 minute at a time. In general, places containing this gas should be well ventilated with fresh air before the wearer of the mask enters, thus reducing the concentration of hydrocyanic acid gas to low fractional percentages.

(3) The HCN canister affords no protection against carbon monoxide which may be encountered in fires in inclosed spaces or around leaking gas mains, or against ammonia gas which may be encountered in refrigeration plants.

21. Oil vapor canister.—*a. Description.*—The oil vapor canister (fig. 22) is painted black. On the outside of the canister is pasted a label on which brief instructions for the use of the mask are printed. In the canister above the inlet valve is a perforated metal dome which supports the granular, activated charcoal absorbent for the oil vapors and permits the passage of air into the charcoal. The 1,150 cc of granulated charcoal are held in place by means of a spring which presses against a stiff screen and cotton pad on the upper surface of the charcoal. The cotton pad also prevents any leakage

of the charcoal or its dust into the spring compartment, whence the dust, if present, might be carried into the facepiece.

b. Protection.—(1) The oil vapor canister will provide protection for at least 3 hours against 0.25 percent of chlorpicrin vapor in air of 50 percent relative humidity, flowing at the rate of 32 liters per minute. The canister will restrain up to 2 percent of oil vapor, but the life is reduced accordingly.

(2) In addition to the protection afforded against oil vapors, the oil vapor canister will provide similar protection against other organic vapors such as alcohol, aniline, benzene, carbon bisulfide, carbon tetrachloride, ether, and toluene. It also provides some protection against acid gases such as phosgene, hydrochloric acid gas, chlorine, sulfur dioxide, hydrogen sulphide, and formic acid because the activated charcoal also adsorbs these gases to some extent. Better protection against some acid gases is provided by the acid vapor gas mask.

c. Special precautions.—(1) Concentrations in excess of 2 percent by volume may quickly penetrate the mask, hence the mask should not be worn in such concentrations. Concentrations as high as 2 percent will not be found in the open air or in well-ventilated rooms where the vapors occur because of leaking containers or the spilling of liquids. Concentrations greatly in excess of 2 percent may be found in storage tanks or bunkers for petroleum, gasoline, and other volatile organic liquids. Tanks and bunkers should be thoroughly drained and aired to reduce the vapor concentration below 2 percent before the individual may enter. If it becomes necessary to enter a tank wherein the vapors have not been reduced to less than 2 percent, a hose mask should be employed, or a self-contained oxygen breathing apparatus as approved by the United States Bureau of Mines should be worn.

(2) When the canister approaches saturation with any of the oil vapors, a slow but gradually increasing leakage will take place. The odor of the vapor will warn the wearer of the mask of the penetration, and when this occurs the canister must be replaced.

(3) The oil vapor canister affords no protection against carbon monoxide which may be encountered in fires in inclosed spaces or around leaking gas mains, or against ammonia gas which may be encountered in refrigeration plants.

22. Ammonia canister.—*a. Description.*—The ammonia canister (fig. 22) is painted green. On the outside of the canister is pasted a label on which brief instructions for the use and storage of the mask are printed. Absorbent chemicals which have a high capacity for absorbing ammonia are placed in the canister in two layers. The first layer, which consists of 100 cc of silica gel, rests on a perforated metal dome. Above this is a layer of 1,000 cc of "kupramite." Silica gel is a silicic acid preparation formed by precipitation from solution, dehydration, and granulation. The kupramite is a hydrated copper sulfate impregnated into pumice stone granules. These absorbents are held in place by means of a spring which presses against a stiff screen and a cotton pad on the upper surface of the kupramite. The cotton pad also prevents any leakage of the chemicals into the spring compartment.

b. Protection.—The ammonia canister is designed to protect only against ammonia gas in concentrations not exceeding 2 percent by volume. It affords no protection against other gases or smokes. Concentrations in excess of 2 percent will quickly penetrate the canister. Such concentrations may quickly be reduced by spraying the contaminated air with water since ammonia gas is very soluble in water.

c. Special precautions.—(1) If the feeling of irritation on the skin exposed to ammonia gas becomes acute, the concentration is excessive and the gas may penetrate the canister. Continued exposure, even though the mask restrains the ammonia, may result in blisters on the skin. Wearers of masks with the special ammonia canister should leave the contaminated atmosphere when skin irritation becomes acute. Concentrations may be reduced by ventilation or by water spray.

(2) When penetration of the canister starts it will increase slowly, thus affording the wearer sufficient time to leave the contaminated atmosphere before a dangerous concentration passes.

23. General safety precautions applicable when using special canisters.—*a.* The extreme maximum concentrations of gas in which any of these canisters should be used is about 2 percent by volume. However, the mask should not be worn in concentrations above 1 percent, so that there is always an ample margin of safety. Concentrations as high as 1 percent are not ordinarily found in open air or in buildings where small spills or leaks occur. There is, however, danger of concentrations above 1 or 2 percent in tanks, around gas wells, or in rooms where breaks have occurred in the gas circulating systems, as for example, in refrigeration or manufacturing plants.

b. In the event there is any question concerning the amount of the concentration likely to be encountered, or in case it is suspected that the oxygen content of the air is low, an air analysis should be made.

There are two ways of making the analysis for oxygen content. The first is by means of the miner's flame safety lamp. If the lamp does not burn, the oxygen concentration is too low to support life. The flame safety lamp is necessary, because there is danger of explosion in certain gas-air mixtures, especially around ammonia or organic vapor accidents.

NOTE.—Flames will propagate even through a flame safety lamp in the presence of hydrogen or acetylene gas-air mixtures; for these gases, analytical tests must be made. If an absence of oxygen is indicated by either of the above methods, ventilation of the tank, bunker, or room either by natural or forced draft should be arranged before workmen are allowed to enter with a canister type of gas mask.

c. For working in unventilated spaces, or where there is an oxygen deficiency, the hose mask or the oxygen breathing apparatus may be used, providing the gas or vapor encountered is not absorbed through the skin, such as in the case of hydrocyanic acid gas or some of the intensely irritating vapors. Only specially trained men should be permitted to wear the oxygen breathing apparatus.

d. Where work is to be done in a vapor-filled inclosed space, good safety practice will require that there be at least one man stationed at some point where he can watch and assist the workman who is to enter the space or room. It may even be necessary to provide a safety rope between the safety man and the workman. In any event, an unimpeded way or method of escape should always be planned and left open.

SECTION V

CARE, HANDLING, PACKING, AND SHIPPING

24. Care.—*a. General precautions.*—(1) The gas mask is specially designed and constructed to withstand the wear and tear of field service and, with reasonable care, will have long life. Rough handling of a gas mask may cause serious mechanical damage such as dents or breaks in the metal parts, tears in the rubber or fabric, cracked or scratched and broken eye lenses, and torn valves. Any of these may occur if other articles are carried in the carrier, or if the entire mask is handled carelessly, sat upon, or used as a pillow.

(2) Care must be taken to prevent prolonged exposure to moisture, since this tends to cause rotting of the stockinette fabric and the

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deterioration of the protective tape around the wire bindings of the deflector, outlet valve, angletube, and hose, thus exposing them to rust and decomposition. Dampness also causes mildew of fabrics. These will not happen if the mask receives reasonable care. The mask can be worn for extended periods in the rain without any harm resulting, if water is not permitted to collect in the carrier, and if the mask and carrier are dried out soon after use.

b. Deterioration factors.—(1) The gas mask is made of a number of basic materials such as rubber, metal, canister chemicals, and filter materials, fabrics, and plastics. With the exception of the rubber, these materials will last indefinitely if kept in a cool, dry place where they will not be injured. Rubber, on the other hand, will rapidly deteriorate unless special care is taken to prevent it. Deterioration of rubber is called "aging" and is a form of oxidation or burning which starts slowly and, as it progresses, goes on at an increasing rate. Aging results from the contact of the oxygen of the air with the rubber, particularly in sunlight, and from the reactions of substances within the rubber itself.

(2) The first signs of aging may be observed when the rubber begins to lose its elasticity and begins to set in distorted shapes. This may be followed by "tackiness," at which time the rubber becomes sticky and loses most of its elasticity. Later, the rubber becomes dry and brittle. Once it becomes tacky, it is worthless and should be replaced. Aging is speeded up chiefly by light, heat, contact with certain materials, and the action of organic solvents, such as gasoline and oil.

(3) It is a fundamental principle of chemistry that the rate of any reaction (and this includes the rate of deterioration of rubber) just about doubles for every increase of temperature of 10° C. or 18° F. Thus, at 96° F., the aging rate of rubber is approximately four times the rate at 60° F. Therefore, storage of gas masks in high temperatures should be avoided.

(4) If rubber is creased, folded, stretched, or otherwise unnaturally distorted in one place for a long time, it tends to fail along the fold or the stretched point. With gas masks this failure can be prevented to a large extent by placing face forms in the facepieces or by keeping them, when not in actual use, in approved storage racks as described in paragraph 27 and shown in figure 23.

c. Prevention of aging.—There are several ways of slowing down or preventing the aging of rubber:

(1) *Compounding.*—Certain materials called vulcanization accelerators, antioxidants, and fillers are mixed with the crude rubber. The accelerators combat aging by permitting vulcanization at lower tem-

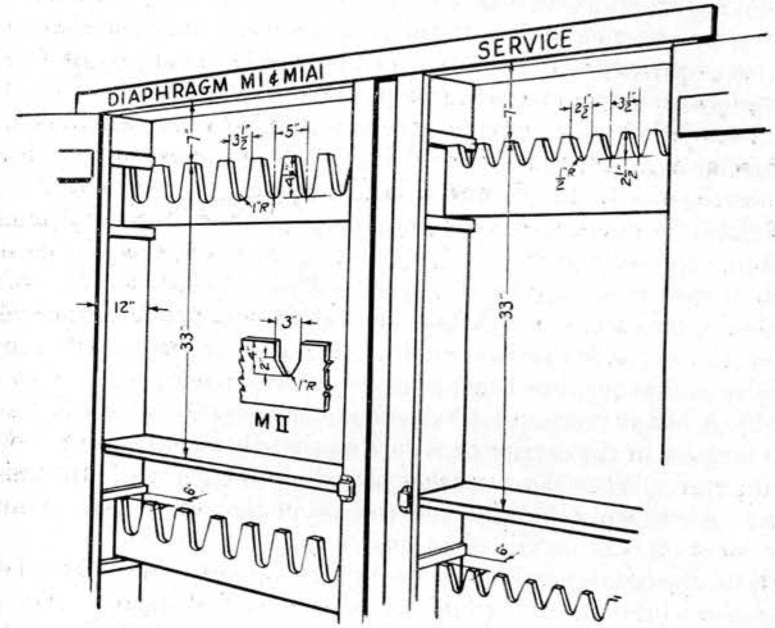


FIGURE 23.—Storing gas masks in garrison.

peratures and by speeding up the process; this improved cure renders the rubber compound less subject to deterioration. The antioxidants are substances which may react with oxygen more readily than the rubber molecule, or they may decelerate the oxidation of the rubber. In either case the result is the same, because aging is chiefly oxidation, the prevention of which extends the usefulness of the important flexible parts of the mask. The life of the mask has been greatly increased in recent years by the use of these substances. Various manufacturers use different compounding formulas.

(2) *Neutral storage.*—(*a*) An additional and very effective way of delaying the aging process is to seal the rubber in a container in which there is no air or oxygen, thereby permitting only the limited spontaneous aging of the rubber due to its components. In the case of the gas mask, packing in vacuum is impractical because the mask is relatively large, and any vacuum-sealed can or container would have to be very strong, heavy, and expensive in order to withstand the pressure involved. However, the same effect can be had by replacing the air with an inert atmosphere which contains no oxygen. In this case, pressures on the container are low.

(*b*) As explained in paragraph 26, the air in a unit container is removed and replaced by a nitrogen atmosphere from which the oxygen has been removed. Containers with masks intended for war reserves are sealed and stored in this manner, and a number of theoretical tests have indicated that such canned gas masks do not age appreciably in 20 years of undisturbed storage, providing the containers do not leak. However, once the mask is removed from the neutral atmosphere within the container, the aging of the rubber starts and proceeds normally.

d. Distortion prevention.—(1) Distortion or "permanent set" of rubber mask parts happens most frequently near the chin of the facepiece and to the hose whenever the mask is improperly placed in the carrier so that the hose bends over the outlet valve guard.

(2) A bad permanent set to the hose may also be caused by placing the canister in the carrier backward so that the canister nozzle points to the rear. When the canister is placed in the carrier in such manner, the hose is sharply kinked across the end of the nozzle and the flow of air is cut off. If permitted to remain in this position for any length of time, the damage will necessitate the replacement of the hose. Correct procedure when returning canisters to carriers will prevent distortion, especially if the position of the mask in the carrier is frequently checked by inspection.

(3) A hose guard (fig. 18) is used in packing to aid in preventing kinking of the hose against the outlet valve guard. Permanent set of the facepiece is prevented by using metal, paper, or papier mâché faceforms when the mask is not issued to an individual wearer (figure 27). The metal hose guard prevents kinking of the hose when the mask is in the carrier, while storage in organizational racks, as described in paragraph 27 and illustrated in figure 23, will prevent the hose from being distorted when not in the hands of an individual. The metal outlet valve guard protects the outlet valve from distortion. When the mask is packed for long storage or shipment, these may be augmented by two small pieces of cardboard inserted into the guard to prevent accidental folding of the valve. When stored unboxed, loose masks must not be piled more than five masks high.

e. Temperature and light control.—Temperature and light both act on rubber to speed up the aging process. For this reason, all masks not in unit containers should be kept at as low a temperature as is possible with the facilities available. Individuals must be cautioned to avoid placing their masks near heated radiators, stoves, or fires. In a warehouse where the circulation of air among the boxes is most important, sufficient air space must be left between adjoining packages. The storage space should be kept dark.

25. Disinfection and cleaning.—Gas masks are individual equipment and whenever they are turned in or are to be used by another person they should be disinfected.

a. Individual disinfection.—There are two ways in which the gas mask disinfection process may be organized and carried out. The first is by individuals as prescribed in FM 21-40. Each individual cleans and dries his own mask before turning it in or exchanging it. This process is supervised by a trained gas noncommissioned officer or chemical warfare maintenance soldier, who inspects each mask before the individual is relieved of responsibility for the mask.

b. Large scale disinfection.—(1) There is sometimes a necessity for disinfection of a great number of gas masks, especially where individual soldiers are not available. Examples are in mask salvage operations after a battle or when organizations are demobilized. In this case, the work is performed by one or more of the salvage squads in the chemical maintenance company.

(2) If the quantities of salvaged gas masks to be cleaned and disinfected are great enough, it may be advisable to improvise special equipment such as special racks, as described below, spray guns for applying the disinfectant, vacuum driers, and special carrier cleaning and washing machines. This process is a part of any large repair project and will be carried out only after the masks have been repaired and inspected for serviceability.

(3) The disinfection solution used is a 3 percent solution of formaldehyde or a 2 percent solution of lysol or cresol such as is prescribed in FM 21-40 as amended. However, instead of applying the solution by hand, it would be feasible to use a paint spray apparatus for the purpose. Gas masks must be worn by spray gun operators and assistants because the formaldehyde solution gives off irritating fumes. When large numbers of masks are disinfected, the operators' hands should be protected by rubber gloves. The facepieces should first be scrubbed with soap and water, then rinsed with clear water. The facepiece to be disinfected must be held in an upside down position while being sprayed. Also, the canisters should be set above the facepieces so that the solutions will not run into the hose. An improvised folding rack with a shelf for the canisters and notches to hold the facepieces similar to that shown in figure 24 may speed up the process. It is probable that a number of these racks or similar holders might be needed for large disinfection jobs. After the facepieces have been disinfected, the masks may be dried by

means of an air jet. The masks should be aerated 24 hours after the disinfecting to remove the formaldehyde.

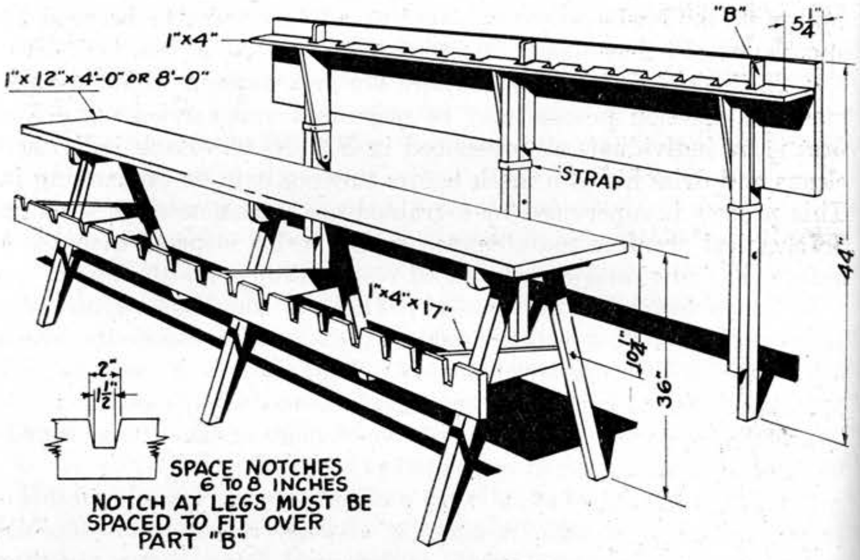
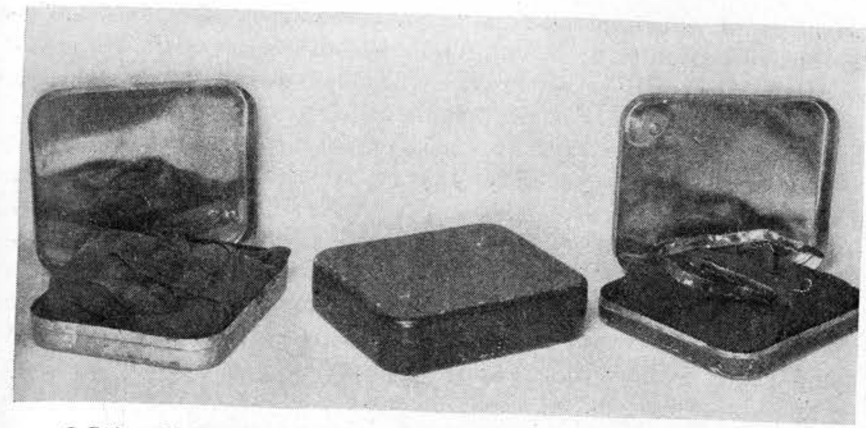


FIGURE 24.—Folding rack or holder for gas masks.

c. Cleaning of carrier.—Mud, grease, and soil may be removed from carriers by brushing vigorously and dry-cleaning, or if that is not practicable, by washing superficially with soap and water. The carriers should not be laundered because laundering causes shrinkage to such an extent that the mask may be difficult to replace in the carrier. Laundering also has a tendency to remove the waterproofing compound.

26. Packing and shipping.—*a. Unit containers.*—The problem of keeping gas masks from contact with air, moisture, and sunlight has been solved by storing the masks in individually sealed, nitrogen-filled metal containers. The complete gas mask with a faceform is placed in a metal unit container. The air is removed by a vacuum pump and is replaced by nitrogen. The container is then sealed and is placed in a wooden box which holds ten unit containers. This box is then stored until the masks are to be issued to the individual soldier.

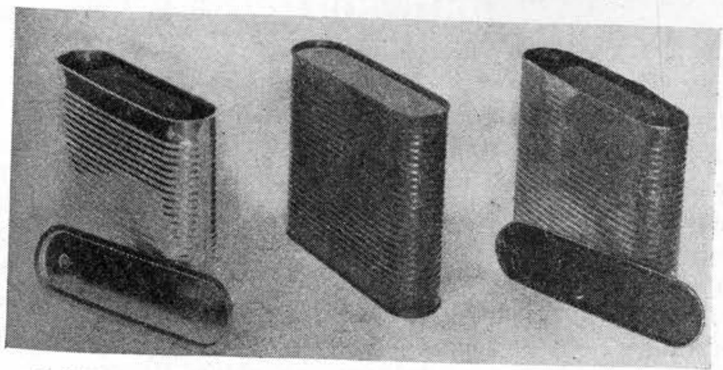
(1) *MI* (fig. 25).—The MI unit container consists of a flat tin-plate box $12\frac{1}{2}$ inches wide by $14\frac{7}{16}$ inches long by $3\frac{9}{16}$ inches high. The corners are rounded and the box is made in two parts, which are joined together by means of a tear strip soldered all around



① Before closing. ② Sealed. ③ After opening.
FIGURE 25.—Unit container MI.

the periphery. When the mask is packed, it is placed in the container and the tear strip is soldered. A small hole, $\frac{1}{8}$ inch in diameter, is left in the top section for evacuation of the air and refilling with nitrogen, after which the hole is covered by a small disk of tin plate and soldered. Because of the tendency for leaks to appear around the tear strip, the MI container has been replaced by the MII. The container is opened by grasping the small tab on the tear strip with the pliers (item 3) and pulling.

(2) *MII* (fig. 26).—The MII unit container is a rectangular metal box $4\frac{1}{4}$ inches by $14\frac{3}{4}$ inches by $12\frac{5}{8}$ inches, shaped like a flattened cylinder. The sides are corrugated to increase strength and the top and bottom are double seamed to the body of the container. The bottom and body are assembled first and the mask placed therein.



① Before closing. ② Sealed. ③ After opening. (With pedestal type opener.)
FIGURE 26.—Unit container MII.

The top, in which there is a small filling hole 1/4 inch in diameter, is then placed onto the body. Air is withdrawn from the container and it is then filled with nitrogen; a small metal disk is soldered over the filling hole. To prevent damage to masks during opening, containers are opened by means of a unit container opener.

(3) *Gas mask bag* (fig. 27).—In a type of package used in packing the M3 diaphragm gas masks, the gas mask (in the carrier) is placed in a large pliofilm or bag envelope, which is then sealed by heating and crimping the open end. Cellophane may be substituted for the pliofilm in some cases. A moisture and dustproof package is thus formed. This type of container should not prevent aging to any marked degree, however. The mask is further protected by packing in individual strawboard boxes or cartons. Ten of these units are shipped in a wooden box.

FIGURE 27.—Unit container gas mask bag.

b. Types of unit container openers.—There are two types of unit container openers (figs. 28 and 29):

(1) *Pedestal, type A.*—(*a*) *Description.*—Unit container opener, pedestal, type A, consists of a cutting head mounted on a floor pedestal equipped with a large floor flange so that the opener may stand firmly on any level surface. The opener is operated by hand. The cutting head is equipped with a pair of cutting wheels, a handle for operating the cutting wheels, and a guide plate to assist in manually guiding the container in its passage between the cutting wheels. The upper cutting wheel is normally held in an elevated position by means of a

spring to provide space between the cutting wheels for insertion of an edge seam of the unit container. A foot pedal, attached to the pedestal, is arranged to depress the upper cutting wheel, thus causing the upper wheel to grip and cut into a peripheral surface of the unit container when the container is in position for opening.

(*b*) *Accessories.*—A small box for tools is mounted on the pedestal. It contains one pair of spare cutting wheels and a combination, double open end, and spanner wrench. The wrench is for use as follows:

1. Standard nuts.—The large open end is for the 5/8-inch standard nuts on the pedal mechanism.

2. Set screws.—The small open end is for the 4/8-inch set screws on the head socket and on the handle adjustment.

3. Lock nuts.—The spanner pins are for the lock nuts on each of the two cutting wheels.

(*c*) *Adjustments.*—Before operating the opener the following parts in particular should be in accurate adjustment:

1. Guide plate.—The face of the guide plate should be flush with the front annular surface of the shoulder of the lower cutting wheel. After setting the guide plate, the two knurled adjusting screws and the two knurled lock nuts should be made handtight in order to fix the guide plate in this position. A tool should not be used to grip the knurled screws or nuts; they should be operated by hand. Both screws should be turned in unison to prevent straining the adjusting mechanism.

2. Cutting wheels.—When the upper cutting wheel is lowered, the rear face of its cutting edge should be exactly 3/64 inch forward of the front face of the lower cutting wheel. The pedal should not be operated if the wheels are out of adjustment, lest the edges of the cutting wheels be damaged.

3. Foot pedal.—The foot pedal should be adjusted by means of the turnbuckle on the rod to the lever for lowering the upper cutting wheel so that when the wheel is fully depressed the lever clears the baseplate by about 1/8 inch. Then tighten the lock nuts against the two ends of the turnbuckle. This adjustment facilitates ease of operation.

(*d*) *Operation.*—Two men compose a crew for opening unit containers—a guider, who handles the unit containers and guides them through the cutting wheels of the opener, and an operator, who depresses the pedal and turns the handle.

1. Guider.—The guider may assist in steadying the opener, if it is not fixed to a floor or base, by standing with one foot on the base of the opener. The guider manipulates a unit container as follows:

(a) *Body seam.*—The guider picks up a unit container and holds it with the longitudinal seam on the body of the container uppermost and horizontal.

(b) *End seam.*—A double seamed edge that joins either end of the unit container to the body is next placed between the cutting wheels with the body seam adjacent to and to the left of the cutting wheels as viewed by the guider.

