U113
.2
TM
1942

TM 3-300

WAR DEPARTMENT

U.S. Dept. of Army

TECHNICAL MANUAL

# IRRITANT CANDLES, TEAR POTS, SMOKE POTS, AND CHEMICAL LAND MINES

April 13, 1942

UNIVERSITY OF CALIFORNIA
LIBRARY
SEP 17 1942
DOCUMENTS DIVISION

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

TM 3–300
C 1

TECHNICAL MANUAL

# IRRITANT CANDLES, TEAR POTS, SMOKE POTS, AND CHEMICAL LAND MINES

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON 25, D. C., 14 October 1943.

TM 3–300, 13 April 1942, is changed as follows:

The symbol for mustard gas is changed from HS to H. This symbol will be corrected wherever it occurs in the manual.

[A. G. 300.7 (2 Oct 43).] (C 1, 14 Oct 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
*Chief of Staff.*

OFFICIAL:
J. A. ULIO,
*Major General,*
*The Adjutant General.*

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

556332°—43
U. S. GOVERNMENT PRINTING OFFICE: 1943

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

U113
.2
TM 3:300
1942



TECHNICAL MANUAL
No. 3–300

WAR DEPARTMENT,
WASHINGTON, April 13, 1942.

# IRRITANT CANDLES, TEAR POTS, SMOKE POTS, AND CHEMICAL LAND MINES


| SECTION I. General. | Paragraph |
|---|---|
| Purpose | 1 |
| References | 2 |
| II. DM irritant gas candle MI. | |
| General | 3 |
| Description | 4 |
| Manual firing | 5 |
| Electric firing | 6 |
| Safety precautions | 7 |
| Packing | 8 |
| Storage and shipment | 9 |
| III. HC smoke pot MI. | |
| General | 10 |
| Description | 11 |
| Manual firing | 12 |
| Electric firing | 13 |
| Safety precautions | 14 |
| Packing | 15 |
| Storage and shipment | 16 |
| IV. CN tear gas pot M1. | |
| General | 17 |
| Description | 18 |
| Manual firing | 19 |
| Electric firing | 20 |
| Safety precautions | 21 |
| Packing | 22 |
| Storage and shipment | 23 |
| V. Chemical land mine. | |
| General | 24 |
| Description | 25 |
| Accessories and tools for firing | 26 |
| Filling machines | 27 |
| Filling precautions | 28 |
| Inspection and testing | 29 |
| Packing | 30 |
| Shipping | 31 |
| Storage | 32 |
| Assembly, installation, and firing | 33 |


*This manual supersedes TR 1120–5, February 9, 1931.

450993° 42——1



M558612

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

SECTION VI. Firing components and equipment. Paragraph
Fuzes ---- 34
Blasting caps ---- 35
Cord, detonating (primacord) ---- 36
Electric squibs ---- 37
Burster, nitrostarch, M2 ---- 38
Accessories ---- 39
Page
APPENDIX I. List of references ---- 41
II. Tables ---- 42

## SECTION I

## GENERAL

Paragraph
Purpose ---- 1
References ---- 2

**1. Purpose.**—This manual deals principally with miscellaneous training and combat chemical munitions. The structure, filling, storage, use, shipment, and safety precautions for the DM irritant gas candle MI, the HC smoke pot MI, the CN tear gas pot M1, and the chemical land mine are described.

**2. References.**—Appendix I contains a complete list of references for each of the munitions described.

## SECTION II

## DM IRRITANT GAS CANDLE MI

Paragraph
General ---- 3
Description ---- 4
Manual firing ---- 5
Electric firing ---- 6
Safety precautions ---- 7
Packing ---- 8
Storage and shipment ---- 9

**3. General.**—*a. Purpose.*—The DM irritant gas candle is in effect a generator for producing a toxic suspension of solid particles of DM in the air. The cloud is not a gas but a yellow-colored smoke which has the effect of quickly rendering unprotected personnel unfit for the physical demands of combat. It is not considered lethal in its effect.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

*b. Use.*—This munition is employed in combat principally for harassing value and to render an enemy unfit to cope with a more lethal agent. It may be used to advantage for the humane control of civil disturbances. Its chief advantages are that the agent acts rapidly in very low concentration, and that it will penetrate all but the most efficient gas masks. The chief disadvantages are that it must be ignited within friendly lines; that the wind must be favorable and blow toward the target; and that it has a relatively low chemical efficiency. The effect of the agent on personnel is soon lost.

**4. Description.**—*a.* The DM irritant gas candle consists of two cylindrical compartments of sheet steel 7 inches in inside diameter and 8¼ inches in over-all outside diameter, including flanges. When bolted together these form a container approximately 6¼ inches in height.

*b.* The lower compartment, flanged at the top, contains a 3¼-

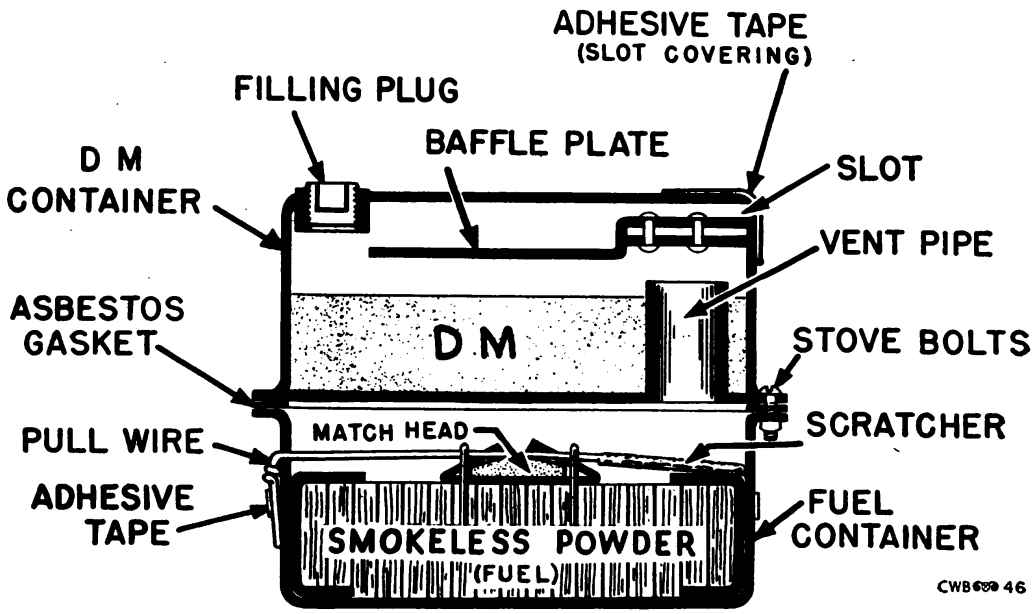



FIGURE 1.—DM irritant gas candle MI—sectional diagram.

pound cake of fuel (consisting of smokeless powder bonded with acetone-alcohol), a matchhead, and a firing pull wire.

*c.* The matchhead is contained in a metal ring and anchored to the fuel cake by means of two wires. These wires also provide a guide for the pull wire.

*d.* The pull wire extends across the matchhead to the outside of the container and is terminated in a loop 1 inch in diameter. This



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

loop is bent against the side of the candle and held securely in place by a strip of adhesive tape circumscribing the candle.

*e.* The upper compartment has a metal separator plate welded to its bottom. This and the upper body are flanged. Holes in the flange permit bolting to the lower body. The separator plate is pierced by a flue or vent pipe 1 inch in diameter and 2 inches long. A baffle plate is welded to the inside of the upper compartment near the top and above the opening of the vent pipe. An emission slot is cut into the side of the upper body near the top and above the baffle plate so that it will extend nearly halfway around the circumference. The baffle plate does not extend completely across the top but is terminated opposite the slot to permit the escape of gas and to enable 2 pounds of melted DM to be filled into the upper compartment through a filling hole in the top, thus forming a cake of the solidified agent on the separator plate. The filling hole is stoppered by an ordinary pipe plug, and the emission slot closed by means of adhesive plaster.

*f.* The completely assembled candle weighs about 9¼ pounds and burns from 2 to 4 minutes.

**5. Manual firing.**—*a. Preparation.*—The adhesive tapes are removed from the emission vent and the pull wire, and the candle placed on the ground with the vent pointing downwind. The pull wire is withdrawn quickly. Should the candle fail to ignite, the pull wire is reinserted, twisted slightly, and again pulled out smartly.

*b. Functioning.*—When the matchhead starts to burn, it in turn ignites the smokeless powder cake. The hot gases formed by the burning fuel pass through the vent pipe and are deflected by the baffle plate so that they pass over the cake of DM. The DM distills off and passes through the emission vent into the open air as illustrated by figure 2. The vapors immediately condense to form microscopic particles of yellow smoke which are borne with the wind.

*c. Precautions.*—Personnel engaged in firing the DM irritant gas candle should always wear gas masks containing an efficient filter in the canister. As soon as the candles are ignited the firers should retire about 5 yards upwind.

**6. Electric firing.**—*a. Preparation.*—While the DM irritant gas candle is primarily designed to be fired by hand, it may also be set off electrically if a few minor alterations are made. For this the stove bolts holding the two sections together are removed and the upper part and gasket set to one side. The pull wire is removed, care being taken that the matchhead is not disturbed. An electric squib and wires, such as described in paragraph 37, are taped down



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

to the matchhead by means of adhesive plaster, and the wires passed out through the pull wire hole, which is enlarged if necessary. Should the matchhead come loose it is placed in a square of thin paper folded to keep the loose grains from being lost and together with the squib taped in place. The two halves of the body are then reassembled and bolted together again, and the candle is ready for firing.

*b. Firing.*—Wiring diagrams and instructions for firing numbers of the irritant gas candles electrically are contained in FM 3–20. Equipment and additional supplies for electric firing are discussed in section VI.

**7. Safety precautions.**—*a.* All persons working around or han-

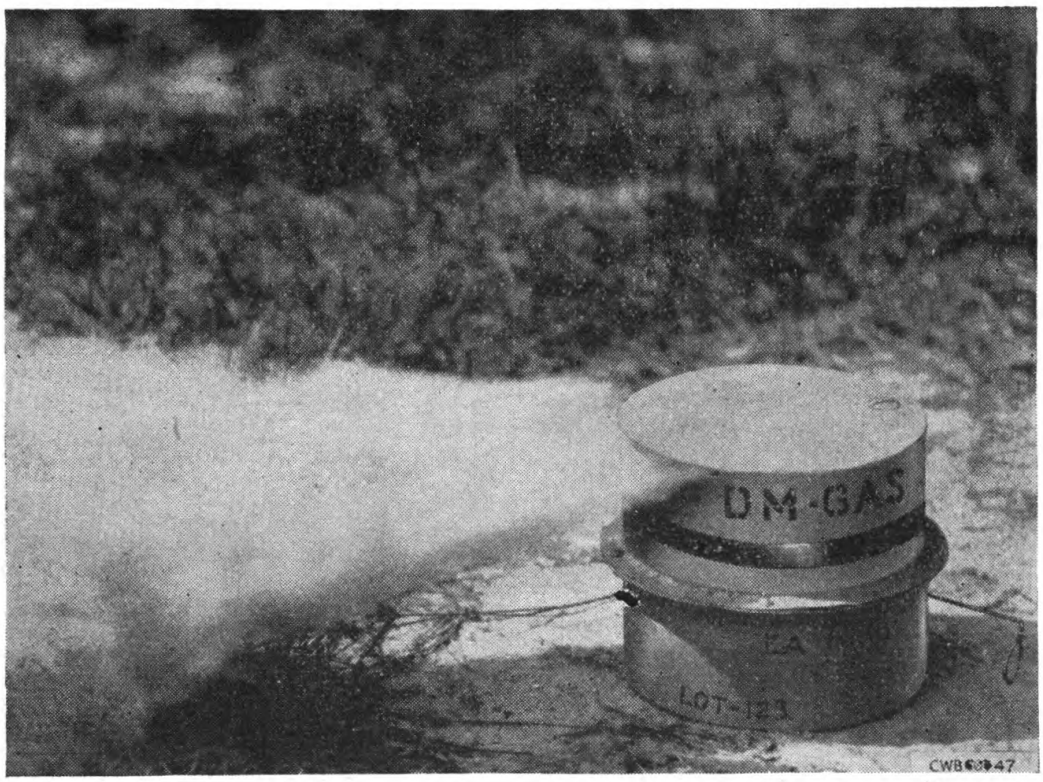



FIGURE 2.—DM irritant gas candle MI in operation.

dling DM candles should be equipped with a gas mask. Diphenylaminechlorarsine when breathed in the form of dust or smoke even in very small quantities produces a violent irritation of the nose and the upper respiratory tract. It produces violent sneezing, coughing, and a burning pain in the nose, and to a slight extent an irritation of the eyes. Headache, nausea, and vomiting usually follow. Exposure to high concentrations may cause disability for 1 to 3 hours or longer.

*b.* The tape covering the firing wire should not be removed until the candle is to be ignited.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

*c.* The emission vent should be pointed downwind, and persons firing the candle should stand upwind.

*d.* Candles should not be placed within 2 feet of dry grass or other readily inflammable materials.

**8. Packing.**—*a.* The DM irritant gas candle is painted blue-gray. Stenciled in red on the side are the Chemical Warfare Service symbol, "DM," and the word "GAS." The loading plant's identification mark, the date of filling, and lot number are also stenciled on the lower half in red. A single red band is painted around the side of the candle to indicate that the munition produces a nonpersistent gas of the harassing type.

