

TECHNICAL REGULATIONS
No. 1120-5

WAR DEPARTMENT,
WASHINGTON, February 9, 1931.

CHEMICAL WARFARE SERVICE

CANDLES

Prepared under direction of the
Chief of Chemical Warfare Service

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SECTION I

GENERAL

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1. Purpose and scope.—These regulations are intended for the using arms. They give all necessary information regarding the construction, functioning, and identification of candles manufactured and issued by the Chemical Warfare Service.

2. References.—*a.* For marking shipments, see United States Army Specification No. 100-2B.

b. The cost of the candles described herein is contained in the price list, Chemical Warfare Service.

c. All personnel charged with handling chemical ammunition should familiarize themselves with AR 30-1270.

d. Pending the issue of a standard nomenclature list, Chemical Warfare Service, the nomenclature herein is mandatory and will be used in all requisitions.

3. Storage.—Candles should be stored in a cool, dry magazine and protected from the direct or reflected rays of sunlight.

4. Disposition of defective candles.—Defective candles (except the candle, irritant) which can not be fired and which have been condemned, should be destroyed, preferably by burning. If this method of disposal is not feasible, they may be destroyed by breaking up and burial under $2\frac{1}{2}$ or more feet of earth or in 10 or more feet of water.

If practicable the candle, irritant, will be destroyed only under the supervision of a Chemical Warfare Service officer. It should be determined with certainty that the contents of the candle, irritant, after being disposed of, can not come in contact with man or domestic animals in any way. Water or food is easily polluted by contents of the candle, irritant.

5. Reports of defective material.—A report of defective material will be submitted through channels to the Chief, Chemical Warfare Service, under the following headings:

- a. Name of the candle and lot numbers.
- b. Conditions of storage.
- c. Apparent cause of failure.
- d. Additional pertinent data relative to malfunctioning.

SECTION II

GENERAL DISCUSSION

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6. General remarks.—All candles described herein function by burning. The principle of operation for each candle is set forth in detail under the section of these regulations describing the candle.

7. Types of candles.—a. Three types of candles are manufactured, namely: Nontoxic smoke candle; lacrimatory (tear gas) candle; and irritant candle.

(1) There are three kinds of nontoxic smoke candles issued, namely: Candle, smoke substitute; candle, smoke, H. C., MI; and candle, smoke, H. C., MII.

(2) There are two types of lacrimatory candles issued, namely: Candle, lacrimatory, C. N., fast, MI; and candle, lacrimatory, C. N., slow, MI.

(3) There is only one kind of irritant smoke candle issued, namely: Candle, irritant, MI.

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b. Components.

Name	Size	Average weight	Composition		
			Candle	Starting mixture	Match head
1. Candle, smoke substitute.	Cylindrical; height, 6½ inches, w/cov.; diameter, 3¾ inches.	Pounds 3½	Nitre, coal dust, sulphur, borax, hard pitch.	-----	Potassium-chlorate, antimony, sulphide, dextrin.
2. Candle, smoke, H. C., MI.	Rectangular; length, 5¼ inches; width, 3¼ inches; thickness, 1½ inches.	2	Hexachlorethane, powdered zinc, zinc oxide.	Potassium perchlorate, antimony, zinc dust.	Same as No. 1.
3. Candle, smoke, H. C., MII.	Cylindrical; height, 5¼ inches w/mech; diameter 2¾ inches.	1¾	Hexachlorethane, powdered zinc, ammonium perchlorate, ammonium chloride.	Potassium nitrate, antimony trisulfide, dextrin.	
4. Candle, lacrimatory, C. N., slow, MI.	Cylindrical; height, 2¾ inches; diameter, 4 inches.	1¾	Chloracetophenone, magnesium oxide, .30 cal. smokeless.	Ferrous sulfide, hammer scale, black powder grade A, No. 7.	Do.
5. Candle, lacrimatory, C. N., fast, MI.	Cylindrical; height, 5¼ inches w/mech; diameter, 2¾ inches.	1	Chloracetophenone, magnesium oxide, E. C., blank fire powder.	Ferrous sulfide, hammer scale, black powder grade A, No. 7.	
6. Candle, irritant, MI.	Cylindrical; height, 5¼ inches; diameter, 7 inches.	9¼	Smokeless powder, diphenylamine-chlorarsine.	-----	Do.

8. Identification.—For identification purposes, candles, with the exception of the candle, smoke substitute, are given a mark number, painted gray and marked to show contents and persistency.

SECTION III

CANDLE, SMOKE SUBSTITUTE

Description	Paragraph
Action upon firing	9
Method of firing	10
Safety precautions	11
Painting and marking	12
Packing box for candles, smoke substitute	13
	14

9. Description.—The candle, smoke substitute, is the British type S, ground-smoke candle reconditioned for use. This candle will not be issued when the present supply is exhausted.

The candle consists of a tin case, cylindrical in shape, 5¾ inches high and 3¾ inches in diameter, filled with a solid smoke mixture. Figure 1 shows this candle in detail.

To the top of the case is fitted a case cover, containing a central circular hole 1 inch in diameter, through which the match head is inserted and from which the smoke escapes when the candle is

fired. A cardboard disk containing the match head is placed on top of the case cover. The match head extends down through the hole in the case cover and acts as the igniter for the smoke mixture. A scratch block for igniting the match head is taped to the cardboard disk on one side of the match head and a small strip of wood, the same size as the scratch block, is placed on the other side of the match head in such a manner that they are easily removable. The strip of wood, together with the scratch block, forms a protection for the match head. A metal cover is fitted over the top of the candle and sealed with adhesive tape.

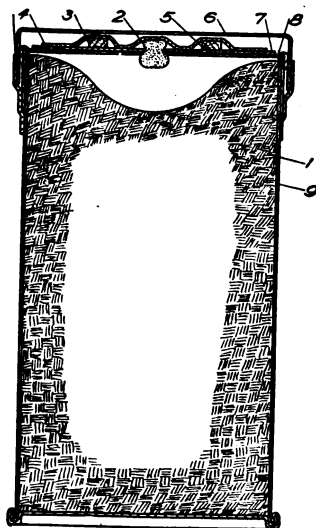


FIGURE 1.—Candle, smoke substitute

- | | | |
|---------------------|-------------------|--------------------|
| 1. Smoke mixture. | 4. Adhesive tape. | 7. Cardboard disk. |
| 2. Match head. | 5. Wood spacer. | 8. Inner cover. |
| 3. Scratcher block. | 6. Outer cover. | 9. Body. |

The candle completely assembled is $6\frac{1}{2}$ inches high and $3\frac{3}{8}$ inches in diameter, weighs $3\frac{1}{2}$ pounds, is painted black and is not marked or stenciled in any way. Figure 2 shows the candle, smoke substitute.

10. Action upon firing.—By drawing the scratch block quickly across the match head, the latter is ignited and flashes into the candle, igniting the smoke mixture. A delay of about three seconds occurs between the scratching of the match head and the evolution of smoke. The cardboard disk holding the match head burns off.

Smoke of a yellowish-brown color is generated in considerable volume for a period of three to four minutes. A small cloud of vapor

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at the finish usually lasts for another half minute. Figure 3 shows the candle, smoke substitute, in operation.

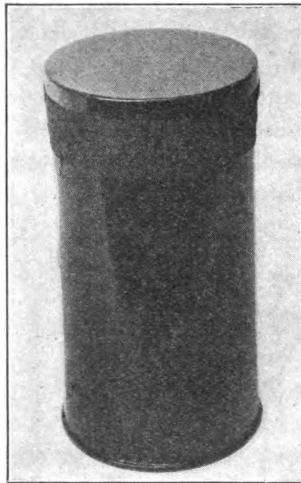


FIGURE 2.—Candle, smoke substitute

11. Method of firing.—*a. With scratch block.*—Remove the adhesive tape from the cover of the candle and remove cover. Place

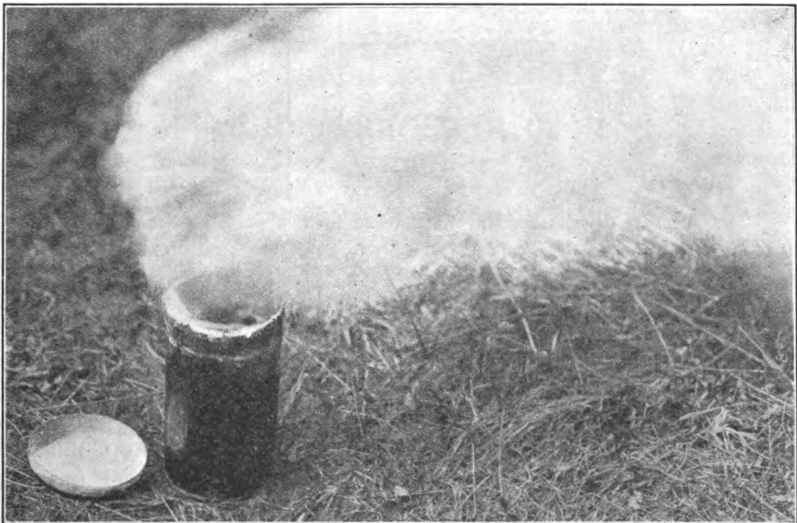


FIGURE 3.—Candle, smoke substitute, in operation

the candle in an upright position on the ground, grasp the scratch block, at the same time removing tape from the match head, and draw the scratch block across the match head.

b. With electric squib.—Remove the adhesive tape from the cover of the candle and remove cover. Remove the scratch block and tape exposing the match head. Remove the plug from the base of an electric squib and tape the squib with base (open end) securely against the match head.

To fire two or more candles, connect all the candles in a series and attach to the blasting machine. (See fig. 4.) The number of candles which may be fired electrically is limited only by the capacity of the exploder or blasting machine used.

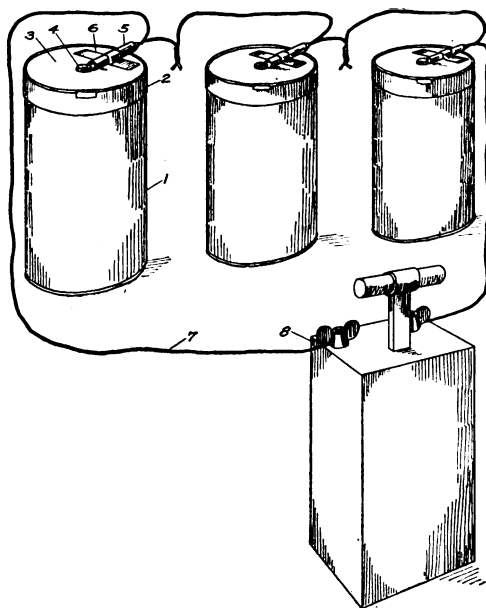


FIGURE 4.—Illustration of electrical method of firing candles

- | | | | |
|-----------------|--------------------|-------------------|---------------|
| 1. Candle. | 3. Cardboard disk. | 5. Squib. | 7. Lead wire. |
| 2. Inner cover. | 4. Match head. | 6. Adhesive tape. | 8. Exploder. |

12. Safety precautions.—*a.* After the cover is removed from the candle, the match head must be kept dry until it is ignited.

b. The candle should not be placed within 5 feet of dry grass or other readily inflammable material if a fire is to be avoided.

c. After igniting the match head, the firer should step back five paces. This precaution is necessary to prevent personnel from becoming spattered with burning particles should the candle not function properly. Owing to the length of time these candles have been in storage, they do not function as smoothly as could be desired, although there is no danger to anyone not standing directly over the candle.

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d. Should the candle burst into flames at the orifice, the flame may be extinguished by striking the orifice with any pliable object, such as a small branch of tree.

e. Store in a cool, dry place.

13. Painting and marking.—The candle, smoke substitute, is painted black. Paint is applied by dipping the candle in asphaltum paint for the purpose of protecting the container and preventing the access of moisture to the contents. No marking is placed on the candle, smoke substitute.

14. Packing box for candles, smoke substitute.—*a. Type.*—The candle, smoke substitute, is packed 20 to the box in a standard packing box of wood, made in accordance with the United States Army specifications and complying with Interstate Commerce Commission regulations.

The dimensions of the box are 21 by 15 $\frac{7}{8}$ by 9 $\frac{7}{8}$ inches. The box empty weighs 18 pounds. Weight of the packing box containing 20 candles is approximately 88 pounds. Displacement is 1.9 cubic feet.

To remove contents, the top of the box is pried off.

Each box contains two cards, one giving directions for the use of the candle and the other a card of data giving the lot number, date of reconditioning, date of packing, etc.

b. Marking.—The marking which appears on the packing box for candles, smoke substitute, is shown in Figures 5, 6, and 7.

SECTION IV

CANDLE, SMOKE, H. C., MI

	Paragraph
Description.....	15
Action upon firing.....	16
Directions for firing.....	17
Safety precautions.....	18
Painting and marking.....	19
Packing box for candles, smoke, H. C., MI.....	20

15. Description.—The candle, smoke, H. C., MI, is a rectangular tin container 1 $\frac{1}{2}$ by 3 $\frac{1}{4}$ by 5 $\frac{1}{4}$ inches high with crimped joints and rounded corners, containing a solid smoke mixture, starting mixture, match head, and scratch block. For details, see Figure 8.

The inner cover with rectangular hole in the center 2 by $\frac{7}{16}$ inches is fitted to the can on top of the smoke mixture.

A zinc cup, rectangular in shape, containing the starting mixture, is pressed into the recess of the inner cover and soldered to the inner cover. The match head contained in a small strip of card-

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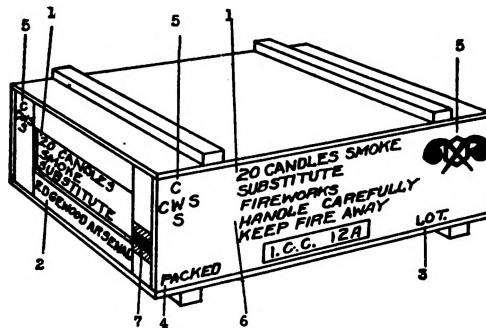


FIGURE 5.—Marking of packing box for candle, smoke substitute

1. Quantity and kind of candle.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Yellow stripe on blue-gray background.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 7.

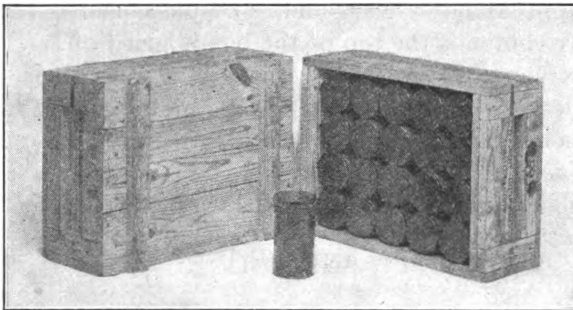


FIGURE 6.—Candle, smoke substitute, showing shipping containers, and method of packing and marking

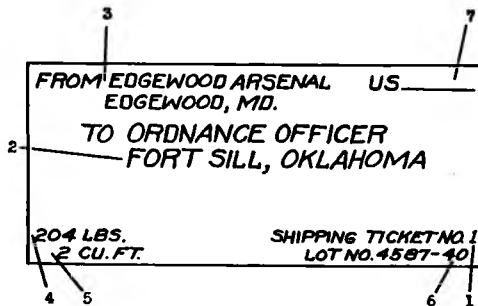


FIGURE 7.—Address side for all packing boxes

1. Number of shipping ticket.
2. Designation and address of consignee (as shown on shipping instructions).
3. Consignor.
4. Gross weight, in pounds.
5. Cubic displacement, in cubic feet.
6. Ammunition lot number.
7. To indicate United States property.

NOTE.—Shipping officer may omit 2 and 3 in carload shipments.

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board is assembled to the zinc cup containing the starting mixture and crimped to hold it in place.

The match head is covered by a paper sheet of the inside dimensions of the can which protects the match head from the scratch block. The scratch block is placed on top of the paper, the outer tin cover fitted over the top of the can and sealed with adhesive tape.

The candle weighs approximately 2 pounds.

16. Action upon firing.—The scratch block drawn quickly across the match head ignites the match head, which in turn ignites the starting mixture. The starting mixture burns through the zinc

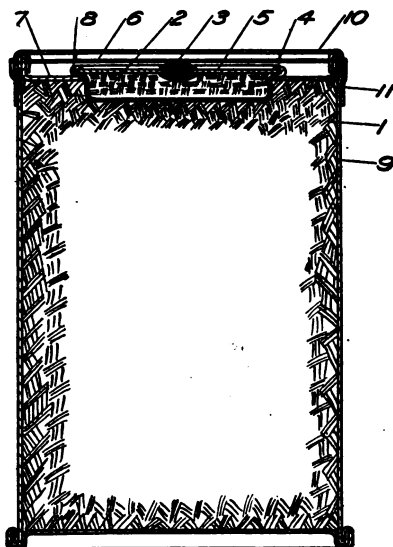


FIGURE 8.—Candle, smoke, H. C., MI

- | | | | |
|----------------------|----------------------|------------------|--------------------|
| 1. Smoke mixture. | 4. Scratcher block. | 7. Inner cover. | 10. Cover. |
| 2. Starting mixture. | 5. Match head plate. | 8. Ignition cup. | 11. Adhesive tape. |
| 3. Match head. | 6. Shield. | 9. Body. | |

cup and starts a chemical reaction of the smoke mixture, generating considerable heat with the formation of zinc chloride.

The zinc chloride escapes into the air as a dense white smoke, composed of finely divided solid particles, which readily absorb moisture and become highly obscuring liquid particles.

The candle burns from 2 to 4 minutes in full volume. A small stream of vapor lasts for one-half minute longer. Figure 9 shows the candle, smoke, H. C., MI, in operation.

17. Directions for firing.—*a. With scratch block.*—Remove the tape from the top of the can. Take off the cover and remove scratch

block and paper disk. To fire, rub the scratch block across the match head.

b. With electric squib.—The candle is fired electrically as described in paragraph 11*b*.

18. Safety precautions.—*a.* After removal of the cover from the candle the match head must be kept dry until ignited.

b. The candle should not be placed within 5 feet of dry grass or other readily inflammable material, if a fire is to be avoided.

c. After the candle is ignited, personnel should remain at least 10 feet away from the burning candle. While the candle is practi-

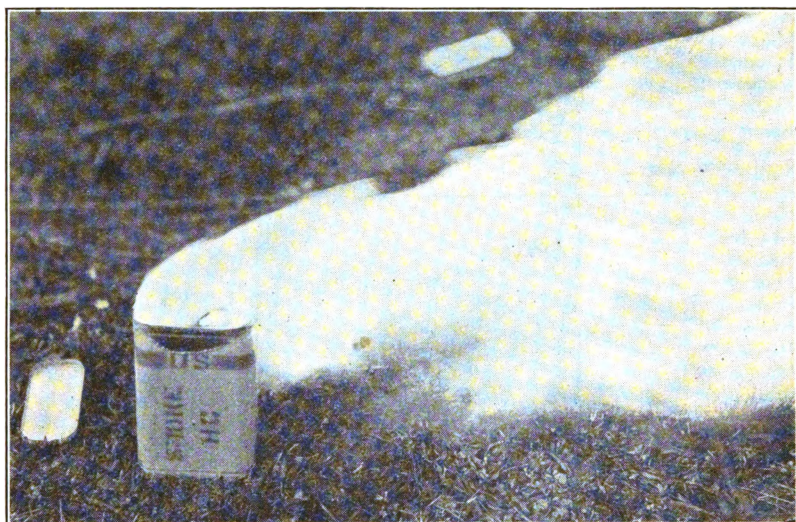


FIGURE 9.—Candle, smoke, H. C., MI, in operation

cally harmless, there is a tendency to throw out hot particles of the smoke mixture.

d. Store in a cool, dry place.

19. Painting and marking.—The candle, smoke, H. C., MI, is painted gray. A broken yellow band one-half inch wide containing the letters "U. S." on both sides is stenciled around the can 1 inch from the top. Stenciled on both sides of the can in yellow are the type and symbol, "Smoke, H. C." On the bottom of the can, stenciled in yellow, are the manufacturer's identification mark and the lot number. (See fig. 10.)

20. Packing box for candles, smoke, H. C., MI.—*a. Type.*—The candle, smoke, H. C., MI, is packed 25 to the box in a standard packing box of wood, constructed in accordance with United States

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Army specifications and complying with Interstate Commerce Commission regulations. The dimensions of the box are 19 by 9 $\frac{3}{4}$ by

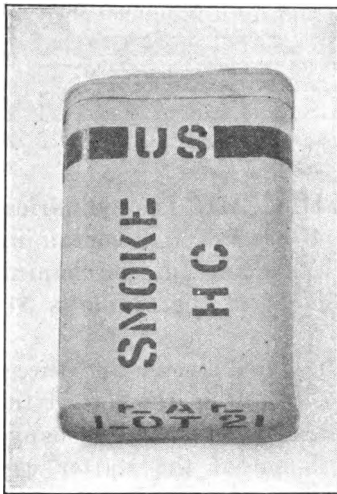


FIGURE 10.—Candle, smoke, H. C., MI, showing details of marking

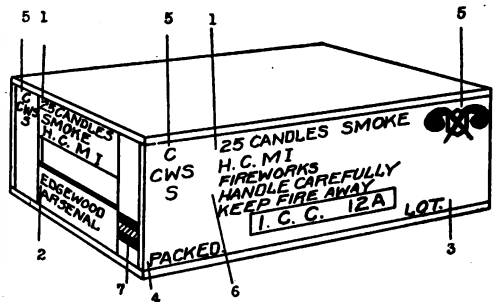


FIGURE 11.—Marking of packing box for candle, smoke, H. C., MI

1. Quantity and kind of candle.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Yellow stripe with blue-gray background.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 7.

6 $\frac{1}{2}$ inches. Weight of the box empty is 10 pounds; weight filled with 25 candles is approximately 60 pounds; displacement 0.7 cubic foot. Each box contains two cards, one giving directions for the

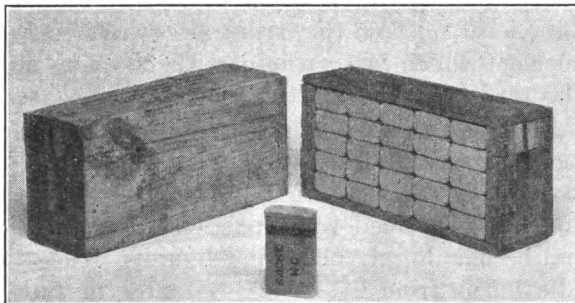


FIGURE 12.—Candle, smoke, H. C., MI, showing shipping containers and method of packing and marking

use of the candle, the other a card of data, giving the lot number, date of manufacture, date of packing, etc.

b. Marking.—The marking which appears on the packing box of candles, smoke, H. C., MI, is shown in Figures 7, 11, and 12.

SECTION V

CANDLE, SMOKE, H. C., MII

	Paragraph
Description.....	21
Action upon firing.....	22
Method of firing.....	23
Safety precautions.....	24
Painting and marking.....	25
Packing box for candles, smoke, H. C., MII.....	26

21. Description.—The candle, smoke, H. C., MII, is a cylindrical tin container $2\frac{5}{16}$ inches in diameter and $4\frac{1}{2}$ inches high containing a solid smoke mixture and a starting mixture and fuze mechanism for firing; with the fuze attached the height of the candle is $5\frac{3}{4}$ inches. For details, see Figure 13.

A zinc cup circular in shape, $1\frac{1}{8}$ inches in diameter and three-fourths inch deep, is placed in a depression left in the top of the smoke mixture. The top of the cup is flanged outward, the flange being nine-sixteenths inch wide. The flange of the starter cup covers the entire surface of the mixture.

The container top, in which there are four $\frac{1}{4}$ -inch holes covered by squares of adhesive tape and to which a brass adapter is riveted, is fitted to the can on top of the zinc starter cup. Into the brass adapter is assembled a fuze, MI.

The candle, with fuze attached, weighs approximately $1\frac{3}{4}$ pounds.

22. Action upon firing.—When the safety pin of the fuze is pulled and the lever released the striker fires the primer, this ignites the delay element which in turn ignites the starting mixture. The starting mixture burns through the zinc cup and starts a chemical reaction of the smoke mixture, generating considerable heat with the formation of zinc chloride.

The zinc chloride escapes into the air as a dense white smoke, composed of finely divided solid particles, which readily absorb moisture and become highly obscuring liquid particles.

The candle burns from $2\frac{1}{2}$ to $3\frac{1}{4}$ minutes in full volume. A small stream of vapor lasts for possibly $\frac{1}{4}$ minute longer. Figure 14 shows the candle, smoke, H. C., MII, in operation.

23. Method of firing.—Grasp the candle with lever held firmly against candle body, withdraw safety pin, keeping a firm grasp around candle and lever. Either throw the candle with a full swing of the arm like a grenade or place on the ground. As the candle

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is released from the hand the lever drops away allowing the striker to fire the primer.

24. Safety precautions.—*a.* The candle should not be thrown into or placed within 5 feet of dry grass or other readily inflammable material, if a fire is to be avoided.