(c) *Guide plate.*—As much as possible of the edge of the end seam is held snugly against the guide plate. *The guider, with the container in position ready for cutting, should exercise special care in guiding the container so the end will be parallel with the guide plate throughout the cutting operation, and also held with a slight pressure against the guide plate.*

(d) *Rotation.*—As the operator turns the cutting wheels, the guider carefully guides the container against the guide plate while rotating the container in a counterclockwise direction as viewed by him, until the container nearly completes one revolution and the body seam is immediately to his right of the cutting wheels. The body seam should not be cut because it is too thick for the machine to cut readily and it may put the machine out of adjustment.

(e) *Removal.*—The operator now raises the upper cutting wheel, and the guider removes the container from the opener.

(f) *Command of operation.*—The guider should be in charge of the immediate operation. He should employ the commands: READY; CUT; STOP. The operator should conform to these directions. Such procedure eliminates confusion, reduces fatigue, and increases output.

2. Operator.—The operator should assist in steadying the pedestal and himself as well by grasping with his left hand the top of the housing of the opener. He may assist

in steadying himself by resting the ball of his left foot on the pedal, and the heel of that foot on the floor. When the container is in readiness to be opened, the operator operates the opener as follows:

(a) *Lower pedal.*—The pedal is lowered by foot pressure until the upper cutting wheel pierces the edge of the body of the container near the body seam, in the location described in (*d*)*1* above.

(b) *Handle.*—While maintaining only just sufficient pressure on the pedal to cut the edge of the body of the container properly, the handle is rotated in a direction away from the operator until the container nearly completes one revolution, and the body seam is immediately to the right, as viewed by the guider, of the cutting wheels. The body seam should not be cut.

(c) *Pedal pressure.*—The work required to turn the handle increases with the pressure applied on the foot pedal. Sufficient pressure to prevent slippage of the unit container between the cutting wheels is needed. An excess of pressure beyond this increases the labor and may be avoided after some experience in opening the unit containers.

(d) *Raise pedal.*—The pedal is raised by releasing the operator's foot pressure until the cutting wheels are separated so that the guider may remove the container from the opener.

(*e*) *Care.*

1. Greasing.—When the opener is not in use the cutting wheels and the guide plate should be kept well covered with a heavy lubricant to prevent rusting.

2. Sharpening.—When the cutting wheels become dulled they should be replaced; two spare cutting wheels are included for this purpose in the box on the pedestal. The dulled wheels should be carefully ground by an expert machinist to sharpen them. The sharp spare wheels should be kept well greased in readiness for use. The wheels should be handled with care at all times to avoid damage to them.

3. Oiling.—The bearings and working parts of the machine should be oiled as needed to reduce friction and to prevent wear of the parts.

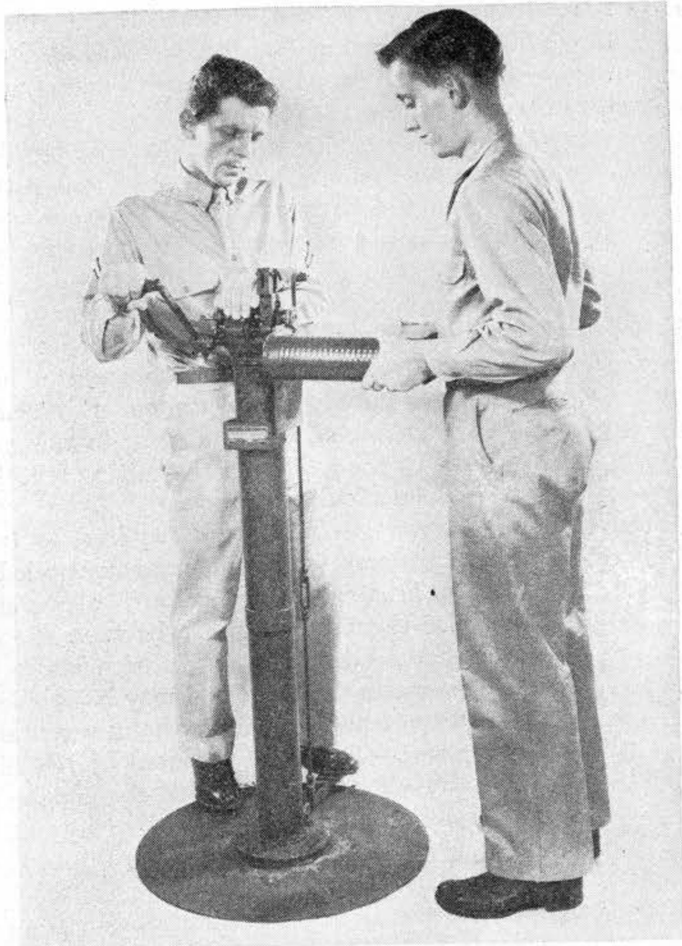


FIGURE 28.—Unit container opener, pedestal type.

(2) *Bench type.*—(*a*) *Description.*—The bench type unit container opener is a commercial, heavy-duty can opener designed for fastening to a work bench or table. It can be operated by one man, but an assistant should be furnished to handle containers if speed is to be attained in the operation.

(*b*) *Operation.*

1. Take lever with the right hand, and with thumb push up automatic lock and raise lever.

2. With top (or bottom) of can up, slip rim of unit container up under cutting wheel. Push lever all the way down, puncturing top of container with cutting wheel. Lever

will now be locked and container should be held firmly in place during the cutting process.

3. Rotate crank away from operator until lid is almost cut out. Turn handle slowly and as lid of container raises up, take hold of it with left hand and complete cut.

4. To release, take hold of container with left hand and with right thumb push up on automatic lock, then raise lever.

NOTE.—Keep working parts of opener well oiled.

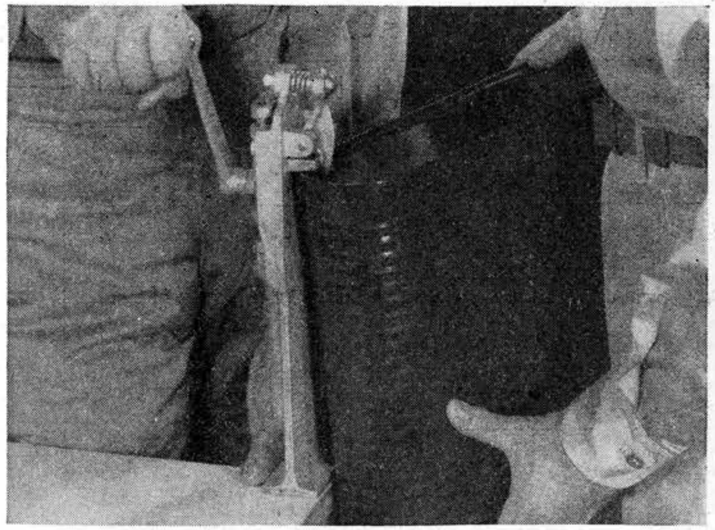


FIGURE 29.—Unit container opener, bench type.

c. Packing and shipping containers.—(1) Service gas masks are packed in two ways:

(*a*) Type A packing—20 masks not in unit containers in a wooden box, packed four in a tier, five tiers to a box.

(*b*) Type K packing—10 masks in metal unit containers in a wooden box, packed five in a tier, two tiers to a box.

(2) Diaphragm masks are packed in three ways:

(*a*) Type B corresponds to type A.

(*b*) Type M corresponds to type K.

(*c*) Type R corresponds to type K, except that the unit container gas mask bag and strawboard box (fig. 27) are used instead of the metal unit container.

d. Care in handling shipments.—When masks are transported in packing boxes, stevedore hooks must not be used, nor must boxes be permitted to drop or break. Boxes must be properly loaded and placed in railroad cars or trucks; otherwise, damage to the masks may occur. Particularly good care should be taken when unboxed masks are handled. They must not be piled higher than five masks per pile; otherwise, permanent distortion of the rubber parts may result.

e. Transportation data.—The dimensions and weights of shipping packages for gas masks and other related articles, together with railroad car and truck capacities, are given in table V.

TABLE V.—*Transportation data*

Item	Model	Pounds	Dimensions of package	Railroad cars		Trucks 1½-ton		Trucks 2½-ton	
				Boxes	Units	Boxes	Units	Boxes	Units
20 service or diaphragm masks in a wooden box—not in unit containers (type L or M).	MIA2–VIII–IIIA1	160	26⅞″ x 25″ x 18¼″.	280	5, 600	12	240	24	480
10 service or diaphragm masks in a wooden box—in unit containers (type A or B).	MIA2–VIII–IIIA1	133	29⅛″ x 15⅞″ x 21¼″.	360	3, 600	24	240	40	400
36 service or diaphragm facepieces in a wooden box.	MIA1, MIA2, or MII.	80	28⅝″ x 15½″ x 20⅜″.	390	14, 040	27	972	48	1, 728
24 canisters in a wooden box.	MII	88	22⅞″ x 21½″ x 10½″.	612	14, 688	48	1, 152	59	1, 416
24 canisters in a wooden box.	MIIR	90	22⅞″ x 21½″ x 10½″.	576	13, 824	48	1, 152	55	1, 320
20 canisters in a wooden box.	MIII	73	23⅞″ x 18¼″ x 10⅞″.	720	14, 400	41	820	68	1, 360
20 canisters in a wooden box.	MIV	76	23⅞″ x 18¼″ x 10⅞″.	720	14, 400	40	800	65	1, 300
20 canisters in a wooden box.	MVIII	69	23⅞″ x 18¼″ x 10⅞″.	720	14, 400	43	860	72	1, 440
75 carriers in a wooden box.	MII	117	23¾″ x 22¼″ x 18¾″.	320	24, 000	24	1, 800	40	3, 000
75 carriers in a wooden box.	MIII	117	23¾″ x 22¼″ x 18¾″.	320	24, 000	24	1, 800	40	3, 000
75 carriers in a wooden box.	MIIIA1	122	22¾″ x 22¼″ x 18¾″.	320	24, 000	24	1, 800	40	3, 000

TABLE V.—*Transportation data*—Continued

Item	Model	Pounds	Dimensions of package	Railroad cars		Trucks 1½-ton		Trucks 2½-ton	
				Boxes	Units	Boxes	Units	Boxes	Units
80 carriers in a wooden box.	MIVA1	125	29⅛″ x 15⅞″ x 21⅝″.	360	28, 800	24	1, 920	80	3, 200
54 cartons or 1,296 sets of antidim in a wooden box.	MI	127	23″ x 22⅝″ x 17½″.	320	414,720	22	28, 512	39	50, 544
200 company gas mask repair kits in a wooden box.	MII	92	25″ x 23½″ x 12½″.	448	89, 600	32	6, 400	54	10, 800
1 regimental gas mask repair kit.	MI	39	23¼″ x 8¾″ x 10⅞″.	1, 408	1, 408	76	76	128	128
20 training masks	MI or MIA1	76	27¼″ x 20⅝″ x 14⅝″.	360	7, 200	27	540	48	960
50 noncombatant masks in a wooden box.	MI	120	20″ x 22″ x 30″.	288	14, 400	18	90	32	160
20 optical masks in wooden boxes in cardboard cartons.	M1-1-5	131	45″ x 20¼″ x 19¾″.	250	5, 000	18	360	24	480
10 diaphragm masks in wooden box, sealed in cellophane bags.	M3-IXA1-IVA1	100	29″ x 15¾″ x 21¾″.	360	3, 600	24	240	40	400
1 gas mask repair kit for training masks—regimental.	M3	27	16½″ x 11½″ x 9¼″.	2, 112	2, 112	120	120	180	180

27. Storing.—*a. In organizations.*—As long as a gas mask is left in its unit container its storage presents no particular problem. However, once the mask has been issued to an organization or individual, its care becomes somewhat more difficult. Organizational masks should be stored in racks as prescribed in FM 21–40. The dimensions and general perspective views of satisfactory storage closets suitable for a company in garrison are shown in figure 23. Less elaborate racks may be made by placing the shelves and notched facepiece holders along a wall, or on posts or uprights in the store room, and covering the masks with curtains to protect them from dust and light. Satisfactory curtains may be made from salvage shelter tents or blankets. A room for these storage racks should be cool and dry.

The use of the special racks prevents collapse of the hose or creasing of the facepiece.

b. Warehousing.—(1) *Buildings.*—Gas mask warehouse buildings should be free from dust and vermin. They must be cool, dry, well ventilated, and protected from fire hazards.

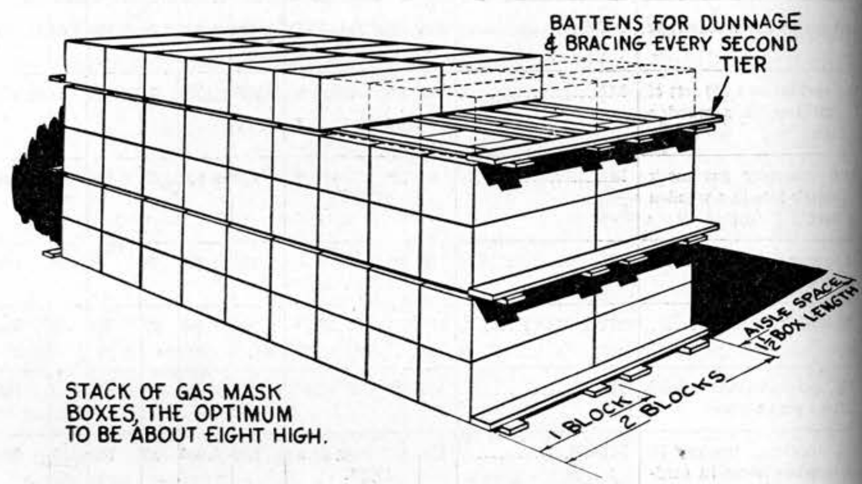


FIGURE 30.—Piling of gas mask boxes.

(2) *Open air storage.*—For temporary field storage, boxes of gas masks may be stored in piles under tarpaulins, providing the lower tiers of each pile are raised to protect them from dampness.

(3) *Piles.*—A storage pile which is two "blocks" or two box-lengths wide, has been found best for convenience in inventorying, handling, fire fighting, and fire prevention. The length of these piles is determined by local conditions such as the length of the room or the width of the building; while the height of the gas mask storage pile depends upon the strength of the underpinning or floor, and also upon whether the various tiers are tied together by means of battens and dunnage. However, for best economy of labor, this height has been found to be about eight boxes. Figure 30 illustrates the use of pile, block, tier, dunnage, and battens.

(4) *Calculations.*—Table VI contains data for estimating the space required for storing gas masks, facepieces, carriers, canisters, and training masks in their containers. The floor space and volume data are calculated on the basis of the standard pile described above, taking into consideration adequate aisle and ventilation space.

TABLE VI.—*Storage data*

Item	Model	Suggested storage height		Load in pounds per square foot	Area per unit stored one package high (sq. ft.)	Displacement per unit (cu. ft.)
		Packages	Feet			
Gas mask, service or diaphragm—boxed, not in unit containers.	Masks with facepieces MI, MIA1, MIA2, MII.	8	12.2	274	0.357	0.542
Gas mask, service or diaphragm—boxed in unit containers.	Masks with facepieces MI, MIA1, MIA2, MII.	7	12.4	288	.492	.868
Facepiece—service boxed	MI, MIA1, MIA2	7	11.9	182	.132	.224
Canister—boxed	MIV	13	11.8	325	.232	.210
Carrier—boxed	MIIIA1	7	10.9	244	.72	1.120
Training masks—boxed	Masks with facepieces MI, MIA1.	10	12.2	194	.293	.344
Noncombatant masks—boxed	MI-I-I	6	11.0	173	.125	.153
20 optical masks in wooden boxes in cardboard cartons.	M1-1-5	7	11.8	142	6.35	10.45
10 diaphragm masks in wooden box, sealed in cellophane bags.	M3-IXA1-IVA1	8	12.2	139	3.15	5.75
80 carriers in a wooden box	MIVA1	8	12.2	322	3.15	5.79
1 gas mask repair kit, regimental, in wooden box.	MI	10	7.3	221	1.76	1.29
1 gas mask repair kit, company, in wooden box.	MII	12	7	144	.77	.60
1 gas mask repair kit for training masks, regimental.	M3	11	7.9	225	1.32	1.02
Gas masks, service or diaphragm, in carriers, loose (unboxed).	*Temporary.*—Store flat on shelves, not more than 5 masks high. *Semipermanent.*—In racks with hoses straight and facepieces in forms.					
Gas masks, training in carriers, loose (unboxed).	*Temporary.*—Store flat on shelves, not more than 5 masks high. *Semipermanent.*—Facepieces in forms—Carriers hung free by their slings from rods or hooks.					

NOTE.—The above storage data allow for space between rows and aisles. To find the area of floor space necessary to store a given number of boxes, multiply the number of boxes by the figure for the area per unit stored one package high, and divide by the number of packages high that the articles are to be stored.

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SECTION VI

REPAIR KITS

28. General.—*a.* Even with the best of care, gas masks may get out of order and require repairs. Some repairs are quite minor and can be made easily in the field; some can be made only by specially trained maintenance personnel, while others may be made only at an arsenal or depot.

b. No repairs other than the ones authorized should be attempted by the various agencies, except in very grave emergencies. The lists given in paragraph 36 show which repairs may be made in the field by regimental gas mask repair personnel or by chemical warfare maintenance personnel. Other repairs should not be attempted except by special authorization from the Chief of the Chemical Warfare Service.

c. For field repairs, there are six different repair kits available for use in the Army.

d. Descriptions of each of these follow in paragraphs 29 to 34, inclusive. The tools, spare parts, and materials are numbered in such manner that an item has the same number regardless of which repair kit it may be contained in. For example, 6-inch shears will always be item 4. In some repair kits certain items may not be included and in such cases the number assigned to that item will be vacant in that kit. In the directions for the repair of masks (sec. VII), the various items referred to are given numbers corresponding to the numbers in the list of items shown in appendix II.

e. Maintenance companies will possess sufficient repair equipment to make authorized repairs in the field and will improvise or add to the standard tools as necessity and experience may require.

29. Company gas mask repair kit MII.—The company gas mask repair kit (fig. 31) consists of a small cardboard carton with a metal bottom and metal screw top. It contains a tube of rubber cement, a 3½-yard roll of ⅞-inch olive drab adhesive tape (bias strapping), and directions for their use. This repair kit is intended for making emergency repairs in the field such as the repair of small holes in the facepiece or hose. At the earliest time possible, masks having such emergency repairs will be turned over to the regimental gas noncommissioned officer for further repair or disposal.

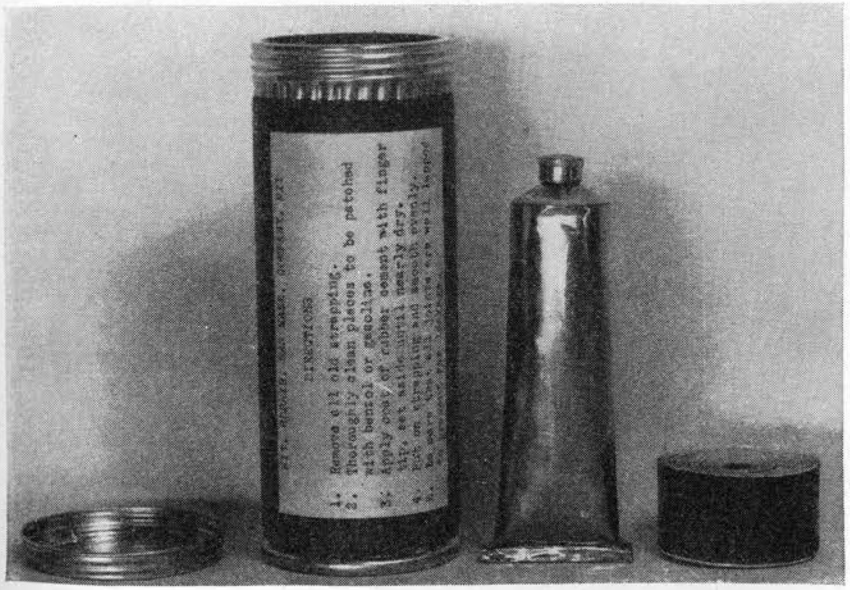


FIGURE 31.—Company gas mask repair kit MII.

30. Regimental gas mask repair kit MI.—The MI regimental gas mask repair kit (figs. 32 and 33) is a wooden box with metal trays and partitions containing the materials, implements, and directions for repairing masks with service facepieces MI, MIA1, and MIA2 and diaphragm facepieces MI, MIA1, and MII in the field. This repair kit is also suitable for such repairs of all gas mask hose, carriers, and service canisters as may be made in the field. A list of these materials and tools appears in paragraph 1, appendix III.

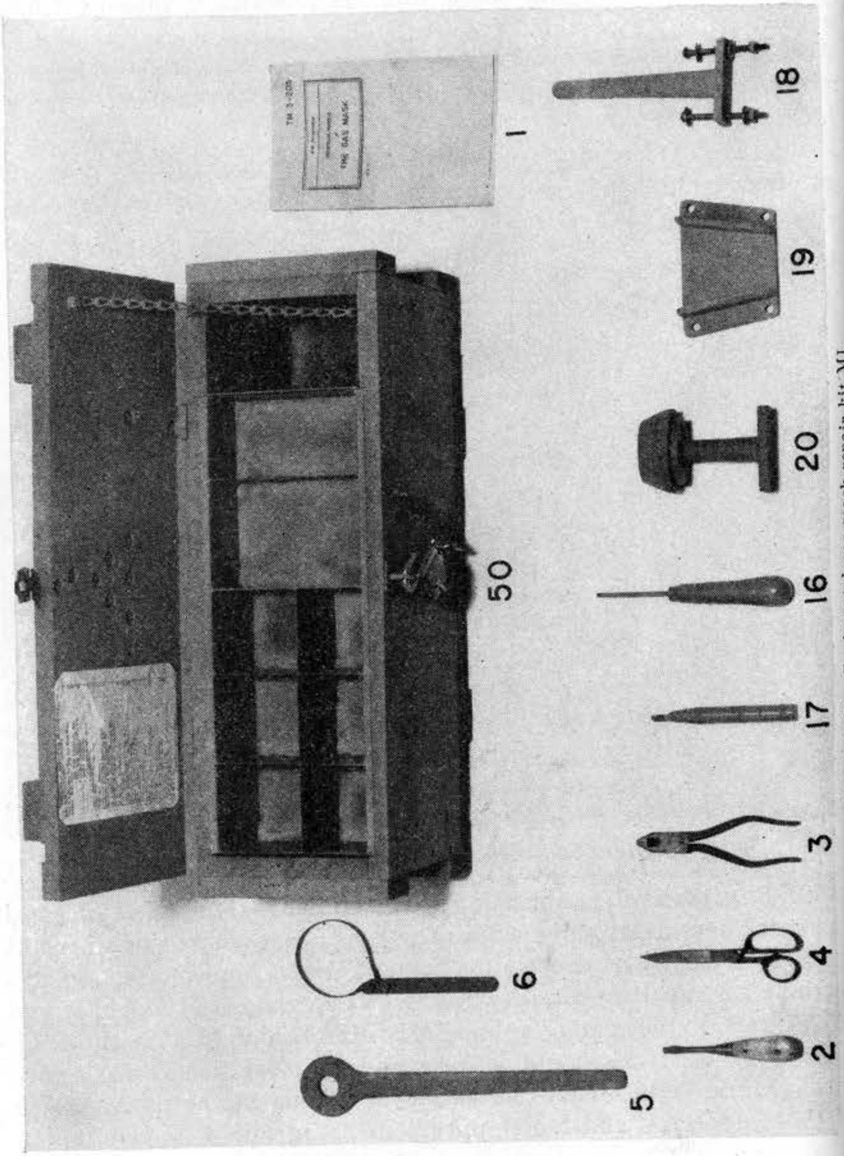


FIGURE 32.—Regimental gas mask repair kit M1.