*b.* Ten irritant gas candles are packed in a standard wooden pack-

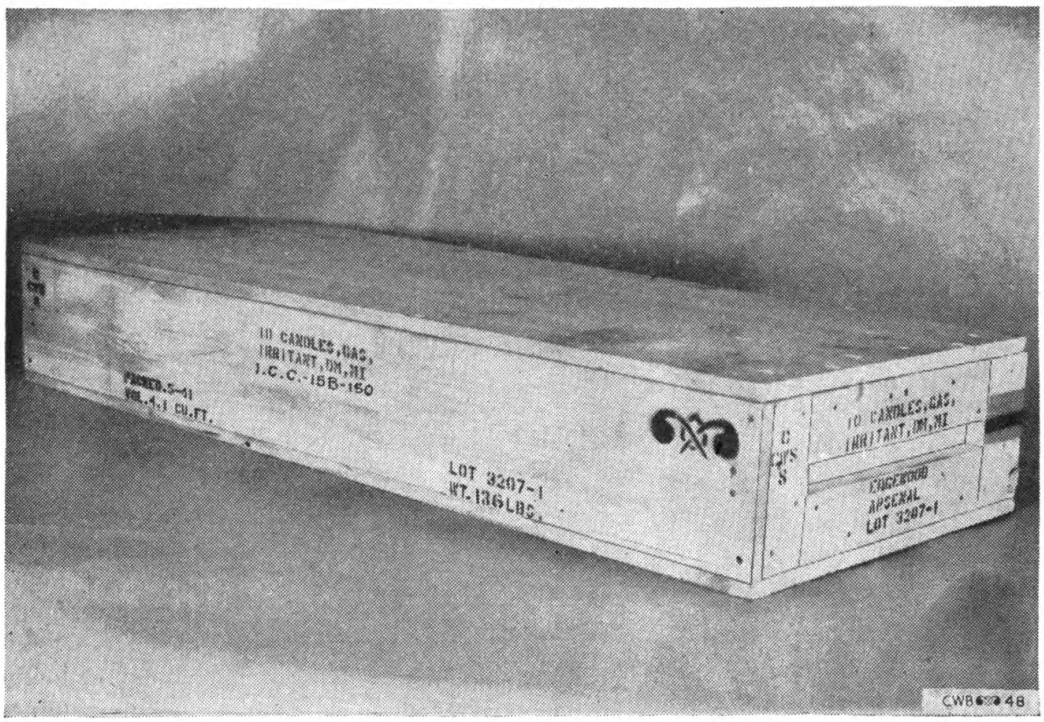



FIGURE 3.—Packing box, DM irritant gas candle MI.

ing box (fig. 3). The weight of the empty box is about 44 pounds. Filled with 10 candles it weighs approximately 136 pounds and displaces 4.06 cubic feet. The box contains a data card giving the lot number, date of manufacture, and date of packing.

*c.* Packing boxes for irritant gas candles are marked to show the data on the candle and, in addition, the total weight and volume.

**9. Storage and shipment.**—*a.* The DM irritant gas candle, a group B munition, is inflammable. In the zone of the interior, boxes of DM irritant gas candles are stored in igloo magazines. The fuel



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

cake is subject to aging and subsequent deterioration, even to the point of spontaneous combustion. If stored over a long period, representative samples should be inspected and tested at frequent and regular intervals as prescribed by surveillance regulations. Piles of boxed DM candles should be so stacked that a circulation of air around each box is possible. In the theater of operations, DM irritant gas candles are stored so that other supplies are not endangered. Piles or stacks in the open are placed on a dunnage foundation and protected from weather or aerial gas spray by gasproof tarpaulins. Not more than 600 candles are placed in any one stack or pile. Piles are irregularly spaced, are camouflaged, and are separated by at least 50 feet.

*b.* Shipment of DM candles by railroad, steamship, or interstate commercial truck in the zone of the interior must conform to Interstate Commerce Commission (I. C. C.) regulations. The candles are shipped boxed. Railroad cars must be certified, cleaned, and properly marked with the correct I. C. C. placard. Trucks, either commercial or Government, must be properly marked by flags, manned by at least two persons, and must conform to the laws of all localities through which the shipments pass. Oversea shipments conform to regulations for transport.

## Section III

## HC SMOKE POT MI

| | Paragraph |
|---|---|
| General | 10 |
| Description | 11 |
| Manual firing | 12 |
| Electric firing | 13 |
| Safety precautions | 14 |
| Packing | 15 |
| Storage and shipment | 16 |

**10. General.**—The HC smoke pot MI was developed to be used principally as a training munition. It can, however, be used for setting up smoke clouds within friendly lines under combat conditions. The smoke from the pot is nontoxic and practically harmless. Its chief advantages are that it will produce a maximum amount of smoke at a minimum expense. It is rugged, easily transported, and its size facilitates use in the field. It has the disadvantage that it is dependent upon favorable wind conditions and must be set off within friendly lines. The several training uses of the smoke cloud are described in TM 3–305 while tactical and combat employment schemes are set forth in FM 3–5 and 3–20.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

**11. Description.**—The HC smoke pot consists essentially of two main parts: the container and the filling.

*a. Container.*—The container is a cylindrical tin can 7¾ inches in height by 5 5/16 inches in diameter.

(1) The top, in which a circular hole 1⅛ inches in diameter is punched, is crimped to the side along the upper edges. A cylindrical and flanged zinc cup 1⅛ inches in diameter for the starting mixture




FIGURE 4.—HC smoke pot MI.

is fitted into the circular hole of the top. The zinc cup is in turn covered by a circular piece of cardboard which is also pierced by a small hole ¼ inch in diameter so that it may receive the matchhead.

(2) A cover with a carrying handle is furnished. This cover fits inside of the top and is held in place by means of a strip of adhesive plaster around the rim. A metal band encircling the body and a transverse metal strap which passes over the cover hold the



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

handle in place. The total height, including the handle, is about 9½ inches.

*b. Filling.*—The filling actually consists of three components, two

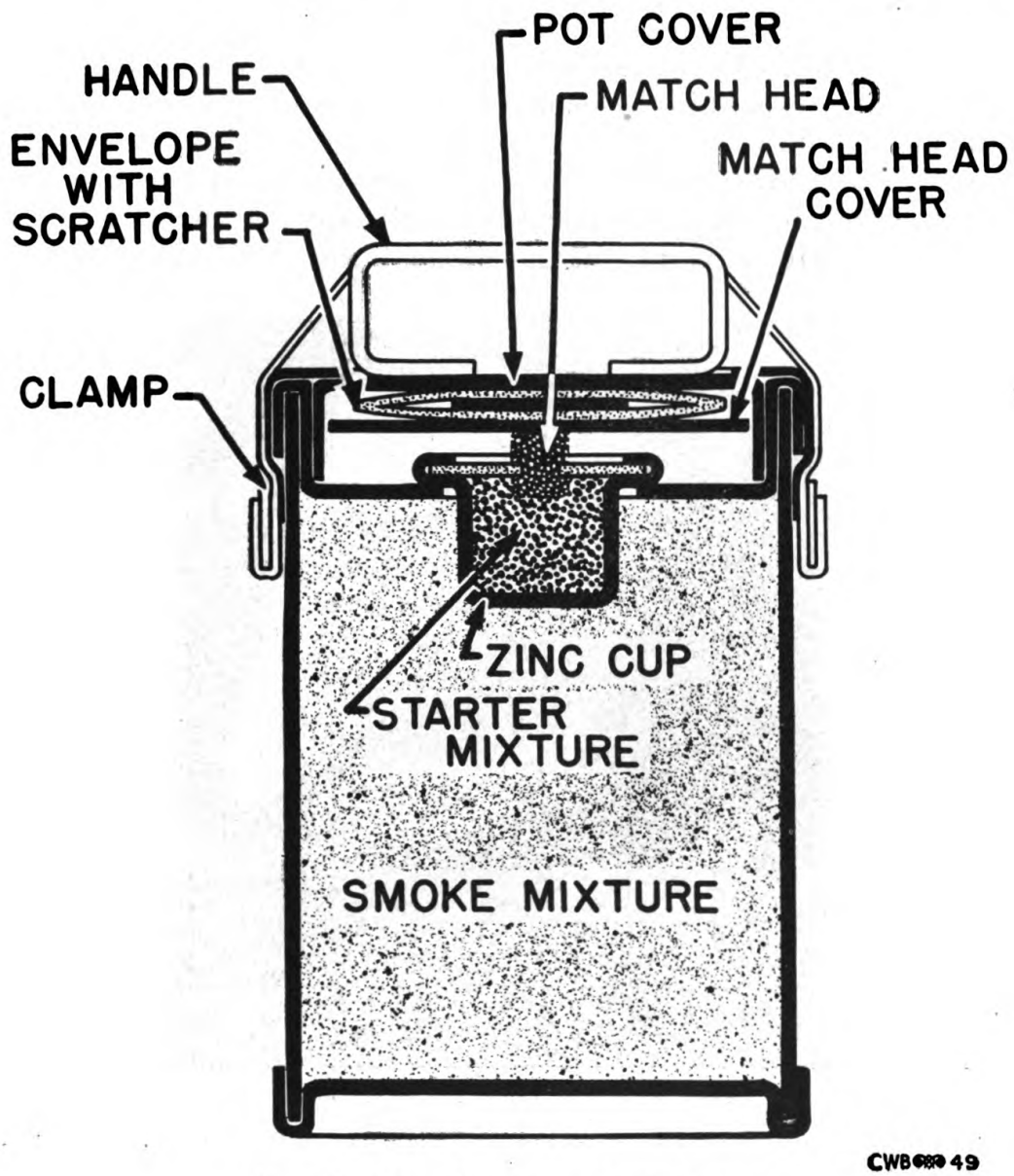



FIGURE 5.—HC smoke pot—sectional diagram.

of which are designed to ignite the third one. These, in order, are the matchhead, the starter mixture, and the HC filling.

(1) The matchhead is composed of potassium chlorate, antimony sulfide, and dextrin. The mixture is plastic when freshly prepared,



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

and a small lump is pressed into the hole in the matchhead disk where it soon dries. A protective disk of heavy paper is placed over the matchhead when assembled in the body. In order to start the matchhead, a scratcher block is necessary. This consists of a strip of wood coated on one side with a mixture of red phosphorus, dextrin, and sand. The scratcher block is contained in a small manila envelope and placed in the smoke pot above the paper disk protecting the matchhead.

(2) The starter mixture is a powder composed of potassium perchlorate, zinc dust, and powdered antimony.

(3) The HC mixture consists of an intimate mixture of hexa-

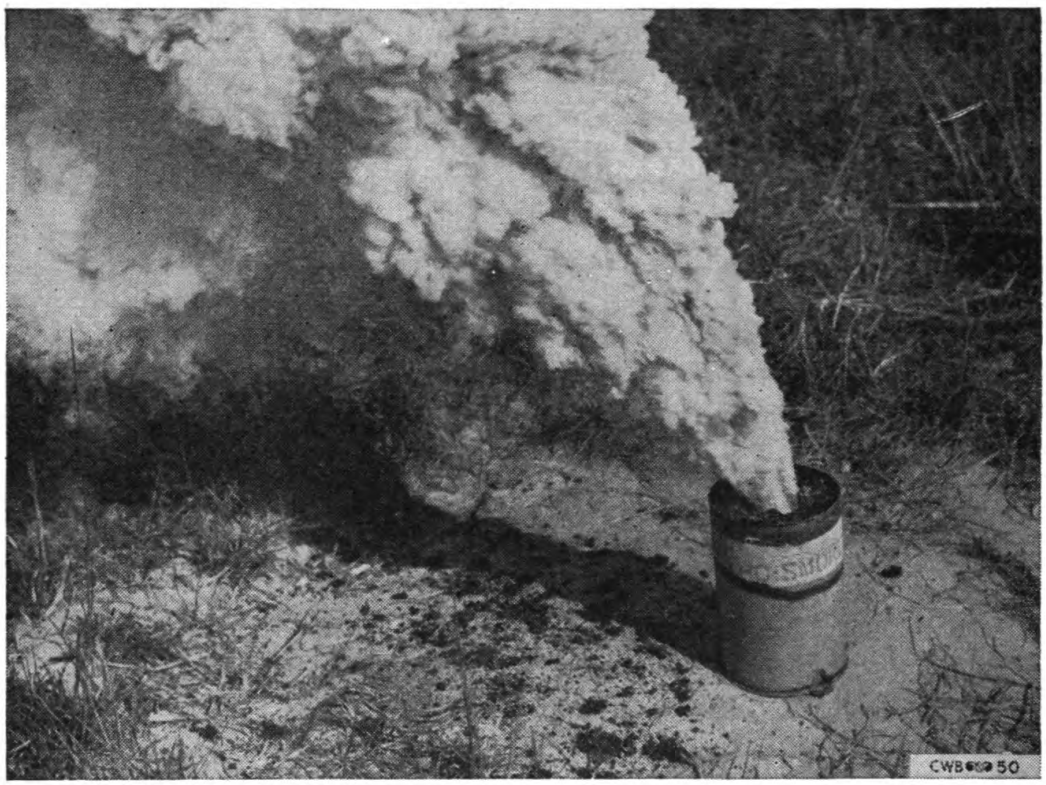


FIGURE 6.—HC smoke pot in operation.

chlorethane, powdered zinc, ammonium perchlorate, ammonium chloride, and calcium carbonate. This material is tightly compressed into the smoke pot body. When ignited, the chemical reaction produces a dense white smoke consisting principally of zinc chloride.

*c. Weight and burning time.*—The average total weight of the smoke pot is about 13¼ pounds. The burning time varies from 5 to 8 minutes but averages about 6¼ minutes.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

**12. Manual firing.**—*a. Preparation.*—The smoke pot is prepared for firing by removing the metal clamp and strap which hold the cover in place. The strip of adhesive tape around the cover and body of the candle is then removed and the cover taken off. The scratcher is removed from the envelope and held in readiness for firing. The matchhead must be protected from moisture when the cover is removed and until the pot is ignited.