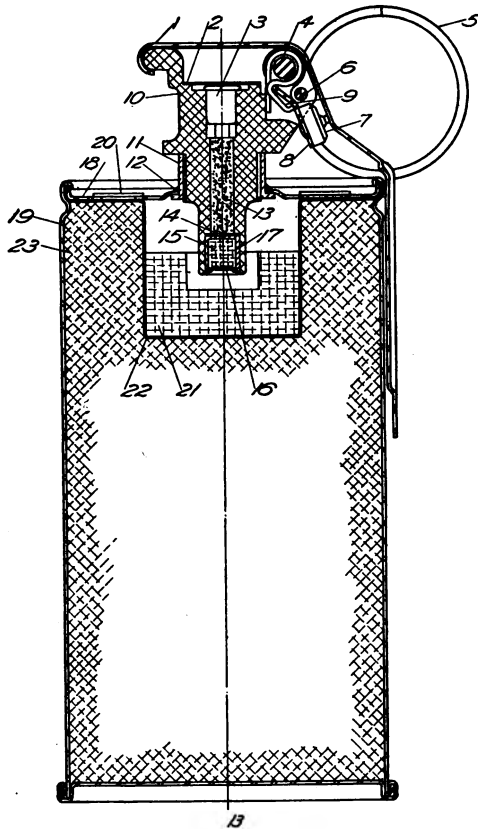


FIGURE 13.—Candle, smoke, H. C., MII

- | | | |
|------------------------------------|----------------------------------|-------------------------------|
| 1. Lever. | 10. Fuze body. | 17. Cup. |
| 2. Disk. | 11. Adapter. | 18. Top. |
| 3. New No. 4 primer. | 12. Solder. | 19. Container body. |
| 4. Hinge pin. | 13. Delay element. | 20. Zinc oxide adhesive tape. |
| 5. Ring. | 14. 0.06 gram Army black powder. | 21. Starter mixture. |
| 6. $\frac{1}{8}$ -inch cotter pin. | 15. 0.12 gram Army black powder. | 22. Starter mixture cup. |
| 7. Striker point. | 16. Cup disk. | 23. Smoke mixture. |
| 8. Striker. | | |
| 9. Spring. | | |

b. After the candle is ignited, personnel should remain at least 5 feet away from the burning candle. While the candle is practi-

cally harmless, the smoke is evolved with great vigor and there is a tendency to throw out hot particles of residue.

c. Store in a cool, dry place.

25. Painting and marking.—The candle, smoke, H. C., MII, is painted gray. A yellow band $\frac{1}{2}$ -inch wide is painted around the can, 2 inches from the top. Stenciled in yellow in $\frac{1}{2}$ -inch letters is the symbol "H. C." $\frac{1}{2}$ inch from the top of the container and the type "SMOKE" $1\frac{1}{4}$ inches from the top of the container. Below the yellow band, stenciled in yellow, are the letters "U. S.," the

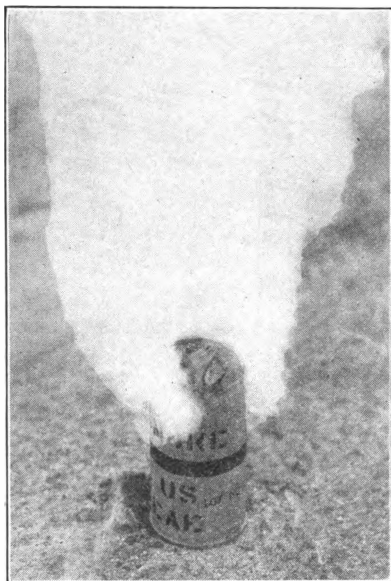


FIGURE 14.—Candle, smoke, H. C., MII, in operation

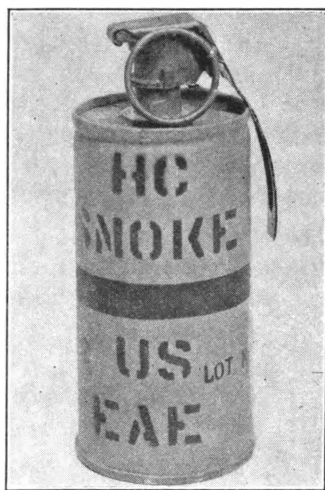


FIGURE 15.—Candle, smoke, H. C., MII, showing details of marking

manufacturer's identification mark and the lot number. (See fig. 15.)

26. Packing box for candles, smoke, H. C., MII.—*a. Type.*—The candle, smoke, H. C., MII, is packed 25 to the box in a standard packing box of wood, constructed in accordance with United States Army specifications and complying with Interstate Commerce Commission regulations. The dimensions of the box are $13\frac{5}{16}$ by $13\frac{9}{16}$ by $7\frac{5}{8}$ inches. Weight of the box empty is 6.25 pounds. Weight filled with 25 candles, approximately 50 pounds. Displacement 0.8 cubic foot. Each box contains two cards, one giving directions for the

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use of the candle, the other a card of data, giving the lot number, date of manufacture, date of packing, etc.

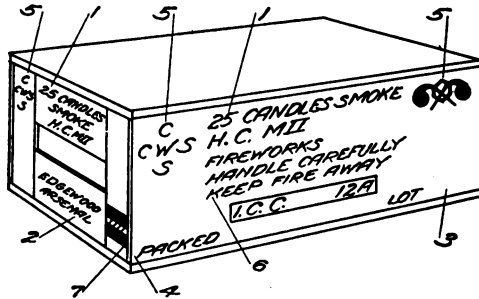


FIGURE 16.—Marking of packing box for candle, smoke, H. C., MII

1. Quantity and kind of candle.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Yellow stripe with blue-gray background.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side) see Figure 7.

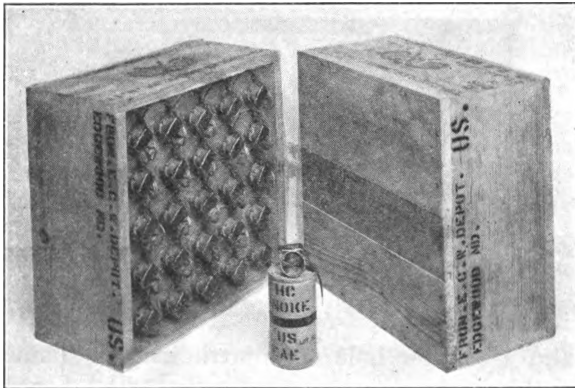


FIGURE 17.—Candle, smoke, H. C., MII, showing shipping container and method of packing and marking

b. Marking.—The marking which appears on the packing box of candles, smoke, H. C., MII, is shown in Figures 7, 16, and 17.

SECTION VI

CANDLE, LACRIMATORY, C. N., SLOW, MI

	Paragraph
Description.....	27
Action upon firing.....	28
Method of firing.....	29
Safety precautions.....	30
Painting and marking.....	31
Packing box for candles, lacrimatory, C. N., slow, MI.....	32

27. Description.—The candle, lacrimatory, C. N., slow, MI, consists of a cylindrical tin container 4 inches in diameter and $2\frac{3}{4}$ inches in height, filled with a solid lacrimatory, C. N., mixture. An ignition tray of tin containing a hole seven-eighths inch in diameter in

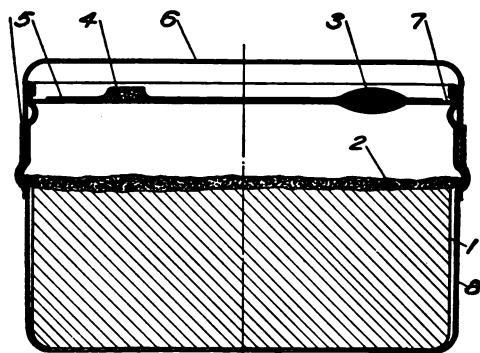


FIGURE 18.—Candle, lacrimatory, C. N., slow, MI

- | | |
|-------------------------|-------------------|
| 1. Lacrimatory mixture. | 5. Adhesive tape. |
| 2. Starter mixture. | 6. Cover. |
| 3. Match head. | 7. Ignition tray. |
| 4. Scratcher block. | 8. Body. |

the center and a smaller hole one-fourth inch in diameter on one side fits over the starter mixture. (See fig. 18.) A match head is placed in the $\frac{1}{4}$ -inch hole and a scratcher block, coated side down, is placed opposite the match head. A piece of adhesive tape is placed so as to cover the match head and the orifice and holds the scratcher block securely in position. The center-hole or orifice, seven-eighths inch in diameter, is provided as an outlet for the gases on ignition. A removable tin cover fits over the candle and is sealed by a strip of adhesive tape placed around the candle. The candle weighs $1\frac{3}{10}$ pounds.

28. Action upon firing.—On ignition, the match head ignites the starting mixture, which in turn ignites the lacrimatory mixture of the candle. Three seconds after igniting the match head the candle generates a lacrimatory, C. N., vapor, white to colorless, hav-

ing a fruitlike pungent odor. The candle comes to full volume within 30 seconds of ignition and continues in full volume for a period of 4 to 6 minutes. A small stream of vapor sometimes lasts for one-half minute longer. Figure 19 shows the candle, lacrimatory, C. N., slow, MI, in operation.

29. Method of firing.—*a. Scratcher block.*—Remove the cover. Remove the adhesive tape from the orifice and match head and secure scratch block. Place the candle on the ground and ignite the match head by a sharp stroke of the scratch block.

b. Electric squib.—The candle, lacrimatory, C. N., slow, MI, is fired by electric squib in the manner described in paragraph 11b.

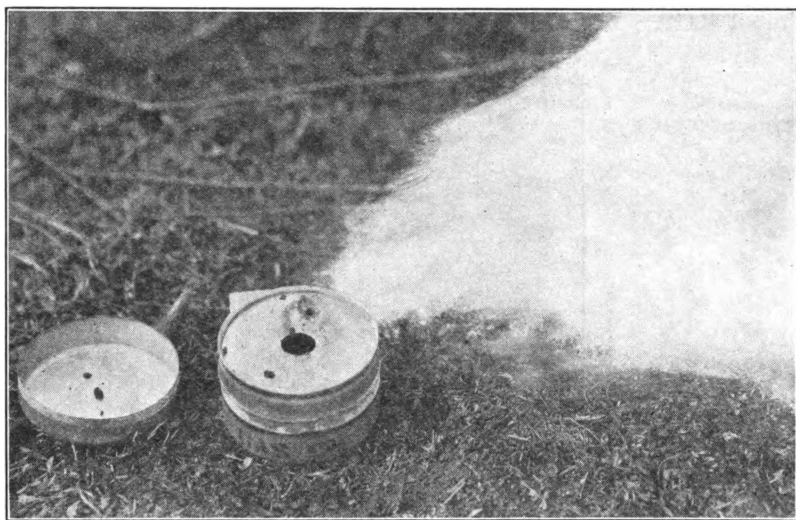


FIGURE 19.—Candle, lacrimatory, C. N., slow, MI, in operation

30. Safety precautions.—*a.* After the cover is removed from the candle, the match head must be kept dry until ignited.

b. The candle should not be placed within 2 feet of dry grass or other readily inflammable material if a fire is to be avoided.

c. In view of the fact that occasionally these candles start with great vigor, personnel igniting them will keep their faces well to one side and will not bend over the candle in such a way that the eyes are over the center hole.

d. If the vapors should flame at the orifice of the candle, the flame may be extinguished by striking with a leafy branch or other pliable object.

e. After the candle has been ignited, the firer should move upwind from the candle.

f. In open country with a 5-mile wind the territory gassed may be traversed without a mask within 5 minutes after the vapor cloud has passed.

g. The smokeless powder content will deteriorate when stored at high temperature, but does not constitute an explosive hazard because of the retarding effect of the chloracetophenone.

h. Candles, even though not ignited, will give off lacrimatory vapors when left uncovered in a room.

i. Store in a cool, dry place.

31. Painting and marking.—The candle, lacrimatory, C. N., slow, MI, is painted gray. One green band $\frac{1}{2}$ inch wide is painted around the can below the cover. Below the green band the type and symbol "GAS C. N.," are stenciled in $\frac{1}{2}$ -inch green letters. On



FIGURE 20.—Candle, lacrimatory, C. N., slow, MI, showing details of marking

the bottom of the can are stenciled in green the manufacturer's identification mark, lot number, and the letters "U. S." (See fig. 20.)

32. Packing box for candles, lacrimatory, C. N., slow, MI.—

a. Type.—Candles, lacrimatory, C. N., slow, MI, are packed 25 to a box. The packing box is a standard wooden box $22\frac{1}{4}$ by $22\frac{1}{4}$ by 4 inches, constructed in accordance with United States Army Specifications and complying with Interstate Commerce Commission regulations. Weight of the box is 20 pounds. The box filled with 25 candles weighs approximately 52 pounds. The displacement is 1.1 cubic feet. Each box contains two cards, one the directions for firing the candle, the other a card of data, showing manufacturer's lot number, date of manufacture, date of packing, etc.

CANDLES

b. Marking.—Packing boxes for candles, lacrimatory, C. N., slow, MI, are marked as shown in Figures 7, 21, and 22.

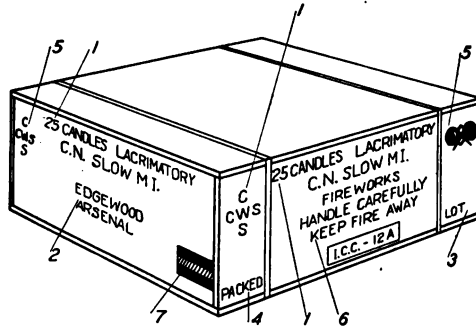


FIGURE 21.—Marking of packing box for candle, lacrimatory, C. N., slow, MI

- | | |
|---------------------------------|--|
| 1. Quantity and kind of candle. | 5. C. W. S. insignia. |
| 2. Name of place where packed. | 6. To comply with I. C. C. regulations. |
| 3. Lot number. | 7. Green stripe with blue-gray background. |
| 4. Month and year of packing. | |

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see Figure 7.

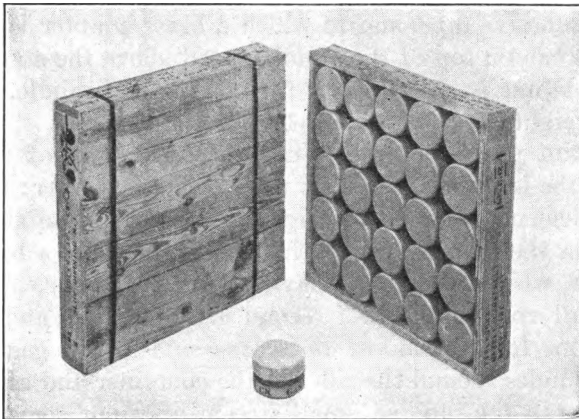


FIGURE 22.—Candle, lacrimatory, C. N., slow, MI, showing shipping container and method of packing and marking

SECTION VII

CANDLE, LACRIMATORY, C. N., FAST, MI

	Paragraph
Description.....	33
Action upon firing.....	34
Method of firing.....	35
Safety precautions.....	36
Painting and marking.....	37
Packing box for candles, lacrimatory, C. N., fast MI.....	38

33. Description.—The candle, lacrimatory, C. N., fast, MI, consists of a cylindrical tin container $2\frac{5}{8}$ inches in diameter and $4\frac{1}{2}$ inches high containing a solid lacrimatory, C. N. mixture, and a starting mixture and a fuze mechanism for firing; with the fuze attached the height of the candle is $5\frac{3}{4}$ inches. The container is provided with three rows of six holes each. The holes are five thirty-seconds inch in diameter. The rows of holes are perpendicular to the bottom of and spaced 120° apart on the circumference of the container. For details, see Figure 23.

The container top in which there are six $\frac{5}{32}$ -inch holes covered by squares of adhesive tape, and to which a brass adapter is riveted, is fitted to the can on top of the annular bead above the starter. Into the brass adapter is assembled a fuze, MI. The candle, with fuze attached, weights approximately 1 pound 1 ounce.

34. Action upon firing.—When the safety pin of the fuze is pulled and the lever released the striker fires the primer; this ignites the delay element which in turn ignites the starting mixture. Two seconds after the primer is fired the candle generates a lacrimatory, C. N., vapor, white to colorless, having a pungent odor. The candle comes to full volume within 1 second after ignition and functions at full volume for a period of 25 to 35 seconds. The gas is emitted from the 18 holes around the sides of the container and also through the six holes in the top. A small stream of vapor sometimes lasts for 10 to 15 seconds longer. Figure 24 shows the candle, lacrimatory, C. N., fast, MI, in operation.

35. Method of firing.—Grasp the candle with lever held firmly against candle body, withdraw safety pin, keeping a firm grasp around candle and lever. Throw the candle with a full swing of the arm. As the candle is released from the hand the lever drops away allowing the striker to fire the primer.

CANDLES

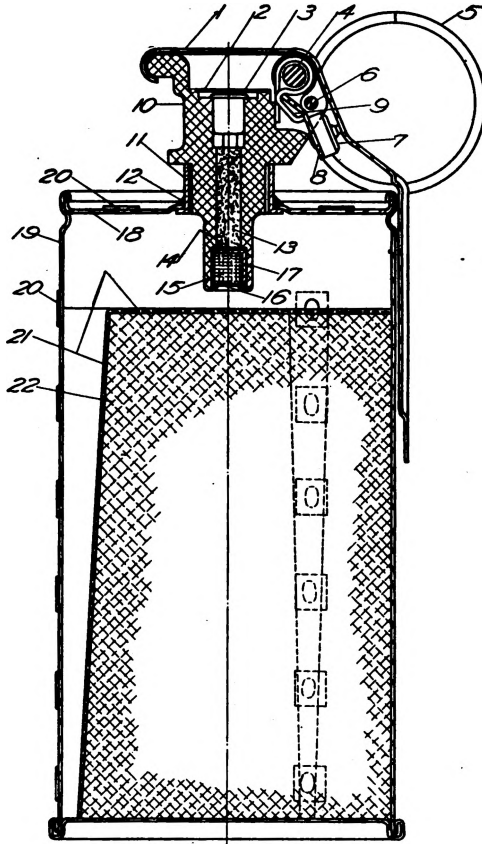


FIGURE 23.—Candle, lacrimatory, C. N., fast, MI

- | | | |
|------------------------------------|----------------------------------|-------------------------------|
| 1. Lever. | 10. Fuze body. | 16. Cup disk. |
| 2. Disk. | 11. Adapter. | 17. Cup. |
| 3. New No. 4 primer. | 12. Solder. | 18. Top. |
| 4. Hinge pin. | 13. Delay element. | 19. Container body. |
| 5. Ring. | 14. 0.06-gram Army black powder. | 20. Zinc oxide adhesive tape. |
| 6. $\frac{1}{8}$ -inch cotter pin. | 15. 0.12-gram Army black powder. | 21. Starter mixture. |
| 7. Striker point. | | 22. Lacrimatory mixture. |
| 8. Striker. | | |
| 9. Spring. | | |

36. Safety precautions.—*a.* The candle should not be thrown into dry grass or other readily inflammable material if a fire is to be avoided.

b. Do not hold the candle in the hand after the lever has been released, as these candles start very violently within two seconds after the primer is fired.

c. After the candle has been ignited the firer should move upwind from the candle.

d. In open country with a 5-mile wind the territory gassed may be traversed without a mask within five minutes after the vapor cloud has passed.



FIGURE 24.—Candle, lacrimatory, C. N., fast, MI, in operation

e. It is thought that the powder content will deteriorate when stored at high temperature, but does not constitute an explosive hazard because of the retarding effect of the chloracetophenone.

f. The candle, lacrimatory, C. N., fast, MI, is designed for use as a grenade, and as such should be used.

g. Store in a cool, dry place.

37. Painting and marking.—The candle, lacrimatory, C. N., fast, MI, is painted gray. A green band one-half inch wide is painted around the can, 2 inches from the top. Stenciled in green in $\frac{1}{2}$ -inch letters is the symbol "C. N.," one-half inch from the top of the container and the type "GAS," $1\frac{1}{4}$ inches from the top of the container. Below the green band stenciled in green are the

letters "U. S.," the manufacturer's identification mark and the lot number. (See fig. 25.)

38. Packing box for candles, lacrimatory, C. N., fast, MI.—

a. Type.—The candle, lacrimatory, C. N., fast, MI, is packed 25 to the box in a standard packing box of wood, constructed in accordance with United States Army specifications and complying with Interstate Commerce Commission regulations. The dimensions of



FIGURE 25.—Candle, lacrimatory, C. N., fast, MI, showing details of marking

the box are $13\frac{5}{8}$ by $13\frac{9}{16}$ by $7\frac{5}{8}$ inches. Weight of the box empty is 6.25 pounds. Weight of the box filled with 25 candles is approximately 32.75 pounds; displacement 0.8 cubic foot. Each box contains two cards, one giving directions for the use of the candle, the other a card of data, giving the lot number, date of manufacture, date of packing, etc.

b. Marking.—The marking which appears on the packing box of candles, lacrimatory, C. N., fast, MI, is shown in Figures 7, 26, and 27.

CHEMICAL WARFARE SERVICE

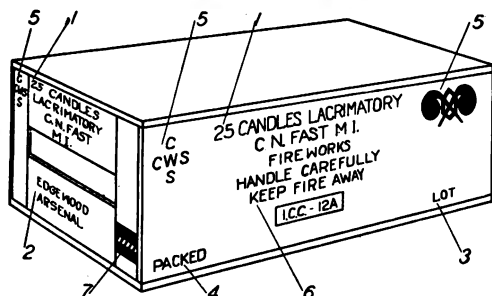


FIGURE 26.—Marking of packing box for candle, lacrimatory, C. N., fast, MI

1. Quantity and kind of candle.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Green stripe with blue-gray background.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see Figure 7.

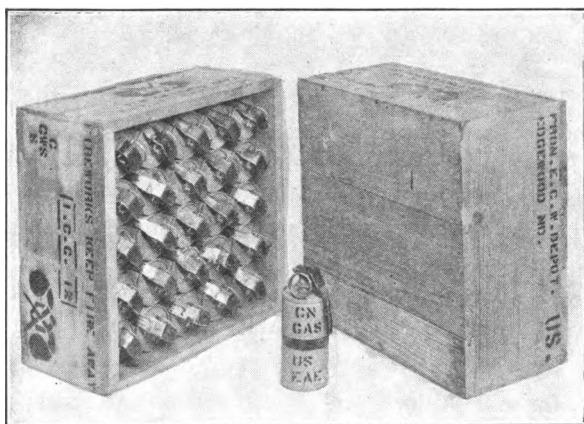


FIGURE 27.—Candle, lacrimatory, C. N., fast, MI, showing shipping container and method of packing and marking

The upper compartment, flanged at the bottom and constructed to form a flue, contains a 2-pound cake of D. M. (diphenylamine-chlorarsine). This compartment is assembled to the lower one by means of five bolts and an asbestos gasket. A slot at the top forms an orifice for the exit of the vapor. This slot is closed by means of adhesive tape. The filling hole opposite the exit slot is threaded to receive a metal plug.

The candle completely assembled weighs $9\frac{1}{4}$ pounds.

40. Action upon firing.—When firing wire is pulled out, the match head is ignited. This, in turn, ignites the smokeless powder which burns from 2 to $4\frac{1}{4}$ minutes.

The hot gases from the combustion of the smokeless powder pass up through the flue in the upper compartment and are deflected onto

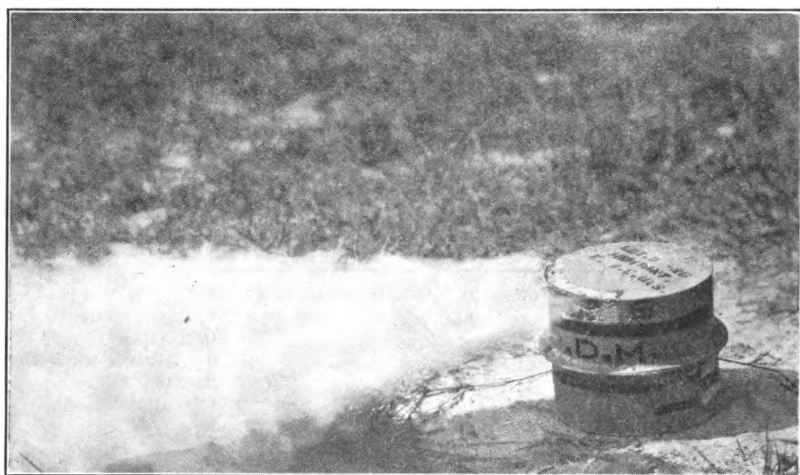


FIGURE 29.—Candle, irritant, MI, in operation

the surface of the D. M. prior to reaching the orifice of the candle. The D. M. is distilled off and passes out with the combustion gases of the smokeless powder, forming a characteristic cloud of D. M. irritant smoke—canary yellow in color. Figure 29 shows the candle, irritant, MI, in operation.

41. Directions for firing.—Remove the adhesive tape from the orifice. Remove the adhesive tape from the firing wire. Place the candle on the ground with the orifice downwind, hold the candle firmly to the ground, straighten the firing wire to a horizontal position and pull outward quickly. A hissing sound indicates that the match head has been ignited. In case of failure on the first trial, push the firing wire back to its original position and again

CANDLES

pull outward. Immediately after the candle is ignited, withdraw to a position 5 yards upwind from the candle.