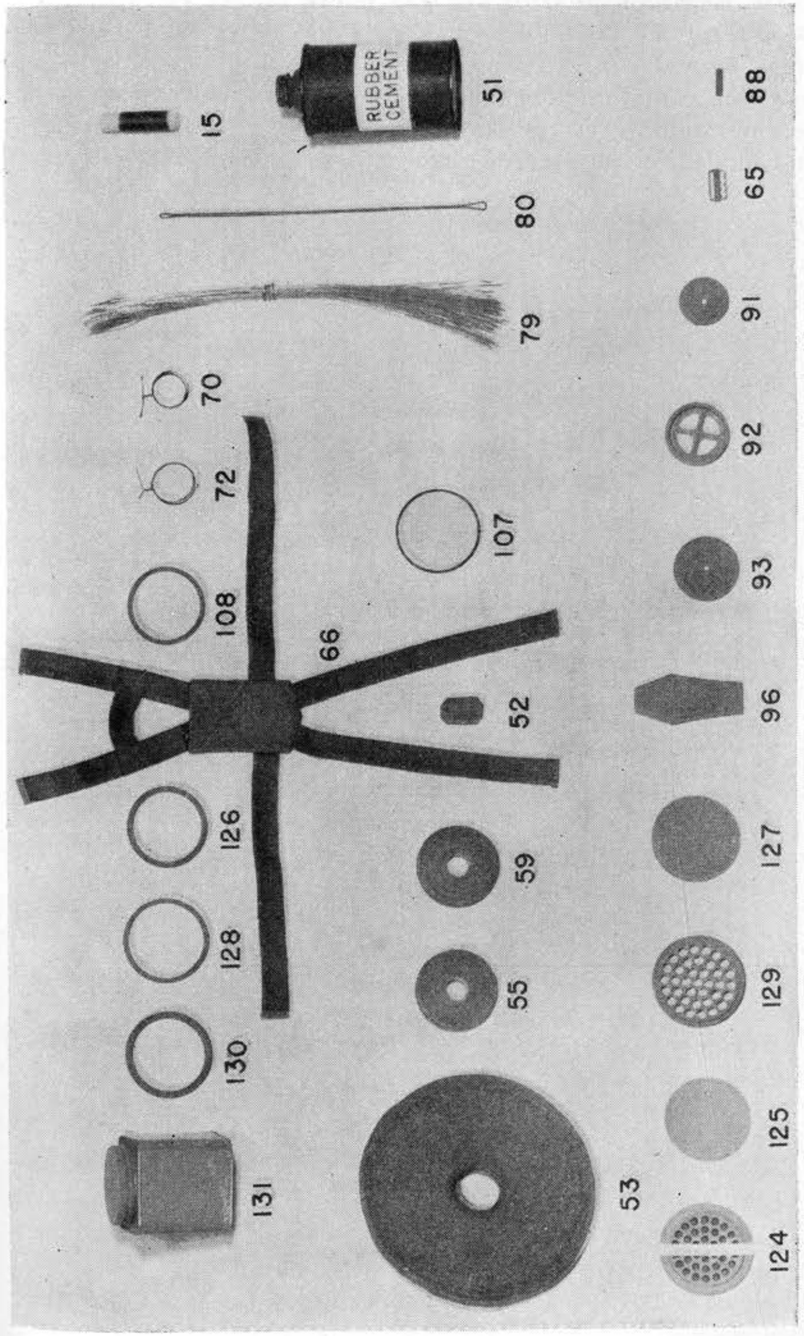


FIGURE 33.—Regimental gas mask repair kit M1—spare parts and materials.

31. Regimental training gas mask repair kit M3.—The gas mask repair kit for training masks MI and MIA1 (or M2 and M2A1) (figs. 34 and 35) is a wooden box containing a wooden tray and partition, containing the materials, implements, and directions for repairing training gas masks in the field. A list of these materials and implements appears in paragraph 2, appendix III.

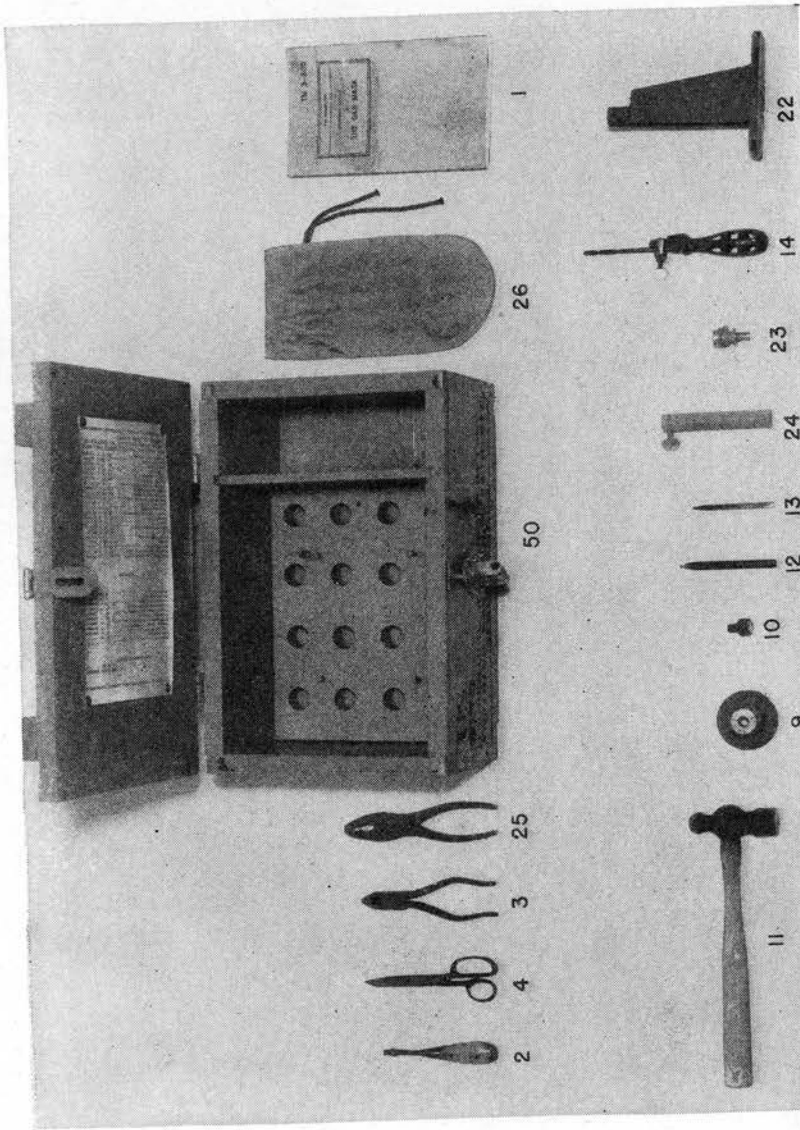


FIGURE 34.—Regimental gas mask (training) repair kit M3—tools.

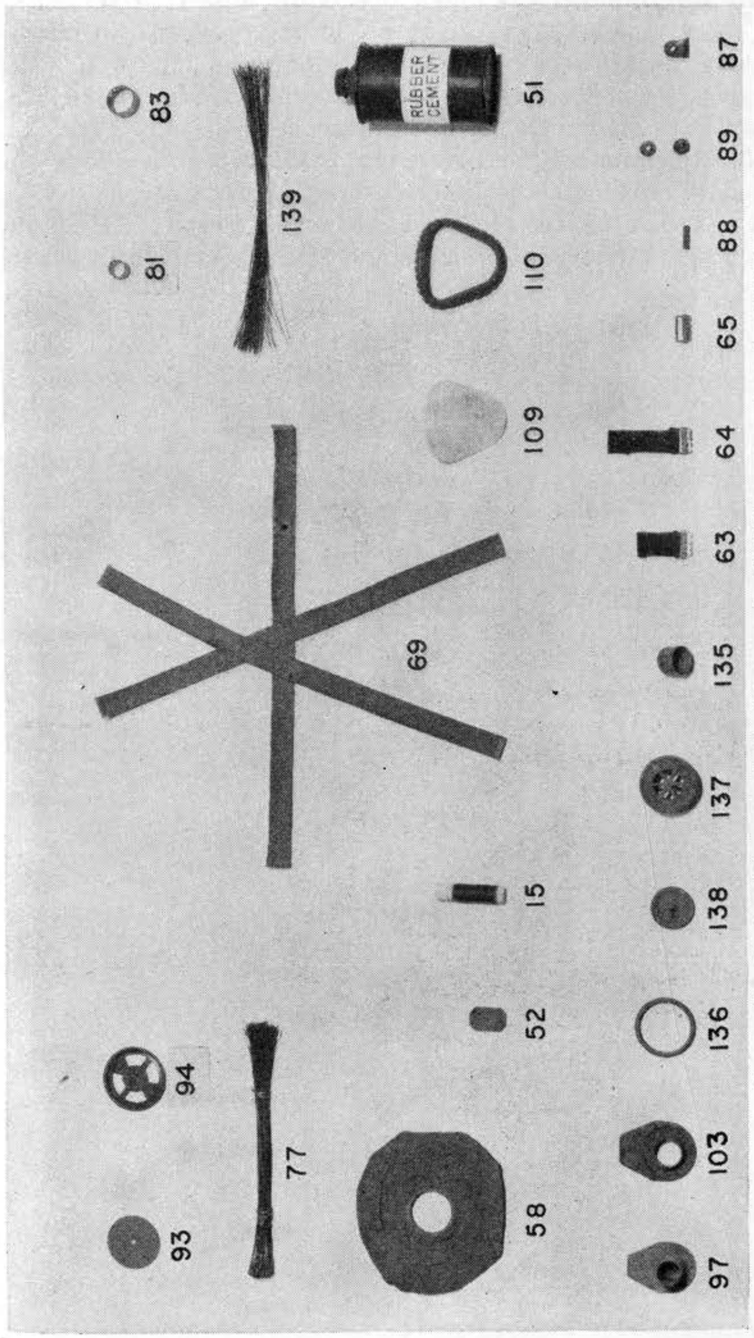


FIGURE 35.—Regimental gas mask (training) repair kit M3—spare parts and materials.

32. Regimental gas mask repair kit M4.—The M4 regimental gas mask repair kit was designed for the repair of all masks covered by the MI repair kit, and also for the repair of the M3 diaphragm facepiece, covered by the M5 repair kit. This kit has been classified as limited standard and is not issued.

33. Regimental gas mask repair kit M5.—The M5 regimental gas mask repair kit was designed for and contains tools, spare parts, and materials for the repair of the service facepiece MIA2 and the diaphragm facepiece M3 (figs. 36 and 37). This repair kit is also suit-

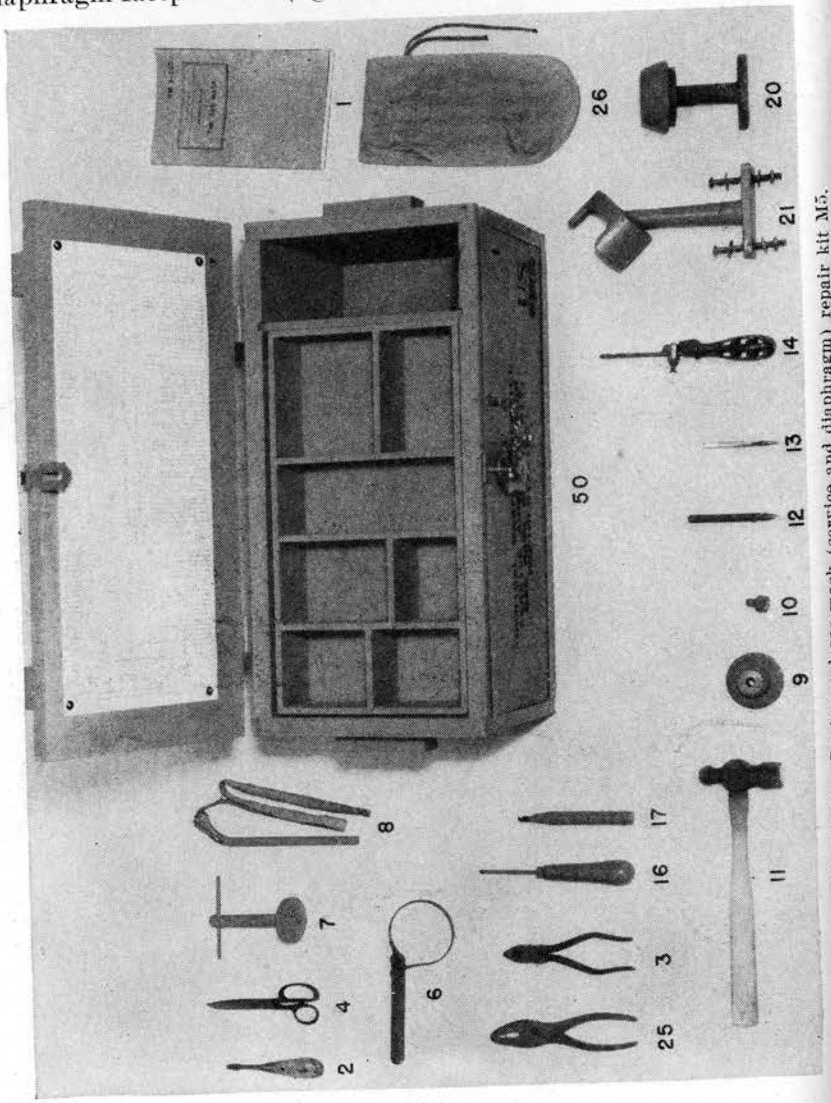


FIGURE 36.—Regimental gas mask (service and diaphragm) repair kit M5.

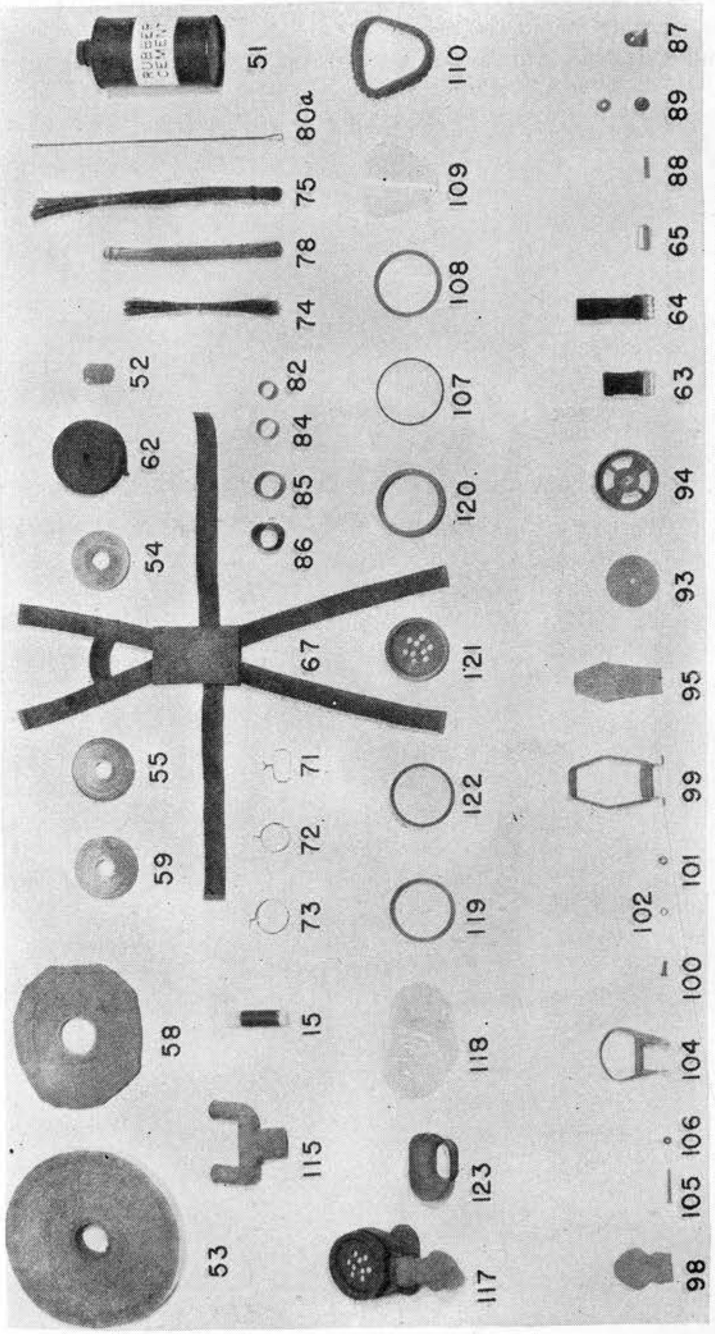


FIGURE 37.—Regimental gas mask (service and diaphragm) repair kit M5—spare parts and materials.

able for such repairs of all gas mask hose, carriers, and service canisters as may be made in the field. A list of the tools, spare parts, and materials appears in paragraph 3, appendix III.

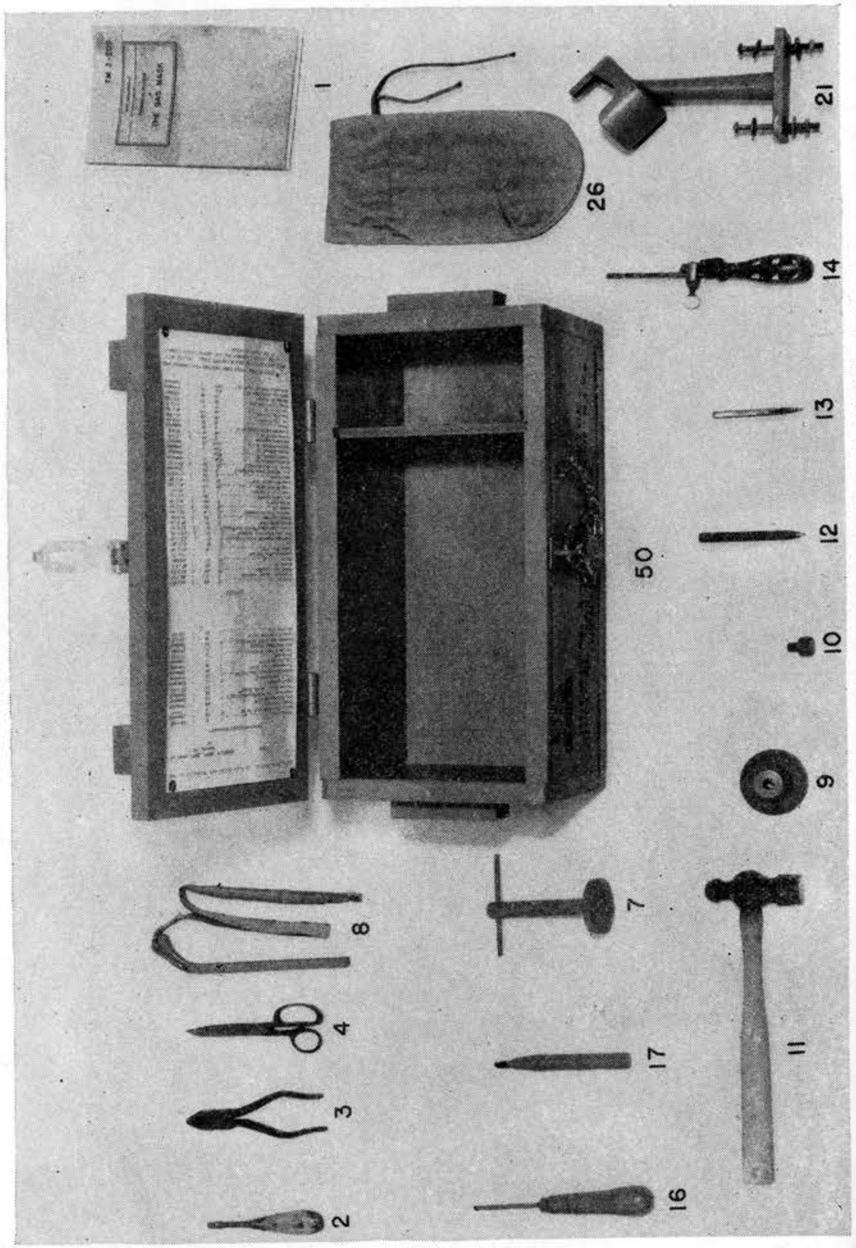


FIGURE 38.—Regimental gas mask (optical) repair kit M6—tools.

34. Regimental gas mask repair kit M6.—The M6 regimental gas mask repair kit was designed for and contains tools, spare parts, and materials for the repair of the optical gas mask M1–1–5 (figs. 38 and 39). A list of the tools, spare parts, and materials appears in paragraph 4, appendix III.

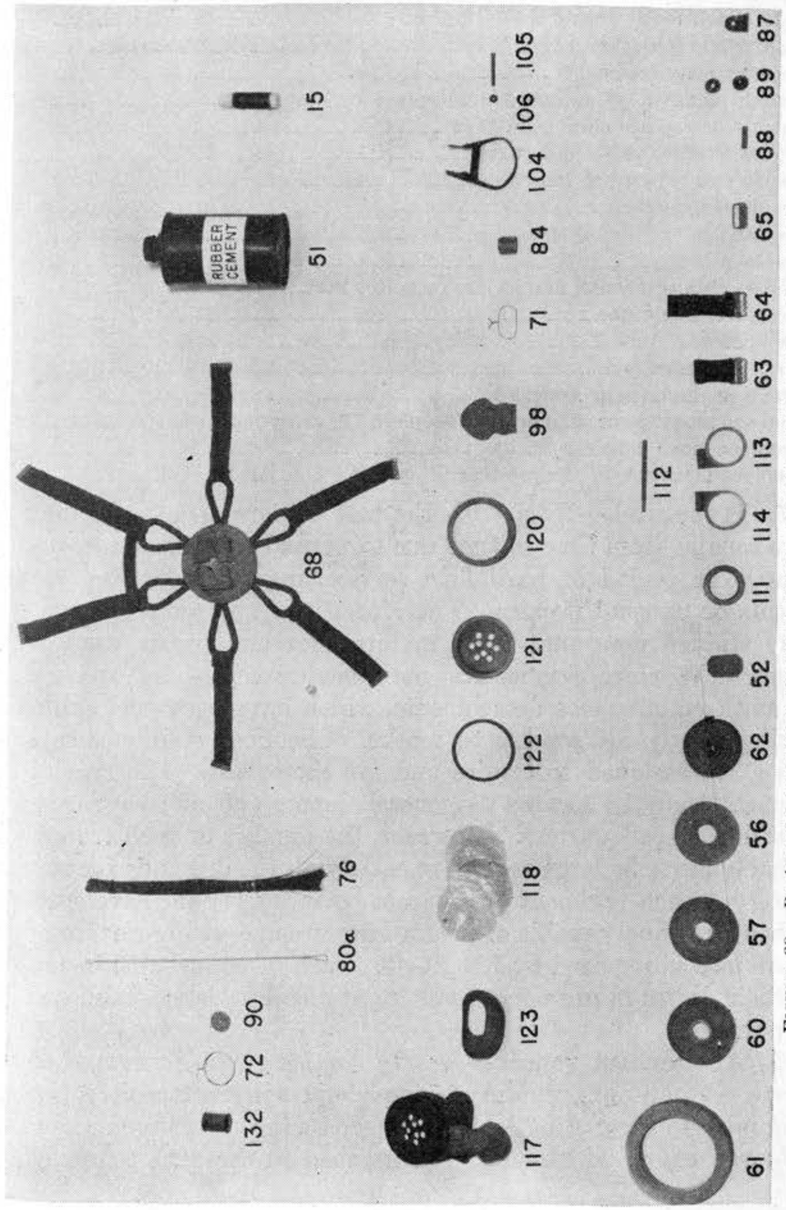


FIGURE 39.—Regimental gas mask (optical) repair kit M6—spare parts and materials.

SECTION VII

REPAIR PROCEDURE

35. Personnel.—Even with the best of care, gas masks may require repairs from time to time due to normal wear and tear. After a battle or period of hard field service, many masks may require difficult or unusual repairs. Therefore, it is necessary to have specially trained personnel to do maintenance and repair work. The Chemical Warfare Service has maintenance companies and special gas mask maintenance detachments, which have personnel skilled in making nearly all repairs to masks. Chemical maintenance companies are assigned to armies and are motorized. The special detachments may be located at general depots and at corps area and department headquarters. However, the number of such troops will probably never be large enough to satisfy all the demands for repairs. Therefore, each regiment or separate battalion should have specially trained personnel capable of performing or supervising certain minor repair jobs as required by FM 21-40. Such personnel will be trained for their duties in gas noncommissioned officer schools established for the purpose.

36. Authorized repairs.—*a. By company gas noncommissioned officers.*—Temporary repairs of minor defects in the facepiece, hose, or other parts of the gas mask may be made by the company gas noncommissioned officer with materials furnished in the MII company gas

mask repair kit. Any more serious repair must be made by other agencies.

b. By regimental or battalion gas noncommissioned officers.—When the regiment or separate battalion is in garrison and is located so that shipment of reparable gas masks to any chemical depot or a chemical maintenance company is not economical or feasible, as decided by the army commander, masks will be repaired within the organization concerned. These repairs will be supervised by the unit gas officers of the organization who will be assisted by the organizational gas noncommissioned officers (sometimes called chemical noncommissioned officers in Tables of Organization). The latter will organize and train such personnel as may be detailed to make the repairs and will act as inspectors and foremen of improvised mask repair crews. These gas noncommissioned officers or improvised repair crews will not undertake any repairs other than those specifically authorized herein. Masks requiring repairs of a more difficult nature will be turned over to special chemical maintenance company or detachment personnel for reconditioning or disposal. The following repairs or replacements may be made within the organization by experienced and trained regimental or battalion gas noncommissioned officers:

(1) Change or replace the head harness of all masks (par. 39). Replace buckle tabs on masks with fully molded facepieces.

(2) Patch small holes, cracks, or tears in the facepieces of all masks (par. 40).

(3) Repair the chin seam of the service facepieces MI, MIA1, and MIA2 and diaphragm facepieces MI and MIA1 (par. 41).

(4) Replace the outlet valve, service facepieces MI, MIA1, MIA2, M2, and M2A1; the training facepieces MI, MIA1, M2, and M2A1; the diaphragm facepiece M3; and the optical facepiece M1 (par. 42 *b*, *c*, and *d*).

(5) Replace eyepieces on all masks except the MI service, MI diaphragm, and the optical facepiece.

(6) Change or replace the canister on all gas masks (par. 44).

(7) Replace the inlet valve disks on all canisters except the MIX (par. 45).