*b. Functioning.*—The smoke pot is usually placed upright on the ground for firing, but when there is little or no wind it should be placed upon its side, pointing downwind of what wind there is. When standing on end, it will usually burn for a longer period than when placed upon its side. To ignite the smoke pot, the scratcher is drawn quickly across the exposed matchhead until the matchhead starts to burn. As the matchhead burns it ignites the starter mixture, which in turn ignites the smoke mixture. The smoke pot should come up to full production in 10 to 20 seconds. It then burns at full volume for 5 to 8 minutes after which time a small amount of smoke is emitted for about half a minute. Two or more pots may be stacked or laid end to end; the first or top pot ignites the one behind it by its heat when it is almost burned out. This practice will give a longer burning time to a smoke screen.

**13. Electric firing.**—*a. Preparation.*—The smoke pot is prepared for electric firing by removing the cover and taking out the matchhead. The open end of an electric squib (see par. 37*a* for description), is then inserted to insure that the flash holes will point toward and be in contact with the starter mixture on the top of the filling material. The squib is securely taped in place by means of an electric tape or adhesive plaster. The connector wires are then looped in a half hitch around the smoke pot so that the squib cannot be pulled loose if the ends of the wires are pulled.

*b. Firing.*—Smoke pots are wired in series and fired by means of a blasting machine as explained in TM 3–305.

**14. Safety precautions.**—*a.* The smoke is nontoxic and probably as nearly harmless as any smoke that can be used for training purposes. Nevertheless, no one should remain in the cloud for more than 15 minutes or in very dense smoke for a shorter period without wearing a gas mask.

*b.* After the cover has been removed the matchhead and the top of the smoke pot must be protected from moisture until fired. Moisture may destroy the starter mixture and water in contact with HC



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

mixture may cause ignition. Some protection against moisture can be obtained by temporarily replacing the cover.

*c.* The individual igniting a smoke pot by means of the scratcher should hold his face well to one side so that sparks or flame from the center hole cannot strike him in the face. Neither should he approach too close to the burning pot after it has been burning for some time because a puff of gas may expel hot cinders.

*d.* Smoke pots should not be ignited within a radius of 5 feet of any readily combustible material. The fire hazard of pots burning in an area covered with dry vegetation may be reduced appreciably

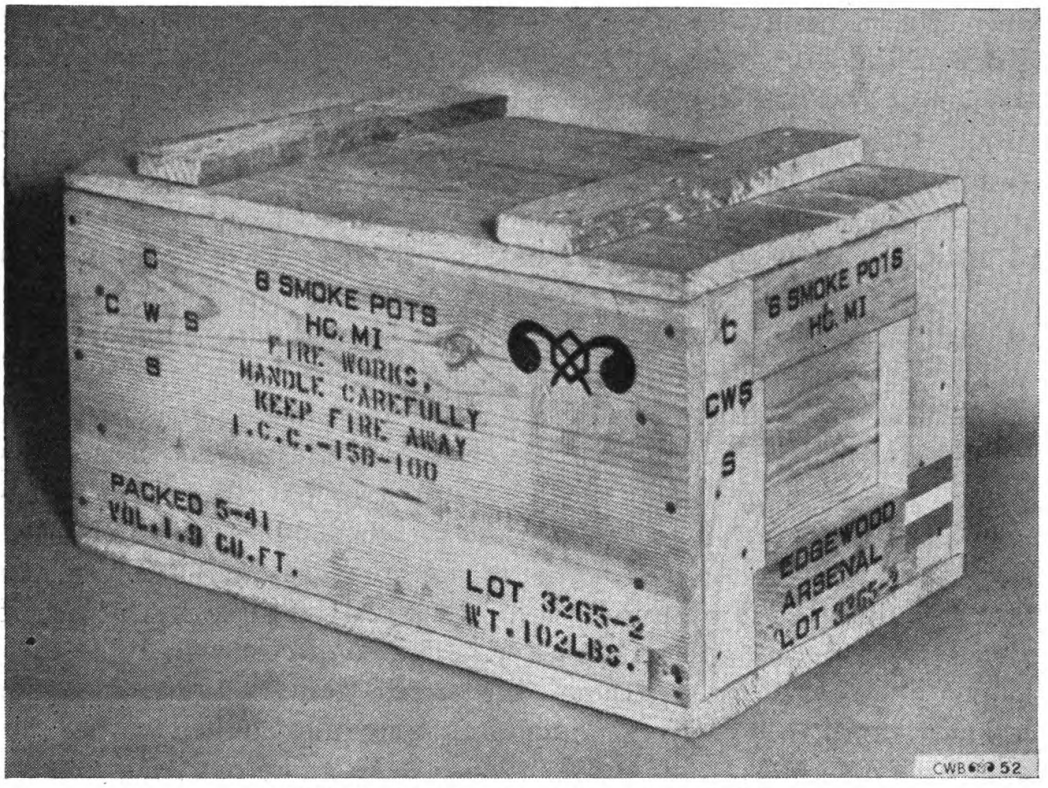



FIGURE 7.—Packing box, HC smoke pots MI.

by skinning off adjacent turf and placing the smoke pot on its side in a hole 6 inches or more in depth. As an added precaution, personnel firing smoke pots should be equipped with means for fighting grass fires. Under no circumstances should burning pots be left unattended during training exercises.

**15. Packing.**—*a.* The MI HC smoke pot is painted blue-gray. Two inches below the top of the container a yellow band ½ inch in width is stenciled around the body to indicate that the munition produces a screening smoke. Above this yellow band is stenciled



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

"HC-SMOKE" in yellow letters. Below the band the loading plant's identification mark and lot number are stenciled.

*b.* Six MI HC smoke pots are packed in a wooden box lined with double-faced corrugated strawboard fillers. The empty box weighs about 20 pounds, and filled, about 100 pounds. It displaces 1.9 cubic feet and is 21⅛ by 13 by 11$^{9}/_{16}$ inches in dimensions. A data and instruction card, properly filled out, is placed in each box.

*c.* The marking on the packing box is in accordance with I. C. C. regulations and contains the data shown on the smoke pots.

**16. Storage and shipment.**—Smoke pots are classed as group C munitions—"spontaneously inflammable." This munition resembles fireworks in its properties, and is stored and shipped in accordance with requirements of FM 3–15, and I. C. C. regulations. The principal precaution to be observed is to prevent moisture from coming in contact with the HC mixture, since water in small quantities reacts with it to ignite the mass. All shipments are marked as prescribed in U. S. Army Specification No. 100–2.

## Section IV

## CN TEAR GAS POT M1

| | Paragraph |
|---|---|
| General | 17 |
| Description | 18 |
| Manual firing | 19 |
| Electric firing | 20 |
| Safety precautions | 21 |
| Packing | 22 |
| Storage and shipment | 23 |

**17. General.**—The CN tear gas pot M1 is a development of the tear gas candle. It is used as a training agent and has only restricted tactical application. It has the limitations common to all munitions of this type in that it must be set off within friendly lines and its effectiveness depends upon a favorable wind. As a training munition it may be used to simulate gas attacks.

**18. Description.**—The CN tear gas pot M1 consists of two main parts, the container and the filling.

*a. Container.*—The container is a cylindrical tin can 3⅜ inches in diameter and 4$^{9}/_{16}$-inches in height. It is lined with a cardboard liner about $^{1}/_{16}$-inch thick which serves the double purpose of reinforcing and protecting the metal body and promoting uniform



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

burning of the filling mixture. Its top is pierced by two holes. One is ¾ inch in diameter and placed on the center for the purpose of providing a vent for the emission of the gas. The other is ¼ inch in diameter and is located about ½ inch from the edge. This latter hole is for the purpose of holding the matchhead in place so that the starter mixture can be easily ignited. The top is protected by a metal cover $3\frac{3}{16}$ inches in diameter by ½ inch in height, fitting just inside of the double seamed edge. The cover is held in place by a strip of adhesive tape encircling the upper portion of the body.

*b. Filling.*—The filling consists of three main parts: the filling material, the starter mixture, and the matchhead and scratcher.

(1) The filling material proper consists of about 1.15 pounds of "CN mixture" (CN 47.4 percent, E. C. powder 50.0 percent and magnesium oxide 2.6 percent).

(2) The starter mixture consists of a thin layer of approximately

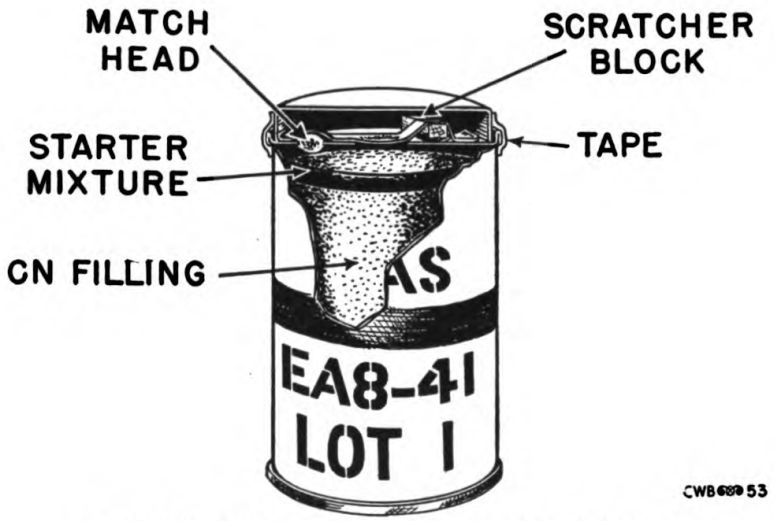



FIGURE 8.—CN tear gas pot M1—sectional diagram.

15 grams of the following: black powder (grade A, No. 7) 48 percent, ferrous sulfide 26 percent, and magnetic iron oxide 26 percent. These are held together by a binder solution consisting of 4 parts (by weight) of transparent sheet celluloid dissolved in 96 parts (by weight) of acetone, and the whole spread over the top of the CN mixture.

(3) The matchhead consists of approximately 1½ grams of a mixture of the following: potassium chlorate 50 percent, antimony sulfide 30 percent, and dextrin 20 percent, with enough water to



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

form a plastic mass. This matchhead is placed in the matchhead hole in the tear pot cover. The scratcher mixture is made of red phosphorus 50 percent, sand 30 percent, and dextrin 20 percent. This is applied to a scratcher block of soft wood $\frac{1}{8}$ by $\frac{1}{4}$ by $2\frac{1}{2}$ inches. The scratcher block is attached to the top of the can by means of adhesive tape. This tape also covers the vent in the center of the lid and the matchhead.

*c. Fuze hole.*—A hole $\frac{17}{74}$ inch in diameter and 1 inch deep is




FIGURE 9.—CN tear gas pot.

drilled in the side of the pot 2 inches above its base at a 90° angle from the seam. This hole is drilled after loading and is for the insertion of one end of the tear gas pot fuze E1 for series firing, as explained in detail in paragraph 20*c*.

*d. Weight and burning time.*—The tear pot weighs about 1 pound 8 ounces and burns from 3 to 4 minutes.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

**19. Manual firing.**—*a. Preparation.*—There are two ways of firing the tear gas pot: by hand or scratcher ignition, and by electric squib ignition. To fire the tear pot by hand, the tape which holds the scratcher block and protects the matchhead is first removed, care being taken not to disturb the matchhead. The treated surface of the scratcher block is pulled across the exposed matchhead in the top of tear gas pot with a motion similar to that of striking a match.

*b. Functioning.*—Upon ignition, the flash of the matchhead will in about 1 second ignite the layer of starter mixture. The starter mixture will burn for about 10 to 20 seconds and then will ignite the CN mixture. This mixture burns from 3 to 4 minutes, giving off a dense grayish cloud of CN.

**20. Electric firing.**—The lay-out and firing methods and wiring

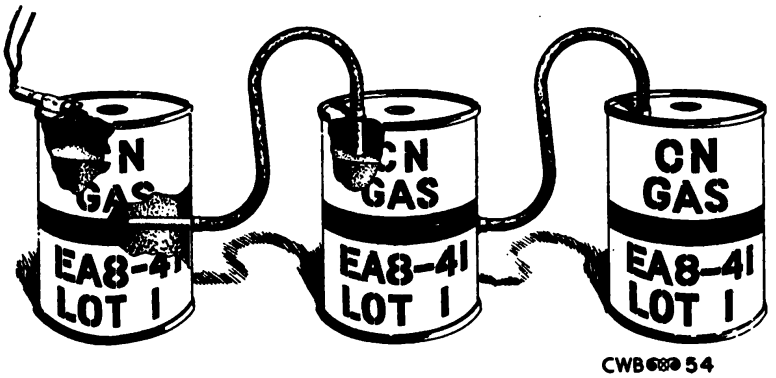



FIGURE 10.—CN tear gas pots—sectional diagram, electrical firing.

diagrams when squibs are used are given in FM 3–20 and TM 3–305, and are applicable to the CN tear gas pot M1.

*a. Preparation.*—The squib is so taped to the top of the container that its flash will ignite the matchhead. If the "flash vented" type of squib (distinguished from the "closed" type by having two holes in the side) is used, it is secured by tape to the top of the container with one hole directly against the matchhead and the other hole closed by tape. The closed type squib should not be used for firing this type of munition. If the open end type is corked, the cork should be removed prior to firing. Another method is to introduce the squib through the vent opening until it comes into contact with the starter mixture, and then to tape the wires to the top of the container.

***Caution:*** Squibs containing sulfur as a sealing mixture should be placed so that the molten sulfur will not come into contact with the burning CN, otherwise the tear pot will ignite and burn with a bright flame emitting no gas.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

*b. Firing.*—The tear gas pots are wired in series and fired by means of a blasting machine.

*c. Firing tear gas pots in series.*—The desired number of tear gas pots are placed upright on the ground about 8 inches apart and connected by means of tear gas pots fuzes E1. Each end of the fuze is sealed by a casing which contains a starter mixture. One end of the fuze is inserted in the opening in the side of the first tear gas pot to be ignited. The matchhead of the second tear gas pot is removed and the other end of the fuze is inserted in the opening and taped in place. The first tear gas pot may be ignited either by the scratcher block or by an electric squib.