42. Safety precautions.—*a.* Have a gas mask ready to adjust in case it is necessary.

b. The candle should not be placed within 2 feet of dry grass or readily inflammable material if a fire is to be avoided.



FIGURE 30.—Candle, irritant, MI, showing details of marking

c. Store in a cool, dry place.

d. Do not remove the tape covering the firing wire until ready to use the candle.

e. When firing, point the orifice downwind, the operator in rear.

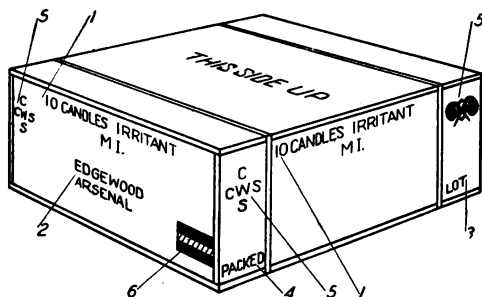


FIGURE 31.—Marking of packing box for candle, irritant, MI

1. Quantity and kind of candle.
2. Name of place where packed.
3. Lot number.

4. Month and year of packing.
5. C. W. S. insignia.
6. Green stripe with blue-gray background.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see Figure 7.

43. Painting and marking.—The candle, irritant, MI, is painted gray. One green band is stenciled around the side of the candle.

On the side of the candle, stenciled in green, is the type and symbol "GAS D. M." On top of the candle stenciled in green are the lot number, date filled, and the designation "IRRITANT." (See fig. 30.)

44. Packing box for candles, irritant, MI.—*a. Type.*—The candle, irritant, MI, is packed 10 candles to the box in a standard packing box of wood, constructed in accordance with United States Army specifications and complying with Interstate Commerce Commission regulations. The weight of the empty box is 47 pounds; filled with 10 candles, 140 pounds, with displacement of 3.3 cubic feet.

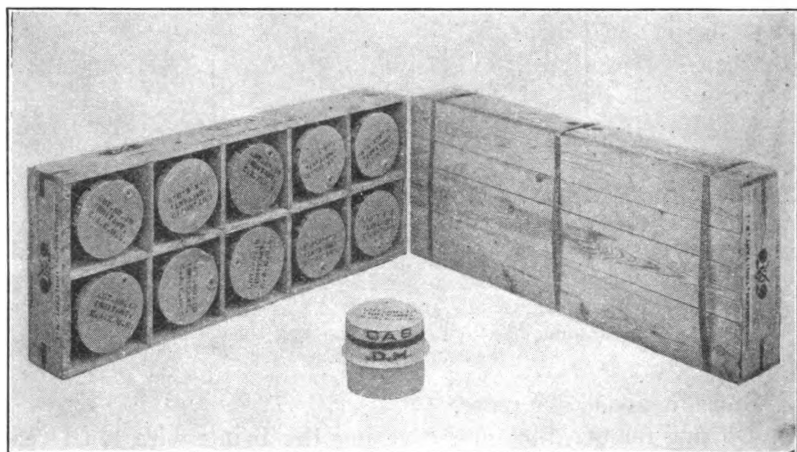


FIGURE 32.—Candle, Irritant, MI, and shipping container showing method of packing and marking

Each box contains two cards of data, one giving the directions for firing the candle, the other the lot number, date of manufacture, date of packing, etc.

b. Marking.—Packing boxes for candles, irritant, MI, are marked as shown in Figures 7, 31, and 32.

[A. G. 062.12 (9-16-30).]

BY ORDER OF THE SECRETARY OF WAR:

DOUGLAS MACARTHUR,

*General,
Chief of Staff.*

OFFICIAL:

C. H. BRIDGES,
*Major General,
The Adjutant General.*

TECHNICAL REGULATIONS
No. 1120-35

WAR DEPARTMENT,
WASHINGTON, October 21, 1930.

THE GAS MASK

Prepared under direction of the
Chief of the Chemical Warfare Service

	Paragraphs
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IV. Care, handling, packing, and storing.....	9-12
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SECTION I

GENERAL

	Paragraph
Purpose.....	1
Scope.....	2
References.....	3

- 1. Purpose.**—These regulations are intended for the using arms and services.
- 2. Scope.**—The scope of these regulations includes all necessary information regarding functioning, components, construction, identification, care and repair of the different types of masks, and the gas-mask repair kits, MIII and MII.
- 3. References.**—*a.* TR 155-5.
b. Standard Nomenclature List (S. N. L.) U-1 to U-22.
c. Procedure G. O., C. C. W. S.—VII.

SECTION II

GENERAL DESCRIPTION

	Paragraph
General description of the gas mask.....	4

4. General description of the gas mask.—*a.* The gas mask is an apparatus which purifies the air which the soldier breathes and protects his eyes and face when he is in an atmosphere contaminated with toxic or irritating gases, vapors, or smokes.

b. The principle of operation of the gas mask, which is based on air filtration, is illustrated in Figure 1. 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 smoke and dust, and the latter adsorbing 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.

a. The gas mask consists of a rubber face piece, a canister which contains the filtration system, and a rubber hose tube which connects the canister with

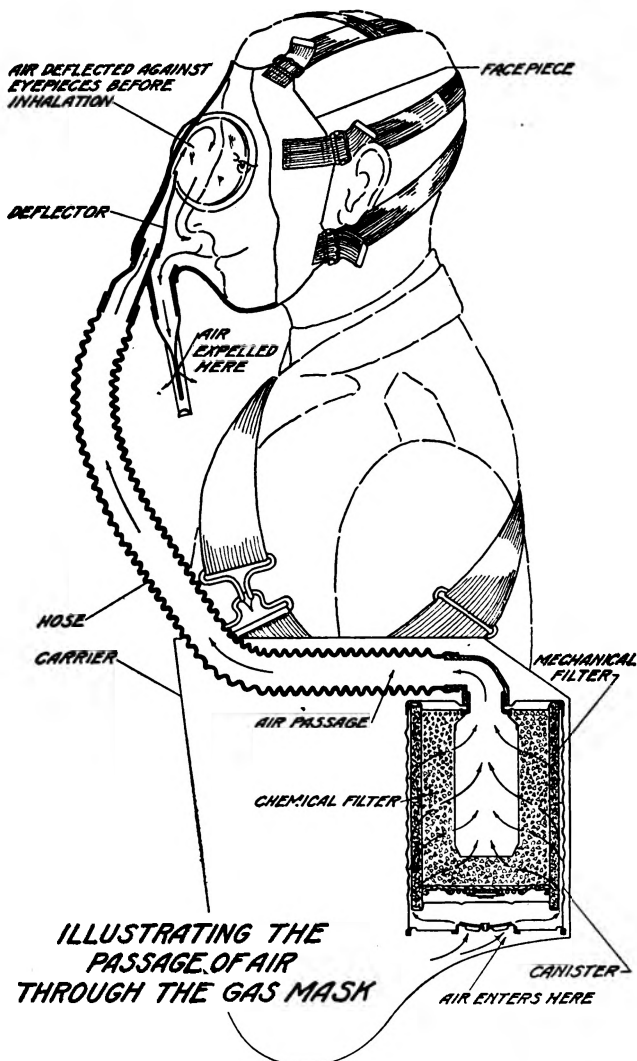


FIGURE 1

the face piece. The face piece fits snugly to the face so as to be gas tight and is held in place by an elastic head harness. It is equipped with glass eyepieces and a deflector which deflects inhaled air against the eyepieces so as to prevent fogging. In addition to this method of preventing dimming of the

eyepieces, a soaplike substance, known as "antidim," is spread as a thin layer over the inside of the eyepieces. The face piece is equipped with an outlet valve through which exhaled air is expelled and a metal tube which is connected to the canister by a rubber hose. The canister is a tin can containing a filter and absorbent chemicals which comprise the filtration system. It is equipped with an inlet valve which permits the entrance of incoming air and a nozzle for the exit of purified air. This nozzle is connected to the face piece by the rubber hose tube through which the purified air passes to the soldier's face. The entire mask is carried in a canvas carrier.



FIGURE 2.—Service gas mask

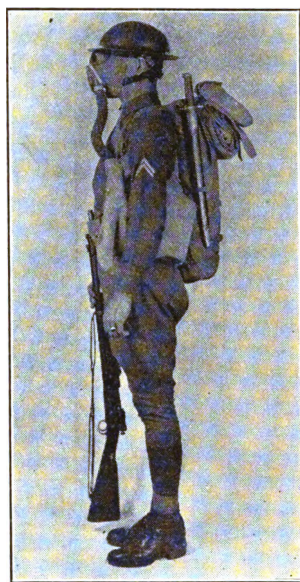


FIGURE 3.—Diaphragm gas mask

d. 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 face piece by any other route. There is at the present time no known toxic gas, vapor, or smoke against which adequate protection can not be provided. Special canisters can be made up with filtration systems that will eliminate from the air breathed any one or all of the known toxic gases or dusts. No canister, however, affords protection indefinitely. The life of the canister is dependent not only on the total quantity of gas which it is capable of filtering out of the air but also upon the concentration of the gas which it is required to eliminate. For very high concentrations the life of the canister may be only a few minutes, while in low concentrations it may be a matter of several hours before the canister becomes so saturated with gas that it fails to protect. The filtration system of the Army canister affords 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 affords no protection, although adequate protection could be provided if neces-

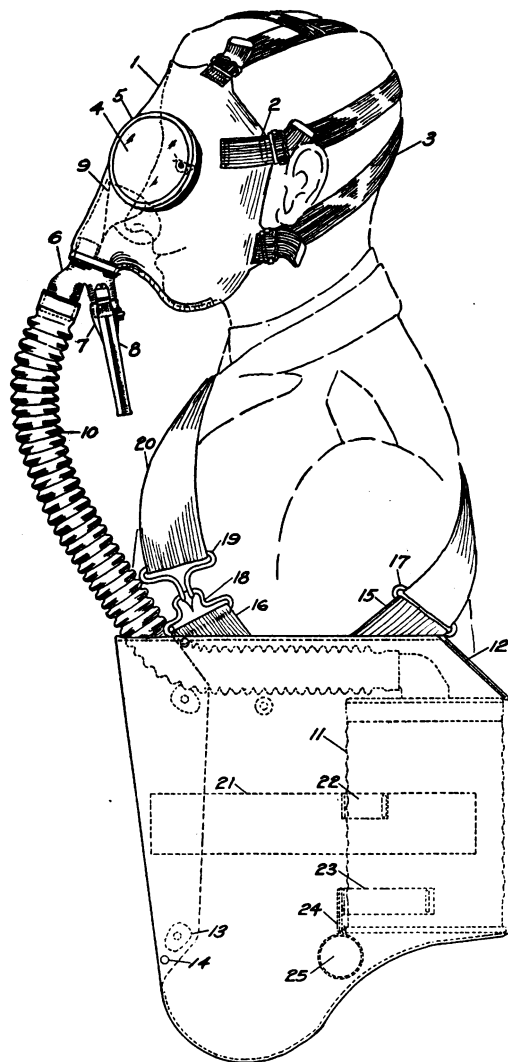


FIGURE 4.—Gas mask with service face piece

- | | | |
|------------------------|----------------------------|------------------------|
| 1. Rubber mask. | 10. Hose. | 19. Hook clasp. |
| 2. Harness attachment. | 11. Canister. | 20. Shoulder strap. |
| 3. Head harness. | 12. Carrier body. | 21. Body strap. |
| 4. Lens. | 13. Lift-the-dot fastener. | 22. Upper can strap. |
| 5. Eye piece. | 14. Rivet. | 23. Lower can strap. |
| 6. Angle tube. | 15. Chape 30°. | 24. Antidim set strap. |
| 7. Outlet valve. | 16. Chape 45°. | 25. Antidim set. |
| 8. Outlet valve guard. | 17. Strap loop. | |
| 9. Deflector. | 18. Eye clasp. | |

sary. Neither does the Army canister, nor any canister type of gas mask, afford protection in an atmosphere containing an insufficient amount of oxygen to support life.

e. There are two types of gas mask approved as standard—the service gas mask (fig. 2) and the diaphragm gas mask (fig. 3). These two types are in many respects the same, the essential difference being that the face piece of the diaphragm gas mask is equipped with a diaphragm to facilitate conversation. In addition to these two there are two others—the A. T. (Akron-Tissot) and the K. T. (Kops-Tissot) which are obsolete, but are still used to some extent for training purposes.

f. There is a number of different types of both the service and the diaphragm gas mask. The difference between these types is in the canister and the carrier. Thus the face piece of the service gas mask, which is designated as face piece, service gas mask, may be assembled with any one of a number of different canisters and carriers, and the same is true for the face piece of the diaphragm gas mask which is designated as face piece, diaphragm gas mask. Each of these types of gas mask is designated by the type of face piece and three numbers which are, in order, the M numbers of the face piece, the canister and the carrier, respectively. Thus mask, gas, service, type 1-4-3, is the service gas mask with MI service face piece, MIV canister, and MIII carrier.

SECTION III

COMPONENT PARTS

	Paragraph
Service face piece MI.....	5
Hose	6
Service canisters.....	7
Carriers	8

5. **Service face piece MI.**—*a. The service face piece MI* (fig. 4), is a rubber mask, with eyepieces, a tube known as the angle tube for connecting the face piece with the canister, a deflector, an outlet valve, and a head harness. This face piece is of the Tissot or single-protection type, in that it has neither nose clip nor mouthpiece. The entering air circulates freely about the soldier's face so that he may breathe either through the mouth or nose. There are two service face pieces, MI and MIAI, the difference being that the eyepieces of the MI are held in place by a crimped type of binder ring while those for the MIAI are held in place by a screwed-in binder ring.

(1) *Rubber mask.*—The rubber mask is made from a flat piece of stockinette-covered rubber known as the face blank. This blank is of such shape that when it is folded double, a single seam (chin seam) will produce the proper shape to fit the face and at the same time provide a small round hole in the lower front portion in which the angle tube is inserted. The holes in the face blank provided for the eyepieces are elliptical in shape so that when the eyepieces are inserted, an uneven tension on the fabric is produced. This causes the mask to fit snugly across the forehead, and the eyepieces to bulge forward and to return to this position if they are pushed in.

(2) *Eyepieces.*—The eyepieces consist of metal eyepiece frames which are crimped to the face blank. Nonshattering laminated glass lenses are held in place in the frames and rendered gas tight by washers and a screwed-in type of binder ring (service face piece MIAI). This type of binder ring makes it

possible to readily replace broken lenses in the field. Service face pieces, MI, many of which are now in use, are not equipped with this screw type of binder ring but are equipped with a crimped type of binder ring which can not be replaced in the field.

(3) *Angle tube*.—The angle tube connects the face piece with the rubber hose, which in turn is connected to the canister. It is made of an aluminum alloy and contains two separate tubes or air passages, through one of which inhaled air enters the face piece while through the other exhaled air is expelled. It is inserted in the hole in the face piece so that one air passage is above the other. The upper passage, which is for incoming air, is connected with the hose on the outside of the face piece and with the deflector on the inside. The lower passage, through which the exhaled air is expelled, is connected on the outside of the face piece with the outlet valve and on the inside is open to receive expelled air. These connections of the angle tube with the face piece, the hose, deflector, and the outlet valve are made air-tight by the use of rubber cement, adhesive tape, and steel binding wire.

(4) *Deflector*.—The deflector is a butterfly-shaped piece of rubber which causes air entering the face piece to pass up and across the inner surfaces of the eyepieces, thus preventing to some extent the obscuration of vision due to condensed moisture on the lenses. It is held in place by its attachment to the angle tube and by cementing it to the face piece just below the eyepieces.

(5) *Outlet valve*.—The outlet valve is made of rubber and opens to permit exhaled air to pass out from the face piece but closes on inhalation. This valve is protected by a metal guard.

(6) *Head harness*.—The head harness, which holds the face piece firmly in place, consists of six elastic tapes each attached at one end to buckles which are in turn attached to the edge of the face piece. The other ends of the tapes are attached to a rectangular piece of canvas-covered felt called the harness pad. Due to the fact that the buckles are attached to the face piece rather than the harness pad, as in early production face pieces, the head harness can now be readily replaced in the field.

b. Diaphragm face piece.—The diaphragm face piece (fig. 5) is in many respects the same as the service face piece, the only difference being the changes necessitated by the modification of the angle tube so as to permit the insertion of a diaphragm to facilitate conversation. The face-piece material, the method of forming the face piece, the eyepieces, the outlet valve, and the head harness for the diaphragm face piece are substantially the same as for the service face piece. The angle tube and deflector of the diaphragm face piece are, however, very different, being combined in a single metal die casting which contains a circular opening for the diaphragm. This die casting, with the perforated metal disk for holding the diaphragm in place, is known as the angle tube assembly. There is but one diaphragm face piece—face piece, diaphragm gas mask MIAI.

This angle tube assembly is inserted into the face piece and held in place in the same manner as the angle tube of the service face piece. Its essential features are a circular perforated inset $2\frac{7}{8}$ inches in diameter, to accommodate the diaphragm, which is a thin disk of Bakelite (micarta¹), two perforated

¹ A tracing-cloth diaphragm was employed in the earlier production of the diaphragm face piece, and some of these are still in use.

THE GAS MASK

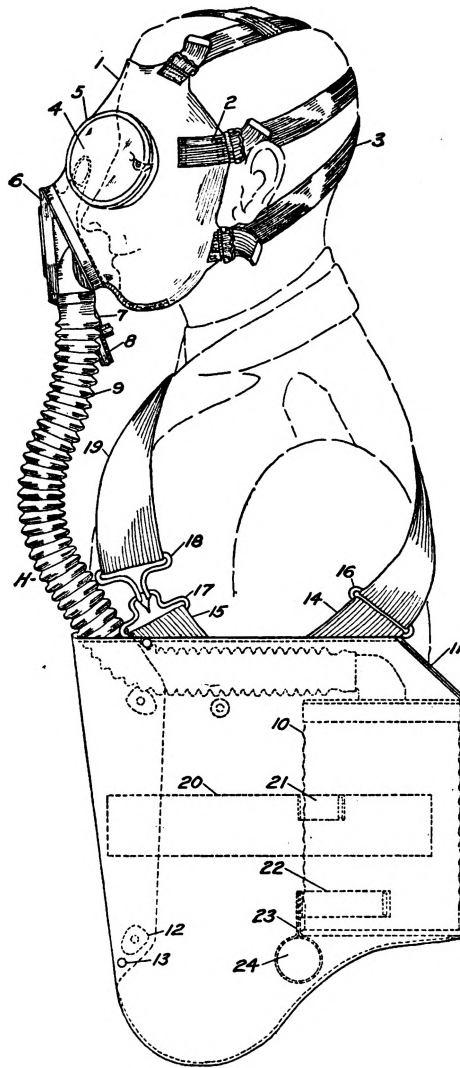


FIGURE 5.—Gas mask with diaphragm face piece

- | | |
|----------------------------|------------------------|
| 1. Rubber mask. | 13. Rivet. |
| 2. Harness attachment. | 14. Chape 30°. |
| 3. Head harness. | 15. Chape 45°. |
| 4. Lens. | 16. Strap loop. |
| 5. Eyepiece. | 17. Eye clasp. |
| 6. Angle tube. | 18. Hook clasp. |
| 7. Outlet valve. | 19. Shoulder strap. |
| 8. Outlet valve guard. | 20. Body strap. |
| 9. Hose. | 21. Upper can strap. |
| 10. Canister. | 22. Lower can strap. |
| 11. Carrier body. | 23. Antidim set strap. |
| 12. Lift-the-dot fastener. | 24. Antidim set. |

metal disks, and a washer for holding the diaphragm in place and maintaining a gas-tight fit, and two separate tubes or air passages extending into the face piece. The air passage for incoming air is connected by an extension on the outside of the face piece below the diaphragm to the hose, while the extension inside the face piece forms a Y-shaped deflector, each branch of which is directly under an eyepiece. Incoming air is equally distributed over the eyepieces by a brass baffle placed in one fork of the deflector. The other air passage, which provides an exit for exhaled air, is merely an open tube within the face piece to which is attached the outlet valve. The attachment of this valve within the face piece rather than to the extension outside the face piece, as in the case of the service face piece, is for the purpose of reducing the length of both the valve and valve guard outside the face piece in order to prevent interference with rifle firing when the mask is worn.

6. *Hose*.—The hose is a tube made of corrugated stockinette-covered rubber and is 27 inches long. It connects the canister to the face piece.

7. *Service canisters*.—*a. General*.—The standard service canister for the Army gas mask has been modified a number of times since the World War as the result of researches which have disclosed means of increasing its efficiency, decreasing breathing resistance, and simplifying its construction. These modifications have resulted in the production of a series of four service canisters: The MI (or blue canister), the MII (or blue canister with olive-drab top), the MIII (or olive-drab canister), and the MIV (fig. 6). All four

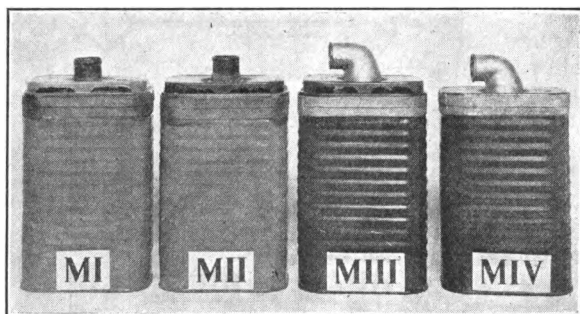


FIGURE 6.—Service canisters MI, MII, MIII, MIV

types of service canisters are being used with both the service face pieces and the diaphragm face piece, but only the canister MIV is approved as standard. In many respects these canisters are very much alike. They are all of the same size and shape, and many of the components used in their construction are essentially the same. In addition to the approved Army gas mask service canisters, the Chemical Warfare Service also produces a training canister, which is the war-time green canister modified for use with carrier MII for training troops, and special canisters for use in affording protection against one or more particular gases and smokes.

b. Service canister MI.—In outward appearance the service canister MI (fig. 7) is a blue tin can or box about 7 by 5 by 2 inches which has two lids, one above the other, and a brass nozzle passing through the center of both lids to the inside of the can. The lower lid or can top has two small holes on either side of the nozzle. These holes are fitted with valve sleeves and

THE GAS MASK

inlet valves which permit the entrance but not the exit of air. The upper lid, known as the rain shield, because it protects the inlet valves from rain and from being torn, is partially cut away on the sides so as to permit the entrance of air. It is held in place by a brass nut screwed down over the nozzle. The nozzle tube, which provides an exit for purified air, is connected with the filtration system within the outer can. This filtration system is built around an inner metal can whose sides are perforated like a sieve and which is known as the chemical container. In the center of the chemical container is a perforated metal, flat, inner tube covered with a muslin bag which extends from near the bottom through the top, where it is connected with the nozzle tube. The remaining space in the chemical container is filled with a mixture of the absorbent and neutralizing chemicals, charcoal and soda lime. These chemicals are held firmly in place by a false metal bottom known as a bottom follower, which is covered with a cotton pad and is supported by a heavy spring which rests on the true bottom of the chemical container. The

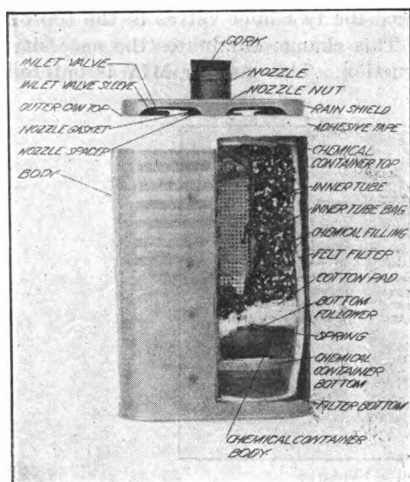


FIGURE 7.—Service canister MI sectionalized, showing component parts

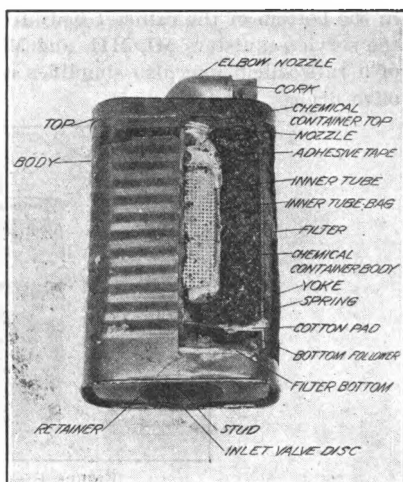


FIGURE 8.—Service canister MIV sectionalized, showing component parts

outside of the chemical container is wrapped with a piece of felt, which is so sealed at the seam and at the top and bottom that no air can enter the chemical container except through the felt. This filtration system, with its filter and the chemical container filled with absorbent and neutralizing chemicals, is a complete canister in itself, but in order to protect it against the weather and wear it is placed in the outer blue can.

c. Service canister MII.—The service canister MII is essentially the same as the service canister MI, the only difference being that the felt filter of the canister MII is impregnated in order to increase the protection afforded against toxic smokes. The top of this canister is painted olive drab and the body blue, in order to distinguish it from the service canister MI.

d. Service canister MIII.—The service canister MIII is essentially the same as the service canister MI, except that the canister MIII is equipped with a filter made of cotton linters which, when impregnated, provides still more effi-

cient protection against toxic smokes and has less breathing resistance than the impregnated felt filter. Both the top and body of the canister MIII are painted olive drab.

e. Service canister MIV.—The service canister MIV (fig. 8), the present standard for production, is the same size and shape as the previous standard, but a number of important changes has been made in its construction. The chemical container has been lengthened to take up all the dead space in the filter jacket (the space between the chemical container bottom and the filter bottom of the canister MIII). This change, by increasing the useful area of the filter and the chemical capacity of the container, decreases the breathing resistance and increases the protection afforded. A longer inner tube further reduces breathing resistance. The bottom follower of the chemical container and a cotton pad are held in position by a coil spring, which is kept in place by a yoke fitted into the chemical container. In addition to these changes in the chemical container an important change has also been made in the outer can of the service canister MIV. A single disk type inlet valve has been placed in the bottom of the canister body to replace the two inlet valves in the top of the service canisters MI, MII, and MIII. This change eliminates the necessity of a rain shield and also simplifies construction. The canister MIV is painted olive drab.