(8) Replace the hose, all masks (par. 46).

c. By chemical warfare maintenance personnel.—Chemical warfare maintenance companies and detachments will have the necessary tools and equipment together with trained personnel experienced for nearly all kinds of repairs. These special gas mask repair sections may, at the discretion of the field army commander, be required to make all the repairs and replacements listed above. These special sections or crews will make all other necessary repairs and replacements except the ones specifically mentioned in *d* below.

d. Repairs not authorized.—(1) The following repairs will not be made in the field without special authorization from the Chief of the Chemical Warfare Service:

(*a*) Any repair which involves disassembly of the canister, such as would be necessary for the repair of the filter or the replacement of the chemicals.

(*b*) The replacement of the lenses in the optical facepiece M1, the service facepiece MI, and the diaphragm facepiece MI.

(2) The above repairs may, however, be made at such especially equipped depots, arsenals, or gas mask manufacturing establishments as may be designated by the Chief of the Chemical Warfare Service.

37. Repair squad organization and training.—In general, there are two types of gas mask repair personnel. They are indicated in paragraph 36*b* and *c*, describing the repairs which may be performed by each.

a. Unit gas noncommissioned officers.—Personnel to assist trained gas noncommissioned officers is obtained from the organization concerned and is trained and supervised by the noncommissioned officers charged with the repairs. The organization of a temporary repair team may follow that shown for the gas mask repair squad described below. However, the circumstances will determine the number of men needed and the type of work they will do.

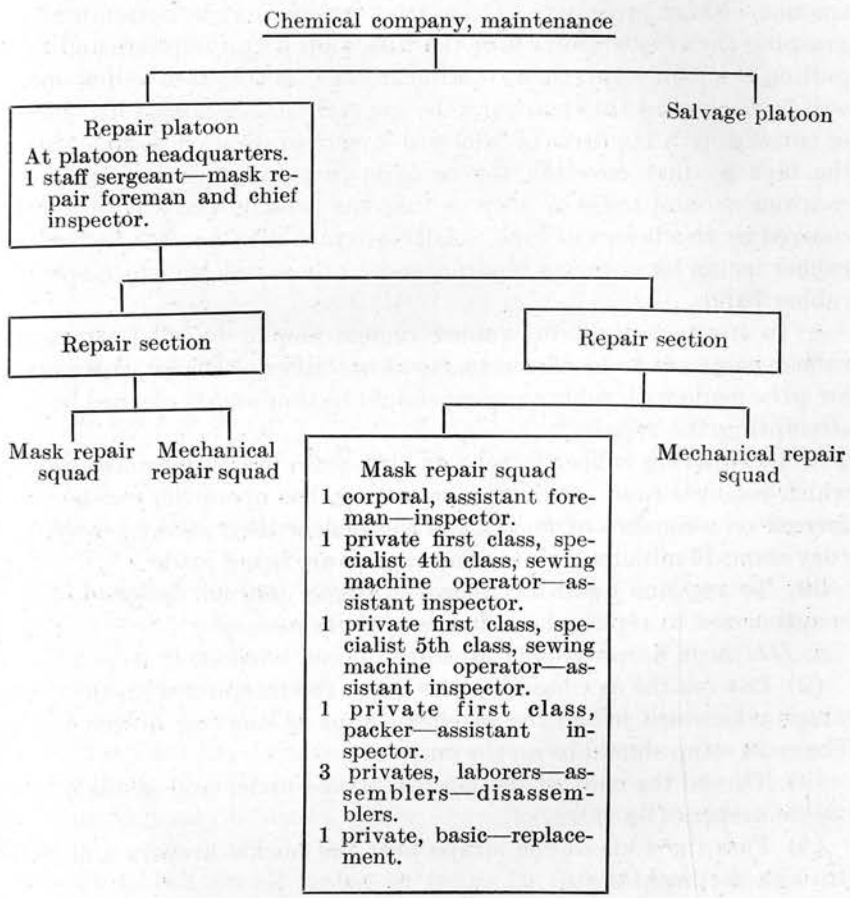
b. Chemical Warfare Service repair squads.—Those repairs which are too extensive, involved, or difficult to be made by the unit gas noncommissioned officers in the field are performed by special gas mask repair sections in the chemical maintenance companies, or gas mask repair detachments at corps area and department headquarters and general depots.

(1) A gas mask repair section of the repair platoon of a chemical maintenance company is shown in the organization diagram in table VII. The squad organization is also suitable for large scale gas mask inspection operations such as described in section VIII. The repair section is equipped with repair tables and benches, all of the tools listed in paragraph 4, appendix III, together with special jigs, dies, racks, sewing machines, canister testing machines, spray painting and disinfecting apparatus. The section may also improvise additional equipment necessary for such other repairs as may be required in the field.

(2) The special gas mask repair detachments may be organized at corps areas and department headquarters or general depots as the

occasion or necessity requires. These do not necessarily have to follow the squad organization outlined in table VII.

TABLE VII.—*Organization of a gas mask repair crew based on T/O 3-47*



38. Standard manipulation.—*a.* In handling repairs of gas masks some of the manipulations are the same for all masks; for example, rubber cement may be applied to chin seams and tears with a small brush, if available. It can be applied to the inside of the ends of hose best with the index finger. Any tool that lends itself to the purpose may be used. Whenever it is necessary to remove old parts from a gas mask in order to make repairs, replacement by new parts should be made where the old ones appear to be near the end of their usefulness.

b. Whenever binding wire is used, it should be tightened carefully; then all the excess wire except three turns (or twists) should be cut off. The turns should be carefully bent alongside parallel to the loop. Practice is required to learn how to tighten the wire to the exact amount without breaking. The correct tension may be determined by grasping the twisted portion of the wire loop with the pliers and first pulling the loop tight, then twisting to take up the slack. Few loops will be broken in this manner. In general, all binding wire should be covered with 1¼ turns of adhesive tape to prevent corrosion. Start the tape by first covering the bent down twist with one end, and continue around the wire loop so that the bent down twist is finally covered by two layers of tape. Adhesive tape may be used instead of rubber bands for covering binding wire in those repairs which specify rubber bands.

c. To insure a tight fit, rubber cement should be used whenever rubber parts are to be affixed to metal or rubber. Places where seals are to be made with rubber cement should be thoroughly cleaned before attempting the repair.

d. In applying rubber cement on chin seam or for facepiece patch, which requires time for drying or setting, the operation can be performed on a number of masks and the cement then allowed to set up (dry about 15 minutes) while other repairs are being made.

39. To replace head harness.—Any gas noncommissioned officer is authorized to replace head harness where necessary.

a. MII head harness.—(1) Remove the old harness.

(2) Lay out the new head harness inside the facepiece with the short straps which are joined by an elastic tape at the top of the mask. The cross strap should be on the outside.

(3) Thread the ends of the harness straps under and inside of the buckle keepers (fig. 40).

(4) Pass the ends of the straps over the buckle keepers and back through the buckles.

NOTE: Since the clinch tip is longer than the buckle opening, it must be inserted at an angle.

(5) Pull ends of strap through buckle about 1 inch.

b. Triangular pad head harness (par. 7*f*).—With the head harness having the triangular headpad, the short straps are assembled to the top buckles in the same manner as the MII head harness.

c. Head harness for optical gas mask M1-1-5.—(1) Release the canister from the bail clamp.

(2) Remove the unserviceable head harness from the facepiece.

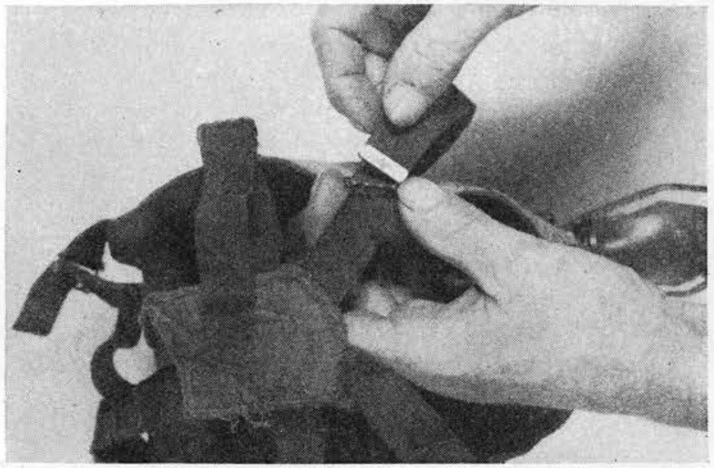


FIGURE 40.—Threading ends of harness straps under and around buckle keepers.

(3) Insert the straps of the new head harness into the respective buckles as described in *a* above, using another fully assembled facepiece as a guide.

NOTE.—The straps which are joined by the cross strap are assembled to the top of the facepiece.

(4) Reattach the bail clamp to the head harness and the canister.

d. Inspect all head harness replacements by stretching the assembled head harness at the headpad to see if all straps are of equal tension and that none are weakened.

e. Except in the event of minor damage to a head harness, it is preferable to replace the damaged head harness with a new one. Repairs such as the application of clinch tips (item 88) or sewing to repair minor damage may be made. (For items for gas mask repair see app. II.)

40. To patch small holes or tears in facepiece or hose.—*a. General.*—Damage to the facepiece rubber caused by a small cut, tear, or puncture may be repaired and made gastight by applying patches on the inner and outer surfaces of the facepiece over the cut, tear, or puncture. Care should be exercised in placing patches adjacent to the deflector or in patching adjacent holes that the patches used do not extend over the deflector or do not overlap. Patches incorrectly placed may cause channels through which air is directed to the hole or tear being repaired.

b. Procedure.—(1) Use solvent (benzene, straight gasoline, or dry-cleaning fluid) and a rag to clean the area around the hole to be covered. This area should be slightly larger than the patch.

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(2) Apply a thin even coat of rubber cement (fig. 41) on the cleaned area.

(3) Let the cement set (dry for about 15 minutes).

FIGURE 41.—Applying rubber cement for facepiece patch.

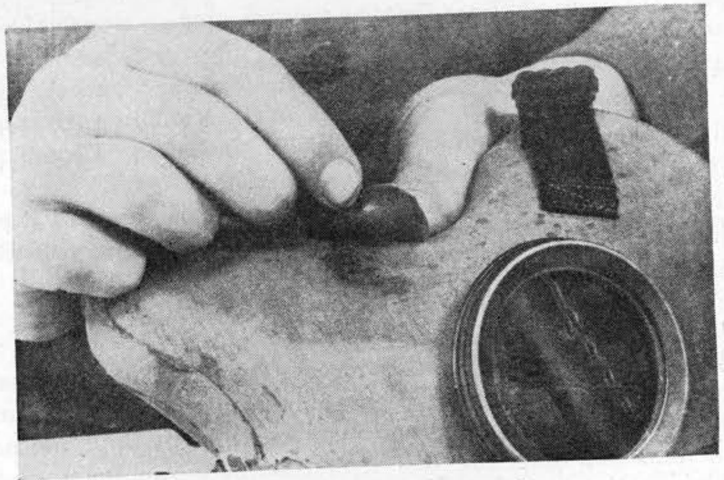

FIGURE 42.—Placing patch over hole.

(4) Apply a second thin coat of cement; let it set.

(5) Place a single patch on the area and press it down with the fingers (fig. 42).

c. Notes.—(1) Patches will adhere to the fabric of cloth-covered rubber facepieces as well as to the rubber. Always apply the rubber side of the patch to the mask.

(2) Tears at the edge of the facepiece must be very carefully inspected after repair to make certain that a crack or channel does not result.

(3) As a rule, a tear in a facepiece that extends to the edge of the facepiece or a tear ½ inch or more in length cannot be successfully repaired due to the strain (stretching of the rubber) in adjustment of the mask to the face. Except in an emergency, a facepiece with a defect of this nature will be replaced.

d. Test mask for leakage as prescribed in FM 21-40.

41. To repair or replace chin seam tape.—*a. If small section of tape becomes loose.*—(1) Apply rubber cement under the loose section of the tape as prescribed in paragraph 40*b*(2), (3), and (4) above.

(2) Press the tape firmly into place and smooth it out with the fingers or a screw driver handle.

(3) Test the mask for leakage as prescribed in FM 21-40.

b. If tape must be replaced.—(1) Remove the adhesive tape covering the wire around the facepiece at the angletube.

(2) Carefully remove the damaged chin seam tape.

(3) Clean with gasoline or other solvent the area to be cemented.

(4) Apply rubber cement as prescribed in paragraph 40*b*(2), (3), and (4) and as shown in figure 43.

(5) When cement is set, cut approximately 12 inches of ⅞-inch adhesive bias tape (item 53) from the roll, leaving the glazed linen fabric on the tape.

(6) Apply tape to the cemented chin seam, beginning inside the facepiece (fig. 44) and tucking it down between the angletube and facepiece as far as possible. Use fingers and screw driver handle to press tape smoothly into place. Keep the protecting linen on tape as long as possible to prevent adhesive side of tape prematurely touching cemented area or fingers. Gradually remove linen as tape is applied along chin seam. Work only a couple of inches at a time, keeping out all wrinkles.

NOTE.—Care must be taken that tape covers entire surface of chin pocket without bridging over. Care should also be exercised that tape is not stretched too tightly at point where it passes over edge of facepiece.

(7) Continue applying tape along outside of chin seam, over wire, and extending to edge of facepiece at angletube. Cut off excess bias tape.

(8) Replace adhesive tape over wire as prescribed in paragraph 38*b*, binding end of chin seam tape into place.

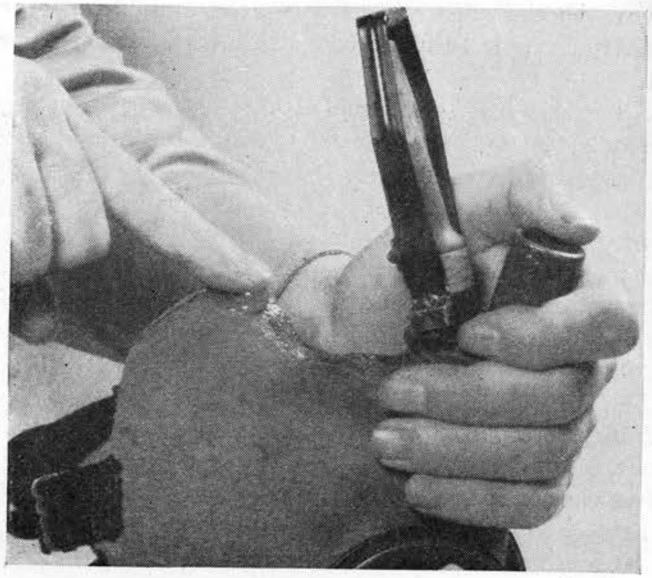

FIGURE 43.—Applying rubber cement to chin seam.

FIGURE 44.—Applying chin seam tape.

(9) Test the mask for leakage as prescribed in FM 21-40.

NOTE.—If chin seam tape between angletube and chin pocket is damaged it may be patched. If damaged elsewhere, it should be replaced.

42. To replace outlet valve and guard.—*a. General.*—Outlet valves usually fail before any of the other parts of the gas mask. Replacement, with the exception of the outlet valves on the MI, MIA1, and MII diaphragm gas masks, is comparatively simple. For these masks, replacements will not be made except by chemical maintenance company gas mask repair personnel as described in *e* and *f* below.

b. Service facepieces MI, MIA1, and MIA2.—(1) Unscrew the guard bolts and remove the guard.

(2) Remove the tape and wire around the outlet valve.

(3) Remove the old valve.

(4) Clean off the angletube outlet valve stem.

(5) Select new MI or MII outlet valve (item 95 or 96) and inspect for serviceability. Check length of valve by slipping it into place on outlet valve stem and hold guard in place on studs on outlet valve stem. End of valve should clear guard by about 3/16 inch. Remove valve from stem. If valve is too long, cut excess length off the *open* end.

NOTE.—The MII outlet valve is designed for use on the MI, MIA1, and MII diaphragm masks, and on the MI, MIA1, and MIA2 service masks. When used with the service masks, it is necessary to cut off 1/8 inch from the open end.

(6) Wrap the valve stem of the angle tube with 1¼ turns of 5/16-inch adhesive tape, allowing edge to extend 1/16 inch beyond edge of valve stem. Press loose edge of tape firmly down over edge of metal stem. Apply rubber cement over the tape and stem about ½ inch from its end.

(7) While rubber cement is still wet, pull the new outlet valve on over the end of the valve stem. Aline valve so that it projects straight out from the stem when viewed from the front, side, and end. Also, end must be parallel to long axis of outlet stem as shown in figure 45. The outlet ports should remain closed.

(8) Where outlet valve covers valve stem, wrap valve with 1¼ turns of 3/8-inch adhesive tape. Place one loop of .020-inch wire (item 70) over tape on outlet valve, tighten and cover as described in paragraph 38*b*.

(9) Replace guard. Lock washer should go under the nuts. The crosspiece (or brace) of the guard should be on the side next to the chin.

(10) Test the mask for leakage as prescribed in FM 21-40.

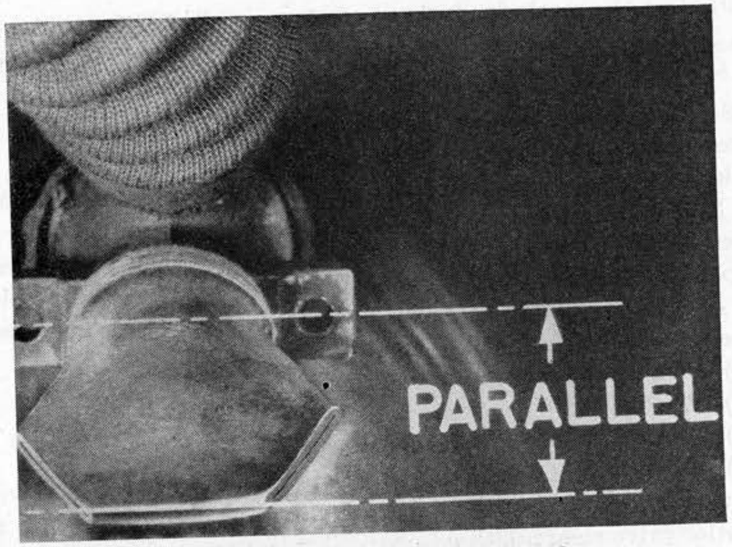

FIGURE 45.—Outlet valve correctly alined.

c. Training facepiece and service facepiece M2 and M2A1.—Replacements of the MIV (item 138) or circular type outlet valve will be made by using the MV valve and valve guard (items 97 and 103).

NOTE.—This will change the nomenclature of the facepiece to add A1 after the model number, i. e., M2 to M2A1.

(1) Remove the rubber band, binding wire, and tape from the outlet stem of the facepiece.

(2) Remove the outlet valve and valve guard from the facepiece.

(3) Remove the outlet valve from the guard.

(4) Insert the stem of a new outlet valve in the stem of the outlet valve guard (fig. 46).

(5) Pull the stem of the valve back onto the stem of the guard (fig. 47).

(6) Insert the valve and guard into the facepiece outlet stem (fig. 48). Be careful to aline vertically the valve unit and to set it all the way into the stem.

(7) Place 5 inches of ⅜-inch tape over the neck of the facepiece outlet valve stem.

(8) Place a 10-inch piece of .032-inch wire (item 77) over the tape and tighten it (fig. 49). Cut off the excess wire except for three twists and bend these twists down alongside, parallel to the loop.

(9) Place a size 1 (the smaller size) rubber band (item 81) over the wire by pulling it over the outlet valve guard (fig. 50).

(10) Test the mask for leakage as prescribed in FM 21-40.

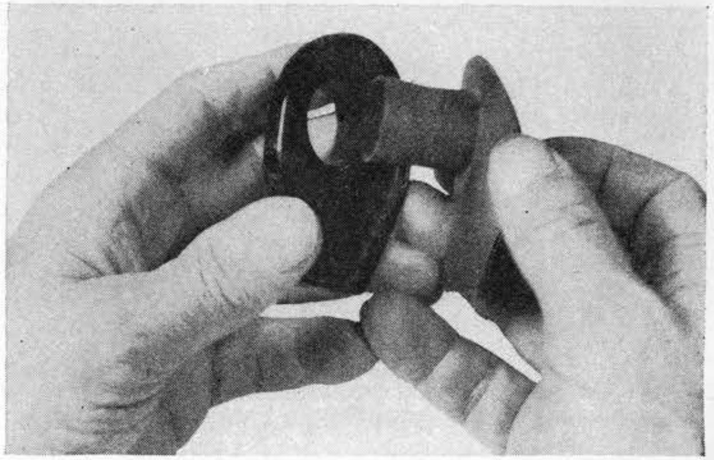

FIGURE 46.—Inserting MV valve in valve guard.

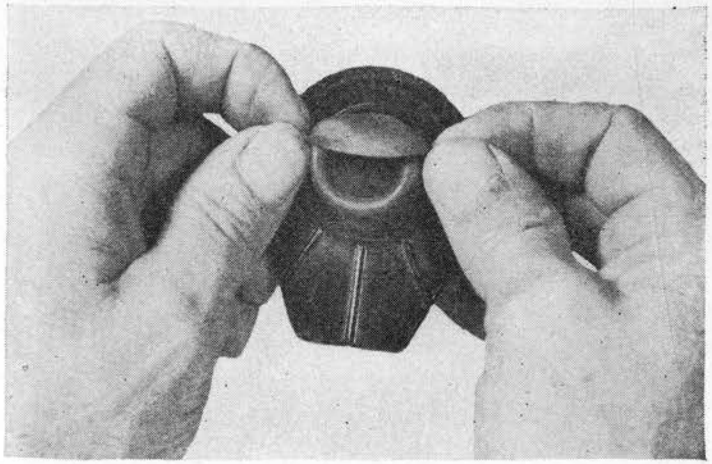

FIGURE 47.—Folding stem of valve over stem of guard.

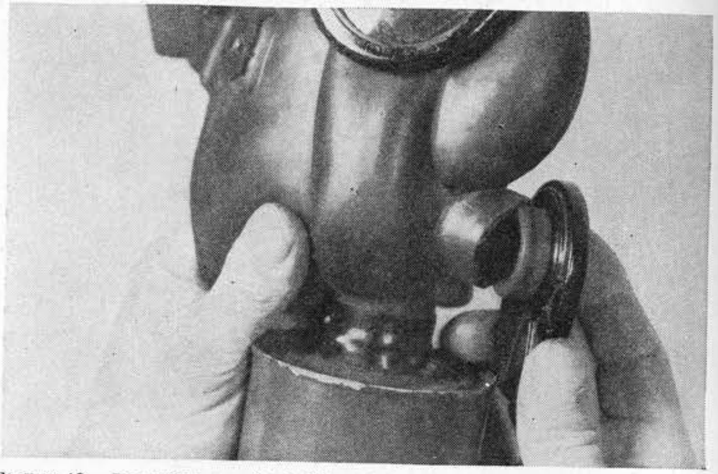

FIGURE 48.—Inserting assembled MV valve into facepiece outlet valve nozzle.

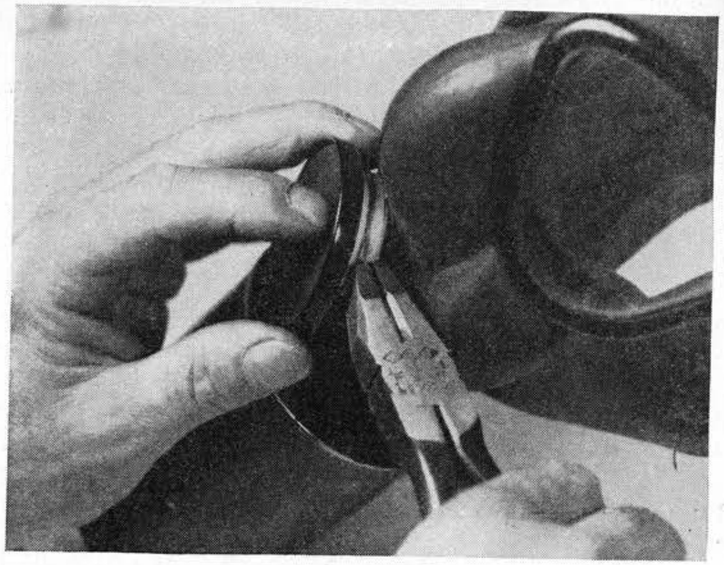

FIGURE 49.—Wiring valve to valve stem.

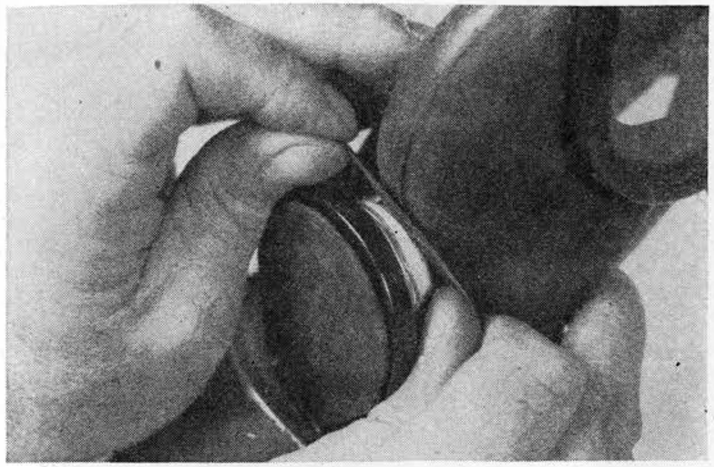

FIGURE 50.—Placing size 1 rubber band over wire.

d. M3 diaphragm and M1 optical facepiece.—(1) Unscrew the outlet valve guard bolt and take off the outlet valve guard.