**21. Safety precautions.**—*a.* Personnel assigned to emplace and ignite tear gas pots should be equipped with gas masks.

*b.* For training exercises, fire fighting equipment such as wet burlap bags, shovels, etc., should be readily available.

*c.* After the cover of the tear gas pot has been removed, the matchhead, scratcher block, and the contents of the pot must be protected from dampness until fired. Some protection can be obtained by temporarily replacing the cover.

*d.* The pot should not be fired within 2 feet of tall, dry grass or other readily inflammable material if a fire is to be avoided. In case the pot must be set off near readily inflammable material, a hole should be dug and the open end of the pot placed against the loose earth.

*e.* Personnel igniting pots should keep their faces well to one side and should not bend over the pot in such a way that their eyes are over the center hole. After the pot has been ignited, the firer should move upwind.

*f.* If an external fire is started too near a burning pot, it may ignite the gases given off and cause the pot to burst into flames. If this occurs, a shovel or some other convenient implement should be used to smother the flames. The flame may also be extinguished by beating the top of the pot lightly with a leafy branch of a shrub or tree. The pot should then return to its normal functioning. Another method is to invert the pot. After the flames have been smothered it may again be placed in its former position.

**22. Packing.**—*a.* The tear gas pot M1 is painted with one coat of blue-gray lacquer enamel. A red band ½ inch wide is painted around the container 2 inches from the bottom to indicate that it contains a nonpersistent harassing agent. Stenciled in red and in ½-inch letters above the red band are the letters "CN" and the word "GAS." Below the red band and also stenciled in red are the load-



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

er's identification mark, month and year of filling, and the lot number.

*b.* The M1 tear gas pots are packed 50 to a wooden box, complying with the latest revisions of U. S. Army specifications. An ammunition data and instruction card is inclosed in each box. A box of 50 pots has an approximate weight of 100 pounds and displacement of 1.95 cubic feet.

**23. Storage and shipment.**—Tear gas pots M1 are classified as group D munitions—"readily inflammable." They should be stored only with other munitions of this group. Tear gas pots should be stored in garrison in sound, weather-tight, fireproof storage magazines. Ample ventilation should be provided and it should be so arranged that in case of an emergency the ventilators may be opened

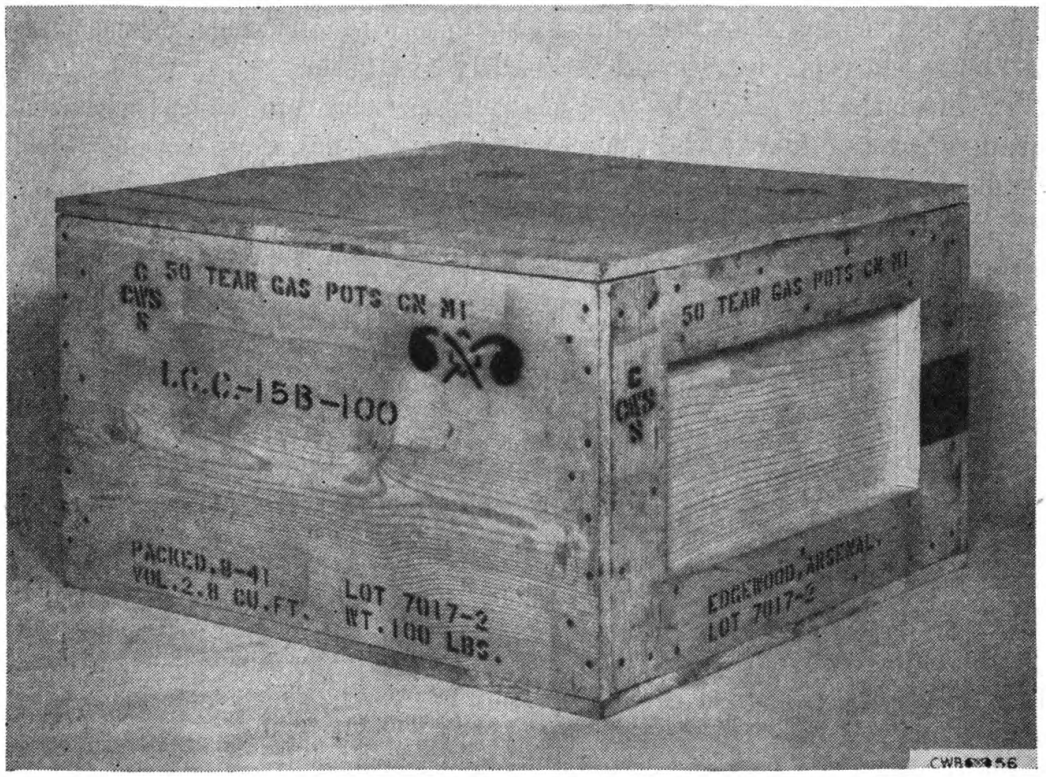



FIGURE 11.—Packing box, CN tear gas pots.

from the outside. Auxiliary fire fighting equipment, such as soda-acid or antifreeze extinguishers, water pails, fire axes, etc., should be provided. In cold climates antifreeze extinguishers should be preferred to the soda-acid type. Placards covering general rules for the storage of chemical munitions and special rules for group D chemical munitions must be posted in each magazine containing tear gas pots.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

## SECTION V

# CHEMICAL LAND MINE

| | Paragraph |
|---|---|
| General | 24 |
| Description | 25 |
| Accessories and tools for firing | 26 |
| Filling machines | 27 |
| Filling precautions | 28 |
| Inspection and testing | 29 |
| Packing | 30 |
| Shipping | 31 |
| Storage | 32 |
| Assembly, installation and firing | 33 |

**24. General.**—*a. Purpose.*—The chemical land mine is a munition designed to be emplaced by hand and later fired so as to scatter or spread chemicals over an area or upon a particular place. In general, it consists of a thin-walled cheap container filled with a chemical agent.

*b. Use.*—It is employed in combat for the purpose of interdicting or rendering unfit for occupation or use, terrain, vegetation, debris, roads, structures, and all sorts of habitations. In this respect the munition has a very great nuisance value and is a potential casualty producing weapon. It is very valuable for training exercises when filled with harmless chemicals and can be used to represent artillery shell and airplane chemical bomb bursts.

*c. Adaptability.*—The chemical land mine has a high chemical efficiency, approximately 87½ percent of the total weight being chemical filling. It is a cheap munition and its construction does not involve great outlays in industrial plants or expensive machinery. Substitutes can be improvised easily, if necessary, out of materials such as bottles or other suitable containers to be found near at hand. The mine can be emplaced exactly as planned and so as to provide the best coverage by the chemical. On the other hand, the filled containers do not hold up well in shipment or storage because their walls are purposely made light and thin. Accidental bursting of the mine in transit or in storage, especially if the contents develop moderate pressures, is likely to occur. Care is also necessary in preventing excessive corrosion and leakage of the containers. Thus, the mine should be filled near the place of use and employed reasonably soon thereafter. Because of these storage difficulties, operations involving many chemical land mines must be planned in advance and be highly coordinated.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

**25. Description.**—In general, all chemical land mines consist of three parts: the container, the filling, and the firing components. As mentioned in paragraph 24, they may easily be improvised, and at times cylindrical tin cans and even bottles have been used, principally for training purposes. Various types of explosive charges have been employed. However, for the mainland of the United

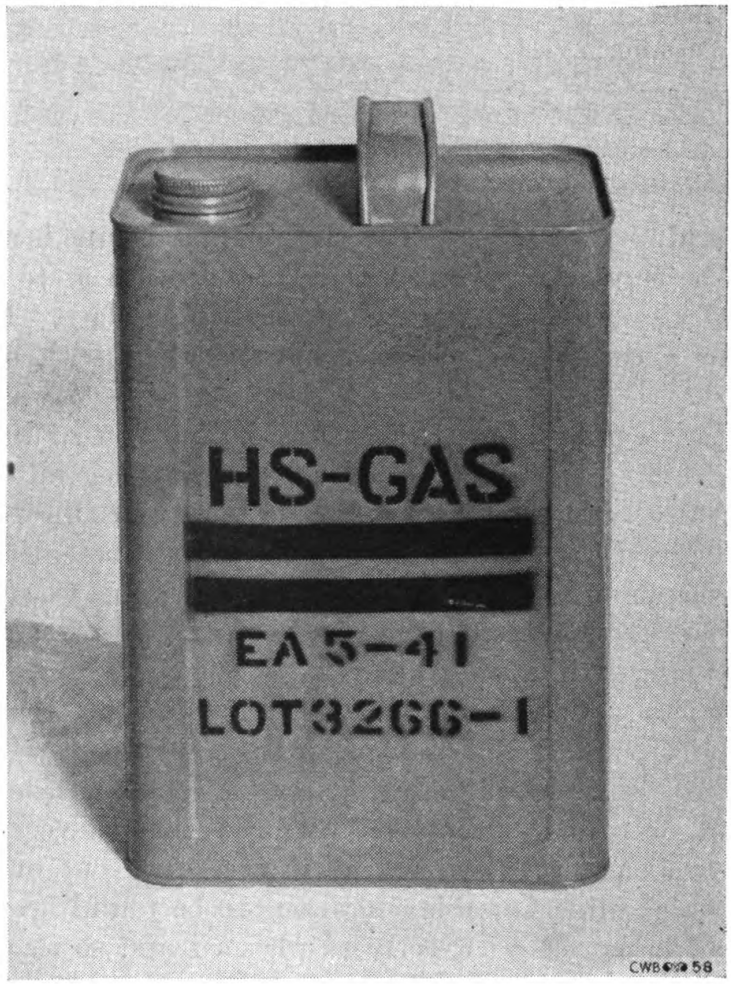



FIGURE 12.—HS land mine.

States the standard chemical land mine as described below will be issued.

*a. Container.*—The standard container is a common rectangular shaped tin can with screwcap and handle soldered on the top. It holds 1 gallon of liquid. The can is 9½ by 6½ by 4 inches. The over-all height including the handle is 10½ inches. The spout or opening is 1 inch in diameter. Two 8-inch copper wires (0.05 inch in diameter), one 3½ inches from the bottom and the other 3½



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

inches from the top, are soldered on one side of the can. These wires are used to hold the burster to the can when the chemical land mine is armed. This is illustrated by figures 15, 16, and 17. On the opposite side the characteristic symbols representing the filling material and the persistency, together with the lot number, are stenciled. Figure 12 shows the method of marking. The empty container weighs approximately 1 pound, and must withstand an internal air pressure of 4 pounds per square inch without leaking. When filled, the complete chemical land mine, including burster charge, weighs approximately 12 pounds, this weight varying with the type of filling.

*b. Fillings.*—In general, filling materials for chemical land mines must not develop pressures within the container. This limits the chemical agent to highly persistent types with low vapor pressures and to those unlikely to decompose. While it would be possible to use any chemical agent conforming to the above requirements, only those two most representative are described. These are mustard gas and simulated mustard gas.

(1) *Mustard gas.*—Mustard gas, symbol HS, is the standard persistent chemical agent. Its properties, chemical behavior, and other pertinent facts are fully described in TM 3–215. With regard to its use in chemical land mines the fact that impure plant-run mustard gas may decompose upon standing and produce high pressures if confined should be borne in mind and only the purest mustard gas be placed in them. In filling the chemical land mines, an unoccupied space or void is left for expansion of the liquid. Each can is charged to the volume specified in the following table for temperature at time of filling:

| Filling temperature | Capacity of container | Volume of HS in container | | Tolerance minus | Void in container at filling temperature | |
|---|---|---|---|---|---|---|
| °C | Milliliters | Percent | Milliliters | Milliliters | Percent | Milliliters |
| 15 | 4068 | 89. 26 | 3631 | 20 | 10. 74 | 437 |
| 20 | 4068 | 89. 63 | 3646 | 20 | 10. 37 | 422 |
| 25 | 4068 | 90. 00 | 3661 | 20 | 10. 00 | 407 |
| 30 | 4068 | 90. 32 | 3674 | 20 | 9. 68 | 394 |
| 35 | 4068 | 90. 76 | 3692 | 20 | 9. 24 | 376 |



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

(2) *Simulated mustard gas.*—(*a*) *Molasses residuum* is a sugar industry by-product. To prevent fermentation, 1.6 percent cresol is added before shipment. Simulated mustard gas, symbol MR, is made by adding water in the proportions by weight or by volume given below:

| | Percent | |
|---|---|---|
| | *By weight* | *By volume* |
| Water | 68.7 | 75 |
| Molasses residuum | 31.3 | 25 |

The resulting liquid has about 0.4 percent cresol which serves to prevent the MR from fermenting and producing pressures in the can. This simulated agent is a cheap, safe, nontoxic substitute for mustard gas and is valuable for many training purposes where use of the true substance would be hazardous.

(*b*) *Asbestine suspension*, the simulated mustard gas designated as AS, is a uniform suspension of fibrous magnesium silicate and bentonite in water, with butyric acid added for odor (in the proportions given) by weight or by volume as follows:

| | Percent | |
|---|---|---|
| | *By weight* | *By volume* |
| Water | 93.7 | 90.1 |
| Magnesium silicate | 3.6 | 7.2 |
| Bentonite | 0.9 | 0.9 |
| Butyric acid | 1.8 | 1.8 |

The container is filled to the same volume as specified for HS filling in (1) above.

*c. Firing components.*—The following fuze and explosive components are used with chemical land mines to burst them and disperse their contents:

(1) The pull wire fuze lighter may be used in conjunction with a safety time fuze to initiate the explosion of the burster charge.

(2) Safety fuze may be employed with a No. 8 common blasting cap to detonate the burster charge.