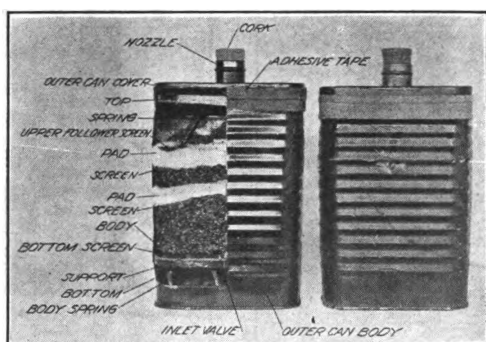


FIGURE 9.—Training canister

f. Training canister.—The training canister (fig. 9) is the old war time green canister which was used with the R. F. K., the A. T., and the K. T. masks, respectively. The chemical filling of charcoal and soda lime is separated by two cotton pads which give slight protection against toxic smoke. There is a large surplus supply of these canisters which are being used for training purposes where only chemical agents against which it does afford protection are employed. This canister is much smaller than the present standard canister and has its inlet valve in the bottom. In order that it may be utilized in the standard carrier, it is placed in the standard canister body and held in place by a coil spring. It was originally painted green but is now painted olive drab. It may be employed with the standard hose and face piece. A nozzle elbow is placed in the canister nozzle to prevent kinking of the hose where it joins the canister.

g. Special canister.—Special canisters are provided for specific purposes. They are filled with chemical absorbents which afford protection against one

or more particular gases which may be encountered in other activities. Their use is limited to the purpose for which designed. These canisters are described in special pamphlets.

8. **Carriers.**—The mask is carried in a canvas pouch known as a carrier. There are three types of carriers (fig. 10) now in use, the carrier MI (two position) and the carriers MII and MIII (side). The latter is the present approved standard.

a. **Carrier MI.**—The carrier MI (two position) (fig. 11) is a rectangular canvas pouch about 12 inches high, 10 inches wide, and 3 inches thick. The entrance is at the top and is closed by means of two snap fasteners. It is carried by means of a web sling which is fastened to the sides of the carrier near the top. It is always carried with the side containing the snap fasteners next to the body. The interior of the carrier is divided into two vertical compartments of approximately equal size. The canister is carried in the right-hand compartment and the face piece in the left. A small can containing a stick of Antidim is also carried in the face piece compartment. The hose passes over the top of the two compartments, and the flap cover is therefore made large enough to pass over and cover the hose. When the mask is in use or being carried ready for use (alert position), it is carried on the chest.

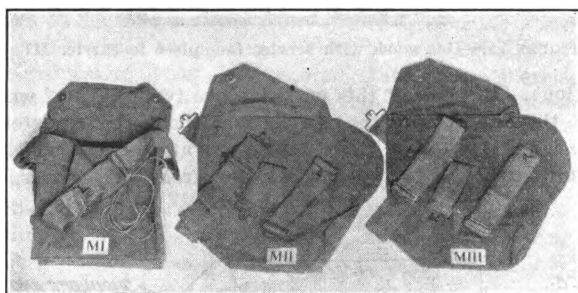


FIGURE 10.—Carriers MI, MII, MIII

There is a metal hook which is fastened to the sling about halfway between its two ends and a metal clasp at the left-hand end of the sling when it is fastened to the carrier. By fastening the hook and clasp together the sling is considerably shortened and when passed around the neck holds the carrier on the chest. A body cord is provided to hold the carrier in position on the chest. This cord has one end attached to the right-hand side of the carrier near the top and is carried in the canister compartment in the slung position. The 12-inch hose is used with this type of carrier.

b. **Carrier MII.**—The carrier MII (side satchel) (fig. 12) differs considerably from the carrier MI (two position). It is slightly larger and is rather irregular in shape. It is carried under the left arm and is held in place by a web sling which passes over the right shoulder, and by a waist strap of the same material. The mask is adjusted to the face directly from the carrying position, thus obviating the necessity of shifting to an alert position as in the carrier MI (two position). This single position has necessitated the lengthening of the hose to 27 inches. This longer hose is responsible for the slightly increased

size of the carrier. The opening is toward the front and is closed by means of a side flap which is provided with snap fasteners. The canister is carried in a compartment in the rear of the carrier. There is no canvas partition between the canister and face piece compartment as in the case of the carrier

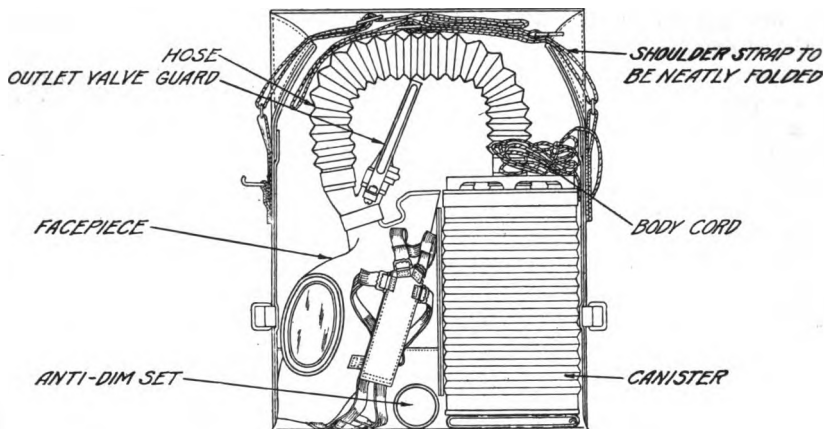


FIGURE 11.—Gas mask with service face piece in carrier MI

MI (two position). In place of this partition are two straps of webbing which extend across the interior of the carrier and hold the canister in proper position. The upper strap has a snap fastener at one end which, when unfastened, permits the removal of the canister from the carrier. The lower

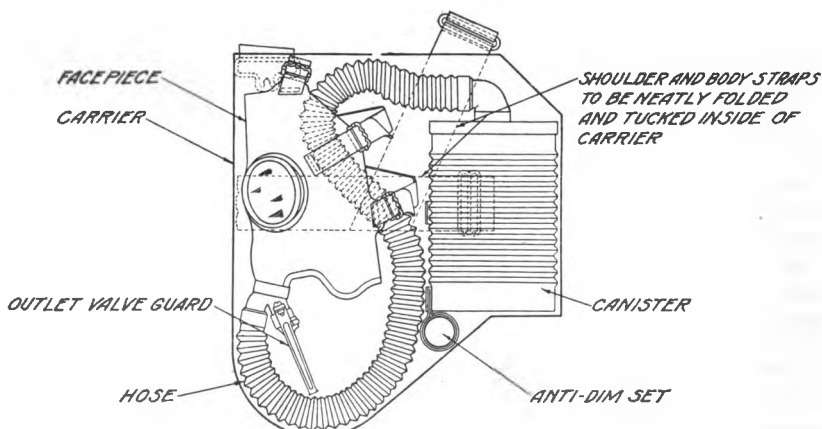


FIGURE 12.—Gas mask with service face piece in carrier MII

strap has a loop which holds the Antidim set. The forward compartment is larger and carries in the bottom the longer hose and above this the face piece. The flap cover can be passed over the hose and fastened again. By thus closing the carrier entrance when the mask is in use the canister is protected from the weather, dirt, and wear.

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c. Carrier MIII.—The carrier MIII is essentially the same as carrier MII, the only difference being that a tuck has been made in that portion of the carrier which covers the inlet valve in the bottom of the canister. This tuck, which is both stitched and riveted, holds the carrier fabric away from the inlet valve and thus insures the ready access of air.

SECTION IV

CARE, HANDLING, PACKING, AND STORING

	Paragraph
General.....	9
Care and handling.....	10
Packing the gas mask.....	11
Storing.....	12

9. General.—The gas mask is specially designed and constructed to withstand the wear and tear of use in the field and with reasonable care will give long service. The attempt is also made to utilize materials in its construction which will not deteriorate with age, particularly in storage. This has been accomplished except for the rubber components.

10. Care and handling.—The chief precaution to be exercised in the field is to prevent rough handling. Rough handling may cause serious mechanical damage such as dents or breaks in the metal parts, or tears in the fabric. This is apt to occur if other articles are carried in the carrier, or if the entire mask is handled carelessly. It is also essential that care be exercised to prevent as far as possible prolonged exposure to moisture, since moisture tends to cause rotting of the stockinette fabric and the deterioration of the protective tape around the wire bindings of the deflector, outlet valve, angle tube, and hose, thus exposing them to rust and decomposition. The outlet valve and eyepiece washer being made of rubber, air leaks in these parts may occur. Separation of the laminated lenses is also caused by dampness, resulting in permanently fogged lenses. Mildew results from the same cause. These defects are not likely to occur under average conditions if the mask receives reasonable care. The mask can be worn for extended periods in the rain, however, without ill effect if water is not permitted to collect in the carrier, and if the mask and carrier are subsequently dried as soon as practicable.

In order that the mask may receive proper care, the following precautions should always be observed:

- a.* Keep the mask from all unnecessary moisture and dry it out if wet.
- b.* Carry nothing in the carrier except the mask and Antidim set.
- c.* When not in use, keep the mask where it will not be damaged by a blow or heavy weight.
- d.* Inspect the mask thoroughly at regular and frequent intervals.

11. Packing the gas mask.—*a. General.*—The problem of packing the gas mask so that it may be kept in serviceable condition in storage is primarily the problem of preventing the deterioration of the rubber components. The other components can be stored almost indefinitely without danger of deterioration if reasonable care is exercised, but the life of rubber in storage is always a matter of uncertainty. Considerable progress has recently been made, however, in compounding rubber so as to improve its aging qualities and in defining the packing conditions required to prevent deterioration. As a result of these developments, the present production masks can be packed with

reasonable assurance that they will be serviceable after 10 or even 20 years' storage if great care is exercised to provide conditions which eliminate the three principal causes of rubber deterioration—oxygen of the air, direct sunlight, and corrosive or solvent liquids. Packing the masks in air-tight containers in such a way as to leave a minimum amount of dead air space is effective as a temporary measure, and the storage space should be kept as cool as possible. When the masks are not to be used for a considerable period of time a more elaborate method of packing is employed. The masks should be packed in a sealed compartment or container from which all of the air can be removed and be replaced with nitrogen. The effect of age on the life of the canister is different for different service conditions. Packed in water-tight boxes with a cork in the nozzle of each canister, no appreciable deterioration will occur over very long periods of time. Canisters stored for 6 to 8 years in this manner have been found practically perfect at the end of that time.

b. Packaging.—The gas masks when assembled in their carriers are packed either in wooden boxes, 20 to a box, or in unit metal containers which in turn

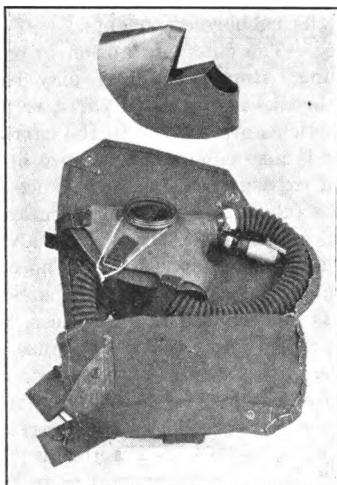


FIGURE 13.—Metal face form to prevent distortion of face piece in storage

are packed in wooden boxes, 10 to a box. During peace time all masks before being assembled in the carrier are provided with metal face forms to prevent deformation of the face pieces as a result of storage. This face form (fig. 13) is securely held in place by two wraps of cotton twine. In case of war production each face piece before being packed and stored is stuffed with paper in place of the metal face form.

c. Wooden packing boxes.—The wooden box (fig. 14) for packing 20 gas masks contains a waterproof paper liner, and the masks when packed are compactly arranged in 5 tiers. Over the packed masks there is placed a corrugated double-faced strawboard filler. The paper liner which is provided with a cover flap is then closed and properly sealed with marine glue. The cover of the box is nailed and both ends of the box are bound with metal strapping.

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d. Unit metal container.—The top of the unit metal container (fig. 15) for packing a single mask is placed as a cover on the bottom so as to fit square and butt joint about the periphery of the bottom. A tear-off strip is securely

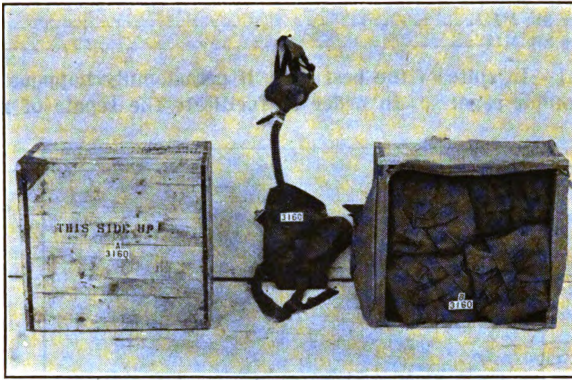


FIGURE 14.—Packing case for gas mask with service face piece and carrier M11, and method of packing

soldered about the container in such a manner as to produce an air-tight seal. The air in the assembled container is replaced by nitrogen. These metal containers are lacquered olive drab and are packed in wooden boxes, 10 to a box



FIGURE 15.—Individual metal packing container

with 5 in each tier, the containers being properly cushioned on all sides with double-faced corrugated strawboard.

12. Storing.—Boxes containing gas masks which have been packed for storage should be placed in a cool, dry warehouse and every precaution taken to insure that the boxes are not damaged in any way and that they be not subjected to the action of corrosive or solvent chemicals.

SECTION V

THE GAS-MASK REPAIR KIT

	Paragraph
General.....	13
Gas-mask repair kit MIII.....	14
Gas-mask repair kit MII.....	15

13. **General.**—In spite of the best care, it occasionally happens that a mask will require minor repairs. In order to facilitate the repair of masks in the

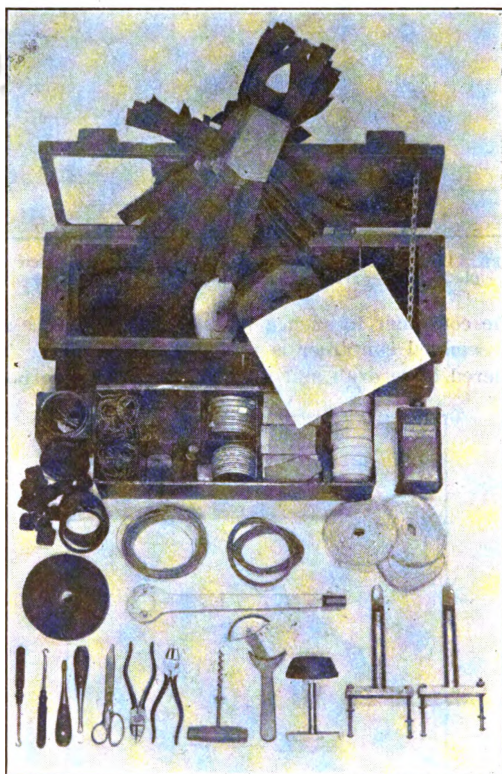


FIGURE 16.—Gas-mask repair kit MIII

field and at garrisons, two gas-mask repair kits have been designed, the MIII and MII, respectively. The gas-mask repair kit MIII contains all the material and tools for making such repairs as are possible outside the mask factory. No gas-mask repairs other than those described will be made in the field except by authority from the Chief of Chemical Warfare Service. The gas-mask repair kit MII contains merely the materials necessary for repairing torn face pieces.

14. **Gas-mask repair kit MIII.**—The gas-mask repair kit MIII (fig. 16) is a wooden box with metal tray and partitions having a gross weight of 32

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pounds and outside dimensions of 23 by 10½ by 7¼ inches. It contains all the materials, implements, and directions required for repairing gas masks in the field. Following is a list of these materials and implements:

Bolts, stove, ¼ by 3 inches-----	6	Patches, large-----	75
Book, instruction-----	1	Patches, small-----	225
Buttonhook-----	2	Pliers, side cutting, 6-inch ¹ -----	2
Can containing:		Screw driver, ¼ by 2-inch blade ¹ -----	2
Gasket, diaphragm-----	10	Shears, 6-inch ¹ -----	1
Gasket, lens-----	10	Tape, adhesive, olive-drab, ⅜-	
Valve, inlet-----	20	inch roll-----	2
Cement, rubber, cans-----	2	Tape, adhesive, zinc oxide, 1.2-	
Corkscrew ¹ -----	1	inch roll-----	10
Diaphragm-----	24	Tape, adhesive, zinc oxide, ⅝-	
Diaphragm, assembly-----	6	inch roll-----	3
Harness assembly-----	12	Tape, adhesive, zinc oxide, ¾-	
Jig, angle tube ¹ -----	2	inch roll-----	1
Jig, eyepiece ¹ -----	1	Valve, outlet-----	72
Kit, sewing:		Washer, iron, ⅜-inch-----	12
Needles-----	5	Wire, binding, galvanized steel	
Thread-----feet-----	50	0.032 inch-----feet-----	100
Lens, laminated-----	12	Wire, binding, galvanized steel,	
Loops, binding, flutter valve,		0.041 inch-----feet-----	100
0.020 inch-----	100	Wrench, combination ¹ -----	1
Loops, binding, deflector, 0.032		Wrench, lens ¹ -----	1
inch-----	100		



FIGURE 17.—Gas-mask repair kit MII

15. Gas-mask repair kit MII.—The gas-mask repair kit MII (fig. 17) consists of a small cardboard carton with a metal bottom and screw metal top, which contains a tube of rubber cement, a roll of ⅜-inch olive-drab adhesive tape and directions for use.

¹ Nonexpendable articles.

SECTION VI

REPAIRS AND ALTERATIONS

General instructions.....	Paragraph 16
Detailed instructions.....	17

16. General instructions.—Such replacements and repairs as may reasonably be made in the field or barracks are specified and described in detail. Such repairs as may not be made, with resultant safety of the mask, are omitted and consequently no repairs other than those described and authorized should be made in the field except by special authorization from the Chief of Chemical Warfare Service.

17. Detailed instructions.—*a. To replace canister or hose.*—(1) To replace a canister, remove the hose from the defective canister. Place a wire loop (0.032 inch) over the free end of the hose, and apply a thin coat of rubber cement to the inside of the hose. Insert and force the nozzle of the replacement canister well up into the hose and adjust it on the canister nozzle in such

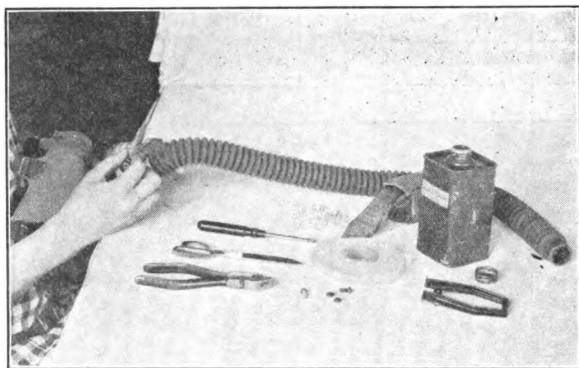


FIGURE 18.—Replacing outlet valve on service face piece

a manner that, upon swinging the canister free and holding the face piece, the canister will come to rest with the broadside approximately parallel to an imaginary plane passed between the eyepieces and through the chin seam. Twist the wire loop over the hose and nozzle until it is tight. Cut the superfluous wire, leaving only three twists, which will then be bent and pressed down (not hammered) to the hose, leaving a reasonably smooth connection. Cover the wire with $\frac{1}{2}$ -inch adhesive tape, which completes the canister replacement.

(2) The hose may be replaced by removing the defective hose at the canister, connecting the replacement hose as described in (1) above, performing a similar operation at the point of connection to the hose stem of the angle tube in the face piece, using wire, cement, tape, and adjustment as prescribed for the connection at the nozzle of the canister.

b. To replace outlet valve on service face piece.—Remove the outlet valve guard. The outlet valves furnished with the repair kit are for use on the diaphragm face piece MII and have an over-all length of $3\frac{3}{8}$ inches, or $\frac{1}{8}$ inch longer than those used with the service face piece MI, therefore $\frac{1}{8}$ inch should

be cut from the neck or open end of the valves furnished. Wrap the valve stem of the angle tube with $1\frac{1}{4}$ turns of $\frac{1}{8}$ -inch adhesive tape. Apply rubber cement over the tape and stem about $\frac{1}{2}$ inch from its end. Pass the outlet valve over the taped and cemented stem for approximately $\frac{1}{2}$ inch. Adjust the valve to provide a slight clearance between all parts of the valve and the valve guard. Also align the valve to insure the closing of both ports. Place about $1\frac{1}{4}$ turns of $\frac{1}{8}$ -inch adhesive tape over the neck of the valve with the edge about $\frac{1}{8}$ inch from its end. Pass a loop of 0.020-inch binding wire over the tape on the valve and twist it until tight. Cut the twisted portion of the wire loop, leaving about $\frac{1}{4}$ -inch length. Press (do not hammer) this remaining portion well down onto the tape and cover all exposed wire with about $1\frac{1}{4}$ turns of $\frac{1}{2}$ -inch adhesive tape. Replace the valve guard, which completes the replacement. This replacement is illustrated in Figure 18.