(2) Remove the rubber band and binding wire from the old valve and pull off the valve.

(3) Unwind the old adhesive tape from the angletube outlet stem. Clean off this stem.

(4) Replace the tape just removed with 2½ inches (1¼ turns) of new ⅜-inch adhesive tape (item 58) with $\frac{1}{16}$ inch of the width of this tape projecting beyond the end of the angletube outlet stem.

(5) Apply a thin coat of rubber cement to the tape.

(6) While rubber cement is still wet, pull the new outlet valve on over the end of the valve stem. Aline valve so that it projects straight out from the stem when viewed from the front, side, and end. Also, end must be parallel to long axis of outlet stem as shown in figure 51. The outlet ports should remain closed.

(7) Where outlet valve covers valve stem, wrap valve with 1¼ turns of ⅜-inch adhesive tape. Place one loop of .020-inch wire (item 70) over tape on outlet valve, tighten, and cover as described in paragraph 38*b*.

(8) Replace outlet valve guard.

(9) Test the mask for leakage as prescribed in FM 21-40.

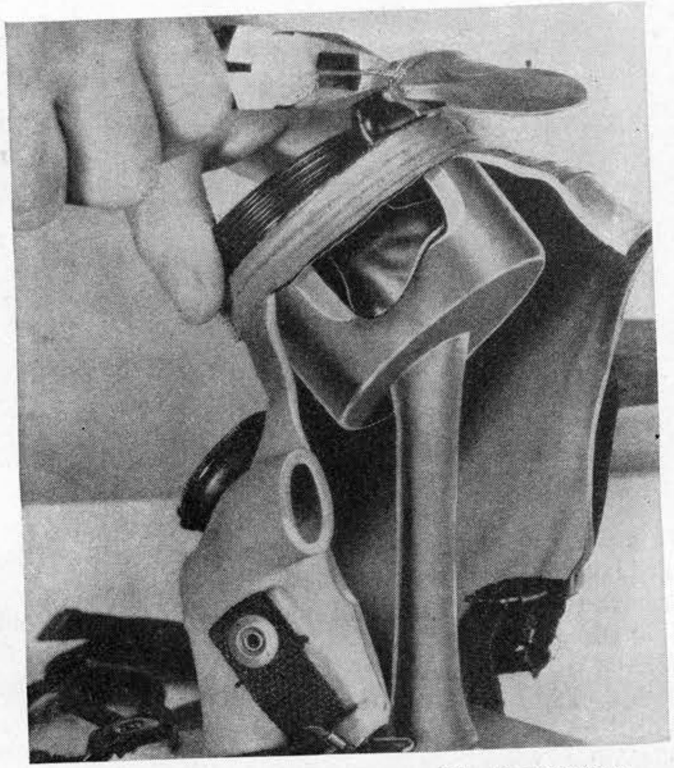

FIGURE 51.—Replacing outlet valve on M1 optical facepiece.

e. Diaphragm facepiece MI and MIA1.—(1) Using the combination wrench (item 5), unscrew and remove the diaphragm assembly (fig. 52).

(2) Remove the tape and wire from around the valve.

(3) Remove the valve.

(4) Remove adhesive tape from angletube outlet stem; clean the stem; replace with 1¼ turns of 5⁄16-inch tape (item 55) folding 1⁄16 inch of width of tape over end of stem.

(5) Insert a new rubber valve (item 96). Fold the end down over the angletube outlet stem (fig. 53).

(6) Where the outlet valve covers valve stem, wrap valve with 1¼ turns of adhesive tape. Place one loop of .020-inch wire (item 70) over tape on outlet valve, tighten, and cover as described in paragraph 38*b*.

(7) Replace the diaphragm assembly as prescribed in paragraph 51*a* (fig. 52).

(8) Test the mask for leakage as prescribed in FM 21–40.

FIGURE 52.—Replacing diaphragm in MI diaphragm assembly using combination wrench (item 5).

f. Diaphragm facepiece MII.—(1) Remove the angletube (fig. 11) from the facepiece as prescribed in paragraph 48*c*.

(2) Remove the tape and wire from around the outlet valve.

(3) Remove the valve.

(4) Take a new MII outlet valve (item 96) and cut off ⅝ inch of the neck. The valve will then be 2¾ inches long.

(5) Insert the new valve in the stem. Fold the end of the neck of the valve down over the outlet valve stem (fig. 54). Center the valve properly. Make certain that the outlet ports of the valve are closed.

(6) Place 1¼ turns (3½ inches) of 5⁄16-inch tape (item 55) around the folded part of the valve.

(7) Place a loop of .020-inch wire around the tape and twist it tightly. Cut off the surplus wire leaving ¼ inch of the twist. Press the twist parallel to the rest of the loop.

(8) Cover the wire with 1¼ turns of 5⁄16-inch tape.

(9) Replace the angletube in the facepiece as prescribed in paragraph 49*c*.

(10) Test the mask for leakage as prescribed in FM 21–40.

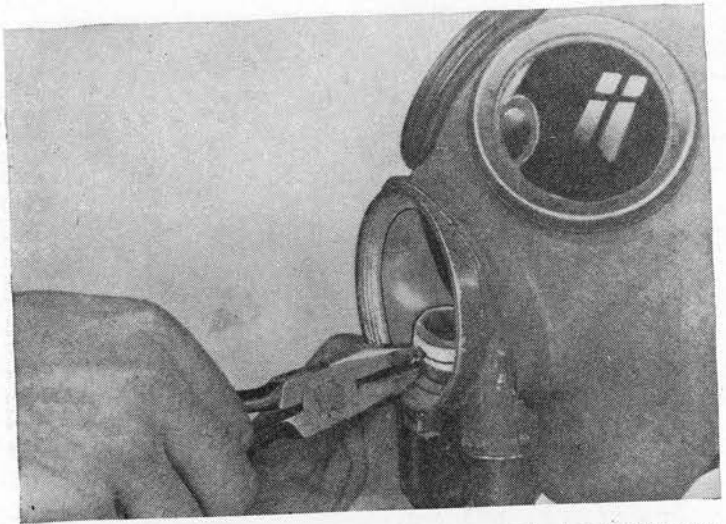

FIGURE 53.—Wiring outlet valve to valve stem on MI diaphragm angletube.

FIGURE 54.—Replacing outlet valve on MII diaphragm angletube.

43. To replace or repair eye lenses.—*a. Types on which repair is impracticable.*—The "crimped on" eyepieces of the MI service and MI diaphragm facepieces and the small well-protected eyepieces of the M1 optical facepiece do not lend themselves to practicable repair or replacement, except by highly skilled mechanics equipped with special tools.

b. Service facepieces MIA1 and MIA2 and diaphragm facepieces MIA1 and MII.—(1) Hold the facepiece with a firm grip with one hand. Unscrew the eyepiece retainer ring with the lens wrench (item 6).

(2) Remove the defective lens and gasket.

(3) Place a thin coat of rubber cement on a new 2¾-inch outside diameter gasket (item 108).

(4) Insert the gasket and the new lens (item 107). (See fig. 55.)

(5) Replace the retainer ring (fig. 56) and tighten it with the lens wrench (fig. 57).

(6) Test the mask for leakage as prescribed in FM 21-40.

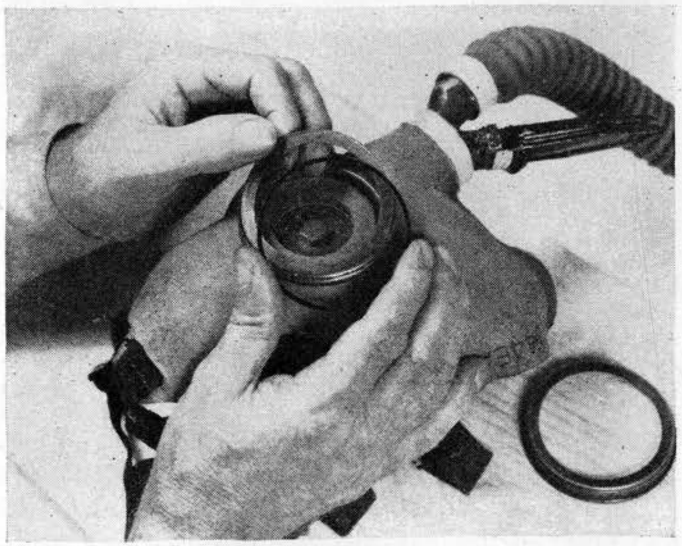

FIGURE 55.—Inserting new gasket and lens.

c. Training facepieces MI and MIA1; M2 and M2A1; service facepieces M2 and M2A1; and diaphragm facepiece M3.—(1) Insert the handle of the 6-inch pliers under each of the 32 tabs of the eye ring (item 110) in turn as shown in figure 58 and bend them back so that they are at right angles to the front surface.

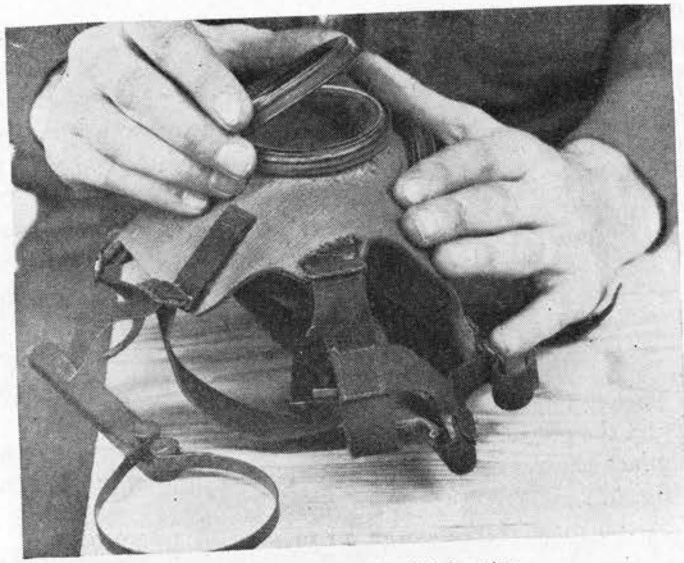

FIGURE 56.—Replacing binder ring.

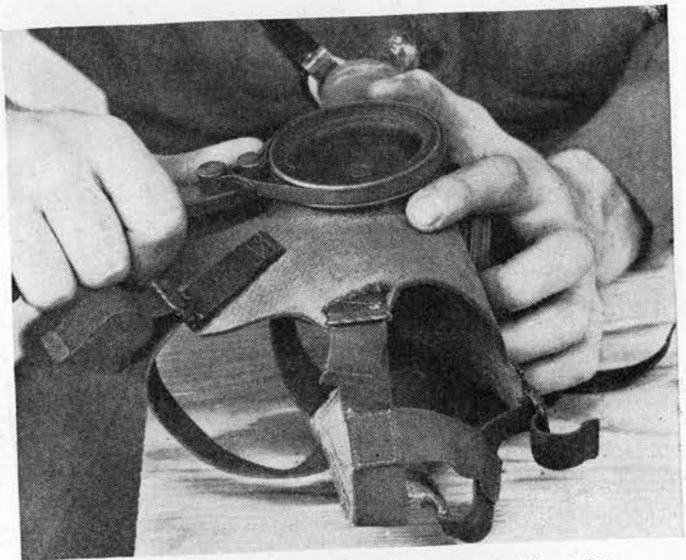

FIGURE 57.—Using lens wrench to tighten retainer ring.

(2) Lift off the eyepiece ring and remove the lens (item 109).
(3) Place the new lens in the socket.

NOTE.—Some lenses are marked with lines while others are marked with dots. Place the eye ring on the lens so that the marks on the ring coincide exactly with those on the lens. Make certain that the lens is in its proper position.

(4) Using the handle of the pliers (or screw driver), bend one of the tabs at the bottom of the eye ring over and behind the eyepiece (fig. 59). Then bend over one on the top and each side of the eyepiece. Continue this in turn until all the tabs have been bent into place (fig. 60).

(5) Test the mask for leakage as prescribed in FM 21-40.

44. To replace canister.—*a. Service and diaphragm masks.*—(1) Remove the tape and wire from the hose at the canister elbow nozzle.

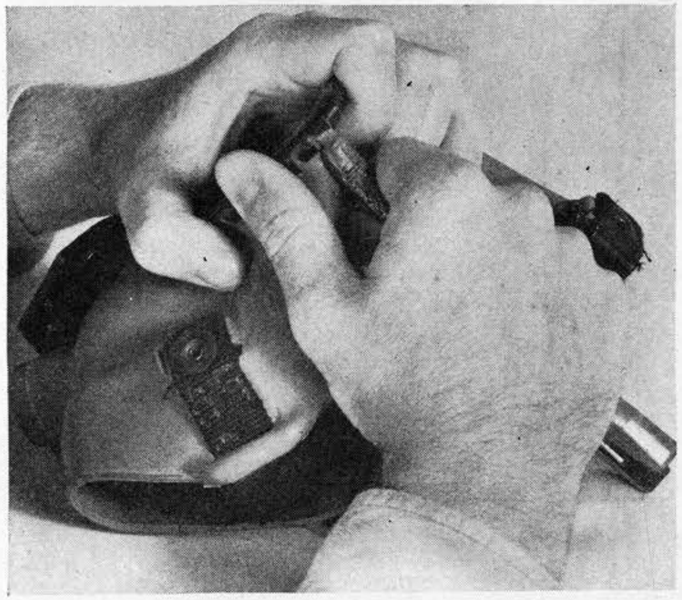

FIGURE 58.—Opening eye ring tabs—training mask.

(2) Remove the old canister.
(3) Place a thin coat of rubber cement on the inside of the hose with the index finger.
(4) Place a loop of .032-inch wire (item 73) over the hose.
(5) Insert the nozzle of the new canister into the hose about ¾ inch.
(6) Tighten the wire loop around the hose (fig. 61).
(7) Cover the wire with 1¼ turns of ½-inch tape (fig. 62).
(8) Test the mask for leakage as prescribed in FM 21-40.

NOTE.—In replacing the canister, observe the same precaution as prescribed in "note," paragraph 46*a* (fig. 65).

FIGURE 59.—Closing corner tab on eye ring—training mask.

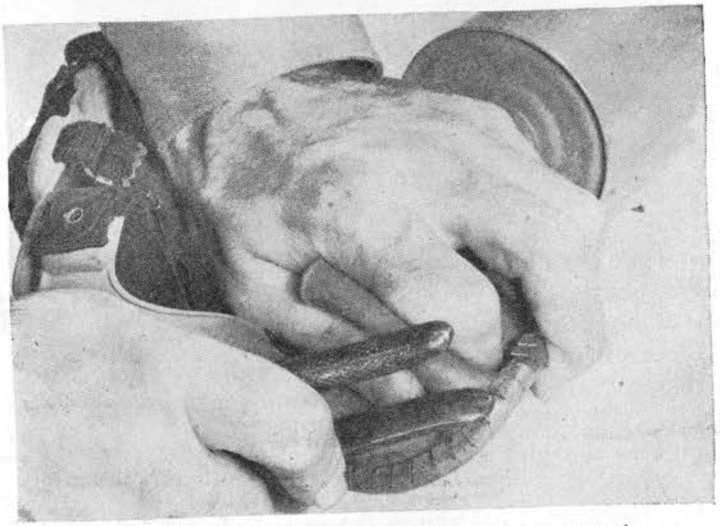

FIGURE 60.—Tightening tabs on eye ring—training mask.

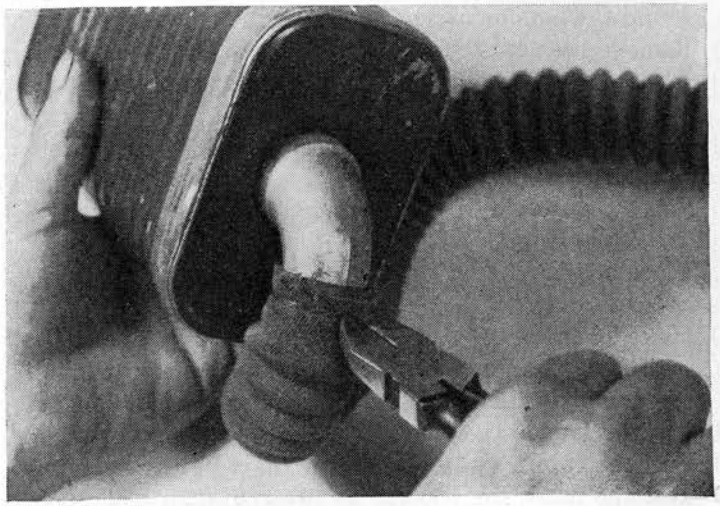

FIGURE 61.—Wiring hose to canister nozzle.

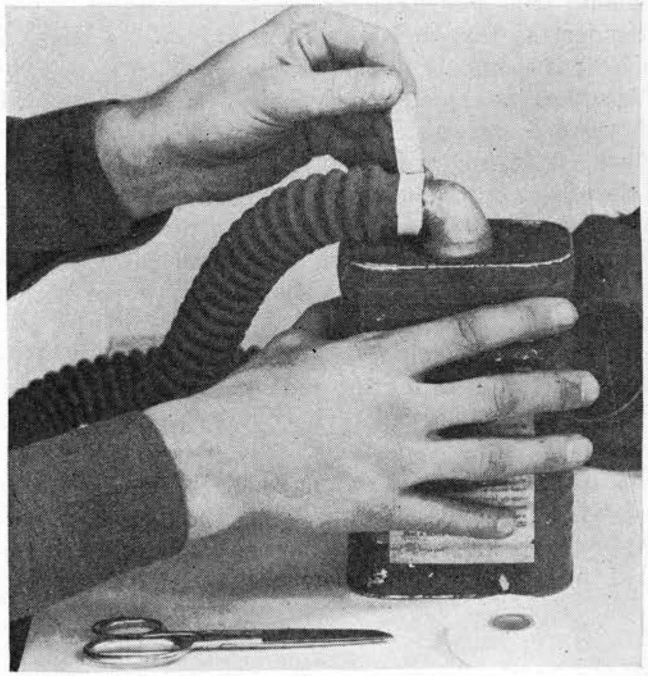

FIGURE 62.—Placing tape around wire.

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b. Training mask.—(1) Remove the rubber band, wire, and tape from around the outside of the canister stem.

(2) Remove the canister.

(3) Place a thin coat of rubber cement around the inside of the inlet stem of the facepiece.

(4) Place a size three rubber band (item 83) around the upper part of the inlet stem.

(5) Force the nozzle of the canister up into the inlet stem of the facepiece.

(6) Place a 5-inch strip of 3/8-inch tape around the inlet stem of the facepiece.

(7) Place 10 inches of 0.032-inch wire (item 77) around the tape, make two loops, tighten the wire with the pliers, cut off all of the extra wire except for three twists. Press these twists down alongside, parallel to the loops.

(8) Pull the rubber band down over the wire.

(9) Test the mask for leakage as prescribed in FM 21-40.

c. Optical gas mask M1-1-5.—(1) Remove the canister from the headpad by lifting the end of the canister spring slightly and pull the bail clamp from under the spring.

(2) Remove the tape and wire from around the hose and detach the hose from the canister.

(3) Place the new canister on the bail clamp with the canister inlet facing downward and to the rear.

(4) Place a 0.032-inch wire loop (item 72) around each hose elbow, and slip them back on the hose until needed.

(5) Apply one coat of rubber cement to the inside surface of the hose elbows, and while the cement is still wet force the hose elbows onto the canister nozzle and place the hose in proper position, using an assembled mask as a guide.

(6) Apply a 5-inch strip of 5/16-inch adhesive tape around each hose at the canister, allowing the ends of the tape to overlap.

(7) Place the wire loops previously placed on the hose around each hose over the adhesive tape and 1/4 inch from the end of the hose, so that the turns of the wire lie together and cross each other where the wire is to be twisted.

(8) Tighten and cover the wire loop as directed in paragraph 38*b*.

(9) Test the mask for leakage as prescribed in FM 21-40.

45. To replace inlet valve disk.—*a. Canisters MIIR, MIIIR, MIV, MVIII, MIXA1 training and special canisters.*—(1) Force the metal valve seat out with a screw driver.

NOTE.—In removing an inlet valve seat with screw driver do not exert pressure in just one place. Insert the screw driver beneath the flange, pry gently, move to another place, and repeat until the valve seat is loosened. To do otherwise is liable to cause a set or bend in the valve seat flange, thus preventing an airtight fit.

(2) Remove the rubber disk and clean the valve seat.

(3) Place a new rubber disk (item 91 or 93) on the metal pin in center of valve seat. (On the MVIII, MIXA1 and training canisters use the large-sized—2 1/16-inch—disks.

(4) Insert the valve in the canister, seat it squarely, then press in place with butt of hand, finally seating with a hard rap of the hand.

(5) To test, fit the assembled mask to the face, close the outlet valve, and exhale. Leakage can be felt at the valve.

b. Optical gas mask canister M1.—(1) Remove the canister from the hose as prescribed in paragraph 44*c*.

(2) Lift the edge of the inlet valve disk with the end of a screw driver until the valve disk can be grasped between the thumb and the screw driver.

(3) Pull the old valve disk out and insert a new valve disk (item 90), pushing it gently over the head of the stud in the valve seat so that the valve disk lies evenly against the valve seat.

(4) Replace the canister on the hose as prescribed in paragraph 44*c*.

(5) To test, fit the assembled mask to the face, close outlet valve, and exhale. Leakage can be felt at the air intake.

NOTE.—Leakage of the inlet valve disks also may be indicated by abnormal fogging of the lenses.

46. To replace hose.—*a. All masks except optical gas mask M1-1-5 and training gas masks.*—(1) Remove the tape and wire from around the hose at both ends.

(2) Remove the old hose from the nozzle elbow of the canister and from the angletube hose stem.

(3) Place a loop of .032-inch wire (item 73) around one end of the new hose.

(4) Apply a thin layer of rubber cement around the inside of the ends of the new hose with the index finger.

(5) While cement is still wet, insert the hose stem of the angletube into one end of hose.

(6) Tighten and cover the wire loop as directed in paragraph 38*b* (figs. 63 and 64).

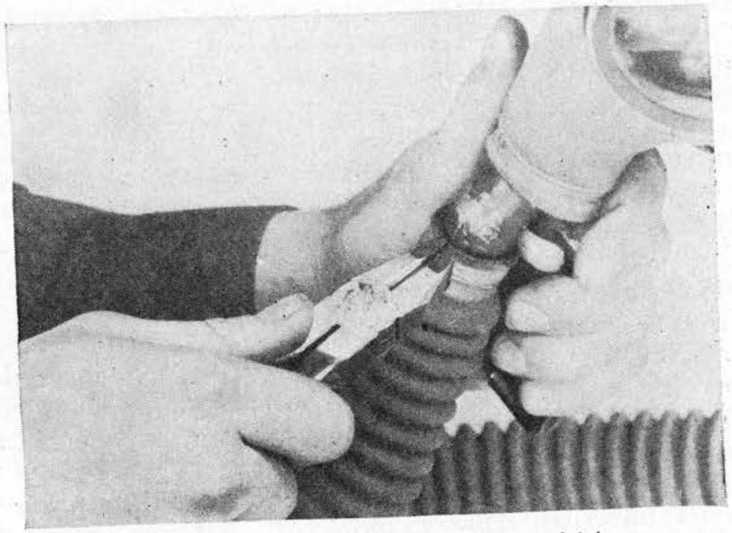


FIGURE 63.—Wiring hose to hose stem of angletube.

(7) Proceed with the attachment of the canister to the other end of the hose (figs. 61 and 62).

NOTE.—When inserting the canister nozzle into the hose, the canister and the facepiece must be in the same plane. Hold the canister and allow the facepiece to hang free. The broad side of the canister should be parallel to the chin seam of the facepiece (fig. 65).

(8) Test the mask for leakage as prescribed in FM 21-40.

FIGURE 64.—Covering wire with tape.

b. To replace elbow hose on optical gas mask M1-1-5.—(1) Detach the defective hose from the canister nozzle and from the metal sleeve in the end of the inlet tube of the facepiece. The defective hose is detached from the metal sleeve in the same manner and with the same tools as used in detaching the hose from the canister.

(2) Attach a new hose to the canister nozzle in the manner described in paragraph 44*c*.

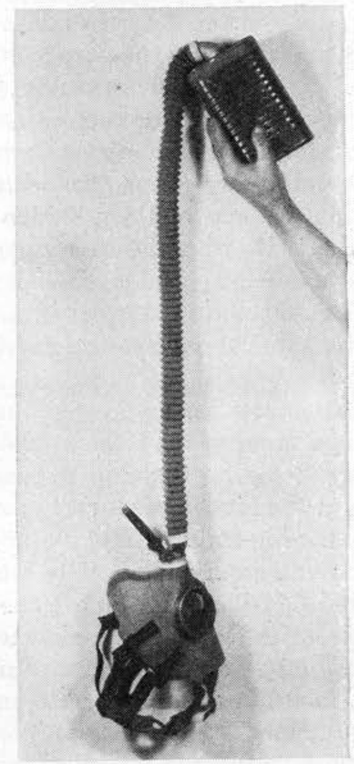


FIGURE 65.—Assembling complete gas mask—canister and facepiece must be in same plane.