(3) For electric firing of chemical land mines the No. 8 blasting cap, electric, with 30-foot lead wires is used.

(4) Two types of bursting charges are available for land mines: the nitrostarch burster M2, and the detonating cord burster M3. The latter is commonly referred to as primacord. Both of these bursters may be used for either manual or electric firing.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

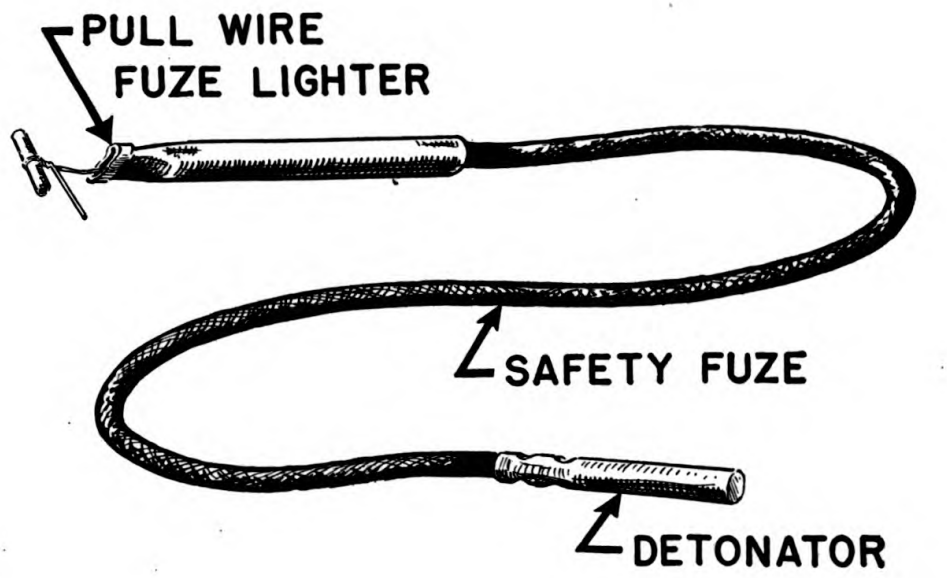



FIGURE 13.—Pull wire fuze lighter, safety fuze and detonator.

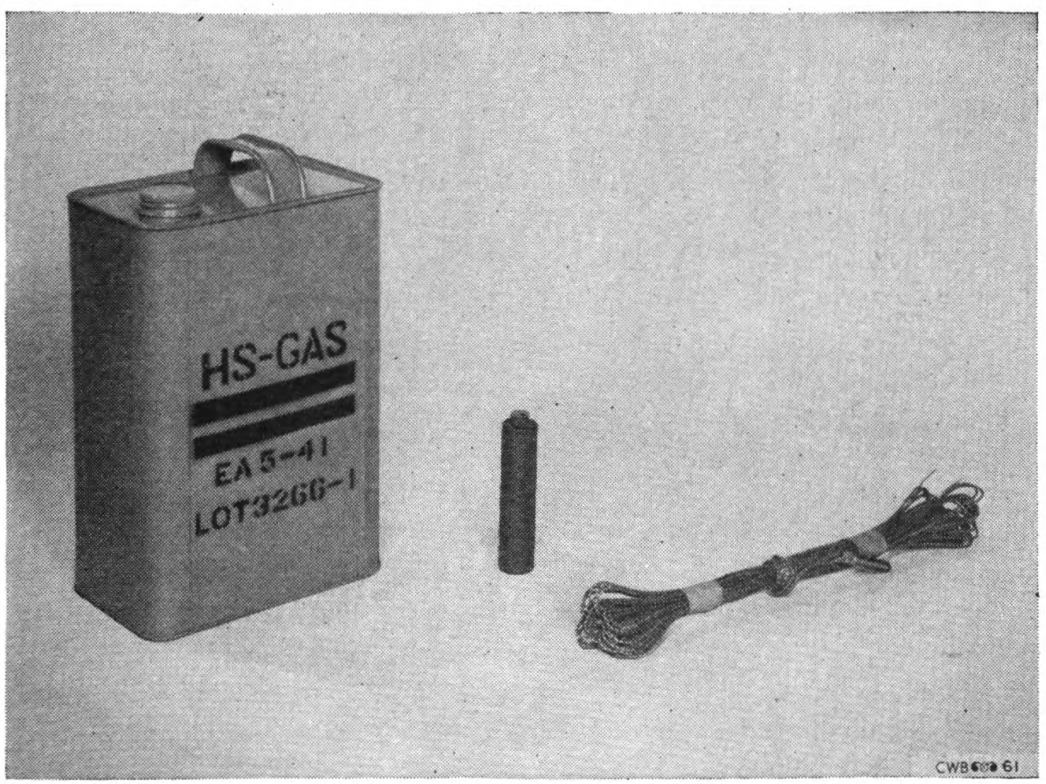



FIGURE 14.—HS land mine, nitrostarch burster and detonator.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

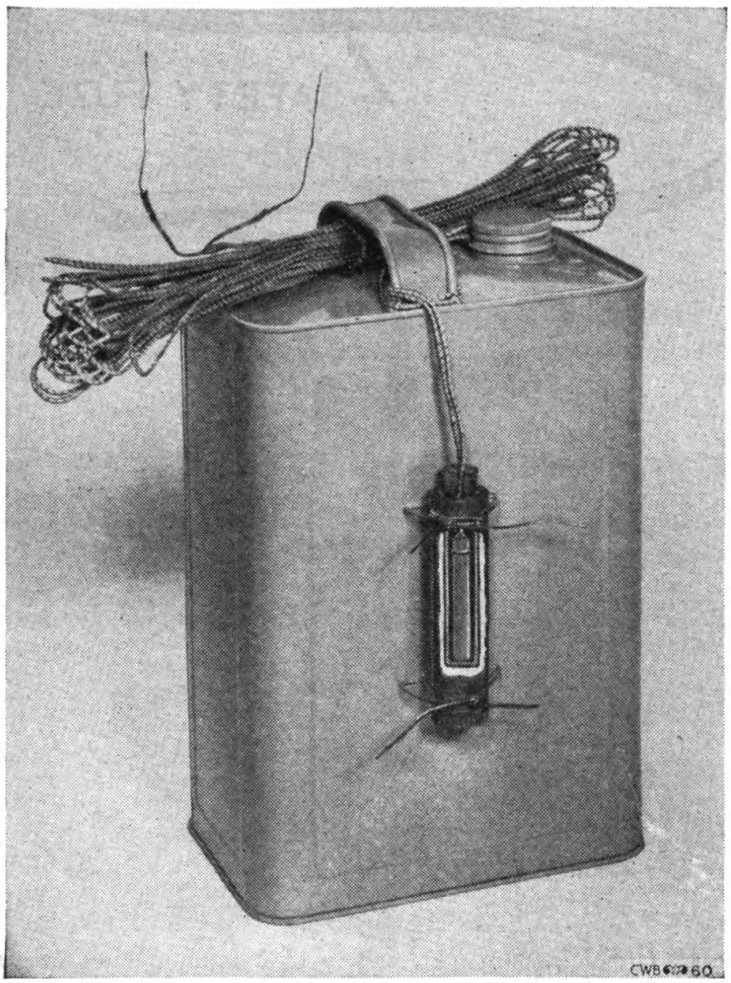


FIGURE 15.—Land mine and nitrostarch burster.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

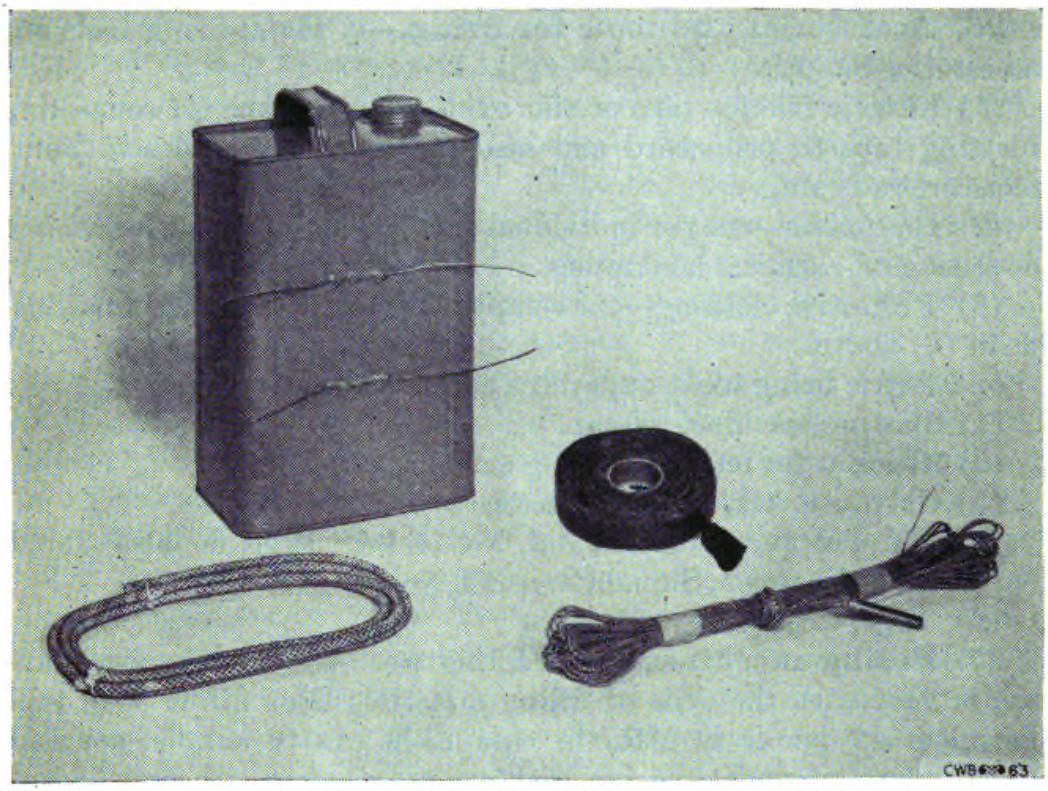


FIGURE 16.—Land mine, detonating cord burster, tape and detonator.

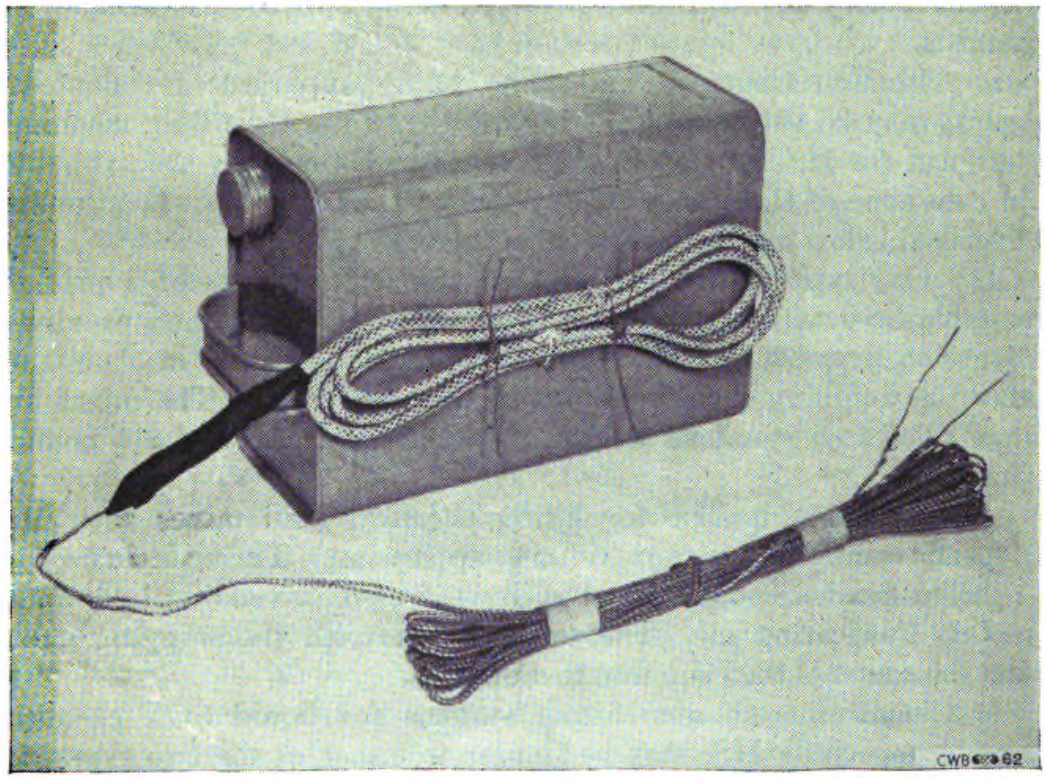


FIGURE 17.—Land mine detonating cord burster, with detonator attached, and lead wire.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

**26. Accessories and tools for firing.**—*a.* Hand firing tools and accessories comprise:

(1) Electric friction tape or zinc oxide adhesive tape for connecting blasting caps to primacord and also for rendering explosive joints moisture resistant.

(2) Gas masks—one per individual engaged in setting out, servicing, or setting off chemical land mines.

(3) Protective clothing—one complete protective suit per individual as in (2) above.

*b.* Electric firing tools, apparatus and accessories comprise:

(1) Blasting machine, 100 cap.

(2) Rheostat for testing blasting machine.

(3) Galvanometer, circuit detector.

(4) Wire, copper, single strand, No. 14 B&S gage, double-covered.

(5) Tools, linesmen, Signal Corps TL No. 33.

(6) Tape, electric, ¾-inch rolls.

**27. Filling machines.**—The filling processes for chemical land mines vary with the type of filling material. For filling with such harmless substances as MR, the equipment can be simple, nor is it necessary to surround the job with exacting safety measures or precautions. In the case of mustard gas or any other toxic material, the machinery is much more involved because of the extra handling hazards.