FIGURE 19.—Removing and replacing diaphragm on diaphragm face piece

c. To replace diaphragm on diaphragm face piece.—The replacement of the diaphragm assembly should not be attempted except in extreme emergencies and then only by experienced operators, since considerable difficulty is experienced even in the factory in making a gas-tight assembly. In making this replacement, first remove the hose at the angle-tube connection. Then remove the diaphragm assembly with the jig and wrench provided for the purpose; replace the defective diaphragm and any other defective parts of the assembly. Return the repaired assembly to its place and seat it securely in such a manner as to insure good, even compression of the rubber gasket in the angle-tube base. Replace the hose as described in *a* (2) above, which completes replacement. This replacement is illustrated in Figure 19.

d. To replace outlet valve on diaphragm face piece.—Remove the diaphragm assembly as prescribed in *c* above. Remove the defective valve. Apply a coat of rubber cement to the tape on the valve stem from which the defective valve was removed. Insert the new valve, neck up, through the outer opening of the stem in such a manner that the valve is properly centered and is clear of the valve guard. Turn the neck of the valve well down over the valve stem. Place $1\frac{1}{4}$ turns of $\frac{1}{8}$ -inch adhesive tape centrally around that portion of the valve turned over the stem. Place a loop of 0.020-inch binding

wire over the tape and twist until tight. Cut the surplus wire, leaving about $\frac{1}{4}$ inch of the twisted portion, which is then bent and pressed (not hammered) down on the tape, leaving a smooth connection. Cover the exposed wire with $1\frac{1}{4}$ turns of $\frac{1}{2}$ -inch adhesive tape. Replace the diaphragm assembly and the

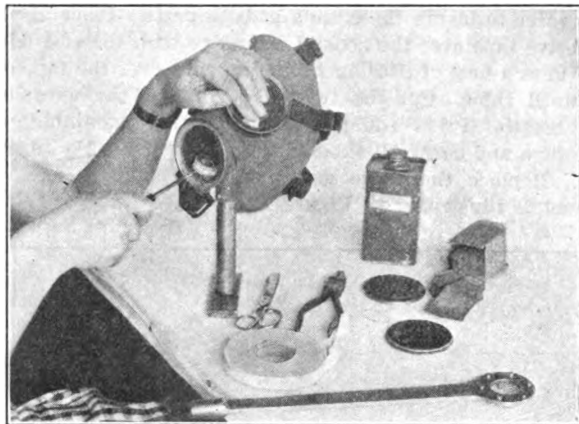


FIGURE 20.—Replacing outlet valve on diaphragm face piece

hose as described in *c* and *a* (2) above. This operation is illustrated in Figure 20.

e. To replace inlet valve on service canister MI, MII, and MIII.—Service canisters MI, MII, and MIII are provided with a rubber valve on each side

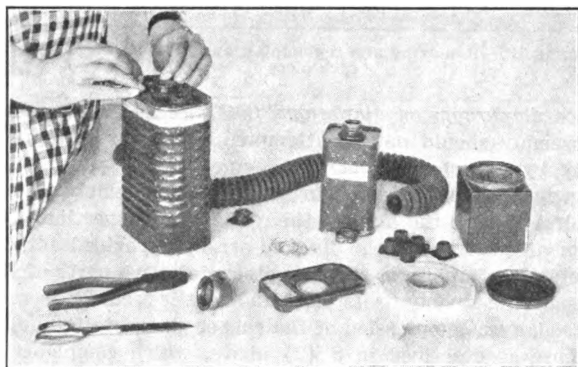


FIGURE 21.—Replacing inlet valve on service canister MI, MII, or MIII

of the nozzle. A rain shield having air inlets on the side covers the valves. In order to replace these valves, remove the hose from the canister. Remove the nozzle nut or elbow nozzle, as the case may be, with the combination wrench; and remove rain shield to give access to the valves. Remove the defective valve and insert a new valve through the sleeve from which the defective valve

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was removed. Apply a thin coat of rubber cement to the outside of the neck of the new valve, and adjust it so that when the neck is turned back upon the sleeve it just touches the canister top. Turn valve neck back over this sleeve. Replace the rain shield, nozzle nut, or elbow nozzle, and the hose, which completes this repair. This repair is illustrated in Figure 21.

f. To replace lens in face pieces.—A recent improvement in gas mask face piece design provides for a screw-type eyepiece assembly so constructed that defective lenses may be replaced readily. In order to make this repair, remove the eyepiece retainer ring, using the eyepiece jig and wrench provided for that purpose. Discard the lens and lens washer. Coat a new lens washer on both sides with rubber cement. Place the washer in position, insert the new lens and tighten the retainer ring securely in place. Every possible visual inspection of this repair should be made, inspecting particularly for stripped threads caused by too great force being applied to the wrench, failure of retainer ring

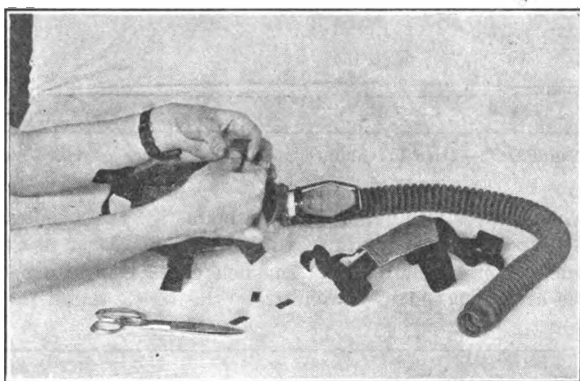


FIGURE 22.—Replacing harness

to tighten on the lens, cracking of lens when retainer ring is tightened, and rupture of the face piece material.

g. To repair head harness.—The head harness used on the face pieces of recent manufacture is so constructed that it may be readily replaced. To replace, remove the defective head harness, attach the new head harness (fig. 22) to the head harness buckles on the face piece in the same order as the attachment was made in the defective head harness removed. In the limited number of service face pieces and diaphragm face pieces remaining in service, it may become desirable to replace or repair head harness where the old method of stitching the elastic to the face-piece rubber was employed. In such cases the stitching required will depend upon the nature of the repair to be made. Needle and thread are provided in the repair kit and, by inspecting a similar face piece in good condition, the required repair may be made properly.

h. To patch or repair small holes or tears in face pieces.—Injury to the face-piece rubber caused by a cut, puncture with a needle in replacing harness, or puncture from other causes, may be repaired and made gas-tight (fig. 23). To do this, clean the spot to be patched with gasoline. Apply a thin coat of rubber cement and allow to dry for about 30 minutes, or until complete drying is assured. Apply a second coat of rubber cement, allow to dry for 30 minutes,

wire over the tape and twist until tight. Cut the surplus wire, $\frac{1}{4}$ inch of the twisted portion, which is then bent and pressed (not down on the tape, leaving a smooth connection. Cover the exposed $1\frac{1}{4}$ turns of $\frac{1}{2}$ -inch adhesive tape. Replace the diaphragm assembly



FIGURE 20.—Replacing outlet valve on diaphragm face piece.

hose as described in *c* and *a* (2) above. This operation is shown in Figure 20.

c. To replace inlet valve on service canister MI, MII, and MIII. Canisters MI, MII, and MIII are provided with a rubber



of the nozzle shield. In order to replace the valves, nozzle and nozzle shield, as the nozzle and shield to give valve a new valve the

was removed. Apply the new valve. Insert the sleeve it just touches. Replace the rain cap. plates this repair. f. To replace lens a piece design provides defective lenses may the eyepiece retain purpose. Disassemble sides with rubber and tighten the tion of this repair caused by use

se should be face piece, and should be applied tion of tape is ent to the angle removed (fig. 24). replaceable face piece connection. Attach

Paragraph 18

(26) consists of a cheesecloth the animal only. Horses and



FIGURE 25.—Horse mask

be through the mouth it is not necessary for the mask jaw. The mask mouthpiece which goes into the and prevents the from being bitten through. The when in place inches above the nostrils provide proper provided which and the op low the m the face se. The are sewe which form the mas se elast on the day and

and attach a patch of proper size selected from the two sizes furnished in the repair kit.

i. To repair chin seam, or replace angle tube assembly.—All present-type face pieces are made to conform to the shape of the chin by the proper fashioning, stitching, and butting of a seam along that portion fitting under

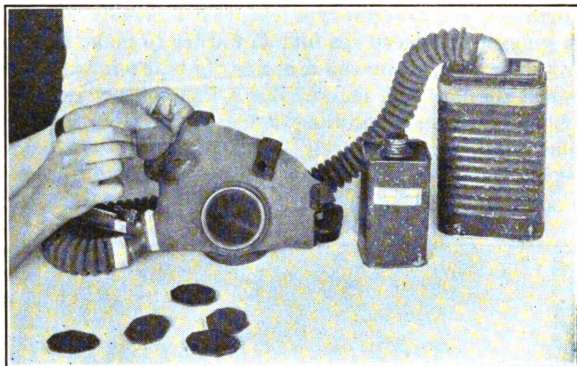


FIGURE 23.—Patching and repairing small holes or tears on face piece

the chin. The joint, stitching, and holes made by the needles are covered with $\frac{7}{8}$ -inch olive-drab adhesive tape, cut on a bias. After use, the tape may become loosened over a small area. In such cases rubber cement should be applied to the area exposed by loosening of the tape. After thorough drying

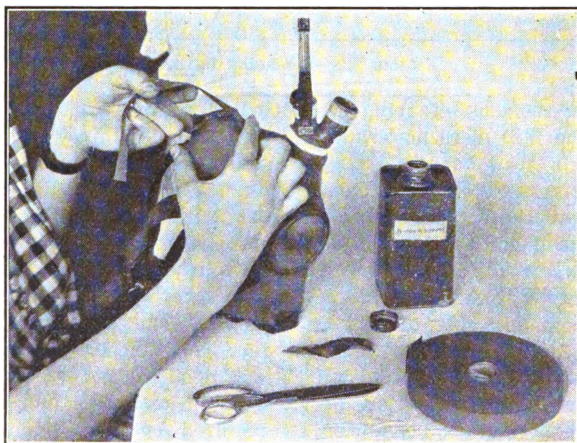


FIGURE 24.—Repairing chin seam

(about 30 minutes), the tape may be pressed firmly into place again and rolled with the handle of a screw driver or similar instrument available in the repair kit. In some cases after long use and continued neglect the tape may become loosened over a large area and so stretched and rolled that replace-

ment of the original tape is impractical. In this case the hose should be removed from the angle tube, the angle tube removed from the face piece, and the old tape removed from the seam. The rubber cement should be applied to the seam and adjacent area and allowed to dry. A new section of tape is then applied and lapped about $\frac{3}{4}$ inch over that area adjacent to the angle tube, in a manner similar to the lapping of the tape removed (fig. 24). Replace and wire the angle tube in position using a serviceable face piece as a guide in placing, wiring, and taping the angle-tube connection. Attach the hose to the angle tube as described in *a* (2) above.

SECTION VII

HORSE MASK

Paragraph

Horse mask ----- 18

18. **Horse mask.**—The horse mask (figs. 25 and 26) consists of a cheesecloth bag which covers the nostrils and upper jaw of the animal only. Horses and

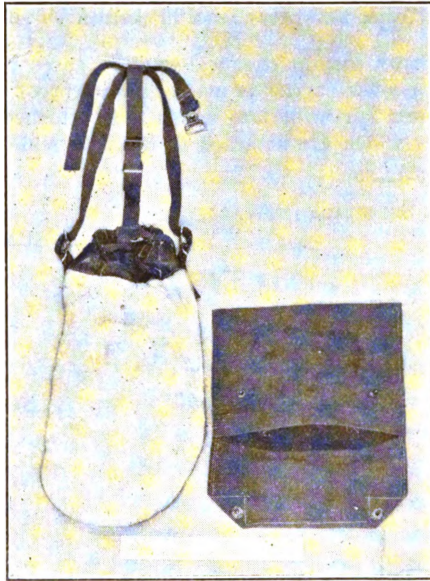


FIGURE 25.—Horse mask

mules never breathe through the mouth, hence it is not necessary for the mask to cover the lower jaw. The mask has a canvas mouthpiece which goes into the horse's mouth and prevents the cheesecloth from being bitten through. The cheesecloth bag when in place extends several inches above the horse's nostrils in order to provide proper breathing. It is provided with a draw string which passes around the opening so as to draw the mask tightly against the face when in use. The ends of the string are sewed onto elastic bands which form part of the mask head harness. These elastic bands keep a tension on the draw string when the mask is adjusted and prevent the draw string from loosening

after it has been pulled tight. Inside the bag, and attached to the canvas mouthpiece, is a canvas frame which is stitched onto the bag in such a way as to prevent the bag being drawn into the nostrils when in use. The animal in breathing draws air through the cheesecloth, which is impregnated with

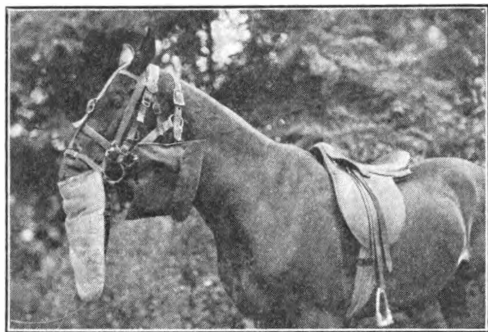


FIGURE 26.—Horse mask in position on animal

chemicals that destroy certain chemical-warfare gases such as phosgene and chlorine. The horse-mask carrier is made of waterproof burlap. It is carried on the breast harness (or bridle) to which it is attached by two leather loop straps with buckles which are attached to the rear slide of the carrier.

[A. G. 062.12 (5-12-30).]

BY ORDER OF THE SECRETARY OF WAR:

C. P. SUMMERALL,
General,
Chief of Staff.

OFFICIAL:

C. H. BRIDGES,
Major General,
The Adjutant General.

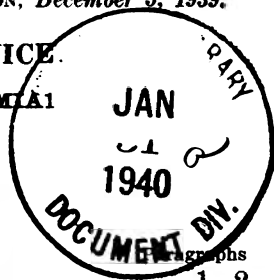
TECHNICAL REGULATIONS
No. 1120-75

WAR DEPARTMENT,
WASHINGTON, December 5, 1939.

CHEMICAL WARFARE SERVICE.

4.2-INCH CHEMICAL MORTAR, MIA1

Prepared under direction of the
Chief of the Chemical Warfare Service



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SECTION I

GENERAL

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1. Purpose and scope.—These regulations are intended for the using services. They give all necessary information regarding the construction, functioning, and identification of all matériel pertaining to the 4.2-inch chemical mortar, MIA1, (surface set-up assembly), including the mortar, ammunition, and transportation equipment, with directions for the operation, care, and maintenance of such matériel. They also give brief directions for the minor repairs that may be made in the field by a mortar company and the replacement of unserviceable parts by a chemical maintenance company.

2. References.—*a.* Handbook for the 4.2-inch Chemical Mortar, 1932, which covers the MI (dug-in type) mortar.

b. Chemical Warfare Service Field Manual, Volume I.

c. TR 1370-A.

d. AR 750-10.

e. Chemical Warfare Service Supply Catalog, July 1, 1937.

f. Standard Nomenclature and Price List of Chemical Warfare Matériel. (Issued annually, giving the correct nomenclature, list of expendable articles, and prices of chemical warfare matériel.)

SECTION II

DESCRIPTION AND DATA

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3. General description.—*a. Mortar.*—(1) The 4.2-inch chemical mortar, MIA1, is a rifled muzzle-loading weapon capable of firing at elevations between 800 mils and 1,066 mils and of being traversed 100 mils right or left of basic.

(2) The mortar (see fig. 1) consists essentially of a barrel, a barrel support (standard), and a baseplate. Practically, it differs from the MI mortar (dug-in type) only in the form of the baseplate which lies flat on the surface of the ground, and in the support for the barrel, designated the "standard". The baseplate does not require the digging of an excavation for its emplacement as does the baseplate of the MI mortar. The standard is shaped like an inverted T. The stem of the T is a hollow shaft housing the elevating mechanism, and the ends of the arms of the T are connected by tie rods, or connectors, to the baseplate so that when the baseplate is forced to the rear by the recoil of the barrel when the mortar is fired, the whole assembly moves back as a unit and the components of the mortar (barrel, baseplate, and standard) remain approximately in the same relation to each other, with a minimum disturbance of the angle of elevation of the barrel. The elevation of the barrel is varied by turning the elevating screw wheel, and lateral displacement is obtained by turning the traversing screw.

(3) A sight is furnished to enable the mortar squad to train the mortar on a given point and to set the barrel at the elevation called for by the range table.

(4) The range may be varied either by changing the elevation of the barrel or by varying the amount of propelling charge, or by a combination of the two.

(5) The mortar may be fired at a rapid rate of fire of 15 to 20 rounds per minute for short periods, or at a sustained rate of fire of 3 to 5 rounds per minute if emplaced normally.

b. Ammunition.—(1) The shell is streamlined and, being provided with interior vanes, gives true flight with either liquid or solid fillings. A bursting charge of high explosive actuated by a point detonating fuze is used to burst the shell and disperse its contents on impact. The propelling charge is attached to the base of the shell, and the pressure developed by the charge when it is ignited

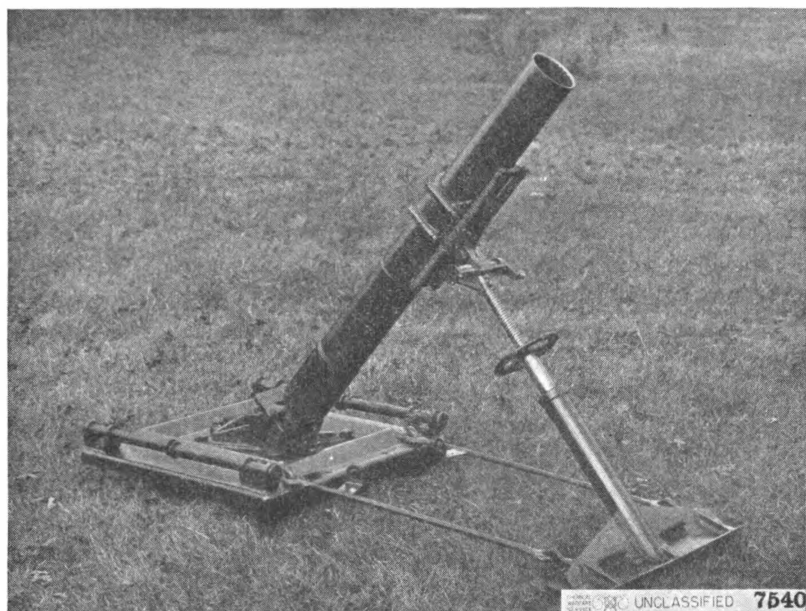


FIGURE 1.—4.2-inch chemical mortar, MIA1.

expands a driving disk of soft brass, also attached to the base of the shell, into the rifling of the barrel. As the shell is forced out of the barrel, rotation is imparted to the shell, resulting in true flight with an increase in range over that obtained with the smooth bore 4-inch chemical mortar, which gives a tumbling shell.

(2) The propelling charge consists of an ignition cartridge and two to eight bundles of powder. The ignition cartridge is a specially loaded 12-gage shotgun shell which fits inside a cartridge container on the base of the shell, while the bundles of powder fit over the outside of the cartridge container and are firmly held over the radial holes in the latter by means of the striker and compression nuts.

The mortar is fired by dropping the complete round down the mortar barrel. The impact of the shell on the firing pin in the base of the barrel causes the ignition cartridge to function. The flame from the cartridge escapes through the radial holes in the cartridge container and ignites the powder surrounding the cartridge container.

(3) The force of the discharge, or setback, and centrifugal force in the rotating shell after it has left the barrel arm the fuze. When the shell strikes a resisting object, such as the limb of a tree, the roof of a house, or the ground, the fuze functions. Care should therefore be taken, when firing from woods, to avoid striking branches of trees which might cause premature explosion of the shell near friendly troops.

4. Detailed description.—*a. Barrel, M1A1.*—(1) The barrel (see fig. 2) is a steel tube (1) 48 inches long, having an outside diameter varying from $5\frac{1}{8}$ inches at the base to $4\frac{3}{4}$ inches at the muzzle, and an inside diameter of 4.2 inches. At the base or breech end it is swaged in to form a bottleneck approximately 2 inches in diameter which is threaded on the outside to receive the base cap (2). On the inside of the base cap is a $\frac{3}{4}$ -inch hole threaded to receive the striker pin (3) which projects inside the barrel. The copper base-cap washer (4) is placed in the base cap to insure a gas-tight joint between the base cap and the barrel. The base cap has two pins (5) 1 inch in diameter screwed into two holes drilled radially 180° apart in the outer walls at right angles to the center line of the base cap just below the shoulder against which the bottleneck of the barrel seats. When the mortar is assembled, these pins fit into slots in the base-cap cup of the baseplate and prevent rotation of the barrel during firing.

(2) The barrel is rifled with 24 grooves and lands. The depth of the groove is 0.03 inch and the width is 0.486 inch; the width of the land is 0.062 inch. The length of the rifling is 42 inches; the pitch increases from zero at the breech to one turn in 20 calibers at the muzzle.

(3) A leather muzzle cover is placed over the muzzle end of the barrel to protect the interior surfaces from grit and moisture.

(4) *Connection to standard.*—(a) The connection between the barrel and the standard is so designed that the shock due to the recoil of the barrel during firing is cushioned by coil springs and is not transmitted to the standard through a rigid connector. This feature decreases the strain on the barrel and standard components and adds to the stability of the mortar while in action. See figure 2, view B—B.

(b) The connection is a large two-piece clamp (6) assembled to the barrel by steel bolts (7), and a steel coupling (8). The lower half of the clamp extends longitudinally underneath the barrel about $5\frac{1}{2}$ inches beyond each pair of bolts. At the ends of this extension the metal is thickened at the corners, which are bent down to form lugs or ears. A T-shaped guide machined on the lower part of the clamp extends about 2 inches beyond the front pair of bolts and $3\frac{1}{2}$ inches beyond the rear pair. A coupling (8) machined to fit the guide is slipped on from the end of the T section of the clamp. Lugs on each side of the coupling are assembled between the ends of two coil springs (9 and 10).

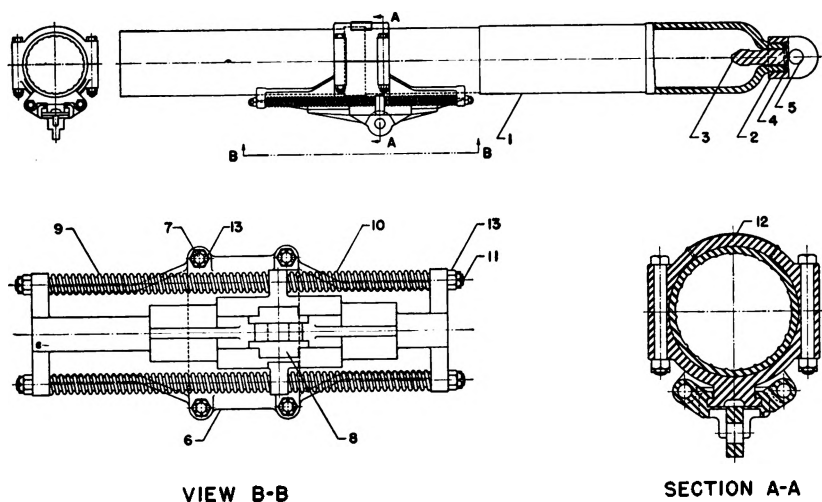


FIGURE 2.—4.2-inch chemical mortar barrel, MIA1.

- | | |
|---------------------------|------------------------|
| 1. Tube. | 8. Coupling. |
| 2. Cap, base. | 9. Spring, front (2). |
| 3. Pin, striker. | 10. Spring, rear (2). |
| 4. Washer, base-cap. | 11. Guide, spring (2). |
| 5. Pin, base-cap (2). | 12. Plate, name. |
| 6. Slide, shock absorber. | 13. Nut, castle (8). |
| 7. Bolt, slide (4). | |

(9) and (10). The springs and coupling lugs are held in place by guide rods (11) which in turn are supported by and bolted to the lugs or ears on the ends of the clamps by nuts (13). The underside of the coupling has an ear projecting downward which fits into a slot on top of the traversing nut on the standard (see b (4) below) and is held in place by a barrel pin passing through holes in the traversing nut and the ear of the coupling. The diameter of the hole in the coupling

is sufficiently large to allow the coupling to rotate about the barrel pin as an axis.

b. Standard, MI.—The standard (see fig. 3) consists essentially of a support welded at the lower end to a base, an elevating mechanism which is housed in the support, and, mounted on the upper end of the elevating screw, a traversing mechanism which also serves as the connection between the standard and the barrel.

(1) *Base.*—The base (30) is an oblong plate of alloy steel with the longer sides turned up $\frac{5}{8}$ inch and the ends bent down $2\frac{3}{8}$ inches to form a rectangle 6 inches wide and $24\frac{1}{4}$ inches long. The turned-down ends act as spades which cut into the ground and prevent excessive side movement. The spades are reinforced by welded ribs underneath the base. Two eyebolts (33) welded to lug ribs on the base are provided for the tie rods or connectors (27) (28) which are used to connect the standard with the base plate. For carrying purposes there is welded to each tie rod a flange or connection bracket with a hole through it so that the connectors may be brought up and the brackets inserted in the slot in the traversing nut (9) and held in position by the barrel pin (6).

(2) *Support.*—The support (32) is a seamless steel tube welded at the bottom to the base of the standard and provided at the top with a retaining collar (19). The union with the base is reinforced by ribs.

(3) *Elevating mechanism.*—The elevating mechanism consists of an elevating screw (23) made of nickel-chromium steel in a sleeve (18) $15\frac{5}{8}$ inches long, the upper end of which is threaded on the inside for a distance of 2 inches. The sleeve has a shoulder $4\frac{3}{4}$ inches from the top which fits free in the support. The outer diameter of the sleeve below this shoulder is such as to leave room between the sleeve and the support for a compression spring (24), the lower end of which rests on a stop or bearing (25) in the support. The purpose of this spring is to allow downward motion of the barrel in the direction of the axis of the support when the mortar is fired, and thus reduce the stresses on the standard. The elevating screw is raised or lowered by turning the sleeve of the bronze elevating screw wheel (31). To prevent backlash of the spring when the sleeve is turned, small ball bearings (21) between thrust washers (20) (22) are provided at the upper end of the spring. The elevating mechanism allows the mortar barrel to be elevated between 623 mils and 1,256 mils.