(3) Place one loop of .032-inch wire (item 72) around the free end of the elbow hose and slip it back on the hose.

(4) Apply one coat of rubber cement to the inside surface of the free end of the hose and before the cement dries slip the end of the hose over the metal sleeve in the inlet tube until the end of the hose and the inlet tube meet, and turn the hose to the proper position, using an assembled mask as a model.

(5) Apply a 4-inch strip of 5/16-inch adhesive tape around the end of the hose, allowing one end of the tape to overlap its other end. An edge of the adhesive tape should be approximately 1/8 inch from the end of the hose.

(6) Place the wire loop previously placed around the hose over the center of the adhesive tape so that the turns of the wire lie together and cross each other at a point where the wire is to be twisted.

(7) Twist the ends of the wire loop, using pliers, until they bind the hose tightly around the metal sleeve in the inlet tube.

(8) Cut off the surplus wire from the wire loop, leaving about three twists, which then will be bent and pressed down (not hammered) to the hose, leaving a reasonably smooth connection.

(9) Cover this wire loop and the adjacent wire loop which binds the inlet tube to the metal sleeve (item 132) with 4 inches of 3/4-inch adhesive tape, allowing one end of the adhesive tape to overlap the other end, covering the twist with the overlapped ends.

(10) Test the mask for leakage as prescribed in FM 21-40.

47. To repair chin rest seam, diaphragm facepiece MII.—*a.* If a small portion of the tape covering the chin rest seam becomes loose, cement it into place.

b. To replace chin rest seam tape—

(1) Remove the tape from around the angletube connection.

(2) Remove the tape covering the chin rest seam. Leave a small section, 1/4 to 1/2 inch, at the binder wires on the angletube connection.

(3) Cement the remaining ends of the tape in place.

(4) Apply cement along seam and allow to set.

(5) Place 10 inches of 7/8-inch bias tape (item 53) over the seam. The ends of this tape should be at the angletube.

(6) Place 15 inches of 1/2-inch adhesive tape over the wire clamp.

(7) Test the mask for leakage as prescribed in FM 21-40.

48. To remove angletube.—*a. Service facepieces MI, MIA1, and MIA2.*—(1) Remove the hose as described in paragraph 46*a*.

(2) Insert the angletube jig (item 18) into the hose stem.

(3) Mark the facepiece and angletube to aid in replacing the angletube.

(4) Remove the tape and wire on the facepiece just above the angletube.

(5) Turn the facepiece inside out.

(6) Detach the butterfly-shaped deflector from the sides of the facepiece.

(7) Remove the tape and wire from the base of the deflector.

(8) Remove the angletube.

b. Diaphragm facepieces MI and MIA1.—(1) Remove the hose.

(2) Remove the tape and wire from the facepiece just behind the diaphragm.

(3) Mark the facepiece and angletube to aid in replacing the angletube in its proper position.

(4) Remove the angletube diaphragm assembly.

c. Diaphragm facepiece MII.—(1) Remove the hose.

(2) Mark the angletube and facepiece so as to help in replacing the angletube.

(3) Remove the tape and wire clamp (item 80) from the angletube.

(4) Remove the angletube.

d. Diaphragm facepiece M3 and optical facepiece M1.—(1) Remove the tape and cut or unfasten the wire clamp (item 80*a*).

(2) Mark the position of the angletube in the facepiece.

(3) Remove the angletube.

49. To replace angletube.—*a. Service facepieces MI, MIA1, and MIA2.*—(1) Clean the grooves around the angletube.

(2) Place 1 1/4 turns of 1/2-inch adhesive plaster in the groove around the larger part of the angletube.

(3) Apply a thin coat of rubber cement on the adhesive plaster.

(4) Insert the angletube into the opening at the facepiece stem and make sure that it is correctly alined and placed.

(5) Place a piece of .041-inch wire (item 79) around the facepiece stem and tighten it.

(6) Cut off all excess wire except about three twists.

(7) Bend the three twists parallel to and against the loop.

(8) Place a second piece of wire on the facepiece-angletube joint. The twists should be on the opposite side of the angletube.

(9) Place 1 1/4 turns of 5/16-inch adhesive tape over the wire and around the outside of the facepiece stem.

(10) Replace the deflector as prescribed in paragraph 50.

(11) Attach the hose to the angletube as described in paragraph 46*a*.

(12) Test the mask for leakage as prescribed in FM 21-40.

b. Diaphragm facepieces MI and MIA1.—(1) Clean grooves around angletube.

(2) Apply a thin coat of cement in the grooves around the angletube. Do not dry.

(3) Insert the diaphragm angletube assembly in the facepiece.

(4) Place a piece of .041-inch wire (item 79) around the rubber facepiece and diaphragm. Tighten the wire, cut off the extra wire, and press the twist alongside the loop.

(5) Place a second loop of wire on the facepiece angletube joint. The twists should be on opposite sides of the diaphragm.

(6) Cover the wire with 1½ turns (about 12 inches) of ½-inch tape.

(7) Replace the hose (par. 46).

(8) Test the mask for leakage as prescribed in FM 21-40.

c. Diaphragm facepiece MII.—(1) Clean groove around angletube.

(2) Apply a thin coat of cement around the groove of the angletube.

(3) Place the angletube in position in the facepiece.

(4) Replace the two ⅞-inch long pieces of ½-inch tape below the eye lenses (fig. 67).

(5) Place an 11²³⁄₃₂-inch wire clamp (item 80) around the angletube near the edge of the facepiece.

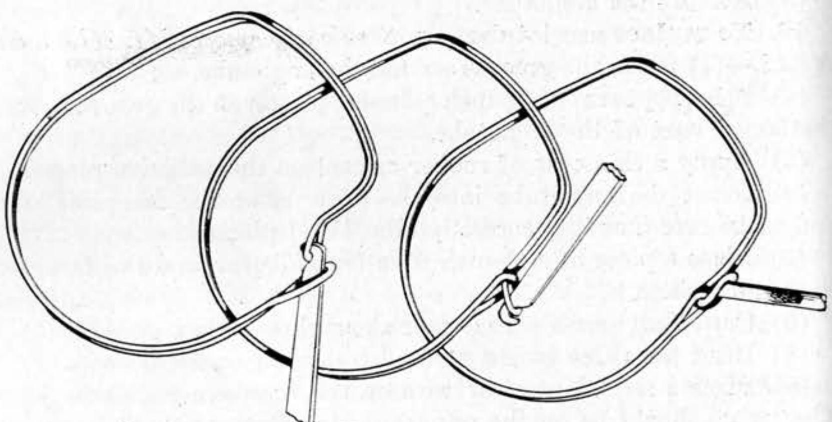


FIGURE 66.—Steps in tightening wire clamp when replacing MII diaphragm angletube.

(6) Insert the notched blade of the wire-clamp tightening tool (item 17) through the larger loop of the clamp into the smaller loop (A, fig. 66 and fig. 67).

(7) Tighten the wire clamp by moving the tightening tool in the direction shown in B, figure 66 and figure 67. When the tool can be forced no farther, remove it.

(8) Insert the wire-closing tool in the smaller loop (the same one as above but on the opposite side of the loop) (C, fig. 66).

(9) Press the loop back against the wire. Bring the two wires of the clamp close together.

(10) Place a second clamp on the facepiece but with the loop on the opposite side of the angletube.

(11) Tighten and close the second loop as before.

(12) Place 13 inches of ½-inch tape over the clamps.

(13) Replace the hose (par. 46).

(14) Test the mask for leakage as prescribed in FM 21-40.

d. Diaphragm facepiece M3 and optical facepiece M1.—(1) Remove the outlet valve guard from the new angletube.

(2) Apply a piece of ½-inch adhesive tape 11 inches long around the groove of the new angletube, with the edge of the tape covering the inner flange of the angletube.

(3) Apply a thin coat of cement in the groove around the angletube. Do not dry.

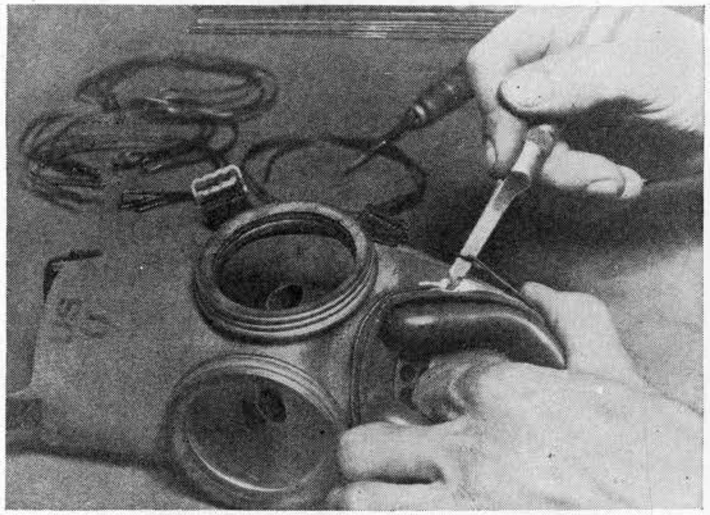


FIGURE 67.—Tightening wire clamp—MII diaphragm mask.

(4) Place the angletube on the angletube jig (item 21) and mount the facepiece on the angletube so that it is in the proper position, using an assembled facepiece as a guide.

(5) Apply a strip of ⅜-inch adhesive tape 11 inches long around the snout of the facepiece, which is over the groove in the angletube.

(6) Bind the facepiece onto the angletube with a 10¹¹⁄₁₆-inch wire clamp (item 80a) by placing the wire clamp around the angletube over the strip of ⅜-inch tape on the facepiece with the joint of the clamp near the bottom of the angletube as shown in figure 68.

(7) The clamp is then joined and tightened by means of a wire-clamp tightening tool (item 17) and a wire-clamp closing tool (item 16). (See fig. 68.)

(8) Cover the wire clamp with a strip of ½-inch adhesive tape 11 inches long, starting the end first applied over the joint of the wire clamp at the bottom of the angletube.

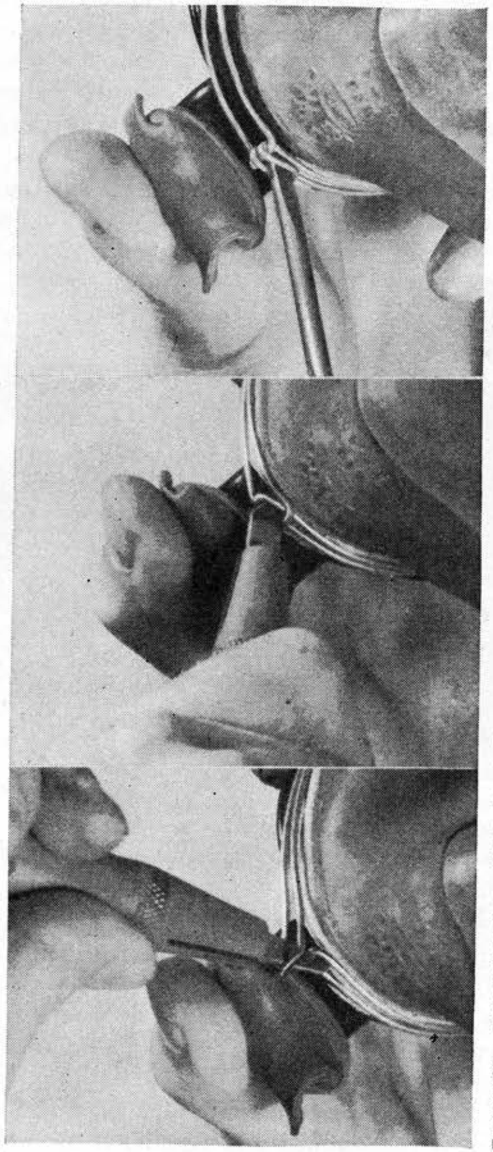


FIGURE 68.—Using wire clamp tightening tool and closing tool in replacing angletube in diaphragm facepiece M3 and optical facepiece M1.

(9) Test the mask for leakage as prescribed in FM 21-40.

(10) Replace the outlet valve guard using an assembled facepiece as a guide.

50. To replace deflector.—*a.* This operation is a part of the repair or assembly of an angletube on the service facepieces MI, MIA1, and MIA2. Deflectors often come loose where cemented to the facepiece.

b. Procedure.—(1) Clean the groove where deflector stem fits around the angletube just inside the junction of the facepiece stem and angletube.

(2) Locate the positions where the deflector wings fit against the facepiece, using an assembled mask as a guide.

(3) Mark these and clean and roughen the facepiece and the deflector where they will join.

(4) Remove the deflector and turn the facepiece inside out so as to make succeeding operations easier.

(5) Place 1¼ turns of 5/16-inch adhesive tape around the angletube deflector stem.

(6) Apply a thin coat of rubber cement to the tape which has just been applied.

(7) Put a loop of .032-inch wire (item 73) loosely over the deflector stem but do not tighten at this time.

(8) Place the deflector stem over the place prepared for it on the angletube and make sure that it is properly alined.

(9) Wrap 1¼ turns of 5/16-inch adhesive tape around the deflector stem.

(10) Slip the wire loop down over the tape and tighten (fig. 69).

(11) Cut off all wire in excess of three twists and bend these parallel to the wire loop.

(12) Cover the wire with 1¼ turns of 5/16-inch adhesive tape.

(13) Apply rubber cement to the marked places on the facepieces and the deflector wings and let it set (dry about 15 minutes).

(14) Turn the facepiece right side out.

(15) Join the facepiece and the deflector at the marked places and press tightly together.

51. To replace diaphragm assembly.—*a. To replace diaphragm assembly in diaphragm facepieces MI and MIA1.*—(1) Using the combination wrench (item 5) unscrew the diaphragm assembly.

(2) Remove the diaphragm assembly and the rubber gasket.

(3) Insert the gasket (item 130). If a new gasket is needed, use a 2⅞-inch outside diameter gasket. Remove the tape from around the new diaphragm assembly; then insert the new diaphragm assembly (item 124).

(4) Tighten the diaphragm assembly with the combination wrench (fig. 52).

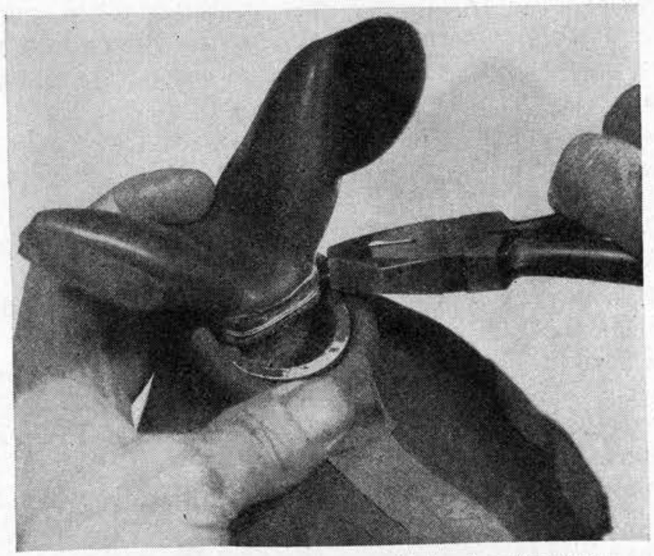


FIGURE 69.—Wiring deflector to angletube of service mask.

b. To replace diaphragm, diaphragm facepieces MI and MIA1.—
(1) Using the combination wrench, unscrew the diaphragm assembly.

(2) Remove the diaphragm assembly and the gasket (fig. 70).

(3) Take the diaphragm assembly apart by separating the two parts of the guard.

(4) Remove the diaphragm (item 125) and the gasket (item 126).

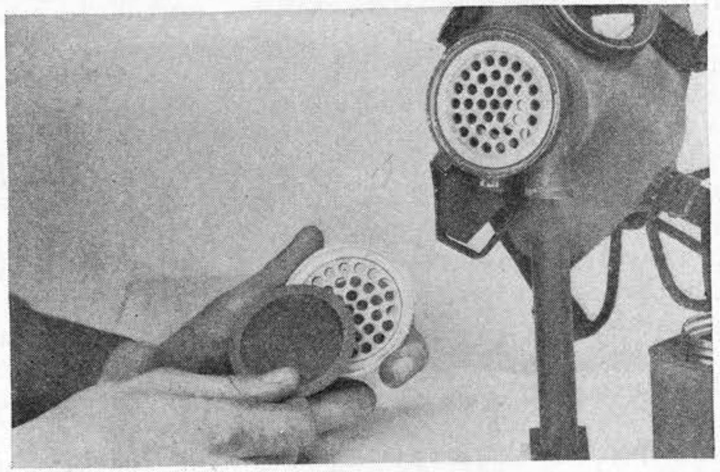


FIGURE 70.—Placing new diaphragm disk in diaphragm guard.

(5) Place a new $2^{11}/_{16}$-inch diameter diaphragm disk in the metal diaphragm guard.

(6) Place the gasket in the guard on top of the disk (fig. 70).

(7) Place the smaller metal guard in the larger guard on top of the gasket.

(8) Place a thin layer of rubber cement on a $2^{7}/_{8}$-inch outside diameter gasket (item 130).

(9) When the cement is set, insert the gasket in the angletube.

(10) Insert the diaphragm assembly into the angletube assembly and tighten it with the combination wrench (fig. 52).

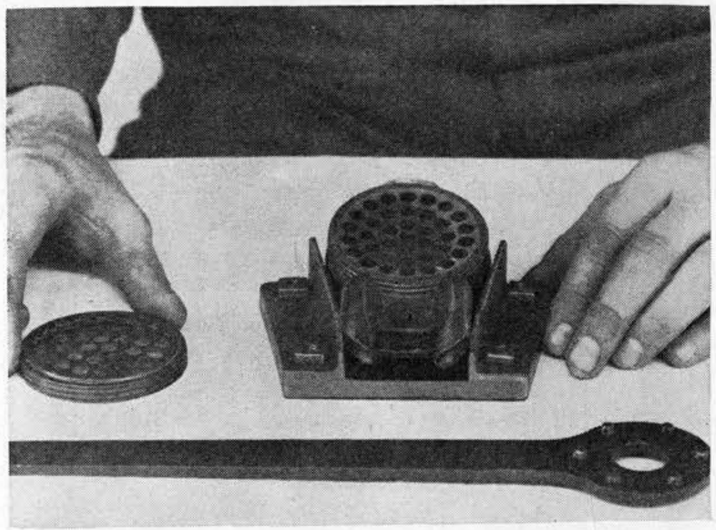


FIGURE 71.—Removing retainer and replacing diaphragm parts.

c. To replace diaphragm assembly, diaphragm facepiece MII.—
(1) Remove the angletube from the facepiece as described in paragraph 48.

(2) Place the angletube in the angletube jig (item 19).

(3) Unscrew and remove the diaphragm retainer (item 129) using the combination wrench (fig. 71).

(4) Replace the defective parts.

(5) Seat the diaphragm on the gasket. If the gasket needs replacement, use a $2^{13}/_{16}$-inch outside diameter gasket (item 127).

(6) Replace the diaphragm retainer using the combination wrench (fig. 72).

(7) Replace the angletube in the facepiece as described in paragraph 47.

d. To replace diaphragm, optical facepiece M1 and diaphragm facepiece M3.—Considerable difficulty has been encountered, even in the gas mask factory, in making a gastight diaphragm assembly of the M3 diaphragm and M1 optical facepieces; therefore the replacement of a diaphragm should not be attempted except in extreme emergencies and then only by an experienced operator, because a diaphragm (item 118) consists of four layers of clear cellulose acetate 0.001 inch thick. Extreme care is required in handling diaphragms.

(1) Place the facepiece over the angletube jig (item 21) so that the angletube jig seats firmly inside the wall of the angletube body.

(2) Seat the strap wrench (item 8) on the diaphragm retainer (item 120).

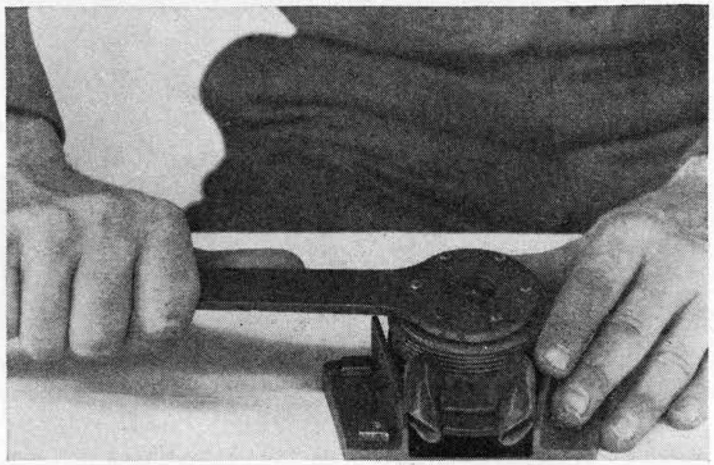


FIGURE 72.—Tightening diaphragm retainer with wrench.

(3) Unscrew and remove the diaphragm retainer from the angletube and then remove the diaphragm guard (item 121), the diaphragm spacer (item 119), and the defective diaphragm.

(4) Next remove and inspect diaphragm gasket (item 122).

(5) If gasket is in good condition, put it back in place; if it is defective, replace it with a new one.

(6) Place the four plies of the new diaphragm on the gasket, taking care that they are flat and smooth.

(7) Place the diaphragm spacer on the diaphragm.

(8) Place the diaphragm guard on the diaphragm spacer.

(9) Screw the diaphragm retainer loosely on the angletube.

(10) While the diaphragm retainer is being tightened, hold the diaphragm guard from turning by holding it with the diaphragm guard wrench (item 7).

(11) Use the strap wrench to tighten the diaphragm retainer until it is securely seated to insure a good, even compression of the rubber gasket under the diaphragm (fig. 73).

(12) Test the mask for leakage as prescribed in FM 21–40.

52. To replace mouthpiece, diaphragm facepiece M3 or optical facepiece M1.—*a.* Remove the defective mouthpiece from the mouthpiece stem of the angletube with the aid of pliers and screw driver as needed.

b. Slip the mouthpiece (item 123) over the mouthpiece stem and orient properly, using an assembled facepiece as a guide.

c. Apply a strip of $\frac{5}{16}$-inch adhesive tape 5$\frac{3}{4}$-inches long around the neck of the mouthpiece.

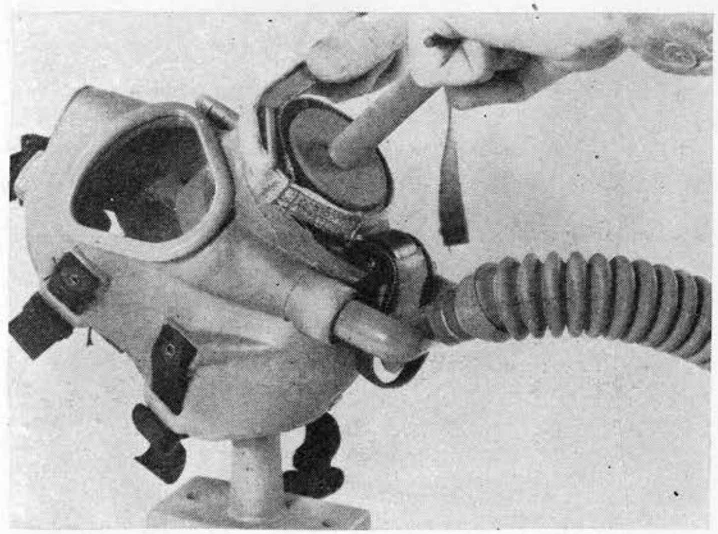


FIGURE 73.—Using strap wrench in replacing diaphragm in diaphragm facepiece M3 and optical facepiece M1.

d. Make one complete turn of 0.020-inch binding wire 7 inches long (item 74) around the neck of the mouthpiece.

e. Twist the wire tightly and cut off the surplus wire, leaving about three turns of the twisted portion which is then bent and pressed (not hammered) down on the neck of the mouthpiece, leaving a smooth connection and surface.

f. Cover the exposed wire around neck of the mouthpiece with a strip of $\frac{5}{16}$-inch adhesive tape 5$\frac{3}{4}$ inches long and overlap the ends of the tape on the twist.

53. To replace head harness buckle tabs.—*a. Service facepieces M1, M1A1, and M1A2 and diaphragm facepieces M1, M1A1,* *and MII.*—There are two types of head harness buckle tabs for these facepieces. The two top or forehead tabs are sewed at one place each, near the top of the facepieces. The four side tabs are sewed in two places each. If tabs are not furnished, they may be made up by sewing buckles (item 65) to black nonelastic tape ¾ inch wide (item 62) on a sewing machine to form the proper type for the repair job needed.

(1) Remove the old tab by cutting the threads, holding it to the facepiece. Remove old cemented-on patches.