*a.* Although chemical land mine filling apparatus for nontoxic agents may be very simple, it is expected to use the filling machines designed for HS for training purposes, providing they are available. In case none of these is at hand, either of the two types of equipment described below may be used to advantage.

(1) One type of filling equipment for MR consists of a pipe or suitable hose with a valve attached to the bulk container, usually a 55-gallon drum. The MR solution container is placed in a position above a weighing scale upon which the mine rests. The mines are then filled to a standard weight of 10 pounds if AS and 9½ pounds if MR.

(2) Other equipment for filling chemical land mines with MR depends upon a constant volume apparatus. This consists of a 1-gallon flexible spout oil can such as is used in vending bulk automobile lubricating oil. The can is filled from the shipping drum and the contents then run into the mine.

*b.* Chemical land mine filling systems for liquid toxic chemical agents, especially HS, may be similar to either of the two types de-



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

scribed below. However, it must be borne in mind that these descriptions explain systems and types rather than any exact machine.

(1) *Constant level filling machine.*—(*a*) *Description.*—For permanently established depots and arsenals, the constant level type of filling machine may be employed. This is a modification of a commercial bottling apparatus. Figure 18 illustrates the fundamentals and important parts by means of a schematic drawing. The machine consists essentially of a small constant level supply tank or reservoir which is fed from the shipping container. A constant level of chemical agent is maintained in the supply tank by means of a float valve. An inverted U-shaped tube called the filling head is arranged so that one end can be raised above the liquid or lowered into it. The other end of this tube, or the filling nozzle, is surrounded by an outer concentric tube which in turn is connected by a flexible hose to a small rotary vacuum pump. This pump returns any excess liquid through a small pipe back to the reservoir. A disk of material perforated in the center, which will tightly stopper the mouth of the chemical land mine body, is penetrated by the filling nozzle and set at such a distance from the mouth of the mine that it will govern the height of the liquid in the mine. This is called the adjustable seal and liquid level gage. (See fig. 18.)

(*b*) *Functioning.*—When the mine is in place and the operating lever controlling the filling head is lowered, one end of the filling head dips into the liquid in the reservoir. The other end enters the can, the adjustable seal stoppers the spout, and the vacuum pump creates a suction inside the mine. The liquid flows into the can until the level reaches the tip of the filling nozzle, where it is drawn by the pump through the vacuum line and returned to the reservoir. A sight glass in the vacuum return system warns when the mine is filled. When the filling head is raised the reservoir end is no longer in the liquid and flow therefore ceases. The construction of the delivery end of the filling head is such that drops of the liquid are sucked into the vacuum system instead of dripping onto the mine or the mine support.

(2) *Constant volume filling machine.*—(*a*) *Description.*—A second system used is the constant volume filling machine. This consists essentially of an accurately gaged pipette, or measuring chamber, which can be safely filled with the chemical agent and the contents then transferred to the chemical land mine without danger to the operator. Because safety requirements are paramount, any filling apparatus of this type is complicated by levers, quick acting valves,



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

and drip trays to catch drops of the agent from the end of the filling pipe. A typical constant volume filling system is shown in figure 19. A bulk container of HS is set up horizontally on supports so that it is higher than the top of the measuring chamber. A flexible

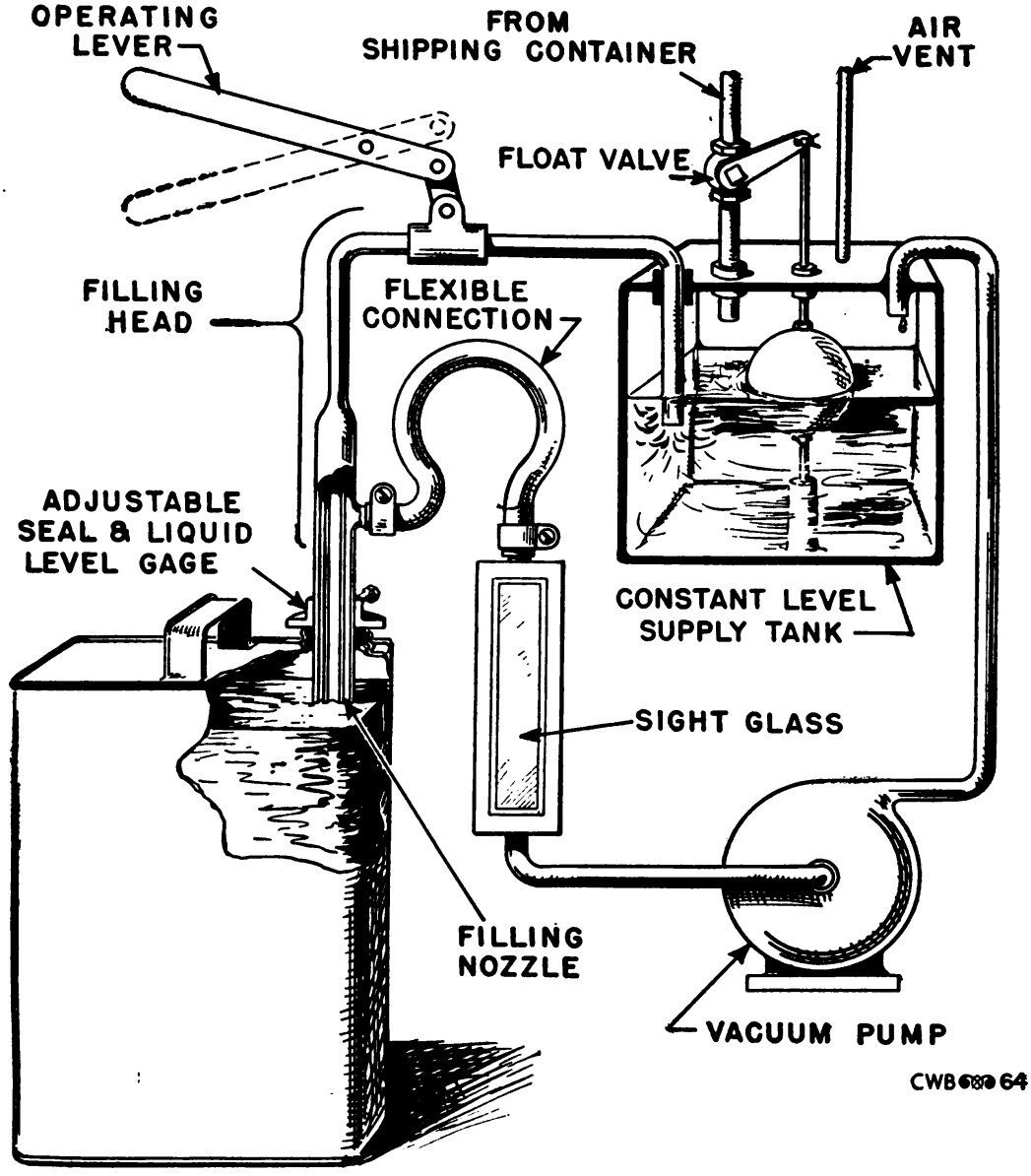



FIGURE 18.—Constant level filling apparatus, land mine.

tube leads from the lower eduction valve of the bulk container to a three-way valve at the bottom of the measuring chamber. The latter valve is so arranged that when the operating lever handle is in one position it allows the agent to flow into the measuring chamber,



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

but when the handle is placed in a second position the agent can run from the chamber through a short delivery nozzle into a chemical land mine below.

(*b*) *Functioning.*—The mine rests on a small metal holding table which has guides to place the mine accurately in relationship both to the table and to the delivery nozzle. An ingenious system of levers is attached to this table so that it can be raised and lowered. At the same time that the holding table is lowered a lever swings a small

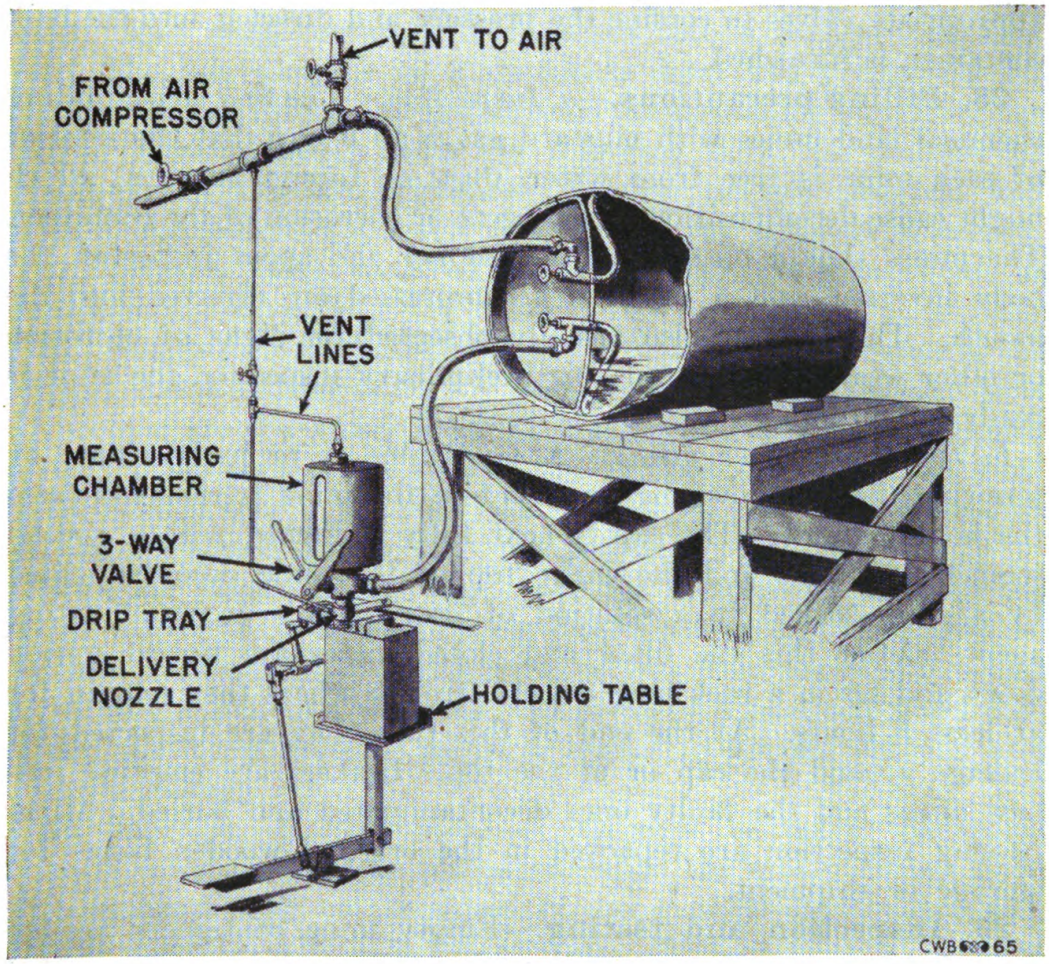



FIGURE 19.—Constant volume filling apparatus, land mine.

drip tray between the delivery nozzle and the mouth of the mine body to catch any drops of HS that might adhere to, and later drip from, the nozzle. This drip tray contains a small amount of non-corrosive decontaminating solution. Small air vent lines lead from the measuring chamber and the delivery nozzle to a header which in turn is connected to the upper eduction pipe of the bulk container. These vent lines are for the purpose of conveying all gas-laden air



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

in the mine and measuring chamber to the bulk container. In this way the system is closed as far as possible.

(*c*) *Emptying bulk container.*—When the liquid in the bulk container has been emptied below the level of the valve of the lower eduction tube, it may be necessary to apply pressure in order to cause the liquid to run out. This may happen if the siphon (column of liquid in the lower eduction tube), set up when starting with a full container, is broken. For such an event a connection to the air header for attaching to a source of air pressure, together with appropriate valves to confine the pressure and direct it into the bulk container, is furnished.

**28. Filling precautions.**—*a. Inspection.*—The first step in filling chemical land mines with mustard gas is to insure that the interior of each mine is free from water, dust, or foreign material which might cause decomposition of the agent or corrosion of the container. The mines should be opened, the stopper and spout inspected, the body inverted, and a jet of dry compressed air directed into the mouth. The body is also visually observed for signs of corrosion or other weaknesses. After this preliminary inspection the mine is ready for filling.

*b. Treatment after filling.*—A land mine is properly closed by screwing the cap down by hand before the mine is removed from the holding table. The cap is next fully tightened with a special wrench or pliers, and the entire top of the mine decontaminated by a swab soaked in a solution of noncorrosive decontaminating agent. After this the filled and closed mines are turned upside down and set in a rack over a metal trough where they remain for at least 6 hours. At the end of this time they are inspected for leakage around the cap or at the top. Leakers are emptied into new mines and the faulty ones decontaminated and buried. Mines passing inspection are repacked in the original wooden boxes for storage or shipment.

**29. Inspection and testing.**—Empty mine containers are inspected for leakage by subjection to an internal air pressure of 4 pounds per square inch while submerged in water. All containers showing evidence of leaks (air bubbles) are rejected. The filled container is inspected daily when in a field depot in order to detect leaks at the earliest possible time. The filled and closed container is visually examined to ascertain that the closing cap has been screwed to a tight seat on the threaded spout. Leakage can be determined as follows: The filled and closed container is placed in an inverted



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

position and allowed to stand for 24 hours during which time there should be no evidence of leaking from the container.

**30. Packing.**—*a. Container.*—The empty container is painted blue-gray. After filling, the characteristic symbols and identification marks are stenciled in green on one side. Thus, for mustard gas, the chemical land mine is marked with the words, "HS–GAS," with two stripes, the filling plant designation, date of filling, and lot number. These are all illustrated in figure 12. The two green stripes indicate that the filling is a persistent casualty agent. Six empty land mine containers are packed into a carboard packing box. The box contains an ammunition data card giving the lot number, date of filling, and instructions for assembling and firing the mines. Packing boxes show the following data: the number of containers in the box, Chemical Warfare Service insignia, and I. C. C. regulations applicable for shipment by commercial carrier.