(4) *Traversing mechanism.*—The upper end of the elevating screw is flattened and slotted to take the traversing slide (26) on which is mounted the traversing screw (10). The screw passes through the

traversing nut (9) which rides along the traversing slide when the screw is turned by the crank (14) and crank handle (15). A hole runs through the top of the traversing nut which is slotted at right angles to the hole to take the bottom lug on the barrel coupling when

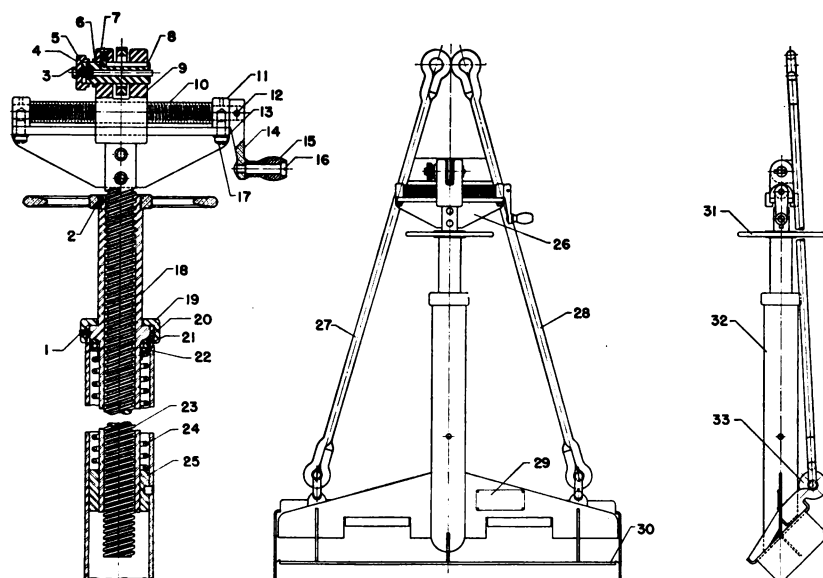
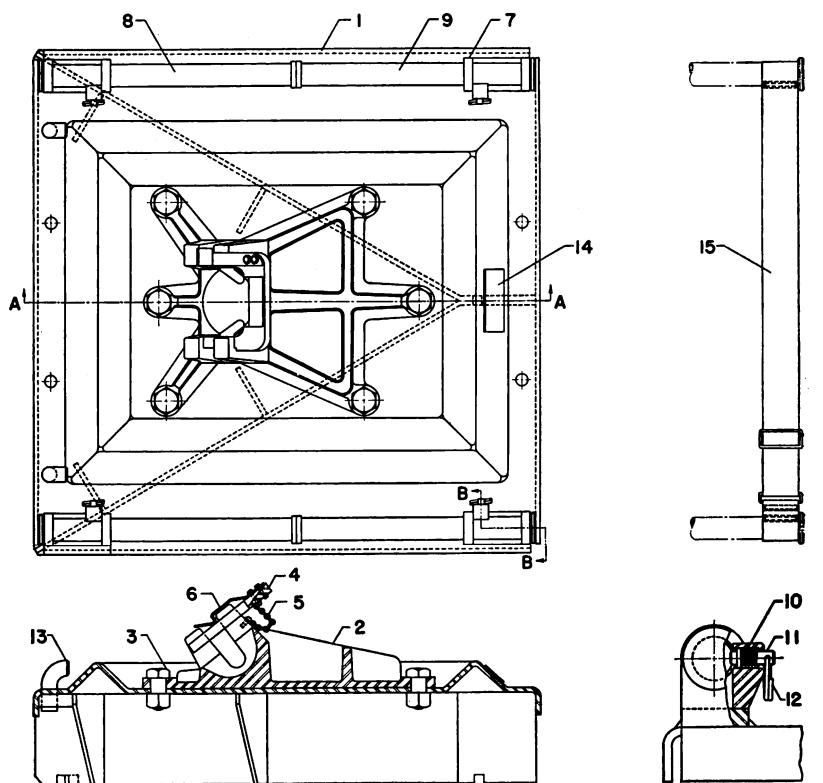


FIGURE 3.—4.2-inch chemical mortar standard, MI.

- | | |
|------------------------------------|------------------------------|
| 1. Screw, set. | 18. Sleeve, elevating screw. |
| 2. Screw, set. | 19. Collar, retaining. |
| 3. Nut, machine screw. | 20. Washer, thrust, upper. |
| 4. Knob. | 21. Retainer, ball. |
| 5. Spring, latch. | 22. Washer, thrust, lower. |
| 6. Pin, barrel. | 23. Screw, elevating. |
| 7. Pin, stop. | 24. Spring. |
| 8. Latch. | 25. Bearing, sleeve. |
| 9. Nut, traversing. | 26. Slide, traversing. |
| 10. Screw, traversing. | 27. Connector, right. |
| 11. Bearing, traversing screw (2). | 28. Connector, left. |
| 12. Pin, taper. | 29. Plate, name. |
| 13. Washer, lock (4). | 30. Base. |
| 14. Crank, traversing screw. | 31. Wheel, elevating screw. |
| 15. Handle, crank. | 32. Support. |
| 16. Stud, handle. | 33. Eyebolt (2). |
| 17. Screw, bearing (4). | |

the standard is assembled to the barrel, or the connector brackets when the connectors are folded up for carrying. In either case, the barrel pin (6) is passed through the holes in the traversing nut and the

barrel coupling or the connector brackets. A stop pin (7) in the upper part of the traversing nut engages in a longitudinal groove in the barrel pin. The barrel pin is reamed eccentrically to take a latch (8) which locks the barrel pin in place. The latch is kept closed by a spring (5) and is released by pushing in on the latch knob (4) and turning it. The traversing mechanism allows 200 mils traverse, 100 mils right and 100 mils left of basic.



SECTION A-A

SECTION B-B

FIGURE 4.—4.2-inch chemical mortar baseplate, MII.

- | | |
|---|------------------------|
| 1. Plate. | 8. Handle, front (2). |
| 2. Cup. | 9. Handle, rear (2). |
| 3. Bolt (6). | 10. Spring, catch (4). |
| 4. Fork, cup. | 11. Catch (4). |
| 5. Chain. | 12. Ring, pull (4). |
| 6. Retainer, fork. | 13. Hook (2). |
| 7. Bracket, handle (2) (right rear and left front). | 14. Plate, name. |
| Bracket, handle (2) (right front and left rear). | 15. Sling (2). |

C. Baseplate, MII.—The baseplate (see fig. 4) rests flat upon the surface of the ground. The plate (1) is a $\frac{1}{4}$ -inch nickel-chromium steel plate with the edges turned down at right angles about $1\frac{1}{2}$ inches and forming a rectangle 26 by 28 inches. On the surface, in the form of a rectangle about $16\frac{1}{2}$ by 21 inches, it has a bead $1\frac{1}{2}$ inches high with an inverted V-shaped cross section. A large Y-shaped spade made of two nickel-chromium steel plates 5 inches wide and $31\frac{1}{2}$ inches long welded together at one end, and four gusset spade plates are welded to the underside of the baseplate with the apex of the Y-spade to the rear. This location of the large spade assists in causing the baseplate to move uniformly to the rear, and the small inside spades or gusset plates restrain the rearward displacement. The cast steel base-cap cup (2) is bolted on the upper surface of the baseplate within the rectangle formed by the V-shaped bead. The butt or base-cap end of the barrel rests in the rounded portion of the cup, with the two base-cap pins in the U-shaped slots. These prevent rotation of the barrel when the mortar is fired, and the cup fork or barrel lock (4), the legs of which engage in the square grooves in the slotted uprights of the cup, straddling the base cap above the base-cap pins, prevents the butt end of the barrel from jumping out of the cup. The cup fork is attached to the base-cap cup by a short length of chain (5). One tine of the fork is provided with a flat spring or fork retainer (6) which bulges out slightly and has a hump about $2\frac{1}{4}$ inches from the end of the tine. This hump fits under the shoulder of the slots for the base-cap pins and prevents the cup fork from jumping out of its own slots during the firing of the mortar. At the corners of the plate handle brackets (7) are welded to hold two-piece retractable handles (8) (9) of seamless steel tubing. Normally, the handles are retracted and held in the position shown in the figure by the spring catches (11), but they may be extended to the front and rear of the baseplate, litter fashion, to facilitate transportation. Slings (15) of heavy cotton webbing are also provided to assist in carrying the baseplate. At the front of the baseplate near the corners two hooks (13) are welded over which the eyes in the ends of the standard connectors are placed when the mortar is assembled for firing.

d. Sight, MII.—The sight (see fig. 5) consists essentially of three major parts (each a bronze casting), body (1), elevation indicator (2), and sighting arm (3). It is used to lay the mortar on the line of sight and to indicate when the barrel has been brought to the desired angle of elevation. The sight fits on the upper end of the muzzle of the mortar when in the firing position and is removed

from the mortar during firing. The elevation indicator pivots around a sleeve (4) at the front end of the body and may be clamped by a thumb screw (8) in the position corresponding to the desired elevation as indicated by the elevation scale engraved on the side of the body. The elevation indicator is provided with a level glass

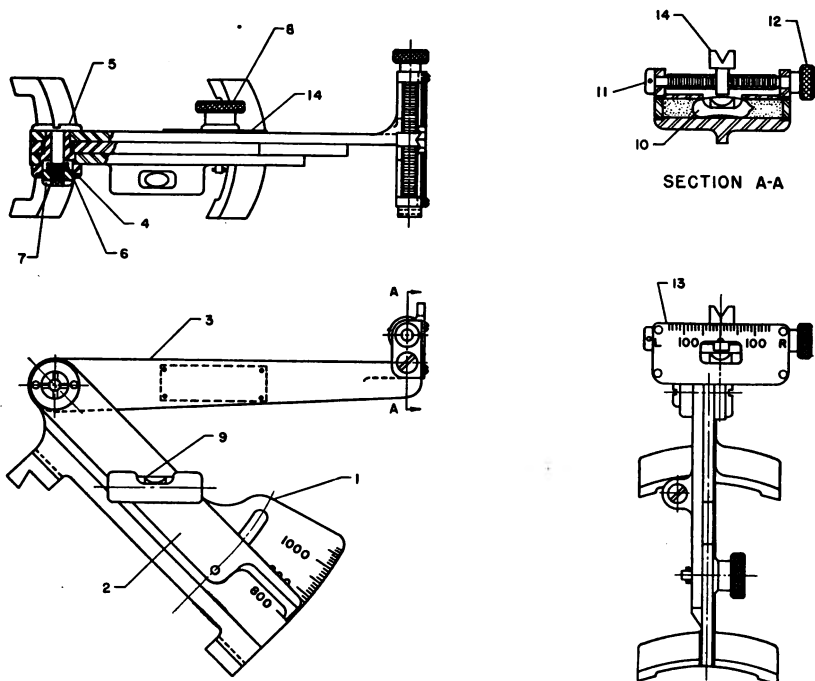


FIGURE 5.—4.2-inch chemical mortar sight, M11.

- | | |
|----------------------------|----------------------------------|
| 1. Body. | 8. Screw, elevation indicator. |
| 2. Indicator, elevation. | 9. Level glass. |
| 3. Arm, sighting. | 10. Level glass. |
| 4. Sleeve, arm tightening. | 11. Collar, screw. |
| 5. Screw, arm tightening. | 12. Screw, traversing indicator. |
| 6. Spring, arm tightening. | 13. Scale, traversing. |
| 7. Nut, arm tightening. | 14. Indicator, traversing. |

(9) so mounted that the bubble occupies the center position when the barrel is elevated or depressed, as the case may be, to the angle at which the indicator has been set. On the sighting arm at the rear end, a cross-level glass (10), the traversing indicator (14) (a movable notch which travels on the traversing indicator screw (12)), and the traversing scale (13) are mounted. Radium luminous material is

applied to the face of the traversing indicator and of the bead on the front end of the sighting arm. The sight is carried in a leather case with shoulder strap, shown in figure 6.

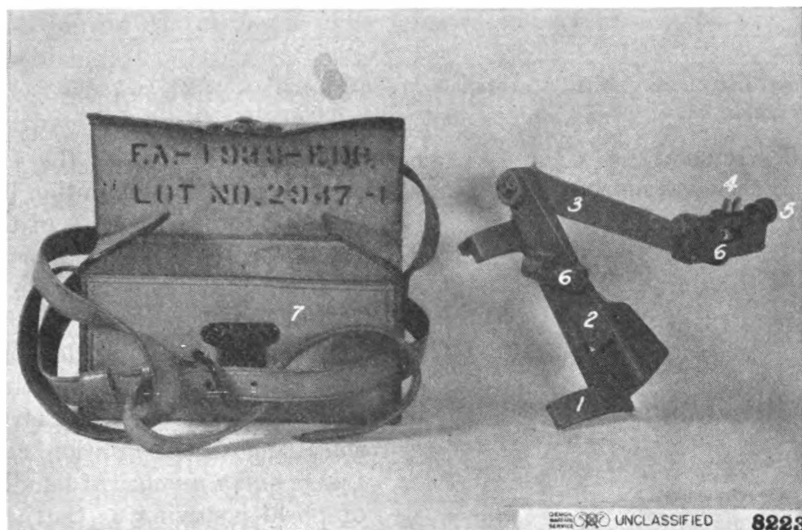


FIGURE 6.—4.2-inch chemical mortar sight, MII, and carrying case.

- | | |
|--------------------------|--------------------------------|
| 1. Body. | 5. Traversing indicator screw. |
| 2. Elevation indicator. | 6. Level glasses. |
| 3. Sighting arm. | 7. Carrying case. |
| 4. Traversing indicator. | |

5. Weights.—a. Mortar:

	Pounds
Barrel, MIA1, approximately.....	91
Baseplate, MII.....	150
Standard, MI.....	53
Sight, MII, in case.....	2
Total.....	296

b. Ammunition (complete round):

Shell body, approximately.....	16.1
Chemical filling.....	5.2-7.7
Fuze and burster tube.....	1.45
Propelling charge.....	.25
Total.....	23.0-25.5

SECTION III

AMMUNITION

	Paragraph
General.....	6
Shell.....	7
Fuze.....	8
Propelling charge, MV.....	9
Packing.....	10

6. General.—*a. Complete round.*—The ammunition for the 4.2-inch chemical mortar, MIA1, may be classed as fixed ammunition because all the components of the

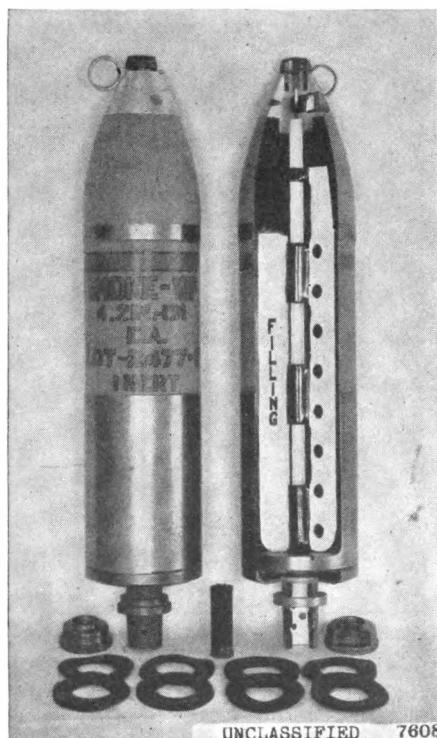


FIGURE 7.—Complete round, 4.2-inch chemical mortar.

NOTE.—The disk propellant powder has been replaced by the powder in square sheets shown in figure 11.

the ignition cartridge. This fires the cartridge which ignites the powder. The pressure of the gases from the burning propellant at

cause all the components of the round are loaded in the mortar as a unit and by one operation. A complete round consists of a filled shell, a point detonating fuze with tetryl bursting charge, and a propelling charge consisting of an ignition cartridge and a number of bundles of powder serving as the propellant (see fig. 7). The ignition cartridge is inserted in a cartridge container fastened to the base of the shell, and the bundles of powder are placed on the outside of the container and held in place by an adjustable upper nut and a striker nut which screws onto the open end of the cartridge container, thus affording a support for both the bundles of powder and the ignition cartridge.

b. Action on firing.—The shell is fired by dropping a complete round down the barrel. As the striker nut hits the top of the firing pin in the base of the barrel, a striker in this nut is driven into the primer in

the same time that it expels the projectile from the mortar is sufficient to actuate the pressure plate, expanding the rim of the rotating disk so that it engages the rifling of the barrel. This imparts rotation to the shell, thus giving stable or true flight and consequently nose impact of the shell. The force of impact causes the fuze to function.

c. Chemical filling.—The following chemical fillings are authorized for use in the shell for the 4.2-inch chemical mortar:

Type	C. W. S. symbol	Name
Gas, persistent.....	HS	Mustard.
Gas, nonpersistent.....	CG	Phosgene.
Gas, irritant.....	CNS	Liquid lacrimator (solution of chloracetophenone).
Gas, irritant.....	CNB	Liquid lacrimator (solution of chloracetophenone).
Smoke.....	WP	White phosphorus (yellow phosphorus).
Smoke.....	FS	Sulfur trioxide-chlorosulfonic acid mixture.
Smoke.....	FM	Titanium tetrachloride.

d. Weights.—The body of the shell weighs approximately 16.12 pounds. The approximate weights of the chemical filling and of the complete round, including filled body, fuze, and propelling charge, are as follows:

Type of filling	Approximate weight of filling	Approximate weight of complete round	Type of filling	Approximate weight of filling	Approximate weight of complete round
	<i>Pounds</i>	<i>Pounds</i>		<i>Pounds</i>	<i>Pounds</i>
HS.....	5.44	23.44	WP.....	7.50	25.50
CG.....	5.00	23.00	FS.....	7.50	25.50
CNS.....	5.75	23.75	FM.....	7.50	25.50
CNB.....	5.25	23.25			

e. Dimensions.—The over-all dimensions of the complete round are major diameter, 4.19 inches and length, 20.40 inches, of which the fuze comprises 2.25 inches.

7. Shell.—*a. Description.*—(1) The 4.2-inch chemical mortar shell which has thus far given the best results and is currently being issued is the E38R2 shell shown in figure 7. To simplify manufacturing operations the E50 shell shown in figure 8 has been designed but is still in the experimental stage. Practically, the only difference between the two shells is that the body of the E38R2 shell is made from a steel forging with base and walls integral and the casing is swaged to form the ogive, whereas in the E50 shell (fig. 8) the body (1) is made of seamless steel tubing with the base (2) and ogive welded to the ends of the tubing. Before the ogive is formed

or welded on, a sheet steel vane (3) is welded inside the body to aid in stabilizing the shell by forcing liquid fillings to rotate with it and thus prevent tumbling during flight. However, as the initial resistance of the liquid filling to take up rotation is so great that a solid vane would be torn loose from its welding, holes are drilled through the body of the vane to allow a certain amount of the liquid to slip by. On the base of the shell is a threaded stud to which the cartridge container (10) is secured. The cartridge container is a tube of machine steel threaded on the inside to screw on the stud on the base of the shell. It is also threaded externally and has two nuts (an upper compression nut (11) and a lower striker nut (12)) to hold the propellant over the vent holes which are drilled radially through the walls of the cartridge container and serve to transmit the flash of the ignition cartridge to the bundles of powder and thus ignite them. The striker nut, in addition to holding the propellant and ignition cartridge in place, also carries a striker plate and point to fire the primer of the ignition cartridge. Moreover, it prevents

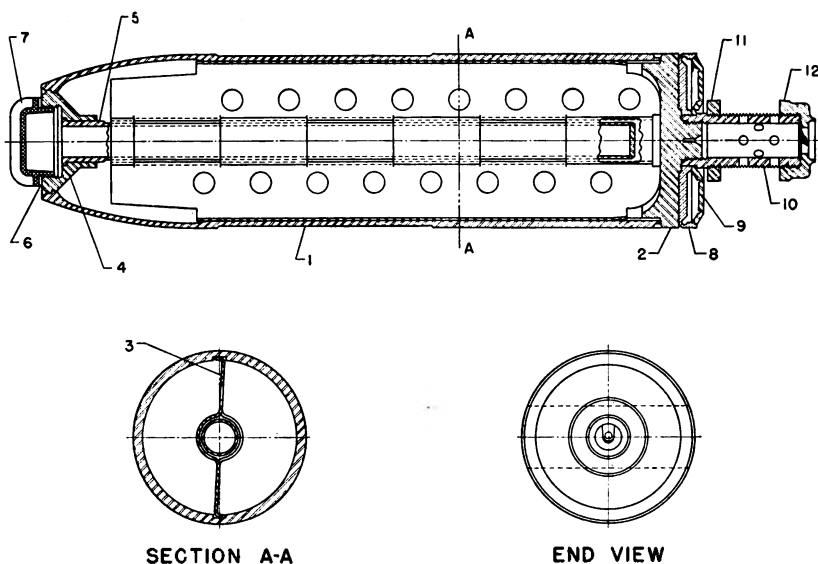


FIGURE 8.—4.2-inch chemical mortar shell.

- | | |
|------------------------|---------------------------|
| 1. Body. | 7. Plug, shipping. |
| 2. Base. | 8. Disk, rotating. |
| 3. Vane. | 9. Plate, pressure. |
| 4. Adapter. | 10. Container, cartridge. |
| 5. Well, burster tube. | 11. Nut, upper. |
| 6. Washer. | 12. Nut, striker. |

the base of the ignition cartridge from being blown out into the base of the barrel when the mortar is fired, and causes the flash of the ignition cartridge to spread through the radial holes in the cartridge container and into the powder rather than be blown out of the rear end of the cartridge container.

(2) In the nose of the shell a steel adapter (4) is welded with a smooth finished central opening into which the burster tube well (5) is pressed after the shell has been filled, thus forming a gas-tight seal.

(3) The rotation unit consists of a brass rotating disk (8) and a steel pressure plate (9). In the surface of the rotating disk is a groove 1.5 inches wide and 0.062 inch deep which fits over a tongue on the base of the shell and locks the disk to the shell. The diameter of the rotating disk is approximately equal to that of the shell, while the pressure plate is slightly smaller and fits into the rotating disk. When assembled, the disk and plate form a hollow ring which collapses under the pressure of the propellant gases, the brass disk expanding and being forced into the rifling grooves.

b. Painting and marking.—The shell, except the guides, are painted blue gray. The markings differ with the type of filling. (See fig. 7.)

(1) On shell filled with persistent gas (HS), two green bands $\frac{1}{2}$ inch wide and $\frac{1}{4}$ inch apart are painted around the shell, the top band $\frac{3}{8}$ inch below the top guide of the shell. The type and symbol of the agent (GAS-HS) are stenciled in $\frac{3}{4}$ -inch green letters below the lower band, and underneath this the following data in $\frac{1}{2}$ -inch green letters and numbers:

4.2 IN-CM.

EA (loader's identification mark).

LOT number.

(2) On shell filled with nonpersistent gas (CG), the markings are the same except that only one band $\frac{1}{2}$ inch wide in green is painted around the shell $\frac{3}{4}$ inch from the top guide.

(3) Shell filled with irritant gas (CNS, CNB) have one band. The band and all other markings are in red.

(4) Smoke shell (WP, FS, FM) have one band. The band and all other markings are in yellow.

8. Fuze.—*a. General characteristics.*—The fuze (see figs. 9 and 10) is an impact fuze of the point detonating type weighing about $1\frac{1}{2}$ pounds. The complete fuze consists of the fuze proper with aluminum body (1) (fig. 10) and the various components, and the seamless steel burster tube (15). The bursting charge consists

of about 65 grams pelleted tetryl in the burster tube and the cup (14). After the burster tube has been screwed into the base of the fuze body the entire outside surface of the tube is given a coating of rust-preventive compound.

b. Safety features.—The fuze has four safety features:

(1) The safety pin (13), a cotter pin which, passing through the body of the fuze, the striker (8), and the retainer (6), secures the retainer and striker firmly against the body of the fuze and prevents their movement. Just before firing, the safety pin is pulled from the fuze by the ring attached to the pin.

(2) The shear wire (11), which passes through the retainer and the fuze body and prevents any movement of the retainer, even after the safety pin has been withdrawn, as long as the shear wire itself remains unbroken. The ends of the shear wire are bent into the annular groove around the outer surface of the retainer. This prevents accidental damage to the shear wire from external sources and also enables the

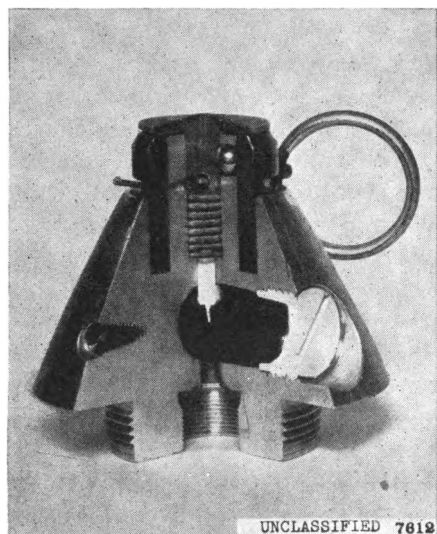
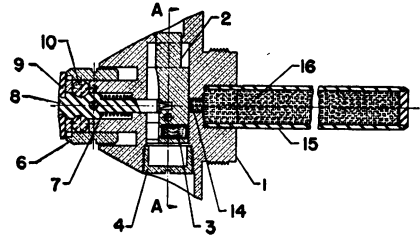
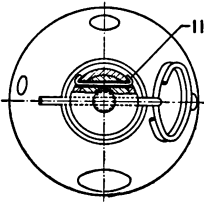


FIGURE 9.—4.2-inch chemical mortar fuze (E15R8).

fuze to arm itself by cutting the shear wire inside the retainer only.

(3) The retainer (6), a brass ring which holds two steel balls (10) in cylindrical holes 180° apart in the upper part of the fuze body. When the striker (8) is in the unarmed position, two hemispherical recesses 180° apart in the stem are located opposite the two holes in the fuze body. The diameter of the holes is slightly larger but their depth is less than the diameter of the balls. When the retainer is held in the unarmed position by the shear wire its inner surface covers the outer openings of the holes so that approximately one-third of each ball fits into the corresponding hemispherical recess in the striker stem while the other two-thirds remains in the cylindrical hole in the body of the fuze. Immediately below the retainer is a well in the fuze body into which the retainer drops when the shear wire is cut.

(4) The slider (2), a brass cylinder of two diameters forming a shoulder at their junction. In the slider holes are cut to take the primer detonator (3), the striker point, and the lock pin (4), and a groove for the guide screw (5). In the unarmed position the primer detonator is out of line with the bursting charge and the striker. The point on the end of the striker fits into a hole in the slider, locking it in place as long as the retainer is held in position by the shear wire.