(2) With a sewing machine, sew the new head harness tab into the proper place, using an assembled mask as a guide. (Note that the proper tension in the loop of the side tabs is important. First, sew the tab near the edge of the facepiece. Second, fold end of tab into 3

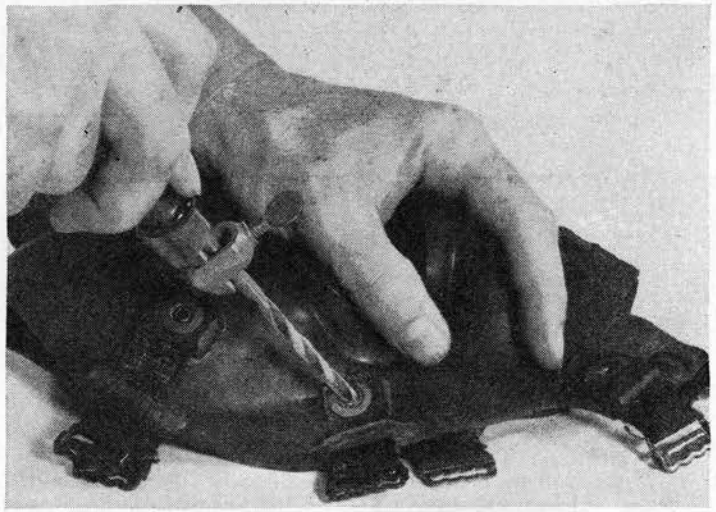


FIGURE 74.—Shank being reamed out with reaming tool.

layers (unless end is already folded and sewed). Third, pull tab until buckle stands up at right angles to facepiece. Then sew folded end of tab in this position.)

(3) Cover the sewing and needleholes with a new single patch, as located on a serviceable facepiece, using cement on facepiece (par. 40).

(4) Examine for holes by holding the work between a bright light and the eyes.

(5) Test the mask for leakage as prescribed in FM 21-40.

b. Service M2 and M2A1, training, diaphragm M3, and optical M1 facepieces.—(1) If tool kit is equipped with tool set (item 12)—

(*a*) Place inner part of facepiece down with head of button (item 89) resting on a hard, flat surface. The tab with the upset end of the rivet will then be facing up.

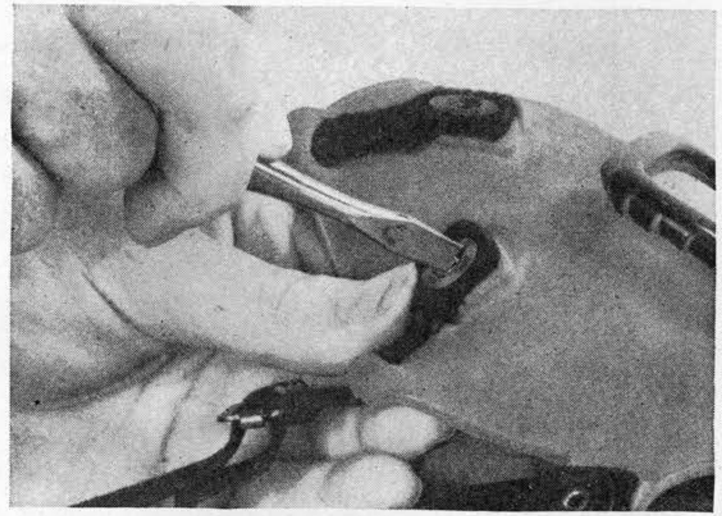


FIGURE 75.—Scraping off end of rivet button.

(*b*) Hold facepiece firmly and ream out the upset end of the rivet with hand drill (item 14) until button and washer fall apart (fig. 74). Remove button and tab from facepiece.

NOTE.—If not equipped with hand drill, use countersink or sharp screw driver (figs. 75 and 76).

(*c*) Lay new tab on piece of hard wood and cut clean hole in end of tab with cutting punch (item 13) and hammer (fig. 77).

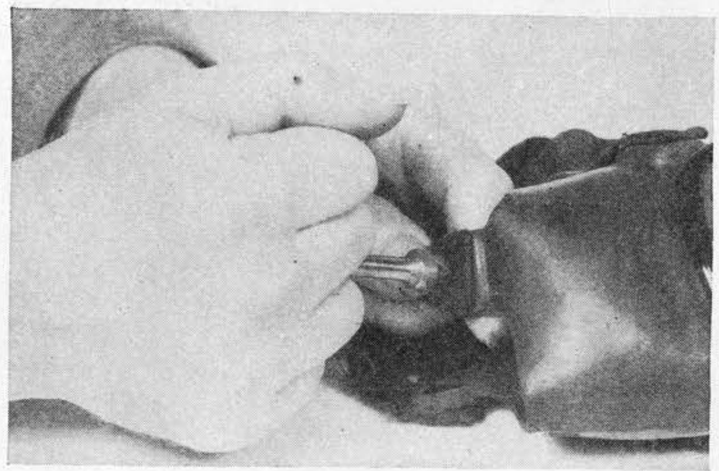


FIGURE 76.—Reaming out end of shank of rivet button with countersink.

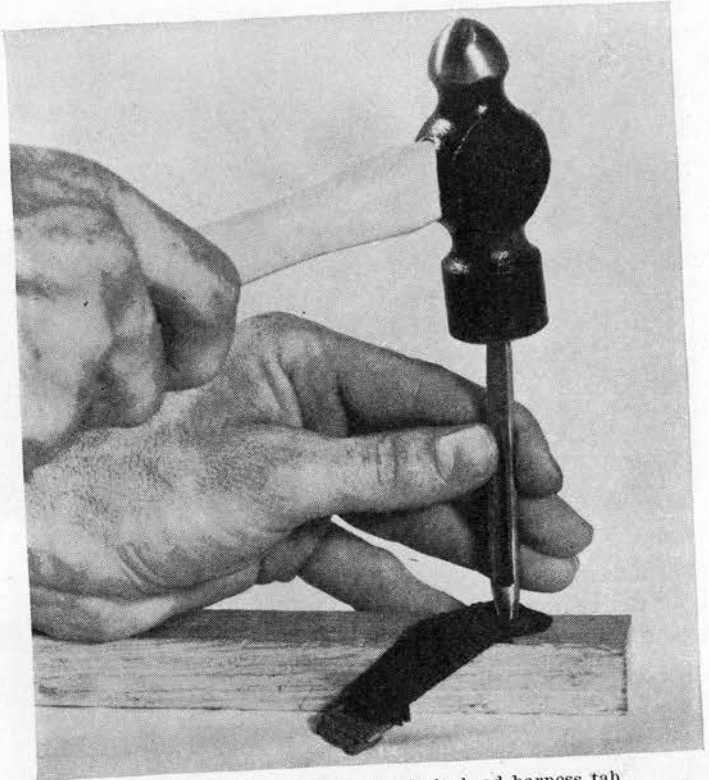


FIGURE 77.—Punching rivet hole in head harness tab.

FIGURE 78.—Placing new rivet button on button die.

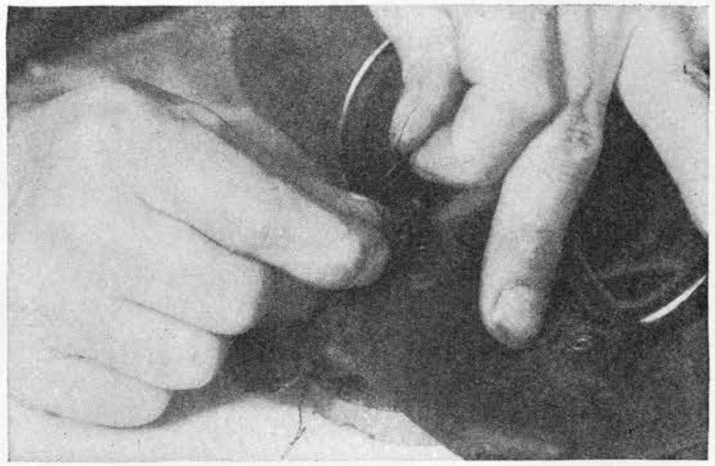


FIGURE 79.—Placing tab and washer on rivet button.

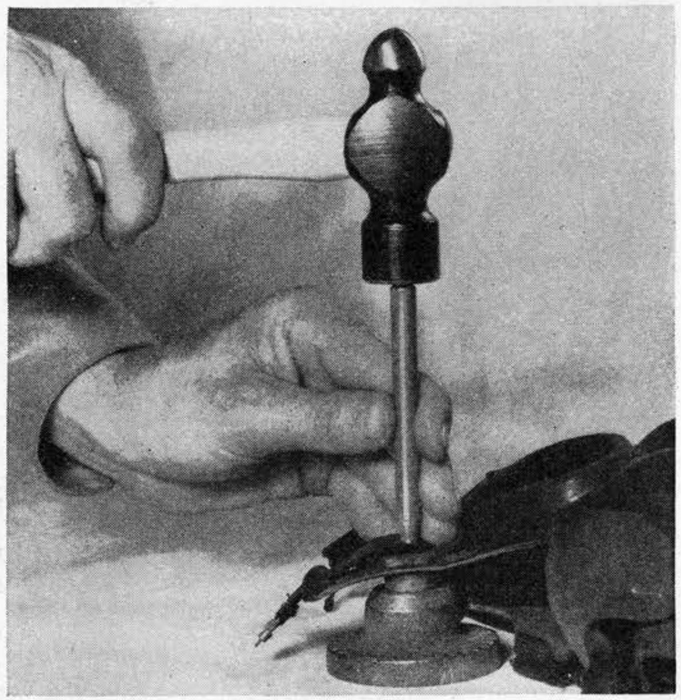


FIGURE 80.—Closing rivet with tool set.

FIGURE 81.—Placing washer in handchuck.

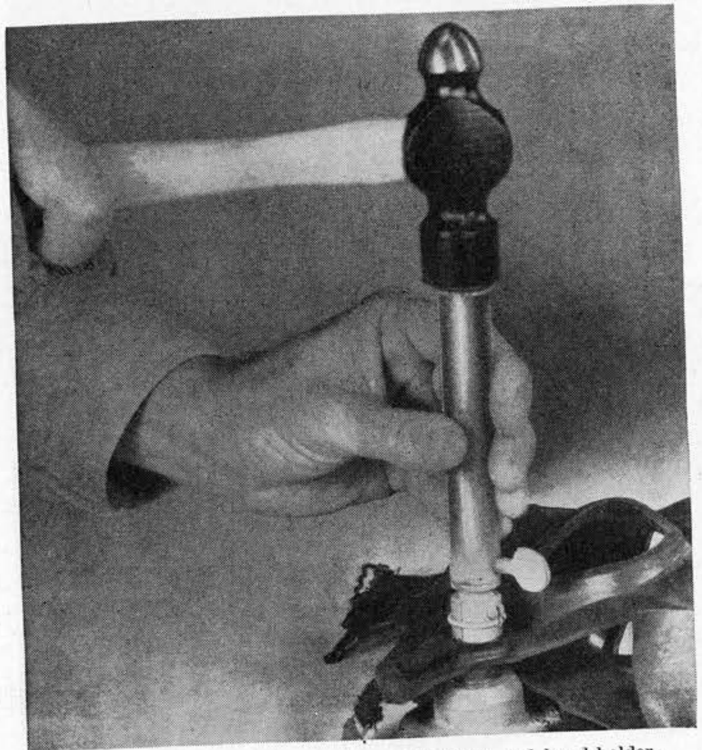


FIGURE 82.—Closing rivet, using eyelet chuck and hand holder.

(*d*) Thread new tab through tunnel in facepiece and line up hole in tab with hole in reinforced part of facepiece.

(*e*) Thread neck of new button through hole in facepiece and tab from the inside, placing new washer (or clip, if for forehead tab) over end of button. (Old washer may be re-used if it is not damaged in removal.) Place head of button in recess in button die and holder assembly (items 9 and 10) (fig. 78). Place washer over neck of button, hollow side up.

(*f*) Rivet securely by use of tool set and hammer (fig. 80).

(2) If tool kit is equipped with eyelet chuck (item 23) and hand chuck holder (item 24) instead of tool set, riveting operation will be completed in the same manner as above except that the assembled eyelet chuck and hand chuck holder are used instead of the tool set (figs. 81 and 82). To use hand chuck assembly for attaching the forehead clip, washer holder should be removed from chuck by loosening its set screw.

NOTES.—1. The two forehead tabs (item 63) are 1$\frac{7}{16}$ inches long; the other four tabs (item 64) are 2$\frac{7}{16}$ inches long. Be careful to use the correct one.

2. The clip (item 87) is used only on the forehead tabs and does not require a washer.

54. To replace metal parts of eyepieces of optical gas mask M1-1-5.—The replaceable metal parts of the eyepiece assembly of optical gas mask M1-1-5 consist of two adapters (item 111), a right holder (item 114), a left holder (item 113), and an adjusting screw (item 112). The adjusting screw is used to adjust the distance between the eyepieces. This screw has a right-hand thread on one end and a left-hand thread on the other end. It may become bent or its threads may be damaged so that adjustment of the eyepieces is prevented.

a. Unscrew both of the adapters and lift as a unit the two holders and the adjusting screw from the facepiece.

b. Unscrew the holders from the adjusting screw.

c. Replace damaged parts with new ones; screw the holders on the adjusting screw to equal distances, and seat, as a unit, this assembly over the eye rings.

d. Screw both of the adapters tightly in place.

SECTION VIII

TESTING AND FIELD INSPECTION

55. Kinds of gas mask inspections.—*a.* Every individual whose duties require the wearing of a gas mask is taught to make an habitual inspection of it daily. This inspection is prescribed in FM 21–40 as a part of the required individual training. Likewise, company or similar unit commanders are required to make periodical inspections of masks and training. The inspection procedure for a company is also explained in FM 21–40.

b. In addition to the typical inspections mentioned above, there are special inspections in connection with salvaging, repairing, or acceptance of gas masks. These special gas mask inspections are made by trained personnel such as—

(1) Enlisted inspectors of the chemical maintenance companies.

(2) Enlisted inspectors of the army chemical depots.

(3) Unit gas officers or gas (chemical) noncommissioned officers.

(4) Military and civilian inspectors at gas mask factories and arsenals.

The procedures to be followed, equipment to be used, organization of assistants, and training of the first three of these are described in the paragraphs below.

56. Chemical maintenance company inspection operations.—The chemical company, maintenance (T/O 3–47), has two main functions. First, it must be prepared to identify, segregate, and handle chemical warfare equipment and materials which may be concentrated as a result of battlefield salvage operations. A salvage platoon is included in the organization for this purpose. The second function is that of repair. Thus, a repair platoon with a special gas mask repair squad is also a part of these companies.

a. Inspection in connection with salvage operations.—(1) Every private, except those trained in other specialties, and every noncommissioned officer of the salvage platoon of the chemical maintenance company will be schooled in the duties of a special gas mask inspector. In action, or after a military engagement, these inspectors will probably work in very close cooperation with Quartermaster Corps salvage

personnel. It will be their duty to see that gas masks which are picked up on the battlefield, or come in from hospitals and first-aid stations, are properly segregated, listed, tagged, and protected from weather or other damage. Under such regulations as may be provided by the commanding general of the field army to which the maintenance company is assigned, these gas mask salvage inspectors will discard and destroy any damaged or infected masks as are judged unfit for further handling or repair.

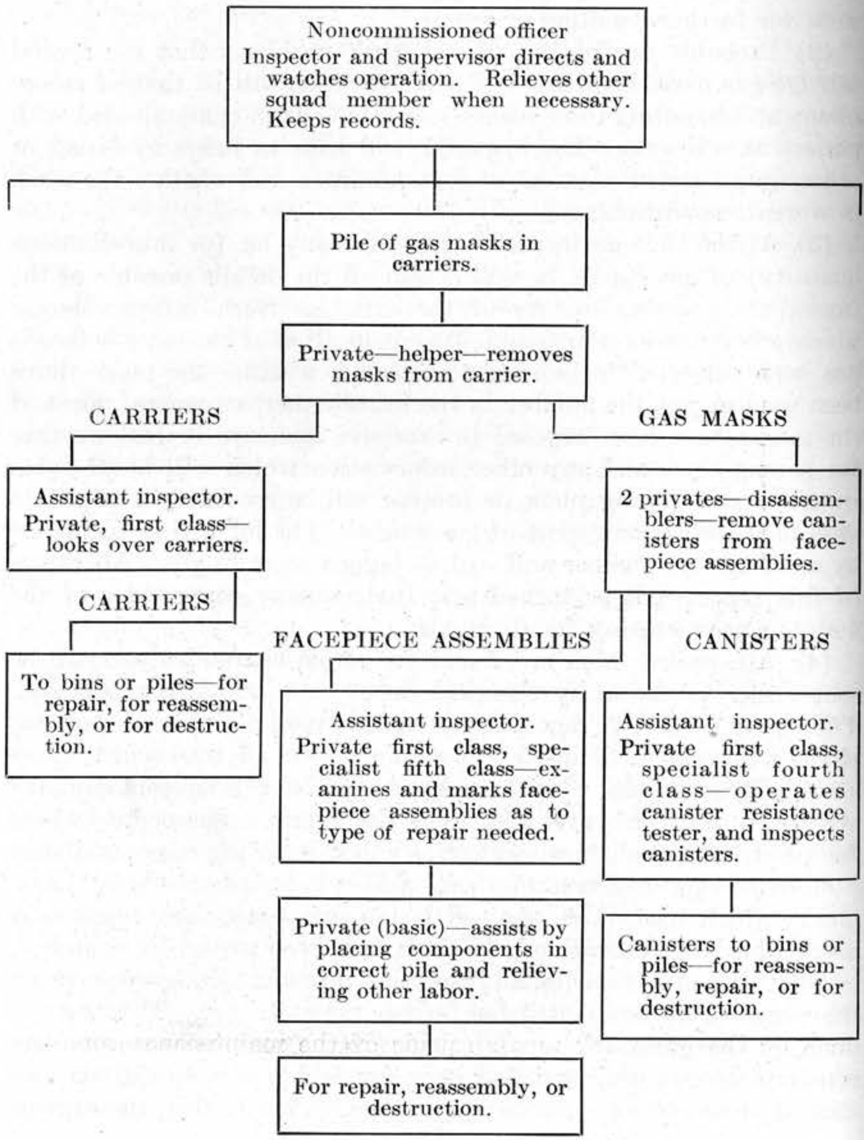
(2) Probably one of the most difficult problems that the special salvage gas mask inspector will have to solve will be that of recognizing and handling those masks which have been contaminated with persistent vesicants. The inspector will have to judge by visual or other simple tests the extent of contamination and whether the mask is worth reconditioning.

(3) At the time an inspector goes over any lot (or miscellaneous quantity) of gas masks, he will obtain all the details possible of the immediate previous history of the articles. Such information as places where the lot was found, present location of the lot, whether it has been subjected to persistent vesicants, whether the masks have been used in gas, the number in the lot, whether, in general, most of the masks have been exposed to excessive moisture or bad weather for a long time, and any other information which will be of value in the reconditioning plans or process will be recorded in triplicate on a field inspection report of gas masks. The lot will be identified by a salvage lot number and will be tagged accordingly. All copies of this report will be turned into the company commander of the maintenance company for disposal.

(4) All masks which are found free from contamination will be sent either to the army chemical depot or to the repair platoon. The trucks of the salvage platoon will be used for this purpose or, if these are not available, by any other means of transportation at hand. Those masks which are known to have been contaminated are taken in special vehicles to a decontamination center where facilities for mechanical cleansing and handling are available.

b. Inspections in connection with field repair operations.—(1) Gas masks which have been received by an army chemical depot as a result of salvage operations, or which have been turned in as unserviceable, are passed through an inspection procedure designed to check the worth of the equipment for further use and issue. This work is done by the gas mask repair squads of the maintenance company repair platoon. An inspection crew for field repair operations consists of a complete gas mask repair squad as outlined in the organization chart shown in table VIII. The squad leader or corporal is the inspector. He is the organizer and supervisor of the work and is the final judge in cases of doubt. He is assisted by three privates who are trained to act as assistant inspectors. The three (or four)

TABLE VIII.—*Gas mask inspection squad organization and typical work flow diagram*



privates who make up the rest of the squad help the assistant inspectors by performing any or all of the routine tasks incidental to preparing the masks for the tests.

(2) The masks are first removed from the carriers. These latter are visually inspected for defects and worn places. The inspector also looks for missing parts such as lost antidim sets. If the carrier is dirty, it is set aside for cleaning before further handling (par. 25*c*), otherwise it is placed in a separate pile or bin and marked according to the repair necessary.

(3) The canister is next removed from the hose. The inspector examines the inlet valve and the outer body for defects. He then subjects the canister to a breathing resistance test such as described in paragraph 59, discarding all those which fail to meet tolerances as announced by regulations set up by the commanding general of the field army.

(4) The facepiece assembly is next examined by distending or flexing the various component parts and visually noting whether or not there are any defects, holes, or cracks in the mask, any marked loss of resiliency in the rubber, or any permanent set which might cause malfunctioning. Valves, valve guards, head harness, buckles, straps, eyepieces, deflectors, diaphragms, chin seams, angletubes, and hose are all carefully checked. The various faulty components and places for repairs are marked or tagged, and the facepiece assemblies put in separate piles or bins according to defect until such time as they may be reconditioned.

(5) After each step in the repair and reassembly of the gas mask, it will be thoroughly checked and inspected, either visually or by any other means, available to the inspector. However, before it is placed back into the carrier for storage or reissue, it will be thoroughly cleaned and disinfected according to instructions contained in paragraph 25.

(6) When a mask has been put back into the carrier, a final check will be made to see that the hose and facepiece are correctly placed therein so as to avoid a permanent set in case the facepiece or hose is kinked in replacement.

(7) In addition to the above inspections, representative samples of each lot of salvaged or unserviceable canisters and of contaminated facepieces and carriers will be analyzed or tested in a laboratory as described in paragraph 60.

57. Inspections by army chemical depot personnel.—In each chemical depot company there are noncommissioned officers who are rated as inspectors and checkers. While there are many other items of storage to be examined in the course of receipt and issue of all the chemical supplies for a field army, the gas mask will undoubtedly be the most numerous single article. Used masks must be checked for completeness and condition by these inspectors before they are accepted for storage and issue. This inspection by the depot company inspectors may be omitted if the maintenance company is repairing salvaged or unserviceable masks within the army depot installation.

58. Inspections by unit gas officers and noncommissioned officers.—*a.* There will be occasions when chemical warfare maintenance personnel will not be available for inspections and repair of gas masks. At other times these maintenance troops will be far too few to do all the work required. Under these and other circumstances, gas mask inspections of all sorts, and such other repairs as they may be authorized to do, are made by the trained gas officers and gas (or chemical) noncommissioned officers required for each regiment and battalion by FM 21-40.

b. In general, these inspectors will be graduates of a gas officers' or gas noncommissioned officers' school and will have been taught the duties of the particular job as a part of the course of training. These special inspectors, for example, the gas noncommissioned officers, may not only be required to examine and repair unserviceable masks within the regiment, but also to pass upon any lot of used masks received for issue. These gas officers and noncommissioned officers must be able to organize, train, and supervise the work of any inspection team or labor assistants which may be furnished by the regiment concerned.

59. Canister resistance tests.—*a. Necessity for tests.*—(1) Canisters that have become wet or have been subjected to excessive moisture are very apt to be unsafe. If water gets into the chemical filter, some of the chemicals may be leached out of the mixture, while in other cases the porosity of the chemical granules may be destroyed. Chemicals may even adhere together causing a cake-like formation. Water coming in contact with a mechanical filter may destroy its efficacy. In any case, the efficiency of the canister may be very greatly reduced.

(2) Sometimes wet canisters may be recognized from their outward appearance by evidence of rust or corrosion. However, it may not always be possible to determine definitely that the canister contains this defect without making a mechanical test. The chemicals which have become wet but have not dried are likely to have a higher resistance to air flow because of caking. On the other hand, if the

canister has dried out, there is a possibility that cracks or channels may have developed because of shrinkage in the previously caked chemicals. In this case, the air flow resistance may be very much under normal. Thus, the resistance to air flow is a means of judging the worth of a canister.

(3) If the resistance as measured by an air flow meter varies greatly from the standard tolerances as found in specifications for the particular type under test, the canister should be considered as unsafe. These resistance tests are not positive, however, and should be confirmed by laboratory smoke and gas penetration tests on representative samples. These tests are described in paragraph 60. Regardless of tests, it is best to replace canisters having abnormal resistance.

b. When canister resistance tests are made.—Canister resistance tests are made on all gas masks that have been collected as a result of battlefield or other salvage operations and are to be reconditioned for reissue. Also, all masks that have a history of having become wet as a result of accidental flooding, or that are known to have been worn in the field for protracted periods of rainy weather, will, when turned in for reconditioning, be tested for air flow resistance. Canister resistance indicators, working along the lines described below, have been developed for this purpose.

c. Operation of typical apparatus.—(1) A number of machines have been developed to test the breathing resistance of canisters. Those in use at manufacturing arsenals are large and cumbersome but sensitive and accurate; those which are intended for use by maintenance companies in depots or in the field are of necessity lighter in weight, more rugged in construction, and less sensitive. However, the canister resistance indicator which is described below is satisfactory for field testing of canisters. Several models have been made, each of which is an improvement over the previous one. All, however, work on the same principle.