*b. Explosive components.*—Packing of explosive components is described in section VI.

**31. Shipping.**—*a. In the zone of the interior.*—In the zone of the interior chemical land mines are packed and shipped as empty cans. In no case are the mines filled with HS. Mustard gas is shipped in bulk containers in the zone of the interior and the mines filled in the combat zone. The bulk agent as well as explosive components are shipped according to I. C. C. regulations.

*b. In the theater of operations.*—In the theater of operations the mines will be shipped six to a cardboard container. Care must be taken to determine that the container is free from sharp protrusions which might puncture the cans. In event of a partially filled container, the mines must be properly braced to prevent shifting and ultimate leakage.

**32. Storage.**—*a. Precautions.*—Care must be taken that filled mines are not dropped or placed one upon the other. Mines filled with mustard must not be stored in excess of 30 days; those with MR, 6 months. Although the corrosive effect of mustard on steel is negligible, the walls of chemical land mines are thin, and only slight decomposition of the agent may release gases which will develop excessive pressures and either spring a seam or rupture the can. All precautions for handling toxic and corrosive chemicals should be observed with mines. They should be kept under packing conditions in their cardboard containers while in transit, and these containers should not be piled more than four deep. They should be stored in the open as yard storage, the boxes being set upon dunnage.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Here they should be piled only one box deep. Piled higher, a leaking container may contaminate the whole pile.

*b. In the field.*—Mines filled either with HS or MR should be stored in the field in a cool, dry place. Coolness is necessary to protect MR from fermentation. Dryness is important regardless of the type of filling, as moisture will weaken the cardboard containers. The grouping of large numbers of mines, empty or filled, should be avoided at all times. Boxes should be set in squares of not more than 100 (600 mines) so that in the event of an airplane attack a large number would not be contaminated. Terrain features and camouflage should be employed to minimize aerial observation. Dunnage is used to keep mines from the ground and prevent rust. The mine wall is thin, and rusting may weaken the can sufficiently to cause leakage with moderate pressure. Storage units when stored in the field should be covered with tarpaulins. The filled mines should be stored separately from bursters, and bursters at least 100 yards from other ammunition dumps. A guard experienced in handling vesicant agents should be placed in charge and provided with protective clothing, gas mask, and sufficient materials to decontaminate leakages promptly.

**33. Assembly, installation, and firing.**—*a. Assembly.*—The burster, either nitrostarch (M2) or detonating cord (M3), is placed against the side of the mine to which the copper wires are soldered. These wires are then wrapped around the burster and the ends twisted, with care being taken that they are not tightened to the extent that the paper wrapping of the nitrostarch burster is broken or that a sharp bend occurs in the detonating cord. The detonator is then attached to the burster. With the nitrostarch burster this is done by removing the rubber stopper, inserting the detonator in the cavity, and replacing the stopper so that the lead wires or safety fuze is in the slot of the rubber stopper. Using M3 the end of the cord is taped to the detonator. If the mine is to be fired manually, the fuze lighter, safety fuze, and common blasting cap assembly are used. Should the mine be fired electrically, the electric detonator with 30-foot lead wires is used, the wires being wrapped twice around the container handle to eliminate any strain on the detonator and burster assembly.

*b. Installation.*—Land mines should be placed flat on the ground with the burster under the mine. When there is probability that they may not be fired for some time, or that it may be necessary to remove them, care should be taken in laying them so that containers are not



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

damaged and cause leaks. Mines to be fired electrically are wired in series, one lead wire being connected to a lead wire of an adjacent mine, and so on, the two remaining lead wires of the end mines in the circuit being connected to the firing wires. When using a 100-cap blasting machine not more than 50 mines should be connected in one firing circuit. In wet or damp weather this number should be reduced to 20. Before splicing the lead wires together a part of the insulation must be removed and the exposed portions scraped with a knife. The wires should be joined by means of the "Western Union" splice and wrapped tightly to insure good contact and low electrical resistance. The splices should be carefully taped with friction tape to minimize the corrosive effect of the atmosphere and provide insulation against current leakage through possible contact with vegetation or the ground. Information regarding the tactical employment of chemical land mines may be found in FM 3–5. The technique of chemical land mines is described in FM 3–20.

*c. Firing.*—(1) Chemical land mines are fired manually by holding the pull wire fuze lighter casing firmly in one hand and pulling the wire handle, which protrudes from the assembly, sharply with the other. About 1 minute elapses from the time of ignition of the fuze to the detonation of the burster charge. However, personnel firing mines manually should move upwind quickly to a distance of at least 50 yards from the mine after lighting the fuze as fragments of the container may be blown for some distance.

(2) The 100-cap blasting machine is the standard instrument for the electrical discharge of chemical land mines. The land mine circuit should be tested with a galvanometer before connecting the firing wires to ascertain that the circuit is complete and that the electrical resistance is not excessive. After the firing wires are connected to the land mine circuit the test should be repeated to detect any breaks in the firing wire. The ends of the firing wire are then connected to the blasting machine, the handle of which is fully raised, and the rack bar plunged in one stroke vigorously down to the bottom of the box. The firing wires must not be connected to the blasting machine until immediately before the mines are to be fired. During electric storms, or when they are likely to occur, the firing wires should not be connected to the mine circuit until it is to be fired. The firing point should be at least 100 yards upwind of the mines to be discharged.

(3) Detonating cord may be used as a combination fuze and bursting charge. When this method is employed any number of land mines can be fired simultaneously. Abrupt turns in the cord should

450093°—42——5

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

be avoided when connecting adjacent rows of mines. Eight-foot lengths of the cord are coiled around the main fuze line under each land mine as shown in figure 17. The explosive wave is initiated by means of a detonator fired either manually or electrically.

## SECTION VI

## FIRING COMPONENTS AND EQUIPMENT

| | Paragraph |
|---|---|
| Fuzes | 34 |
| Blasting caps | 35 |
| Cord, detonating (primacord) | 36 |
| Electric squibs | 37 |
| Burster, nitrostarch, M2 | 38 |
| Accessories | 39 |

**34. Fuzes.**—*a. Safety fuze.*—(1) *Description.*—Safety fuze is a commercial item and is an I. C. C. class C explosive. Sometimes called Bickford fuze, it consists of a thin train of powder tightly compressed in inner and outer wrappings of jute or cotton thread or tape with a waterproofing material between them. It has a smooth white surface. The body of the fuze is flexible and of uniform cross section. There are two standard time fuze rates of burning, one being 30 seconds per foot and the other 40 seconds, although each is subject to a variation of 10 percent. The slower burning fuze should be used in conjunction with firing the land mine. Another type, known as an instantaneous fuze, has a rough, red outer surface. Its use for any purpose is now forbidden by the War Department.

(2) *Blasting cap safety fuze assembly.*—The firing component for the chemical land mine is a No. 8 blasting cap attached by a double ring crimp to a 19⅜-inch length of safety fuze. This assembly is waterproofed.

(3) *Packing.*—Twenty blasting cap safety fuze assemblies placed in a pliofilm bag are packed in a chipboard tube 22 inches long and 1¾ inches in diameter and sealed with fiberboard caps. Each tube is marked to show contents. Twenty of these tubes are packed in a wooden box marked to show contents.

(4) *Shipping.*—Safety fuzes are shipped and marked in conformity with I. C. C. regulations and U. S. Army specifications.

(5) *Storage.*—Blasting cap safety fuze assemblies are stored in igloo magazines. This assembly may be stored in the same magazine as boosters and primers as well as other types of fuzes and detonators. Presence of unopened boxes in the magazine should be avoided.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Storage of an entire supply of blasting cap safety fuzes in one magazine should be avoided. Not over 150,000 assemblies (375 outside boxes) should be stored in the same magazine.

*b. Tear pot fuze E1.*—(1) *Description.*—This fuze is essentially a length of safety or Bickford fuze, each end of which is sealed by a casing containing a starter mixture. One end of the Bickford fuze is inserted in the opening in the side of the first tear gas pot to be ignited. The other end is inserted in the opening in the second tear gas pot from which the matchhead has been removed. Ignition occurs when the first pot burns down to the level of the fuze.

(2) *Packing.*—Tear gas pot fuzes are packed 50 to a metal container. The container is cylindrical and is lined with single-faced corrugated strawboard filler. Four filled containers are packed in a wooden packing box complying with U. S. Army specifications for boxes. An ammunition data and instruction card is inclosed in each box.

(3) *Shipping*—Tear gas pot fuzes E1, I. C. C. class C explosives, are marked and shipped in conformity with I. C. C. regulations.

(4) *Storage.*—These fuzes should be stored in igloo magazines with ample ventilation and in accord with the general provisions of TM 9–1900.

*c. Pull wire fuze lighter.*—(1) *Description.*—The pull wire fuze lighter is shown in figures 13 and 20. The lighter casing is a stiff fiber tube $\frac{1}{32}$ inch thick, $3\frac{3}{4}$ inches long, and $\frac{1}{4}$ inch inside diameter. The ignition device consists of a copper ignition cap containing a relatively insensitive mixture through which a tinned soft steel wire is passed. The end of this wire in the tube is provided with a striking composition essentially of red phosphorus and a fine abrasive which is held on the wire with a moisture-resisting adhesive. The ignition device is securely placed inside and near one end of the tube. The other end of the wire extends through the tube and terminates in a handle. This end of the tube is flattened and tightly sealed by wire stitching. Ignition is effected by the striking composition passing through the copper ignition cap when the handle is pulled. A brass clip is placed inside and at the open end of the tube to hold the fuze securely.

(2) *Packing.*—Fuze lighters are packed in pasteboard tubes, 10 per tube and 40 tubes per wooden box weighing about 10 pounds when filled. The tube is sealed at both ends with glued pasteboard caps and then dipped in a high-grade wax.

(3) *Shipping.*—Fuze lighters, I. C. C. class C explosives, are shipped in conformity with I. C. C. regulations.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

(4) *Storage.*—The outside package is marked to conform with I. C. C. regulations and U. S. Army specifications and is stored in igloo magazines.

**35. Blasting caps.**—*a. Blasting cap, electric, fulminate of mercury and tetryl.*—The electric blasting cap, frequently termed detonator, in most common use is the standard No. 8 commercial blasting cap. This is 2 inches long and $^{15}/_{64}$ inch in diameter. The cap normally requires approximately 1.5 amperes for firing. It is accepted field practice to supply higher voltage than necessary as a factor of safety in event of abnormally high resistances, so that the

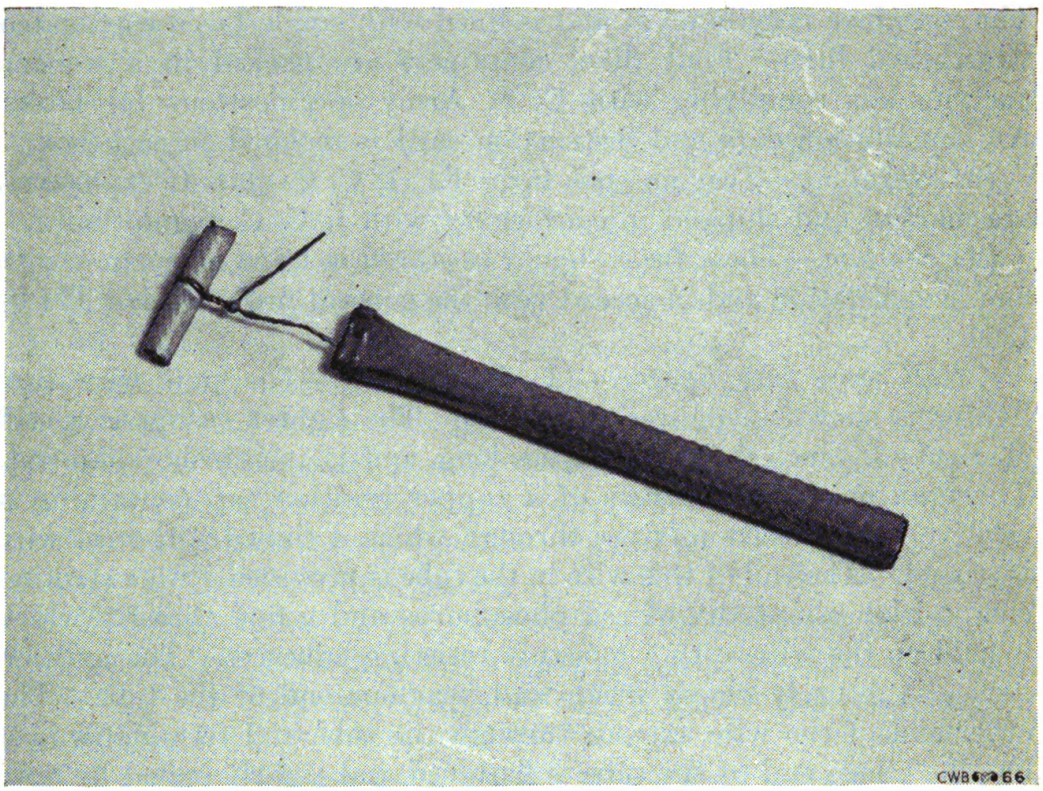


FIGURE 20.—Pull wire fuze lighter.

final current strength will be somewhat higher than 1.5 amperes. The blasting caps in general use are of 2 sizes, No. 6 and No. 8, depending on the amount of fulminate per cap. The No. 8 is twice the strength of the No. 6.

*b. Packing.*—Each shipping unit, marked for identification of contents and manufacturer's name, contains 25 No. 8 detonators with 30-foot leads in a cardboard box and 10 cartons to each wooden box. The filled wooden box weighs 76 pounds.