SECTION A-A

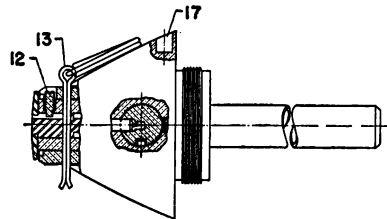
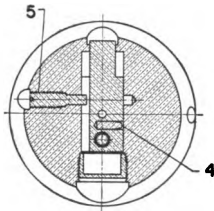


FIGURE 10.—4.2-inch chemical mortar fuze (E15R8).

- | | |
|----------------------|-----------------------|
| 1. Body. | 10. Ball, steel (2). |
| 2. Slider. | 11. Wire, shear. |
| 3. Primer detonator. | 12. Screw, set. |
| 4. Pin, lock. | 13. Pin, safety. |
| 5. Screw, guide. | 14. Cup. |
| 6. Retainer. | 15. Tube, burster. |
| 7. Spring. | 16. Burster charge. |
| 8. Striker. | 17. Fuze wrench hole. |
| 9. Head, striker. | |

c. Functioning.—(1) Just before the shell is inserted in the barrel, the safety pin is pulled out of the fuze. As the shell, after striking the firing pin at the base of the barrel and igniting the propellant, is forced up the barrel by the pressure of the powder gases, the retainer, being a movable part, moves down into the well below it, cutting the shear wire. The inside of the retainer is recessed at the

top so that when the retainer drops into the well below it the recessed portion comes opposite the holes in the fuze body containing the steel balls. The combination of centrifugal force due to the rotating shell and the pressure of the striker caused by the striker spring (7) on the balls forces them out into the additional space in the recessed portion of the retainer. The striker is thus released and the spring forces it up into the armed position with the striker head (9) projecting 0.25 inch above the fuze body.

(2) The striker is prevented from being forced entirely out of the fuze by the set screw (12) which passes through the upper part of the fuze body at the same level as the steel balls and 90° from each ball. A vertical slot is cut in the striker from the bottom of the striker head to the safety pin hole. The point of the set screw extends into this slot and thus controls the movement of the striker. A U-shaped slot in the wall of the retainer at the point where the head of the set screw projects from the fuze body permits the retainer to fit around the head of the set screw without interference with the downward movement of the retainer.

(3) When the striker is free to move, the spring lifts the point of the striker and centrifugal force caused by the rotating shell moves the slider (2) outward until its shoulder meets a shoulder in the fuze body. On completion of this movement, the slider is held fast in the armed position by the lock pin (4), which also functions by centrifugal force and prevents backward movement of the slider. The guide screw (5) in the fuze body fits into a groove in the slider and prevents rotation of the slider until the lock pin functions, thus assuring vertical alinement of the detonator when coming into the armed position. During the flight of the shell, the tension of the striker spring holds the striker up in the armed position. Upon impact, the spring is compressed and the pin of the striker is driven into the detonator, thereby setting off the primer detonator which, in turn, detonates the bursting charge of the shell.

9. Propelling charge, MV.—a. General.—The propelling charge (see fig. 11) consists of an ignition cartridge and eight full bundles and one-half bundle of powder. Two to eight bundles are used, which allows seven zones of fire with approximate ranges of from 600 to 2400 yards. Intermediate ranges are obtained by the use of the half bundle. The number of bundles of powder to be used is determined by the range desired, as given in the range tables. Just prior to firing, the cartridge is placed in the cartridge container of the shell and the bundles of powder are placed over the cartridge container. The upper compression nut is not brought down against

the powder until after the lower striker nut has been screwed on flush with the end of the cartridge container.

b. Ignition cartridge.—The ignition cartridge (see fig. 12) is the same as that used with the infantry 3-inch trench mortar Mk. I.

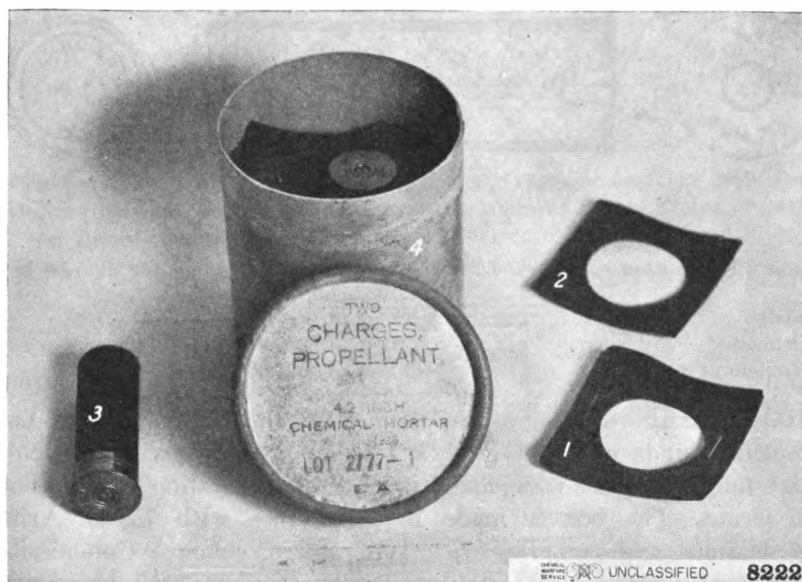


FIGURE 11.—4.2-inch chemical mortar propelling charge, MV, and container for two charges.

- | | |
|--|---|
| 1. Full bundle (150 grains) of powder. | 4. Fiber container for two complete propelling charges, each consisting of eight full bundles and one-half bundle of powder and one ignition cartridge. |
| 2. Half bundle (75 grains) of powder. | |
| 3. Ignition cartridge. | |

It is designated cartridge 12-gage, green, Mk. I, and is procured under U. S. Army Specification Number 50-63-5 as Type I, Class A. It is similar in appearance to a commercial 12-gage shotgun shell.

c. Propellant powder.—The propellant powder is practically non-hygroscopic and smokeless, but not flashless. The individual grains are thin square sheets, 2.18 by 2.18 inches and 0.0125 inch thick, with a circular hole 1.35 inches in diameter in the center of each square. The squares are bound by clips of bookbinding wire into bundles of 150 ± 5 grains and half bundles of 75 ± 2.5 grains. (Until recently, powder in the form of circular grains (disk propellant) as

shown in fig. 7 was used.) The powder is supplied in the proportion of eight full bundles to one half bundle.

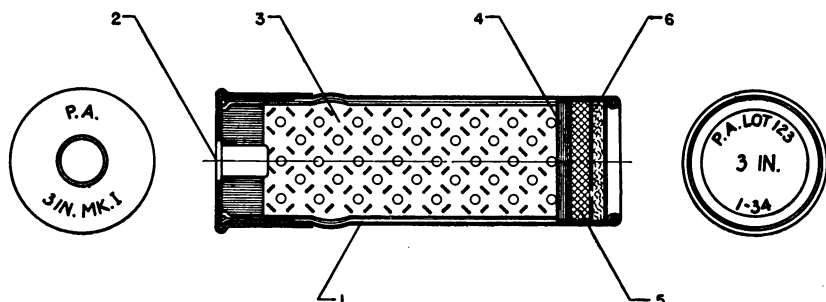


FIGURE 12.—Ignition cartridge, 4.2-inch chemical mortar propelling charge, MV.

- | | |
|-----------------------|-----------------------|
| 1. Body. | 4. Wad, inner. |
| 2. Primer. | 5. Wad, intermediate. |
| 3. Propellant powder. | 6. Wad, outer. |

10. Packing.—*a. Complete round.*—All the components of two complete rounds are packed in a wooden box approximately 25½ inches long, 11 inches wide, and 7 inches high, including top and bottom cleats. The box is made in accordance with U. S. Army specifications and complies with Interstate Commerce Commission regulations. The box lid is hinged and is closed with hasps and latches. The box contains two filled shell with fuzes assembled and one propelling charge container with two complete propelling charges (see *c* (1) below). A data card properly filled out is placed in each box. The weight of the box packed with two complete rounds varies with the type of chemical filling of the shell as follows:

Shell	Pounds (approximate)
Gas, HS-----	62.88
Gas, CG-----	62
Gas, CNS-----	62.5
Gas, CNB-----	62.5
Smoke, WP-----	66
Smoke, FS-----	67
Smoke, FM-----	67

The displacement of the box is approximately 1.12 cubic feet. The markings on the box are shown in figures 13 and 14.

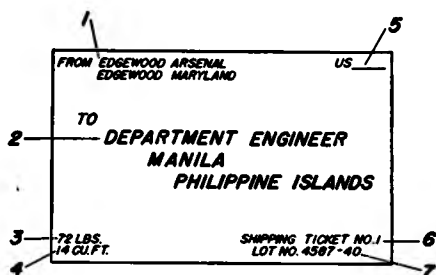


FIG. 13.—Marking, address, side, for all packing boxes.

1. Consignor.
2. Designation and address of consignee.
3. Gross weight (in pounds).
4. Cubic displacement (in cubic feet).
5. To indicate United States property.
6. Number of shipping ticket.
7. Lot number.

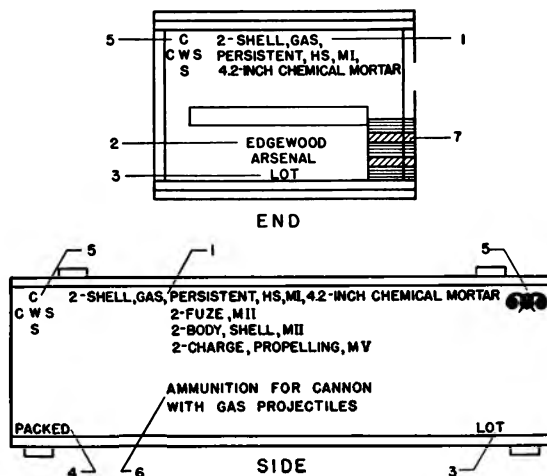


FIGURE 14.—Marking of packing box for two complete rounds for 4.2-inch chemical mortar.

1. Quantity and kind of complete round.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Colored stripes on blue gray background. Color and number of stripes as specified for kind of filling:

Persistent gas (HS)	2 green stripes.
Nonpersistent gas (CG)	1 green stripe.
Irritant gas (CNB, CNS)	1 red stripe.
Smoke (WP, FS, FM)	1 yellow stripe.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

b. Fuze.—When the fuze assemblies are shipped in bulk, they are packed 50 to the box. The box is made of wood in accordance with U. S. Army specifications and complies with Interstate Commerce Commission regulations. The fuzes are packed in 5 horizontal rows of 10 fuzes each, being held in position by means of wooden retainers about 2 inches from the front and rear sides of the box. A data card properly filled out is placed in each box. The lid is secured with 14 screws. The dimensions of the box are approximately $22\frac{1}{4}$ inches long by 18 inches wide by $17\frac{9}{16}$ inches high, including the top and end cleats, with a displacement of 4.07 cubic feet. The shipping weight of the box, with 50 fuzes, is approximately 109 pounds. The markings on the box are shown in figures 13 and 15.

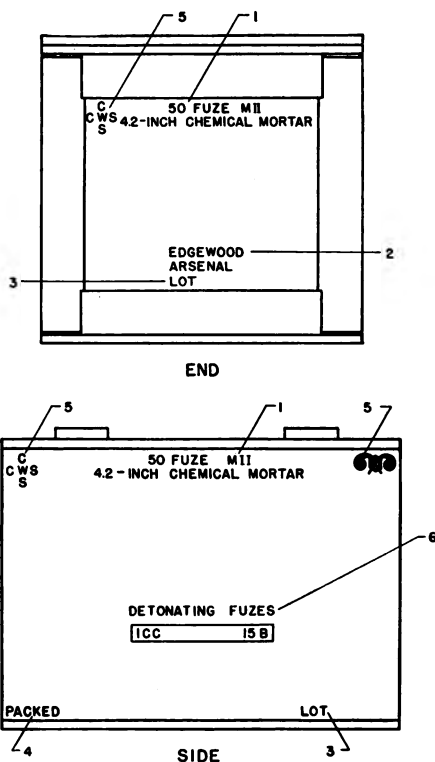


FIGURE 15.—Marking of packing box for fifty fuzes for 4.2-inch chemical mortar.

- | | |
|--------------------------------|---|
| 1. Quantity and kind of fuze. | 4. Month and year of packing. |
| 2. Name of place where packed. | 5. C. W. S. insignia. |
| 3. Lot number. | 6. To comply with I. C. C. regulations. |

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

c. Propelling charge, MV.—(1) *Container.*—Sixteen 150-grain bundles and two 75-grain bundles of powder are packed in a fiber container (see fig. 11), approximately $3\frac{7}{8}$ inches high and $3\frac{3}{16}$ inches in diameter, together with two or with three ignition cartridges. The container is closed with a light friction fit slip cover and the cover seam is sealed with adhesive plaster. Containers in which two ignition cartridges have been packed are stamped in black indelible ink on the top as follows:

TWO
CHARGES
PROPELLING
MV
4.2 INCH
CHEMICAL MORTAR
Date of packing (month and year)
Packer's identification mark
Lot

Containers in which three ignition cartridges have been packed are stamped in red indelible ink as above, with the additional line, **EXTRA CARTRIDGE**, under MV.

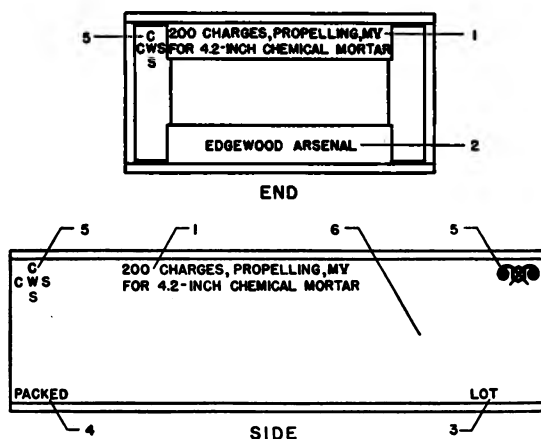


FIGURE 16.—Marking of packing box for 200 propelling charges for 4.2-inch chemical mortar.

- | | |
|---|---|
| 1. Quantity and kind of propelling charges. | 4. Month and year of packing. |
| 2. Name and place where packed. | 5. C. W. S. insignia. |
| 3. Lot number. | 6. To comply with I. C. C. regulations. |

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

(2) *Packing box*.—One hundred propelling charge containers (80 with 2 ignition cartridges and 20 with 3 ignition cartridges) are packed in 2 layers of 50 containers each in a wooden box made in accordance with U. S. Army specifications and complying with Interstate Commerce Commission regulations. An ammunition data card properly filled out is placed in each box. The lid is held securely in place with 16 screws, and the box is bound at each end with nailless strapping. The dimensions of the box are approximately $34\frac{7}{8}$ by $17\frac{1}{2}$ by $9\frac{9}{16}$ inches, with a displacement of 3.38 cubic feet. The approximate weight of the box with 200 propelling charges is 96 pounds. The markings of the box are shown in figures 13 and 16.

SECTION IV

OPERATING INSTRUCTIONS

	Paragraph
Installation of mortar.....	11
Laying the mortar.....	12
Loading and firing.....	13
Precautions.....	14
Misfires.....	15
Going out of action.....	16

11. *Installation of mortar*.—*a*. The location for emplacing the mortar should be selected with care. It should be as level and firm as practicable. If the ground is comparatively level no excavation will be required. A space approximately 3 feet wide and 7 feet long, in line with the aiming stakes, should be cleared of underbrush, stones, and roots. If the topsoil is loose or sandy it should be removed from the cleared space. If the ground is very uneven a space, as above, should be leveled off for the baseplate and the base of the standard. The baseplate is then placed on the cleared space with a line through the aiming stakes bisecting the baseplate cup, and a man standing on the baseplate rocks it from side to side until an impression of the Y-shaped spade is made on the ground. The baseplate is then moved to one side and with the pick end of the pick mattock a crevice is dug to a depth of approximately 5 inches along the Y-shaped impression. The spade of the baseplate is now placed in the crevice and the baseplate is dropped into position. Several men should then stand on the baseplate and force it down until the bottom surface rests firmly on the ground.

b. The upper ends of the tie rods on the standard are released and hooked onto the baseplate and the base of the standard is lowered to

the ground. The base-cap end of the barrel is assembled into the cup on the baseplate and locked in place with the barrel lock (cup fork). The support of the standard is raised and connected to the barrel coupling. The barrel and standard are approximately alined on the aiming stakes and the spades on the base of the standard are forced into the ground.

c. Four sandbags are filled with loose earth or sand for use in holding the baseplate and standard firmly in position during firing. One of these bags is placed on each side of the base of the standard and two near the baseplate to be used when necessary.

12. Laying the mortar.—*a.* For the computation of firing data, see paragraphs 122-128, Chemical Warfare Service Field Manual, Volume I.

b. The aiming stakes having been alined to indicate the direction of fire, the sight is set for the desired elevation, placed on the barrel, and rotated slowly around the barrel until the cross bubble indicates the level position. The barrel is then elevated until the elevation bubble also comes to the level position (desired elevation). Using the sight for alinement and keeping the cross-level bubble centered, the mortar is alined approximately on the aiming stakes by slight movements of the baseplate and standard, and the final exact alinement is made by the traversing screw.

c. During action, if the mortar should shift from its original setting, it can be corrected only between rounds. The sight is not allowed to remain on the barrel when the mortar is fired.

13. Loading and firing.—*a.* The shell, as delivered to the mortar, are packed in boxes containing two complete rounds as described in paragraph 10*a*. To provide replacements for defective cartridges, one of the propelling charge containers with an extra cartridge is packed in every fifth box of shells.

b. Preparation of ammunition.—For purposes of safety as well as economy of effort, the preparation of ammunition should be conducted under competent supervision in an orderly sequence of operations, which should be strictly adhered to, as follows:

(1) Open boxes.

(2) Remove striker nut assembly from cartridge container. Clean the shell by removing all rust-preventive compound and dirt from guides, body, cartridge container, and flash outlet holes. Remove rust or paint from guides by means of emery cloth.

(3) Examine fuze. See that the shear wire on the fuze is in place and bent over at both ends.

(4) Examine guides for burrs which might cause the shell to stick in the barrel. Burrs should be filed down.

(5) Open propellant containers as needed.

(6) Place the necessary number of bundles of powder on the cartridge container.

(7) Insert cartridge in the cartridge container, taking care that the base flange of the cartridge is firmly seated against the cartridge container.

(8) Replace the striker nut assembly on the cartridge container and screw it down tight.

(9) When necessary, the safety pin in the fuze may be straightened with a pair of pliers to facilitate rapid removal by the mortar squad.

c. Firing.—(1) *Immediately before firing, and at no other time, remove the safety pin from the fuze.*

(2) Drop the assembled round into the barrel, fuze end up.

(3) Remove the hand quickly from the muzzle of the mortar after dropping in the shell.

14. Precautions.—For safe and proper operation of the mortar, the following precautions should be observed at all times:

a. Before firing, make sure that all excess oil is removed from the bore of the barrel. If the bore is oily, smoke will be given off and the position disclosed.

b. Cartridges and powder bundles should be kept dry.

c. Guides should be clean and free from burrs.

d. The powder bundles must be secure on the cartridge container.

e. The striker nut must be screwed tightly on the cartridge container.

f. A shell must not be inserted in the barrel if the base cap is not seated in the baseplate cup and held in place by the barrel lock.

g. Do not try to force the shell down the barrel.

h. Be sure that the shell is dropped into the mortar cartridge end first.

i. Pull the safety pin before firing.

j. Drop the hands quickly and lower the head behind the muzzle immediately upon release of the shell.

k. In case of misfire, allow one minute interval to elapse before investigating. See paragraph 15 *b* below and paragraph 14 *d* (3), AR 750-10.

l. The position of the mortar should be checked after the first round as the initial charge always tends to seat the baseplate in the ground, thus causing a change in the setting of the mortar.

m. For detailed safety precautions to be observed in firing ammunition in time of peace, see AR 750-10.

15. Misfires.—*a.* A misfire is the failure of an assembled round to leave the mortar after release into the barrel. Misfires may be due to any of the following causes:

- (1) Defective primer or cartridge.
- (2) Defective propellant.
- (3) Parts of striker nut assemblies or other debris covering the point of the striker pin.
- (4) Loose, bent, or defective firing pin or cartridge container.
- (5) Burrs, rust, paint, or dirt on guides, or dirty bore, preventing the shell from reaching the striker or from reaching it with sufficient force to detonate the primer.
- (6) Striker nut assembly not screwed down tight against the primer.

b. (1) In case of a misfire the gunner (No. 2) will call out "Misfire," and the mortar will not be touched for at least one minute. To remove the shell, the base of the barrel is raised so that the misfired shell will slide out easily into the hands of the firer (No. 1). The safety pin is immediately replaced in the fuze and the defect corrected, or the round is placed on the ammunition dump. While the shell is being removed, no member of the mortar crew should stand directly in front or directly in the rear of the mortar.

(2) If for any reason the shell should stick in the barrel on its way down, extreme care must be exercised. Any movement of the barrel may cause the shell to slide down the rest of the way and be discharged. In such a situation efforts should be made to dislodge and fire the shell by rocking or pounding the mortar without raising the base end of the barrel, and care should be taken that the barrel is not pointed toward any person or solid object while this is being done.

16. Going out of action.—*a.* Remove the sandbags.

b. Dismount the barrel from the standard.

- (1) Depress the barrel to the minimum elevation.
- (2) Withdraw the coupling pin which connects the standard to the barrel.

(3) Lift the barrel from the standard.

c. Dismount the barrel from the base-cap cup.

- (1) Remove the cup fork or barrel lock from the base-cap cup.
- (2) Lift the barrel out from the base-cap cup.

d. Disconnect the connecting rods from the baseplate.

(1) Raise the standard in a rotary motion toward the baseplate until the eyelets of the connecting rods are free.

(2) Bring the free ends of the connecting rods together at the standard head.

(3) Secure the connecting rods in the slot provided at the head of the standard by replacing the coupling pin.

e. Raise the baseplate from the firing position.

(1) Extend the handles on the baseplate. A small amount of dirt may have to be cleared away to allow extension of the handles.

(2) Lift up the baseplate by the handles.

SECTION V

CARE AND MAINTENANCE

	Paragraph
General care.....	17
Disassembly and assembly.....	18
Cleaning before, during, and after firing.....	19
Painting.....	20

17. General care.—*a.* The bore of the barrel and all unpainted surfaces should be kept clean and free from rust. The bore should always be kept lightly oiled with a light oil when not in actual use and the muzzle covered with the muzzle cover. The use of the muzzle cover is especially important in rainy weather, as water, in addition to causing rust, may seriously affect the range of the mortar. The muzzle cover should be held in place by the cord.

b. If the mortar is to remain unused for some time, all bright and unpainted parts such as the bore, the guides, the striker pin, screws, gears, threads, etc., after being first thoroughly cleaned, should be protected by a light coat of rust-preventive compound as issued. The rust-preventive compound is easily removed by the use of burlap or waste dipped in gasoline.

c. The striker pin should be examined from time to time and if found so worn, bent, or defective as to be liable to cause misfires, it should be replaced, care being taken that the new striker pin is screwed tightly into the base cap.

d. The springs should be examined occasionally for defects, and screws and nuts tightened.

18. Disassembly and assembly.—In assembling and disassembling the mortar, no other tools than those issued with the outfit will be used.

a. To remove the barrel base cap.—Use the special wrench provided for this purpose, applying the wrench to the radial pins on the base cap. Light blows with a hammer on the handle of the wrench may be necessary to start the threads.

b. To replace the base cap.—Use the special wrench for replacing the base cap. See that the base-cap washer is in place. Care should

be taken to insure a tight fit between the base cap and the barrel to avoid gas leaks.

c. To remove the striker pin.—Remove the base cap from the barrel and apply the combination wrench to the flat milled section of the striker pin. The base cap may be held against rotation during the operation by the base-cap wrench.

d. To replace the striker pin.—Proceed in reverse order to that prescribed in *c* above. Put a drop of oil on the threads before screwing the striker pin firmly into the base cap.

e. The personnel will have no difficulty in dismounting parts of the remaining mechanism. Care should be taken in dismounting bolts, etc., not to batter them by driving them out with a hammer. A piece of hardwood or a copper drift should be interposed.

19. Cleaning before, during, and after firing.—It is important that proper attention be given to the cleaning and inspection of the mortar before and after firing periods.

a. Before firing.—(1) Remove all oil from the bore and any excess oil on the outside of the barrel and on the standard.

(2) See that the striker pin is screwed firmly home in the base cap and that the base cap is screwed tightly on the barrel, insuring a gas-tight fit. Use the base-cap wrench for tightening the base cap.

(3) See that all nuts, bolts, and screws are in position and securely tightened.

b. During firing.—(1) The barrel should be swabbed out after every five rounds, except in rapid fire.

(2) The base cap and firing pin should be examined at every opportunity and cleaned and tightened.

c. After firing.—(1) Unscrew the base cap and clean and sponge out the barrel, removing all residue. Lightly oil the bore.

(2) Clean the striker pin and then oil lightly.

(3) Clean and oil the base cap.

(4) Examine, clean, and oil all working parts of the standard and barrel. Replace the muzzle cover.

(5) Clean the baseplate.

(6) Tighten all nuts and screws.

20. Painting.—*a.* All parts of the matériel, with the exception of the bore and bearing surfaces, should be kept well painted as a protection against rust. Clean and wash the matériel thoroughly to remove all dirt and grease, and allow to dry before applying the paint.

b. The following parts will be painted with one coat of primer and one coat of olive-drab lacquer enamel:

- (1) The barrel, complete with clamps and springs, except the bore and the slide.
- (2) The standard, except the elevating and traversing screws and the bearing surfaces.
- (3) The baseplate.

SECTION VI

ACCESSORIES, SPARE PARTS, AND FIRE-CONTROL EQUIPMENT

	Paragraph
Accessories and spare parts set.....	21
Mil rule and range indicator.....	22
Packing chest.....	23
Standard packing box.....	24

21. Accessories and spare parts set.—The accessories and spare parts set for the 4.2-inch chemical mortar, MIA1, consists of the following items:

<i>Quantity</i>	<i>Name of part</i>
12	Bag, sand.
1	Bag, wiping cloth.
1	Chest, packing.
6	Cloth, emery, no. 00 sheets.
1 lb.	Cloth, wiping.
1	Cover, muzzle, MI.
1	Lanyard.
1	Mattock, pick.
1	Oil, 1-quart can.
1	Oiler, ½-pint.
1	Rod, cleaning, consisting of—
1	Claw.
1	Handle.
1	Roll, tool, ammunition, containing—
6	Cloth, emery, no. 00 sheets.
½ lb.	Cloth, wiping.
2	File, flat, second-cut, 8-inch.
1	Hatchet, broad.
1	Wrench, fuze.
1	Roll, tool, gunner's, containing—

- $\frac{1}{2}$ lb. Cloth, wiping.
 2 Bolt, slide.
 1 Handle, traversing-screw.
 1 Pin, striker.
 1 Pliers, combination, 8-inch.
 1 Screwdriver, 4-inch blade.
 2 Spring, front.
 2 Spring, rear.
 1 Wrench, base-cap.
 2 Wrench, engineer's single head, $\frac{5}{8}$ -inch milled opening.
 1 Wrench, engineer's. single head, $\frac{15}{16}$ -inch opening.
 1 Spade.
 3 Stake, aiming.

22. Mil rule and range indicator.—*a. Mil rule, MI.*—The rule (see fig. 17) consists of—

(1) The rule proper, graduated in units of 10 mils up to 100 mils on both sides of the zero graduation at the center of the scale. The

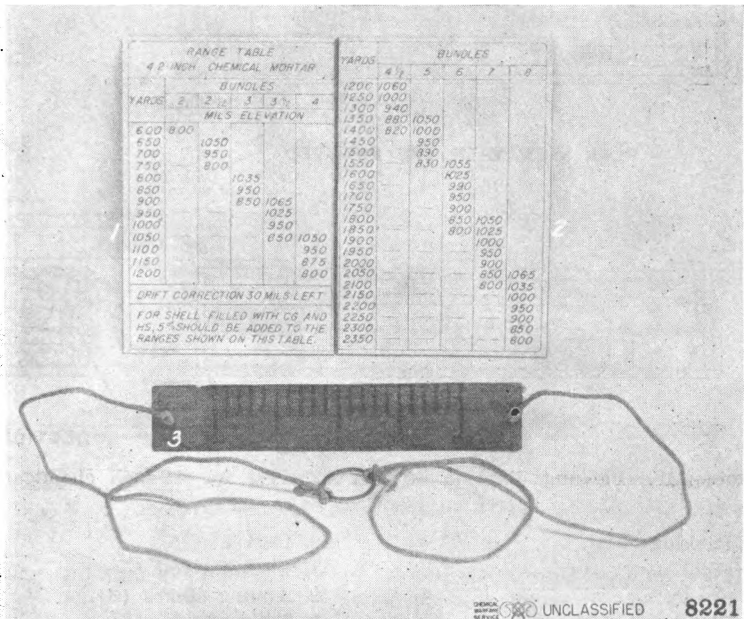


FIGURE 17.—(Chemical mortar mil rule, MI, and 4.2-inch chemical mortar range indicator, MI.

1. Range indicator, MI, front.
2. Range indicator, MI, back.
3. Mil rule, MI.

rule is made of maple wood, and one coat of spar varnish is applied to all surfaces.

(2) Two shock-absorber cords, each tied to the rule proper, $\frac{1}{4}$ inch from the ends, by an overhand knot. The other ends of the cords are fastened by slip knots to a brass ring.

(3) A brass ring, $\frac{3}{4}$ inch inside diameter, to which the two cords are attached.

b. Range indicator, MI.—The range indicator, MI (see fig. 17) is a tablet of plastic material, $5\frac{1}{4}$ by $3\frac{1}{2}$ by $\frac{1}{16}$ inches, on each side of which is printed the range table for the chemical mortar.

23. Packing chest.—When in actual use, the mortar and the various accessories, spare parts, and fire-control equipment are carried on the carts described in section VIII. For purposes of storage and shipment, the components of the accessories and spare parts set

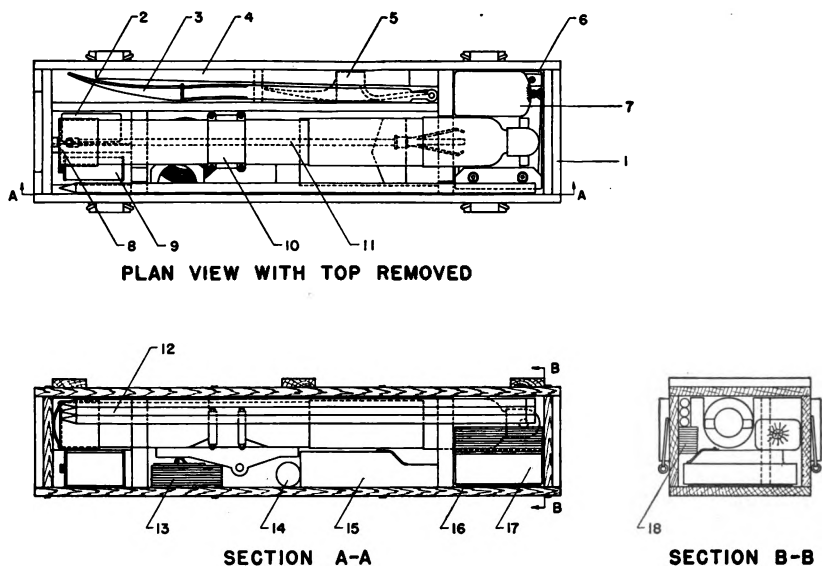


FIGURE 18.—Packing diagram of packing chest for 4.2-inch chemical mortar barrel, accessories, and spare parts.

- | | |
|---------------------------------|---------------------------------|
| 1. Packing chest. | 10. Barrel. |
| 2. Sight. | 11. Cleaning rod. |
| 3. Spade. | 12. Aiming stakes (3). |
| 4. Pick mattock handle. | 13. Lanyard. |
| 5. Pick mattock head. | 14. Oiler, $\frac{1}{2}$ -pint. |
| 6. Packing chest contents card. | 15. Ammunition tool roll. |
| 7. Wiping cloths, 1-pound bag. | 16. Emery cloth, 6 sheets. |
| 8. Muzzle cover. | 17. Gunner's tool roll. |
| 9. Oil can, 1-quart. | 18. Baseplate sling. |

4.2-INCH CHEMICAL MORTAR, MIA1

enumerated in paragraph 21 and, in addition, the barrel, the base-plate slings, the sight, the mil rule, and the range indicator are packed with a packing chest contents card in a packing chest in accordance with the packing diagram shown in figure 18. The packing chest is a strongly braced wooden box secured with nailless metal strapping after the lid has been screwed on. Partitions and cross members on the inside of the box hold the various items in position. Four handles (two at the front and two at the back) are provided to facilitate handling. The outside dimensions of the chest, including the handles at the sides and the cleats at the top, are approximately $55\frac{3}{8}$ by $16\frac{3}{4}$ by $12\frac{1}{4}$ inches, and the displacement is approximately 6.57 cubic feet. The packed chest weighs approximately 220 pounds. For technical markings on the packing chest see figures 13 and 19.

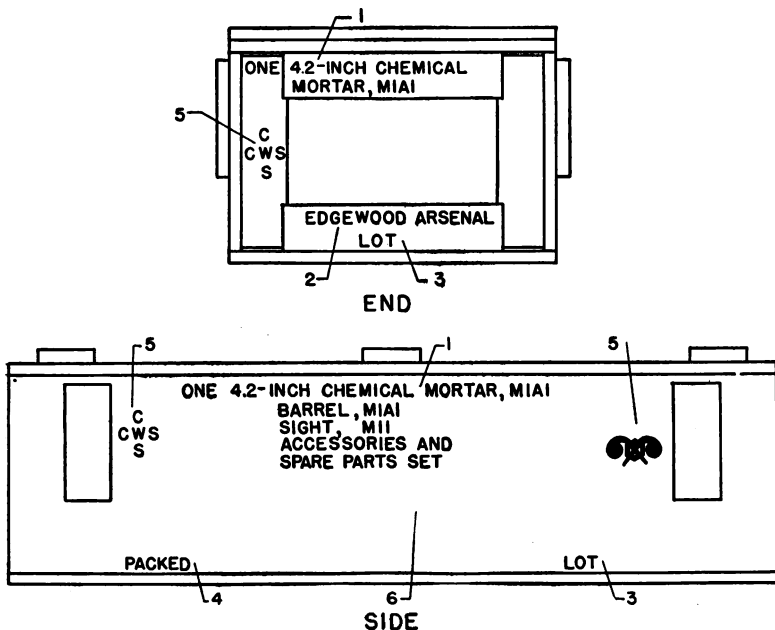


FIGURE 19.—Marking of packing chest for 4.2-inch chemical mortar barrel, accessories, and spare parts.

- | | |
|--|---|
| 1. Quantity and kind of chemical mortar. | 4. Month and year of packing. |
| 2. Name of place where packed. | 5. C. W. S. insignia. |
| 3. Lot number. | 6. To comply with I. C. C. regulations. |

NOTE.—Both ends of chest are marked alike. For marking on side not shown (address side), see figure 13.

24. Standard packing box.—When the standard is to be stored or shipped separately, it is packed in a wooden box approximately $40\frac{1}{4}$ by $26\frac{5}{8}$ by 10 inches (including end, top, and bottom cleats), with a saddle of 2-inch lumber in the center and supports at both ends. The lid is fastened on with screws. The displacement of the box is approximately 6.2 cubic feet and the weight of the packed box is about 110 pounds. For technical markings on the box see figures 13 and 20.

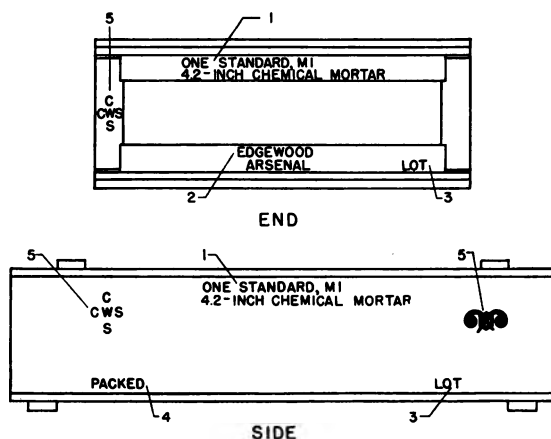


FIGURE 20.—Marking of packing box for 4.2-inch chemical mortar standard, MI.

- | | |
|-----------------------------------|--|
| 1. Quantity and kind of standard. | 4. Month and year of packing. |
| 2. Name of place where packed. | 5. C. W. S. insignia. |
| 3. Lot number. | 6. To comply with I. C.C. regulations. |

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

SECTION VII

TRANSPORTATION EQUIPMENT

	Paragraph
Shell carrier, MI.....	25
Chemical mortar cart, MIA1.....	26
Chemical mortar ammunition cart, MIA1.....	27
Weights of carts and loads.....	28

25. Shell carrier, MI.—The shell carrier, MI (see fig. 21), which is used to carry two chemical mortar shell, is made of paraffined olive-drab cotton duck and consists essentially of two pockets, two shoulder straps, a belt assembly, and a left and a right suspender. It weighs approximately $21\frac{1}{8}$ pounds.

26. Chemical mortar cart, MIA1.—The chemical mortar cart, MIA1, which is used for the transportation of the 4.2-inch chemical mortar, MIA1, and accessories, spare parts, and ammunition, is a two-wheel, man-drawn cart and consists of a chassis and a mortar cart rack (see fig. 22).

a. Chassis.—(1) The frame of the chassis is constructed from 2- by 2- by $\frac{3}{16}$ -inch structural steel angle, and is $26\frac{1}{8}$ inches wide and 37 inches long. The axle is welded near the center and carries motor-cycle wheels, the tires of which are approximately 27 inches outside diameter. The width of the tread is $33\frac{3}{4}$ inches and



FIGURE 21.—Chemical mortar shell carrier, MI.



FIGURE 22.—Hand-drawn 4.2-inch chemical mortar cart, MIA1.

- | | |
|-----------------|-------------------------------|
| 1. Mortar rack. | 4. Rear handle. |
| 2. Tool box. | 5. Adjustable chain coupling. |
| 3. Pole braces. | 6. Lead chains and handles. |

the over-all length of the cart, including the pole, is 7 feet $3\frac{3}{16}$ inches.

(2) At the front end of the frame are welded U-shaped brackets to which are welded the pole braces (3) which carry the detachable pole and handle at their junction. These items are of $1\frac{1}{4}$ -inch tubing. The pole braces are at an angle so that besides strengthening the structure they act as wheel guards, deflecting any brush with which they may come in contact in the field. They also serve as handles in lifting the cart on or off trucks.

(3) In the center of the pole handle is a ring to which are attached by round eye snaps two lead chains with handles (6).

(4) A tool box (2) is located between the pole braces and the front angle of the chassis. Clips for the spade and the pick mattock handle are welded to this angle. On the rear angle of the chassis frame are locating clips for the spade, standard, baseplate, and pick mattock handle. Under it a seamless steel tube (4), $1\frac{1}{4}$ inches in diameter, extends the entire width of the chassis frame and projects at each end to form guards for the wheels and to serve as handles when the cart is lifted on or off trucks.

(5) Near each corner of the chassis frame tightening chains are attached for retaining the load. These chains are pulled taut by a chain coupling (5) operated by a screw.

b. Mortar cart rack.—The mortar cart rack (1) is $40\frac{3}{8}$ inches long, $10\frac{1}{8}$ inches wide, and $9\frac{1}{8}$ inches high. The longitudinal members are constructed from $1\frac{1}{2}$ - by $1\frac{1}{2}$ - by $\frac{1}{8}$ -inch structural steel angle. Of the three cross members, those at the front and rear are channel-shaped, of $\frac{1}{8}$ -inch steel plate, and the middle one is of $1\frac{1}{2}$ -inch steel tubing. Above the channels is a steel strap 1 inch wide and $\frac{3}{16}$ inch thick bent into such a shape as to form a support for the mortar barrel. At each end of the channels are notches that retain the aiming stakes. The rear channel is provided with locking pins that enter holes drilled in the aiming stakes, thus securely locking the stakes to the mortar cart rack. The rack is supported on four brackets made of $1\frac{1}{2}$ - by $1\frac{1}{2}$ - by $\frac{1}{8}$ -inch structural steel. At the lower end of each and projecting down from it, a $\frac{1}{2}$ -inch pin is welded. These pins enter drilled holes in the baseplate, when the mortar cart is loaded, locating the rack and preventing any movement of it.

c. Mortar cart accessories set, MIA1.—The mortar cart accessories set, MIA1, consists of the following equipment:

Quantity	Name of part
1	Bag, tool, containing—
1	Kit, repair, rubber tube, consisting of—
1	Cement, rubber, 1-ounce tube.
1	Patch, rubber, 27-square-inch sheet.
1	Roughener.
5	Valve cores (in box).
1	Wrench, automotive, adjustable, 9-inch.
1	Iron, tire, flat type, 15-inch maximum length.
1	Pump, motorcycle tire, hand.

One of these accessories sets is issued per mortar squad (two carts).

d. Load.—The cart is designed to carry the mortar accessories and spare parts set (par. 21), except the ammunition tool roll and contents, the barrel, the standard, the baseplate, and the mortar cart accessories set, MIA1 (*c* above). The load is placed on the cart in the following order (see figs. 23 and 24):

(1) The pick mattock head, gunner's tool roll, mortar cart accessories set, $\frac{1}{2}$ -pint oiler, and baseplate slings are put in the tool box.



FIGURE 23.—Loaded hand-drawn 4.2-inch chemical mortar cart, MIA1 (front view).

- | | |
|-----------------|-------------------------------|
| 1. Mortar rack. | 4. Rear handle. |
| 2. Tool box. | 5. Adjustable chain coupling. |
| 3. Pole braces. | 6. Lead chains and handles. |

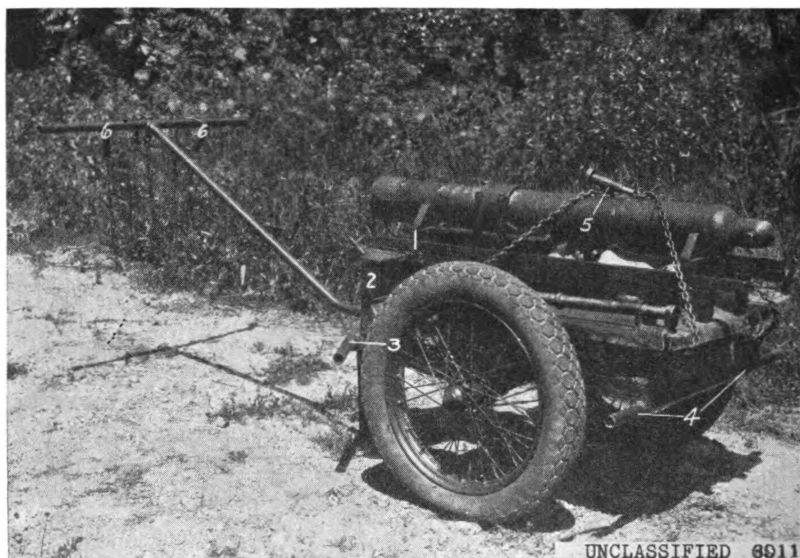


FIGURE 24.—Loaded hand-drawn 4.2-inch chemical mortar cart, MIA1 (rear view).

- | | |
|-----------------|-------------------------------|
| 1. Mortar rack. | 4. Rear handle. |
| 2. Tool box. | 5. Adjustable chain coupling. |
| 3. Pole braces. | 6. Lead chains and handles. |

(2) The spade is placed in the spade support under the front frame angle on the left-hand side of the cart, the handle extending to the rear where it is held by the spade clip. The large end of the pick mattock handle is inserted in the pick mattock clip located under the front frame angle on the right-hand side of the cart, and the hole drilled in the small end of the pick mattock handle is fitted over the pin on the rear angle of the cart chassis.

(3) The standard is next laid in the chassis frame front side up with the connector rods between the standard clips on the rear frame angle.

(4) The baseplate is then loaded with the front of the plate facing the front of the cart and the rear notch in the baseplate spade entering the baseplate guide on the rear angle of the cart frame. The notches in each side of the baseplate are supported by the side angles of the cart frame. These notches prevent any lateral movement of the baseplate, and in turn the baseplate prevents any movement of the spade, pick mattock handle, and standard.

(5) The mortar rack is now placed on the baseplate, the four pins in the feet or supporting brackets entering the drilled holes in the baseplate.

(6) The aiming stakes, two on the right and one on the left side, are put in the mortar rack with the points forward, and are retained in place by the lock pins passing through the holes drilled in the stakes.

(7) Eight sandbags are folded and stowed between the side angles of the rack at the rear of the baseplate cup. The other four sandbags are folded and put in front of the cup.



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FIGURE 25.—Hand-drawn 4.2-inch chemical mortar ammunition cart, MIA1.

- | | |
|-----------------|-------------------------------|
| 2. Tool box. | 5. Adjustable chain coupling. |
| 3. Pole braces. | 6. Lead chains and handles. |
| 4. Rear handle. | |

(8) The mortar barrel, with the cleaning rod inside the barrel and the muzzle cover in position, is placed in the barrel support with the muzzle toward the front end of the cart, and is moved forward until the shock-absorber slide is against the front barrel support.

(9) The chain is now put over the mortar barrel and the chain coupling is tightened, thus holding the entire load securely.

27. Chemical mortar ammunition cart, MIA1.—The ammunition cart, MIA1 (fig. 25), is identical with chassis of the mortar cart, MIA1 (par. 26a), except that no clips are welded to the front and rear angles of the chassis frame to retain the mortar load. It is

designed to carry 5 shell boxes (10 complete rounds) and the ammunition tool roll which is a part of the accessories and spare parts set (par. 21). The shell boxes are placed on the cart with the side up, the rear box against the rear frame angle. The chains are put over the boxes and the chain coupling tightened, thus holding the load securely (see fig. 26). The ammunition tool roll is carried in the tool box. One mortar cart accessories set, MIA1, is issued per ammunition squad (2 carts) and is also carried in the tool box of one of the carts. In an emergency the ammunition cart may be used to carry the mortar cart load (par. 26*d*), except the spade and mattock handle. There are no locating clips for the standard and the notch in the base plate spade, but their absence does not interfere with the load being held securely by the chains.

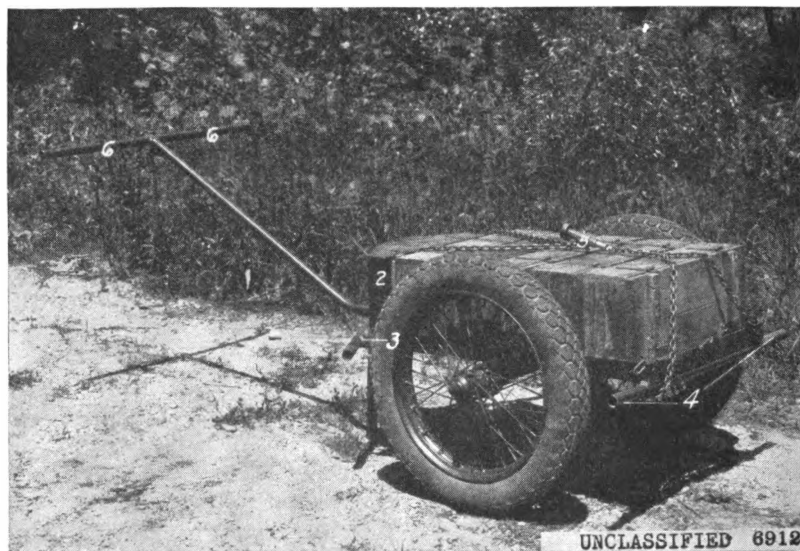


FIGURE 26.—Loaded hand-drawn 4.2-inch chemical mortar ammunition cart MIA1.

- | | |
|-----------------|-------------------------------|
| 2. Tool box. | 5. Adjustable chain coupling. |
| 3. Pole braces. | 6. Lead chains and handles. |
| 4. Rear handle. | |

28. Weights of carts and loads.—The weights of the carts and their loads are approximately as follows:

	Mortar cart, MIA1 Pounds	Ammunition cart, MIA1 Pounds
Chassis -----	149	146
Rack -----	16	---
Load -----	326	330
Cart, loaded -----	491	476

SECTION VIII

REPAIRS IN THE FIELD

	Paragraph
By mortar company-----	29
By chemical maintenance company-----	30

29. By mortar company.—The chemical mortar, MIA1, accessories and spare parts set (see par. 21), which is carried on the mortar cart, contains two spare slide bolts, a traversing screw handle, a striker pin and two front and two rear springs for the shock-absorber, slide. If any of these parts of the mortar should be broken or damaged they may be replaced readily by the mortar company with the tools furnished in the accessories and spare parts set. The procedure used in replacing the striker pin is the same as that given in paragraph 18*d*.

30. By chemical maintenance company.—Since the chemical mortar does not have a breech lock, recoil device, or any fine mechanisms that are apt to get out of adjustment, there are few things that can break or get out of repair, and in general it is more expeditious to replace the damaged part with a new one than to attempt to make repairs in the forward areas. The parts most frequently needing replacement and repair are the slide springs and the tie rods or connectors between the baseplate and the standard. When a detached chemical unit is at some distance from the depot or there is a shortage of parts in stock at the depot, it may be desirable to send forward an element of the weapon section of the chemical maintenance company to make repairs on a damaged mortar while the weapon continues in the possession of the chemical unit. These detachments are furnished with a chest of such tools as chisels, clamps, drills, files, grinders, hacksaws, hammer, hatchet, pliers, screw drivers, sledge, vise, wrenches, etc., and all such basic spare parts of the barrel, baseplate, standard, and mortar and ammunition carts as may be replaced without welding or blacksmithing operations.

[A. G. 062.12 (6-30-39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.