(2) The apparatus consists essentially of air pressure measuring devices. The air stream is supplied by a vacuum pump which is driven by an electric motor, the pressure is maintained by one or more reservoirs of water, and the height of water in the reservoir is indicated by manometers. A flow of air exceeding in amount that breathed by a man engaged at hard labor, which is about 32 liters per minute, is maintained by the vacuum pump. When a resistance is inserted in the air stream, the change in pressure is indicated by the water column in the manometer. Thus, the resistance of the

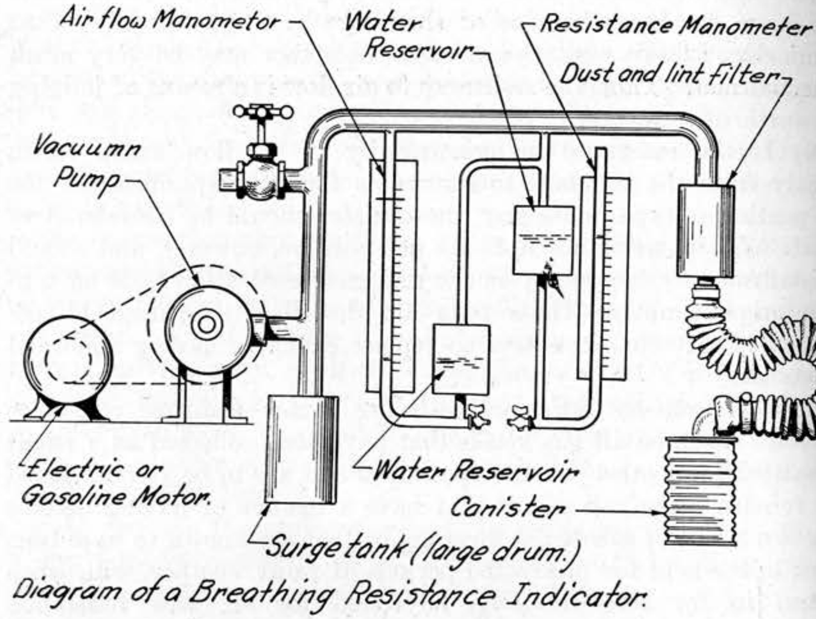


FIGURE 83.—Breathing resistance indicator diagram.

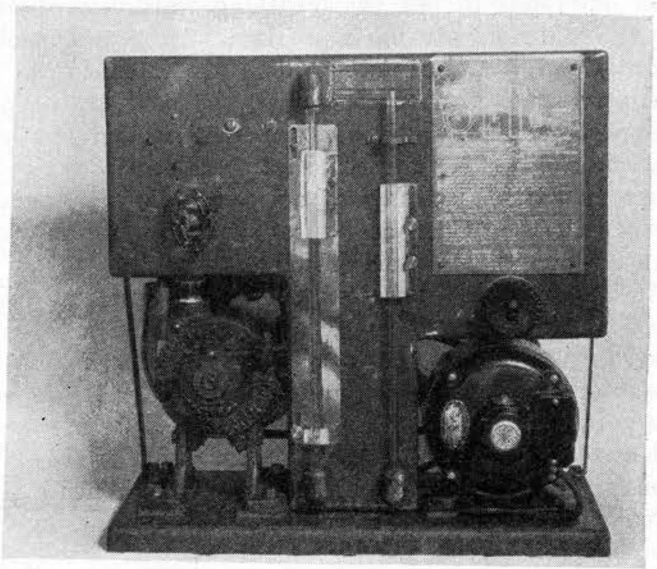


FIGURE 84.—Canister resistance indicator E8R4.

canister is obtained. A schematic drawing (fig. 83) indicates the main parts of a typical machine.

d. Types of machines.—There are two types of machines in use in the field at the present time—the canister resistance indicator MIA1 and the canister resistance indicator E8R4 (fig. 84). Both are essentially the same and resemble one another very closely. A book of instructions containing pictures and drawings accompanies each testing machine for the purpose of teaching the operation and care of each individual type.

e. Breathing resistance specifications.—Tolerances for the breathing resistance of canisters are given in table IX.

TABLE IX.—*Tolerances for breathing resistance of canisters*

Canister	Mm head of water (with valve present)		Mm head of water (without valve)	
	Minimum	Maximum	Minimum	Maximum
MI				
MII	45	92		
MIIR	45	92	37	84
MIII	45	92	37	84
MIIIR	45	92	37	84
MIV	40	82	32	74
MVIII	35	77	32	74
MIX	35	77	(1)	(1)
MIXA1	35	77	32	74
Optical M1	60	90	(1)	(1)
Training MI	42	90	39	87

[1] No inlet Valve.

60. Physical and chemical tests of gas masks and components.—*a.* In addition to the visual and breathing resistance examinations described in the preceding paragraphs, some of the gas mask parts or components undergoing inspection and reconditioning by the maintenance company may be more thoroughly tested by various chemical and physical tests. For each field army there is a chemical laboratory company which is organized, equipped, and trained to make all types of chemical tests and analyses in the field.

b. A part of the duties of such a laboratory company will be concerned with making such tests on gas masks which have been reconditioned from salvage, or have been decontaminated, as may be necessary to confirm without question the visual or other inspection methods utilized by the chemical maintenance company inspectors.

c. In making these laboratory tests it is generally necessary to destroy the article; hence, only a few representative samples in each salvage lot are chosen. The instruction as to the quantities of gas masks or components out of each salvage lot, the methods of sampling, ways of handling and forwarding the samples, and interpretation of results will be found in regulations published by the commanding general of the field army concerned.

d. Tests and analysis which may be made as a matter of routine are—

(1) Tests for contamination of gas masks and carriers.

(2) Canister tests such as—

(*a*) Smoke penetration.

(*b*) Penetration of various gases and vapors.

e. In addition to these, other special tests will be made, for example, strength of fabrics, various leakage tests, and special analysis as circumstances may require. The regulations regarding these tests are to be found in instructions on the technical operations of the chemical laboratory company.

Appendix I

LIST OF REFERENCES

FM 21-40, "Defense Against Chemical Attack."

General and technical instructions prepared under the supervision of the Chief of the Chemical Warfare Service and published by the War Department on—

The Hydrocyanic Acid Gas Mask, February 1, 1932.
The Acid Vapor Gas Mask, September 1, 1932.
The Oil Vapor Gas Mask, July 15, 1932.
The Ammonia Gas Mask, June 15, 1932.
The All-purpose Gas Mask, July 15, 1932.

Section III, Circular No. 197, War Department, 1941.
Training Circular No. 13, War Department, 1941.
Film strips, 3-3, 3-4, 3-5, and 3-6.
Training films 3-216, 3-217, 3-218, and 3-219.

APPENDIX II

TOOLS, SPARE PARTS, AND MATERIALS FOR GAS MASK REPAIR

1. Tools.

No.	Item
1	Book of instructions, TM 3-205, The Gas Mask.
2	Screw driver, 1/4- by 2-inch blade.
3	Pliers, side cutting, 6-inch.
4	Shears, 6-inch.
5	Wrench, combination.
6	Wrench, lens.
7	Wrench, diaphragm guard.
8	Wrench, strap.
9	Holder, bench die.
10	Die, button.
11	Hammer, ball-peen, 12-ounce, machinist's.
12	Set, tool.
13	Punch, cutting, single-bow, 7/64-inch.
14	Drill, hand, 7/32-inch, with handle.
15	Kit, sewing.
16	Tool, wire clamp closing.
17	Tool, wire clamp stretching.
18	Jig, angletube, service and diaphragm facepieces MI and MIA1.
19	Jig, angletube, diaphragm facepiece MII.
20	Jig, eyepiece.
21	Jig, angletube, optical.
22	Jig, facepiece, outlet valve.
23	Chuck, eyelet.
24	Holder, hand, chuck.
25	Pliers, thin, bent-nose, 6-inch.
26	Bag, cloth, for holding supplies.
27	Bag, lens.

2. Spare parts and materials.

No.	Item
50	Box, assembly, repair kit.
51	Rubber cement, can.
52	Patch, adhesive.
53	Tape, bias, adhesive, 7/8-inch, 60-yard roll.

No.	Item
54	Plaster, adhesive, 1/4-inch, 10-yard roll.
55	Plaster, adhesive, 5/16-inch, 10-yard roll.
56	Plaster, adhesive, 5/16-inch, 30-yard roll.
57	Plaster, adhesive, 3/8-inch, 30-yard roll.
58	Plaster, adhesive, 3/8-inch, 60-yard roll.
59	Plaster, adhesive, 1/2-inch, 10-yard roll.
60	Plaster, adhesive, 1/2-inch, 30-yard roll.
61	Plaster, adhesive, 3/4-inch, 20-yard roll.
62	Webbing, cotton, black, type II, 3/4-inch, 12-foot roll.
63	Tab, 1 7/16-inch, assembly (forehead).
64	Tab, 2 7/16-inch, assembly (cheek and chin).
65	Buckle, web strap, 7/8-inch.
66	Harness, head, MII, assembly.
67	Harness, head, MIIA1, assembly.
68	Harness, head, M3, assembly.
69	Harness, head, M4, assembly.
70	Loop, wire, outlet valve, .020-inch wire.
71	Loop, wire, outlet valve, .032 by 1 5/16 by 11/16 inches.
72	Loop, wire, hose, .032- by 1 3/16-inch diameter.
73	Loop, wire, .032- by 1 1/2-inch diameter.
74	Wire, .020 by 7 inches long.
75	Wire, .020 by 10 3/4 inches long.
76	Wire, .020-inch, 100-foot coil.
77	Wire, .032 by 10 inches.
78	Wire, .041 by 7 3/4 inches long.
79	Wire, .041 by 13 inches long.
80	Clamp, wire, 11 23/32-inch.
80a	Clamp, wire, 10 11/16-inch.
81	Band, rubber, size 1.
82	Band, rubber, size 2.
83	Band, rubber, size 3.
84	Band, rubber, size 4.
85	Band, rubber, size 6.
86	Band, rubber, size 8.
87	Clip, head harness.
88	Tip, clinch.
89	Button and washer (rivet).
90	Disk, inlet valve, 29/32-inch diameter (optical canister).
91	Disk, inlet valve, 1 9/16-inch diameter.
92	Seat, inlet valve, 1 9/16-inch diameter.
93	Disk, inlet valve (MIXA1 and training canister), 2 1/16-inch diameter.
94	Seat, inlet valve, assembly (MIXA1 and training canister), 2 1/16-inch diameter.
95	Valve, outlet, MI.
96	Valve, outlet, MII.
97	Valve, outlet, MV.
98	Valve, outlet, M6.
99	Guard, outlet valve (MIA2 service facepiece).

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No.	Item
100	Screw, machine, roundhead, #8, ½-inch.
101	Nut, machine screw, hexagonal, #8.
102	Washer, lock, #8, screw size.
103	Guard, outlet valve (MV valve).
104	Guard, outlet valve (M6 outlet valve).
105	Screw, machine, roundhead, #6, 1¼-inch.
106	Nut, machine screw, hexagonal, #6.
107	Lens, glass, laminated, 2.74-inch diameter.
108	Gasket, lens, 2¾-inch.
109	Lens, plastic.
110	Eye ring (plastic eyepiece).
111	Adapter, eyepiece, optical.
112	Screw, adjusting, eyepiece, optical.
113	Holder, left eyepiece.
114	Holder, right eyepiece.
115	Y-tube assembly.
116	Angletube assembly (M3 diaphragm facepiece).
117	Angletube and guard assembly (M3 diaphragm facepiece).
118	Diaphragm, angletube, cellulose acetate, 2.55-inch diameter.
119	Spacer, diaphragm, M3.
120	Retainer, diaphragm, M3.
121	Guard, diaphragm, M3.
122	Gasket, diaphragm, 2$\frac{35}{64}$-inch outside diameter.
123	Mouthpiece.
124	Diaphragm assemblies, diaphragm facepiece MI and MIA1.
125	Diaphragm, diaphragm facepiece MI and MIA1, 2$\frac{11}{16}$-inch.
126	Gasket, diaphragm, 2$\frac{11}{16}$-inch.
127	Diaphragm, diaphragm facepiece MII, 2$\frac{13}{16}$-inch.
128	Gasket, angletube, 2$\frac{13}{16}$-inch.
129	Retainer, angletube, MII diaphragm.
130	Gasket, diaphragm (disk), 2⅞-inch.
131	Can, gasket and valve.
132	Sleeve, seamless (optical facepiece).
133	Bolt, stove, roundhead, ¼ inch by 3 inches.
134	Washer, iron, ¼-inch bolt size.
135	Ferrule, aluminum.
136	Guard, outlet valve (MIV outlet valve).
137	Seat, outlet valve (MIV outlet valve).
138	Valve, outlet, MIV.
139	Wire, .032 by 11 inches.

APPENDIX III

REGIMENTAL GAS MASK REPAIR KITS

1. Repair kit MI.—*a. Nonexpendable items.*

No.	Item	Quantity
1	Book, instruction, TM 3-205	1
18	Jig, angletube, service and diaphragm facepiece, MI and MIA1	1
19	Jig, angletube, diaphragm facepiece, MII	1
20	Jig, eyepiece	1
3	Pliers, side-cutting, 6-inch	2
2	Screw drivers, ¼- by 2-inch blade	2
4	Shears, 6-inch	1
16	Tool, wire clamp closing	1
17	Tool, wire clamp stretching	1
5	Wrench, combination	1
6	Wrench, lens	1
50	Box, assembly, repair kit	1

b. Expendable items.

No.	Item	Quantity
133	Bolts, stove, ¼- by 3-inch	10
65	Buckles, web strap, ⅞-inch	12
131	Can, containing	1
128	Gaskets, angletube, 2$\frac{13}{16}$-inch	10
126	Gaskets, diaphragm, 2$\frac{11}{16}$-inch	5
130	Gaskets, diaphragm (disk), 2⅞-inch	5
108	Gaskets, lens, 2¾-inch	20
91	Disk, inlet valve, 1$\frac{9}{16}$-inch diameter	20
93	Disks, inlet valve, 2$\frac{1}{16}$-inch diameter	3
51	Cement, rubber (pint size), cans	2
80	Clamps, wire, 11$\frac{23}{32}$-inch	30
124	Diaphragm assemblies, diaphragm facepiece, MI and MIA1	3
125	Diaphragm, diaphragm facepiece, MI and MIA1, 2$\frac{11}{16}$-inch	12
127	Diaphragm, diaphragm facepiece, MII, 2$\frac{13}{16}$-inch	12
66	Harness, head, MII assembly	12
15	Kit, sewing	1
	Needles	5
	Thread, feet	50

No.	Item	Quantity
107	Lens, glass, laminated, 2.74-inch diameter	12
72	Loops, binding, hose, .032-inch diameter wire	100
70	Loops, binding, outlet valve, .020-inch diameter wire	100
52	Patches, facepiece (12 bundles)	300
55	Plaster, adhesive, 5/16-inch, 10-yard roll	6
59	Plaster, adhesive, 1/2-inch, 10-yard roll	10
129	Retainers, angletube, MII diaphragm	6
53	Tape, adhesive, 7/8-inch (bias strapping o. d.), 60-yard roll	2
88	Tips, clinch	12
91	Disk, valve, inlet, 1 9/16-inch diameter	20
96	Valves, outlet, MII (3 bundles)	72
134	Washers, iron, 1/4-inch, bolt size	20
79	Wires, binding, galvanized steel, .041-inch diameter, 13 inches long	50

The can (131) contains four sizes of rubber gaskets as follows:

Quantity	Item No.	Name	Outside diameter (inch)
10	128	Gasket, angletube [1]	2 13/16
5	126	Gasket, diaphragm [2]	2 11/16
5	130	Gasket, diaphragm (disk) [3]	2 7/8
20	108	Gasket, lens [4]	2 3/4

[1] Used in diaphragm mask MII.
[2] Used between diaphragm and smaller metal disk of diaphragm assembly of diaphragm masks MI and MIA1.
[3] Used between diaphragm assembly and angletube in diaphragm masks MI and MIA1.
[4] Used between lens and facepiece in service masks MIA1 and MIA2 and diaphragm masks MIA1 and MII.

The can also contains two sizes of diaphragms for the diaphragm assembly:

Smaller size, 2 11/16 inches outside diameter (item 125), used in diaphragm masks MI and MIA1.

Larger size, 2 13/16 inches outside diameter (item 127), used in diaphragm mask MII.

2. Repair kit M3.—*a. Nonexpendable items.*

No.	Item	Quantity
26	Bag, cloth, for holding supplies	6
1	Book, instruction, TM 3-205	1
23	Chuck, eyelet [1]	1
10	Die, button	1
14	Drill, hand, 7/32-inch, with handle	1
11	Hammer, 12-ounce, ball-peen, machinist's	1

See footnote at end of table.

No.	Item	Quantity
9	Holder, bench die	1
24	Holder, hand, chuck [1]	1
22	Jig, facepiece outlet valve [1]	1
3	Pliers, side cutting, 6-inch	2
25	Pliers, thin, bent-nose, 6-inch	1
13	Punch, cutting, single-bow, 7/64-inch [2]	1
2	Screw driver, 1/4- by 2-inch blade	2
12	Set, tool [2]	1
4	Shears, 6-inch	1
50	Box, assembly, repair kit	1

b. Expendable items.

No.	Item	Quantity
81	Band, size 1, black, synthetic rubber	20
83	Band, size 3, black, synthetic rubber	20
133	Bolts, stove, 1/4 by 3 inches for jig [1]	2
65	Buckle, web strap, size 7/8-inch	12
89	Button and washer	50
51	Cement, rubber, pint can	1
87	Clip, head harness	10
93	Disk, inlet valve, 2 1/16-inch	20
110	Eye ring	12
135	Ferrule, aluminum [1]	10
136	Guard, outlet valve (MIV) [1]	5
103	Guard, outlet valve (MV)	10
69	Harness, head, M4, assembly	12
15	Kit, sewing	1
	Needles	5
	Thread, feet	50
109	Lens	12
52	Patch, 7/8- by 1 3/8-inch, adhesive (12 bundles)	300
58	Plaster, adhesive, 3/8-inch, 60-yard roll	1
94	Seat, inlet valve, assembly, 2 1/16-inch	5
137	Seat, for outlet valve (MIV) [1]	10
63	Tab, 1 7/16-inch, assembly (forehead)	24
64	Tab, 2 7/16-inch, assembly (check and chin)	24
88	Tip, clinch, 7/8-inch	12
138	Valve, MIV, outlet [1]	10
97	Valve, MV, outlet	16
77	Wire, 0.032 inch diameter, galvanized, 10 inches, pieces	175
139	Wire, 0.032 inch diameter, galvanized, 11 inches, pieces [1]	50
134	Washer, iron, 1/4-inch, for bolts [1]	4

[1] These items included in M3 repair kits issued *before* January 1, 1941, *only*, and are no longer issued.
[2] These items included in M3 repair kits issued *after* January 1, 1941, *only*.

3. Repair kit M5.—*a. Nonexpendable items.*

No.	Item	Quantity
26	Bag, cloth, for holding supplies	6
27	Bag, lens	20
1	Book of instruction, TM 3-205	1
50	Box, assembly, repair kit	1
10	Die, button	1
14	Drill, hand, 7/32-inch, with handle	1
11	Hammer, ball-peen, 12-inch, machinist's	1
9	Holder, bench die	1
21	Jig, angletube	1
20	Jig, eyepiece	1
3	Pliers, side cutting, 6-inch	1
25	Pliers, thin, bent-nose, 6-inch	1
13	Punch, cutting, single-bow, 7/64-inch	1
2	Screw driver, 1/4- by 2-inch blade	1
12	Set, tool	1
4	Shears, 6-inch	1
16	Tool, wire clamp closing	1
17	Tool, wire clamp stretching	1
7	Wrench, diaphragm guard	1
6	Wrench, lens	1
8	Wrench, strap	1

b. Expendable items.

No.	Item	Quantity
117	Angletube and guard, assembly (M3 diaphragm facepiece)	2
82	Band, rubber, size 2	24
84	Band, rubber, size 4	24
85	Band, rubber, size 6	24
86	Band, rubber, size 8	24
133	Bolt, stove, round head, 1/4- by 3-inch	4
65	Buckle, web strap, 7/8-inch	48
89	Button and washer (rivet)	100
87	Clip, head harness	24
80a	Clamp, wire, 10 11/16-inch	10
118	Diaphragm, angletube, 2.55-inch diameter, cellulose acetate	10
93	Disk, inlet valve (MIXA1 and training canister), 2 1/16-inch diameter	10

No.	Item	Quantity
110	Eye ring (plastic eyepiece)	4
122	Gasket, diaphragm, 2 35/64-inch outside diameter	5
108	Gasket, lens, 2 3/4-inch	1
121	Guard, diaphragm, M3	5
99	Guard, outlet valve (MIA2 service facepiece)	40
104	Guard, outlet valve (M6 outlet valve)	16
67	Harness, head, MIIA1	25
15	Kit, sewing	5
107	Lens, glass, laminated, 2.74-inch diameter	12
109	Lens, plastic	20
72	Loop, wire, hose, .032- by 1 3/16-inch diameter	50
73	Loop, wire, .032- by 1 1/2-inch diameter	50
71	Loop, wire, outlet valve, .032- by 1 5/16- by 11/16-inch	75
123	Mouthpiece	5
106	Nut, machine screw, hexagonal #6	12
101	Nut, machine screw, hexagonal #8	12
52	Patch, adhesive	300
54	Plaster, adhesive, 1/4-inch, 10-yard roll	3
55	Plaster, adhesive, 5/16-inch, 10-yard roll	6
58	Plaster, adhesive, 3/8-inch, 60-yard roll	1
59	Plaster, adhesive, 1/2-inch, 10-yard roll	6
120	Retainer, diaphragm, M3	5
51	Rubber cement, can	1
105	Screw, machine, roundhead, #6, 1 1/4-inches	12
100	Screw, machine, roundhead, #8, 1/2-inch	12
94	Seat, inlet valve assembly (MIXA1 and training canister), 2 1/16-inch diameter	10
119	Spacer, diaphragm, M3	5
63	Tab, 1 7/16 inches, assembly (forehead)	24
64	Tab, 2 7/16 inches, assembly (cheek and chin)	48
53	Tape, bias, adhesive, 7/8-inch, 60-yard roll	1
88	Tip, clinch	24
95	Valve, outlet, MI	72
98	Valve, outlet, M6	50
134	Washer, iron, 1/4-inch bolt size	8
102	Washer, lock, #8 screw size	12
62	Webbing, cotton, black, type II, 3/4-inch, 12-foot roll	1
75	Wire, .020 inch by 10 3/4 inches	100
78	Wire, .041 inch by 7 3/4 inches	25
74	Wire, .020 inch by 7 inches	20
115	Y-tube, assembly	5

4. Repair kit M6 (optical).—*a. Nonexpendable items.*

No.	Item	Quantity
26	Bags, cloth, for holding supplies	3
1	Book of instructions, TM 3-205	1
10	Die, button	1
14	Drill, hand, 7/32-inch, with handle	1
11	Hammer, 12-ounce, ball-peen, machinist's	1
9	Holder, bench die	1
21	Jig, angletube, optical	1
3	Pliers, side cutting, 6-inch	2
13	Punch, cutting, single-bow, 7/64-inch	1
2	Screw driver, 1/4-inch by 2-inch blade	2
12	Set, tool	1
4	Shears, 6-inch	1
17	Tool, wire clamp stretching	1
16	Tool, wire clamp closing	1
7	Wrench, diaphragm guard	1
8	Wrench, strap	1
50	Box, assembly, repair kit	1

b. Expendable items.

No.	Item	Quantity
111	Adapter, eyepiece, optical	12
117	Angletube and guard assembly	2
84	Band, rubber, size 4	50
133	Bolts, stove, 1/4- by 3-inch, for jig	2
65	Buckle, web strap, 7/8-inch	12
89	Button (rivet)	48
51	Cement, rubber, pint can	1
80a	Clamp, wire, 10 11/16-inch	6
87	Clip, head harness	12
118	Diaphragm, angletube, 4-ply	10
90	Disk, inlet valve, 29/32-inch	20
122	Gasket, diaphragm, 2 35/64 inch outside diameter	10
104	Guard, for outlet valve, M6	5
121	Guard, diaphragm	3
68	Harness, head, M3, assembly	10
113	Holder, left, eyepiece	6
114	Holder, right, eyepiece	6
15	Kit, sewing	1
72	Loop, wire, hose, .032-by 1 3/16-inch	100
71	Loop, wire, outlet valve, .032-by 1 5/16-by 11/16-inch	50
123	Mouthpiece	4
106	Nut, machine screw, hexagonal #6	5
52	Patch, adhesive	125
56	Plaster, adhesive, 5/16-inch, 30-yard roll	1

No.	Item	Quantity
57	Plaster, adhesive, 3/8-inch, 30-yard roll	1
60	Plaster, adhesive, 1/2-inch, 30-yard roll	1
61	Plaster, adhesive, 3/4-inch, 20-yard roll	1
120	Retainer, diaphragm	5
112	Screw, adjusting, eyepiece	6
105	Screw, machine, roundhead, #6, 1-1/4 inch	5
132	Sleeve, seamless	6
63	Tab, 1 7/16-inch, assembly (forehead)	24
64	Tab, 2 7/16-inch, assembly (cheek and chin)	24
88	Tip, clinch	12
98	Valve, outlet, M6	50
89	Washer, for button	24
134	Washer, iron, 1/4-inch bolt size	4
62	Webbing, cotton, black, type II, 3/4-inch (feet)	6
76	Wire, 0.020-inch do	100

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[A. G. 062.11 (8-1-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

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Major General,
The Adjutant General.

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(For explanation of symbols see FM 21-6.)

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