*c. Shipping.*—Electric blasting caps, if shipped in excess of 1,000 units, are considered an I. C. C. class A explosive, and should be



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

shipped in conformity with I. C. C. regulations for this classification. In numbers comprising less than 1,000 units, the I. C. C. regulations for class C explosives apply. This item is not accepted for shipment by railway express.

*d. Storage.*—Blasting caps may be stored in the same magazine with safety fuzes. The magazine should be reasonably cool and dry. In the theater of operations the wooden boxes containing blasting caps are piled on dunnage and covered with tarpaulins. Terrain features or camouflage should be used to give protection from aerial observation. The boxes should be in stacks 100 yards from other explosives except fuzes.

**36. Cord, detonating (primacord).**—*a. Description.*—Detonating cord consist of an explosive core of PETN (Pentaerythritetetranitrate) inclosed in a yellow waterproof textile covering with a rough surface, the whole being $\frac{3}{16}$ inch in diameter. It is flexible, light (15 pounds per 1,000 feet), and easily used. PETN is a stable explosive, insentitive to flame, spark, friction, shock, or ordinary detonation. It requires an electric detonator or an affixed blasting cap to initiate explosion. The detonation is practically instantaneous as the explosive wave is 20,350 feet per second.

*b. Packing.*—For the Chemical Warfare Service, detonating cord may be packed in two different ways. As a burster charge it is supplied in cardboard cartons containing 20 rolls, each roll containing 8 feet of cord, together with one 4-ounce roll of $\frac{3}{4}$-inch adhesive safety tape. Ten cartons are placed in a wooden box. For use in long detonating trains, it is also furnished on light wooden spools in lengths of 500 to 1,000 feet. The boxes must be well secured and tight. Blasting caps are not packed in the same container with detonating cord.

*c. Shipping.*—Detonating cord with an I. C. C. class C rating is classified as a relatively safe explosive. Gross weight of one outside box must not exceed 150 pounds. Each outside container must be plainly marked "HANDLE CAREFULLY." Burster tubes must be shipped separately. Shipment by truck, wagon, or other road conveyances must be in accordance with I. C. C. regulations and local laws of the areas through which the shipment must pass. In the theater of operations shipment of detonating cord is in accordance with regulations promulgated by the commanding general of the military organization controlling the area in which the shipment is made.

*d. Storage.*—Detonating cord is stored in the manner of all high explosives and in accordance with provisions of section IX, Ordnance



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Safety Manual, O. O. Form No. 7224. In the zone of the interior it is stored in igloo magazines. In the theater of operations and in the open, detonating cord in boxes may be stored temporarily in camouflaged or concealed stacks. The boxes are placed on dunnage and covered with tarpaulins.

*e. Assembly and function.*—Successful and positive functioning of detonating cord in either of its two main uses depends upon the correct and exact technique of assembling and laying out the charges or the connecting explosive train. Because PETN is a safe explosive, and because it is relatively difficult to detonate, special methods of connecting and initiating the explosive wave in the train or within the explosive charge are necessary. The explosion must be initiated either by an electric detonator or a blasting cap. The detonator is taped to the side of the detonating cord. Once the explosion has been initiated it will carry on along the length of the detonating cord providing the cord is not broken or bent sharply. For branch lines, the length of the cord is attached to the main line by a double half-hitch pulled tight. Two long lengths of detonating cord may be connected by means of an ordinary square knot pulled reasonably tight.

**37. Electric squibs.**—*a. Description.*—Electric squibs or flash fuzes are devices for igniting burning type munitions such as the DM irritant gas candle, the smoke pot, or the tear gas pot by means of an electric current. They are of commercial manufacture and consist essentially of a small charge of black powder compressed around a fine resistance wire. The squib should be encased in a small tube, one end of which is sealed by a compound, usually of sulfur. This holds the wires and powder charge firmly in place. There are three main types:

(1) *Flash vented type* (fig. 21) consists of a metal tube with two holes in its side. When the squib is fired these cause the flame to shoot at right angles to the tube.

(2) *Open end type* (fig. 21) is a cardboard or metal tube one end of which is open as the name implies. In some cases, until ready for use, this end is closed with a small cork stopper which must be removed before the squib is fired. The single flame of this type of squib is directed against the matchhead or starter mixture by having the open end placed in contact with it.

(3) *Closed type* consists of a metal tube without openings. This squib is not used in firing burning type munitions.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

*b. Packing.*—Squibs are packed in lots of 50 in cylindrical metal cans of 5½-inch diameter and 5⅞-inch height. Ten cans are packed in a wooden box.

*c. Shipment.*—Electric squibs are shipped according to I. C. C. regulations for fuzes and detonators. Each can and box is marked to show the name of the contents, type, and quantity therein.

*d. Storage.*—Electric squibs, a class C explosive, are stored in igloo magazines and may be stored with detonators, fuzes, etc.

*e. Precautions.*—Electric squibs sometimes resemble electric deto-

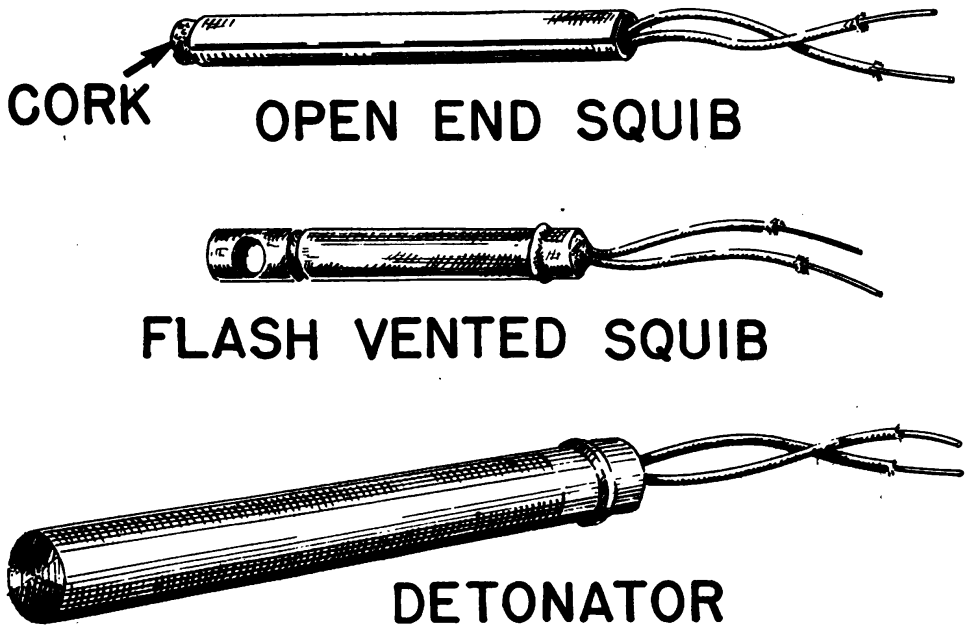



FIGURE 21.—Open end and flash vented squibs and detonator.

nators or blasting caps. All personnel engaged in handling the two should be taught to recognize their differences. Squib tubes are generally made of paper or aluminum. Detonator tubes always have closed ends and are generally made of copper. Detonators contain mercury fulminate (or lead azide in some instances) and must be handled very carefully.

**38. Burster, nitrostarch, M2.**—*a. Description.*—The M2 nitrostarch burster consists of a cylindrical paper burster cap ⅞ inch in diameter and 3½ inches in length loaded with pressed nitrostarch pellets. The paper case is crimped at each end like a paper shotgun shell. One end is reinforced with a collar of thin copper and has a well in the center that will accommodate a No. 8 commercial type



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

electric blasting cap. A rubber stopper is supplied which has a groove to permit the exit of the wires of the blasting cap.

*b. Packing.*—Nitrostarch bursters are packed 50 to a cardboard carton, 10 cartons to a wooden box. The weight of the shipping box filled is 61 pounds.

*c. Shipping.*—The shipping box is marked "DETONATING FUZES—HANDLE CAREFULLY" and should neither be transported with high explosives nor offered for shipment by railway ex-

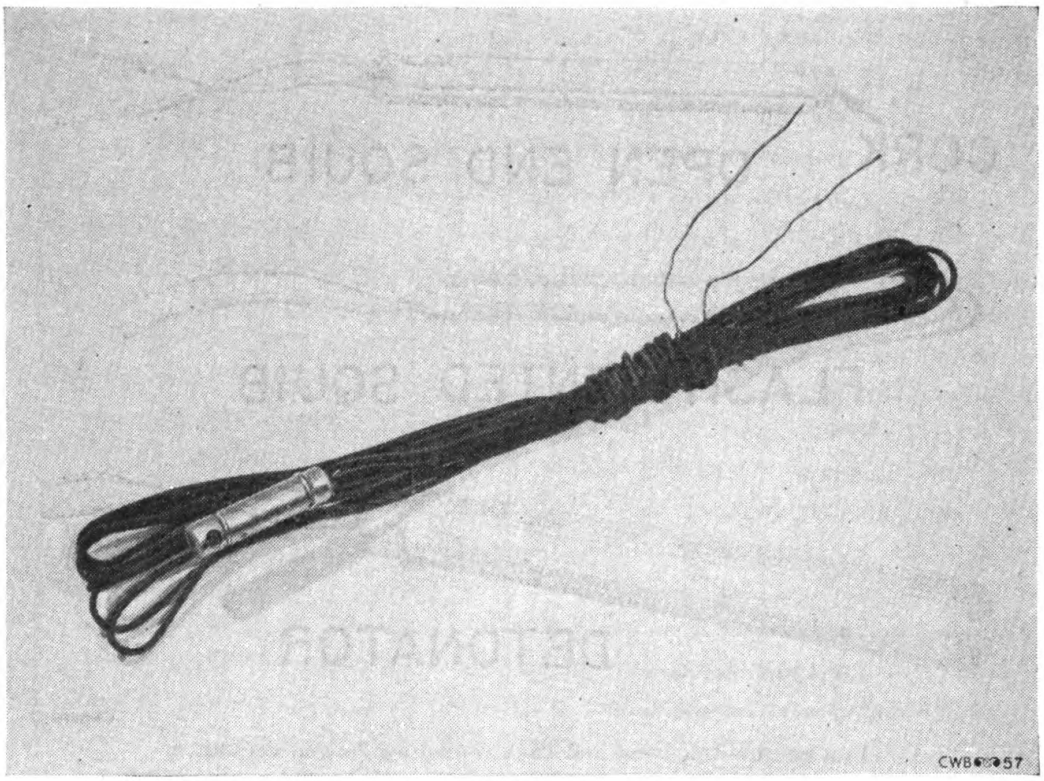


FIGURE 22.—Electric squib.

press. I. C. C. regulations governing the shipment of explosives require that blasting caps and burster tubes be shipped separately.

*d. Storage.*—Nitrostarch bursters may be stored with time fuzes and are stacked with tops up in igloo magazines. Open boxes are not permitted in such storage. In the theater of operations they are stacked on dunnage and covered with tarpaulins.

**39. Accessories.**—Electric firing of munitions herein described requires certain accessory apparatus and materials which are specified in the respective sections of this manual. The publications given as references for each instrument, or piece of apparatus, prescribe proper operating, care, and maintenance methods.



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

## Appendix I

## LIST OF REFERENCES

| | |
|---|---|
| Tactics of Chemical Warfare | FM 3–5 |
| Supply and Field Service | FM–3–15 |
| Organization and Employment of Chemical Troops | FM 3–20 |
| Explosives and Demolitions | FM 5–25 |
| Military Chemistry and Chemical Agents | TM 3–215 |
| Storage and Shipment of Dangerous Chemicals | TM 3–250 |
| The Portable Chemical Cylinder | TM 3–315 |
| Chemical Warfare Service Supply Catalog. | |
| Standard Nomenclature and Price List of Chemical Warfare Matériel. | |
| Ammunition, General | TM 9–1900 |
| Range Regulations for Firing Ammunition in Time of Peace | AR 750–10 |
| Candle, gas, irritant, DM, MI U. S. Army Specification | No. 96–111–14A |
| Pot, smoke, HC, MI U. S. Army Specification | No. 96–111–27A |
| Pot, tear gas, CN, M1 C. W. S. Specification | No. 196–111–33 |
| Mine, land, chemical, 1-gallon C. W. S. Specification | No. 196–92–1 |



Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

## APPENDIX II

## TABLES

### SHIPPING DATA

| Conveyance | No. of filled land mines | No. of filled DM irritant candles | No. of filled HC smoke pots | No. of filled CN tear gas pots | Remarks |
|---|---|---|---|---|---|
| Chemical cart | 21 | 24 | 18 | 200 | Capacity of chemical cart is approximately 325 pounds. |
| Truck (1½ ton) | 200 | 220 | 180 | 1, 850 | |
| Truck (2½ ton) | 300 | 360 | 300 | 3, 000 | |
| Railway car (standard). | 5, 000 | 5, 500 | 4, 500 | 40, 000 | Normally I. C. C. regulations prohibit transportation of filled HS land mines by rail. |

### ORGANIZATION OF CREW FOR MUSTARD GAS LAND MINE FILLING

| Personnel | Operation | Protective equipment and remarks |
|---|---|---|
| 1 | Supplying empty containers. | Gas mask, permeable protective clothing. |
| 2 | Filling | Gas mask, impermeable protective clothing. |
| 1 | Capping and flushing | Gas mask, impermeable protective clothing. (The filled mine will be inverted in bleach solution to remove liquid HS and to test for leakage.) |
| 2 | Packing | Gas mask and permeable protective clothing. |
| 1 | Supervisor | Gas mask and permeable protective clothing. (Noncommissioned officer.) |

[A. G. 062.11 (3–3–42).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,
*Major General,*
*The Adjutant General.*

DISTRIBUTION:

Bn 3 (5); Bn 5 (5); C 3 (2).

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



U. S. GOVERNMENT PRINTING OFFICE: 1942

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA