

TM 3-320

WAR DEPARTMENT TECHNICAL MANUAL

MORTAR, CHEMICAL, 4.2-INCH

WAR DEPARTMENT • JUNE 1945

WAR DEPARTMENT TECHNICAL MANUAL
TM 3-320

This manual supersedes TM 3-320, 15 Oct. 1942, including C 1, 10 Aug. 1943, C 2, 14 Oct. 1943, C 3, 28 Oct. 1943, C 4, 16 Dec. 1943, and C 5, 12 Apr. 1944; TB 3-320-1, 27 Jan. 1944; 3-320-2, 29 Feb. 1944, including C 1, 17 Feb. 1945; 3-320-3, 20 May 1944, including C 1, 26 May 1945; 3-320-4, 22 May 1944, including C 1, 27 Apr. 1945; 3-320-5, 13 May 1944; and 3-320-6, 19 June 1944, including C 1, 20 Sep. 1944, and C 2, 17 Feb. 1945.

MORTAR, CHEMICAL, 4.2-INCH



WAR DEPARTMENT

JUNE 1945

United States Government Printing Office

Washington: 1945

WAR DEPARTMENT
WASHINGTON 25, D. C., 30 June 1945

TM 3-320, Mortar, Chemical, 4.2-Inch, is published for the information and guidance of all concerned.

[AG 300.7 (7 May 45)].

BY ORDER OF THE SECRETARY OF WAR: *

OFFICIAL:

J. A. ULIO
Major General
The Adjutant General

G. C. MARSHALL
Chief of Staff

DISTRIBUTION:

AAF (5); AGF (15); ASF (2); T of Opn (10); Def Comd (5);
Arm & Sv Bd (1); S Div ASF (1); Tech Sv (2); Sv C (2);
PG 3 (20); Ars 3 (10); Pro Dist 3 (5); Gen & Sp Sv Sch (2);
USMA (1); A (5); CHQ (5); D (5); T/O & E 3-25 (4); 3-26
(4); 3-27 (10); 3-47 (2); 3-67 (2); 3-117 (2); 3-137S (2);
3-500 (BA) (BB) (BC) (BD) (BE) (CA) (CB) (CC) (2).

Refer to FM 21-6 for explanation of distribution formula.

CONTENTS

	<i>Paragraphs</i>	<i>Page</i>
PART ONE. INTRODUCTION.		
<i>Section I.</i> General	1-2	2
II. Description and data.....	3-6	2
III. Tools, parts, and accessories.....	7-9	5
PART TWO. OPERATING INSTRUCTIONS.		
<i>Section IV.</i> General	10	12
V. Service upon receipt of equipment.....	11-13	12
VI. Controls	14	12
VII. Operation under usual conditions.....	15-18	14
VIII. Operation of auxiliary equipment.....	19-22	16
IX. Operation under unusual conditions.....	23-24	30
X. Demolition to prevent enemy use.....	25-26	31
PART THREE. MAINTENANCE INSTRUCTIONS.		
<i>Section XI.</i> General	27	32
XII. Lubrication	28	32
XIII. Preventive maintenance services.....	29-32	32
XIV. Malfunctions and corrections.....	33-38	38
XV. Barrel M2	39-44	42
XVI. Standard MI	45-51	47
XVII. Baseplate M2A1	52-55	47
PART FOUR. AUXILIARY EQUIPMENT.		
<i>Section XVIII.</i> General	56	59
XIX. Ammunition	57-70	59
XX. Sighting and fire control equipment.....	71-79	78
XXI. Mortar transport equipment.....	80-86	87
XXII. Subcaliber equipment	87-91	105
APPENDIX I. SHIPMENT AND STORAGE OF MORTAR.....		109
II. REFERENCES.....		113
INDEX		115

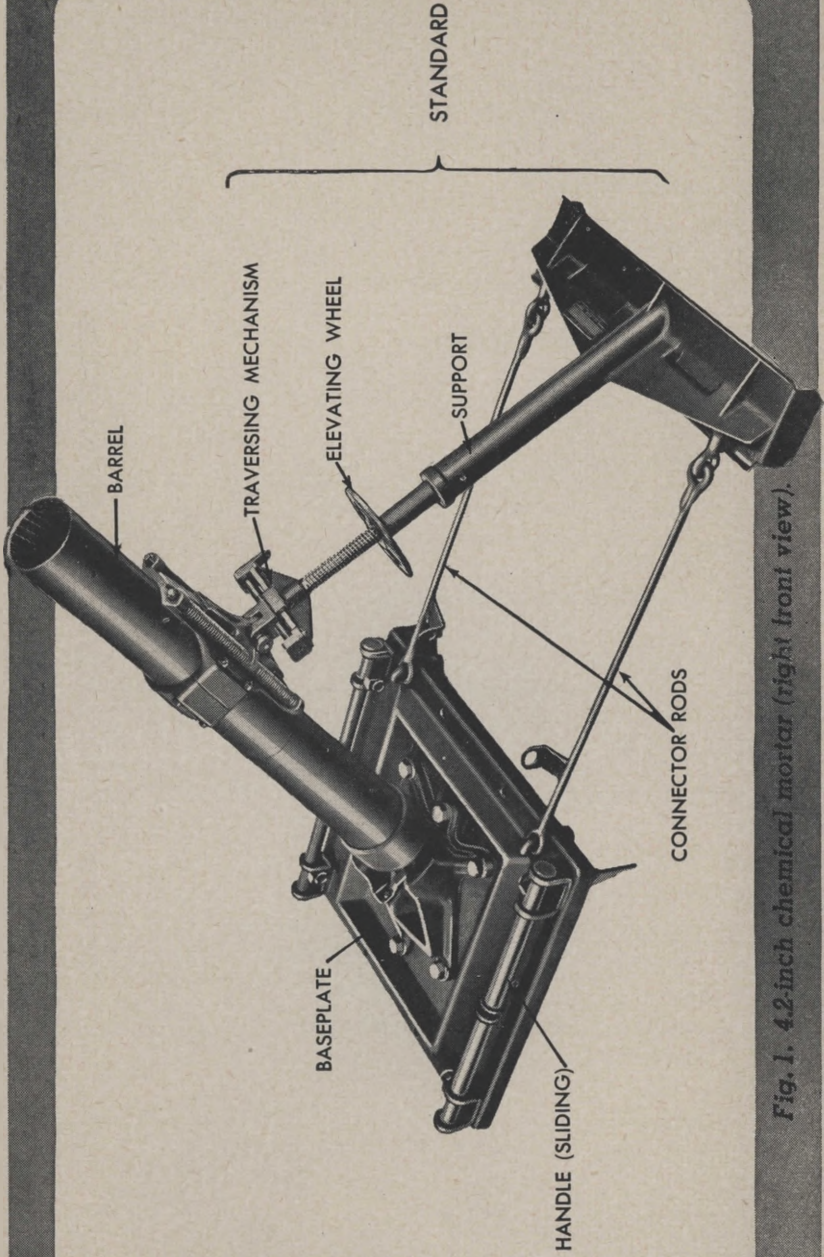
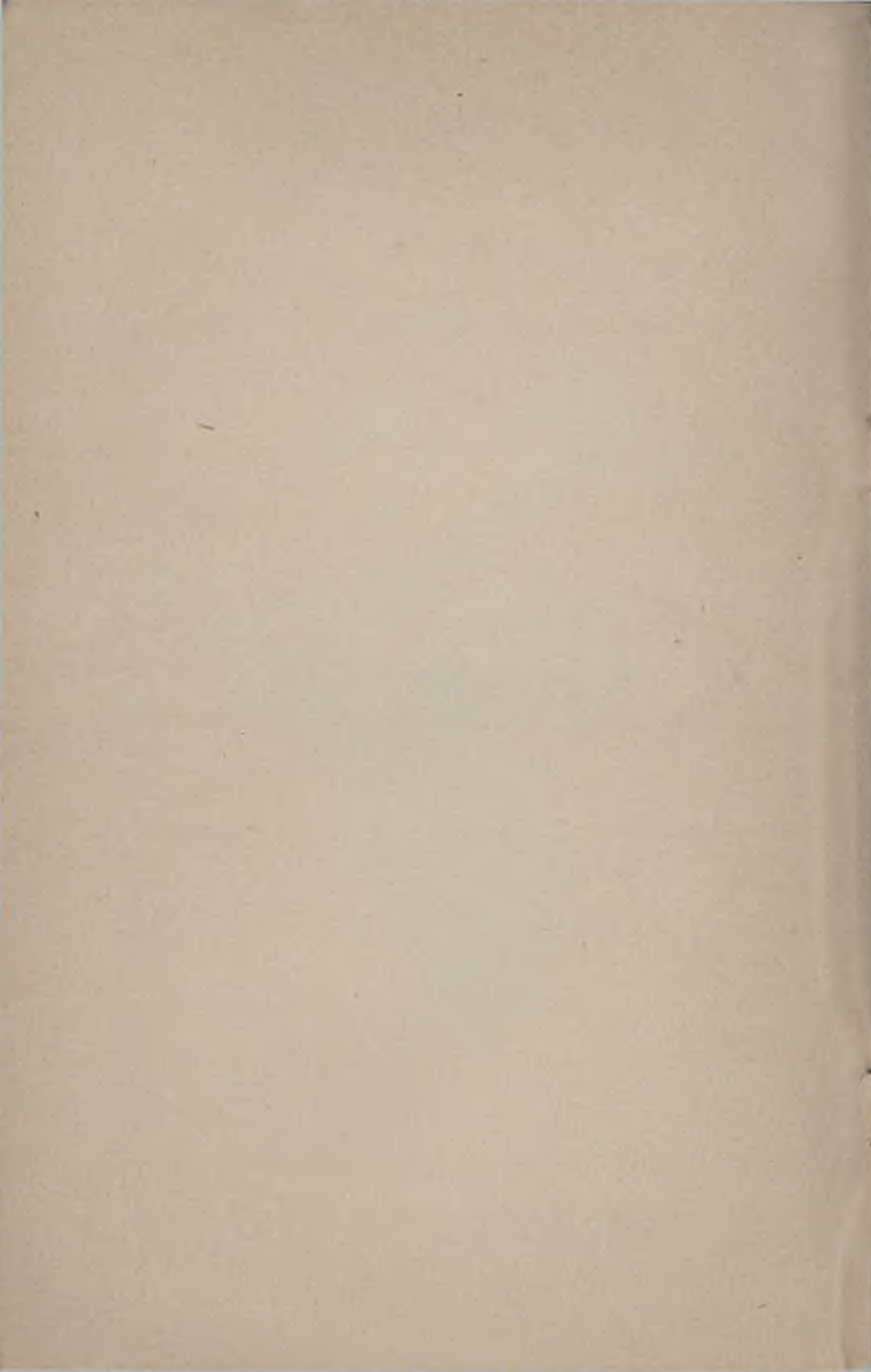


Fig. 1. 4.2-inch chemical mortar (right front view).

SAFETY PRECAUTIONS

1. Before firing, make sure that all excess oil is removed from the bore. If the bore is oily, partial combustion of the powder occurs, resulting in a greatly shortened range. Smoke is given off, and the position may be disclosed.
2. Keep cartridges, powder bundles, and inside of barrel dry. Moisture reduces the range.
3. Be sure base cap is seated in base-cap cup and held in place by cup fork before inserting round in barrel.
4. Do not try to force a round down the barrel.
5. Drop round into mortar, *cartridge end first*.
6. On firing, drop round into barrel so that small end of fuze slider is up.
7. Check condition of fuze by pulling safety pin, noting whether or not striker comes out. *Do not drop an armed round into barrel.*
8. Before firing, make sure that the trajectory of the shell is not blocked by an obstruction, such as a tree limb, which might cause premature detonation near friendly troops.



This manual supersedes TM 3-320, 15 Oct. 1942, including C 1, 10 Aug. 1943 C 2, 14 Oct. 1943, C 3, 28 Oct. 1943, C 4, 16 Dec. 1943, and C 5, 12 Apr. 1944; TB 3-320-1, 27 Jan. 1944; 3-320-2, 29 Feb. 1944, including C 1, 17 Feb. 1945; 3-320-3, 20 May 1944, including C 1, 26 May 1945; 3-320-4, 22 May 1944, including C 1, 27 Apr. 1945; 3-320-5, 13 May 1944; and 3-320-6, 19 June 1944, including C 1, 20 Sep. 1944, and C 2, 17 Feb. 1945.

PART ONE

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the information of the using arms and services.

b. In addition to a description of the 4.2-inch chemical mortar, this manual contains technical information required for the identification, use, and care of the mortar, ammunition, and accessory equipment.

c. In all cases where the nature of the repair, modification, or adjustment is beyond the scope or facilities of the unit, the responsible maintenance service should be informed so that trained personnel with suitable tools and equipment may be provided, or proper instructions issued.

2. Records and Reports

a. CHEMICAL MORTAR BARREL RECORD BOOK. (1) *General*. A complete record of the mortar barrel must be entered in the mortar barrel record book. This is the responsibility of the unit commander. Instructions regarding entries are given in the book. When the mortar is shipped or transferred from one organization to another, the record book must accompany the mortar. During transfer or shipment, the book is kept in a waterproof envelope securely fastened to the barrel. When it is necessary to replace baseplate or standard assemblies, barrel record book remains with the barrel. When barrel is destroyed or otherwise withdrawn permanently from service, the record book is sent to Office of the Chief, Chemical Warfare Service, Washington 25, D. C.

(2) *Entries*. To insure and facilitate proper maintenance of the barrel, the following entries in the record book are prescribed:

(a) Number of rounds, fillings of shell, propelling charge, number of rings, and date of firing.

(b) Shell defects such as premature arming and duds. Component lot numbers should be included.

(c) Repairs made (include name of officer or mechanic making repairs).

(3) *Loss of record book*. If a barrel record book is lost, it should be

replaced at once, and entries brought up to date as accurately as possible. Additional copies of the record book may be obtained by requisition to Office of the Chief, Chemical Warfare Service, Washington 25, D. C.

Note. Record of assignment data must be removed and destroyed prior to entering combat.

b. **FIELD REPORT OF ACCIDENTS.** When an accident involving ammunition occurs during practice, the incident should be reported as prescribed in AR 750-10 by the officer under whose supervision the ammunition is maintained or issued. Where practicable, reports covering malfunctions of ammunition in combat should be made to the Office of the Chief, Chemical Warfare Service, giving the type of malfunction, type of ammunition, lot number of the complete rounds, and condition under which fired.

c. **UNSATISFACTORY EQUIPMENT REPORT.** Suggestions for improvement in design, maintenance, and safety and efficiency of operation, prompted by chronic failure or malfunction of the weapon, spare parts, or equipment should be reported on WD AGO Form 468 with all pertinent information necessary to initiate corrective action. The report should be forwarded to the Office of the Chief, Chemical Warfare Service, through command channels in accordance with instructions on the form. Such suggestions are encouraged in order that other organizations may benefit.

Section II. DESCRIPTION AND DATA

3. General

The mortar, chemical, 4.2-inch, M2 (figs. 1 and 2) is a rifled, muzzle-loading weapon capable of firing at elevations between 800 and 1065 mils, and of being traversed 125 mils right or left of the center of traverse without moving the standard. By shifting the standard, a maximum shift of 350 mils left or right of center of traverse is possible, without changing the emplacement. This is not desirable at long ranges, however, because of the danger of breakage.

a. **COMPONENTS.** The mortar consists of a barrel, baseplate, and standard. The barrel consists of a rifled tube that is closed at the breech end by a tube cap assembly and carries a shock absorber slide assembly to permit attachment to the standard. The baseplate is a square steel plate, reinforced by ribbing and a pressed form, for distributing the shock of recoil over an area of ground. The standard, which has an inverted **T**-shape, consists of a base that is connected to the baseplate by connector (tie) rods and of a single vertical column that houses the elevating mechanism. Elevation is controlled by turning elevating screw wheel, and lateral movement is obtained by turning traversing crank handle and by shifting the standard.

b. **SIGHT.** A sight is furnished to enable the mortar squad to lay mortar for direction and elevation.

c. **RANGE.** Range is controlled by elevation of the barrel and by the

amount of propelling charge. Minimum and maximum ranges differ with types of shell, as indicated in paragraph 6*k*.

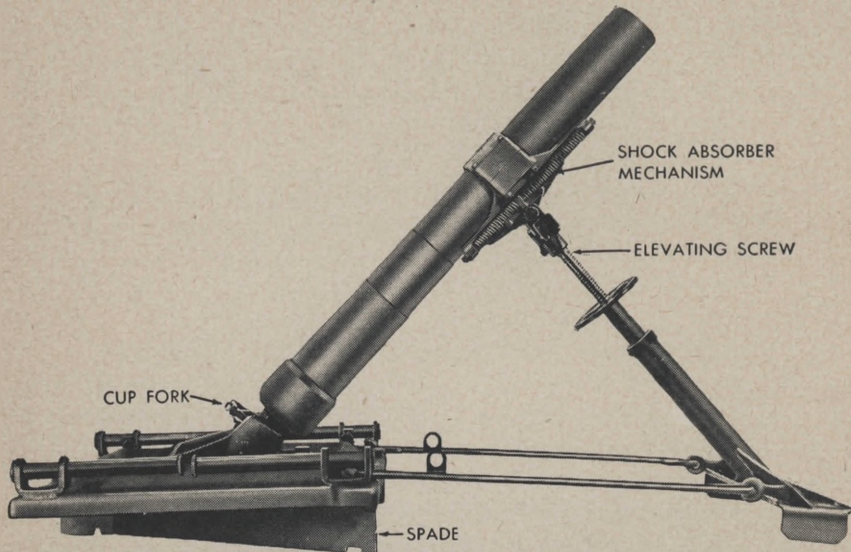


Fig. 2. 4.2-inch chemical mortar (right view).

4. Identification Information

Four serial numbers are available for records concerning the components of this matériel. They are the barrel, baseplate, standard, and sight serial numbers.

- a.* Barrel serial number is stamped 5 inches from muzzle of the barrel.
- b.* Standard serial number is stamped on base of standard.
- c.* Baseplate serial number is stamped on the rear baseplate bead.
- d.* Sight serial numbers are located in the following places:
 - (1) Telescope mount (identification plate).
 - (2) Telescope adapter (identification plate).
 - (3) Elbow telescope (stamped on body).

5. Differences in Models

a. BARREL. The tube of the revised M2 barrel is similar to the tube of the M2 barrel, but the tube cap, base cap, and striker pin are forged in one piece and screwed on the tube as one assembly. None of the components of the tube cap assembly (tube cap, base cap, and striker pin) is replaceable. See section XV for description of these barrels.

b. SIGHTS. (1) Telescope mount M59 with elbow telescope M62 is the standard sight for the 4.2-inch chemical mortar. A complete description of this instrument is found in paragraph 72.

(2) The MII sight is the substitute standard sight. See paragraph 78 for complete description.

6. Tabulated Data

a. MORTAR.

Weight of barrel M2.....	100 lb.
Weight of revised barrel M2.....	105 lb.
Weight of baseplate M2A1.....	175 lb.
Weight of standard MI.....	53 lb.
Weight of telescope mount M59.....	5.25 lb.
Weight of carrying case M48.....	7.4 lb.
Weight of instrument light M42.....	1.4 lb.
Weight of sight MII.....	2 lb.
Length of barrel (over-all).....	48 in.
Length of pitched rifling.....	42 in.
Powder pressure (normal pressure at maximum charge).....	13,500 psi (copper ball gauge pressure)
Type of firing mechanism.....	Fixed firing pin
Muzzle velocity (feet per second)	

	<i>Minimum</i>	<i>Maximum</i>
FS, WP, and CNS-filled shell.....	262	820
TNT, CG, HD, and CNB-filled shell....	260	841

b. AMMUNITION. For complete ammunition data, see Section XIX.

	<i>Rounds per minute</i>
c. RATE OF FIRE.	
Rapid rate	20
Sustained rate	5

d. RANGE 565 to 4,397 yd.

	<i>Mils</i>
e. ELEVATION.	
Maximum	1065
Minimum	800
Elevation per turn of handwheel (approximately).....	12½

	<i>Mils</i>
f. TRAVERSE.	
Right from center of traverse (maximum).....	125
Left from center of traverse (maximum).....	125
Traverse per turn of traversing handle.....	10 to 14

g. SIGHTING SYSTEM.

Components:

- Telescope mount M59
- Elbow telescope M62

h. SIGHTING EQUIPMENT.

- Sight kit M1
- Aiming stake M1
- Aiming post light M14

i. FIRE CONTROL EQUIPMENT.

- Aiming circle M1
- Mil rule M1

j. WEIGHT OF CART AND LOAD.	<i>With mortar</i> (pounds)	<i>With ammunition</i> (pounds)
Chassis	149	149
Rack	16	
Load	335	408
Cart (loaded)	500	557

k. PROJECTILES.		<i>Propelling</i> <i>charge</i>	<i>Range</i>	
<i>Shell type</i>	<i>Fillings</i>		<i>Minimum</i>	<i>Maximum</i>
M2	FS, WP, CNS	M6	579	4,258
M2	HD, CG, CNB	M6	565	4,397
M3	TNT	M6	565	4,397

Section III. TOOLS, PARTS, AND ACCESSORIES

7. Organizational Spare Parts

Organizational spare parts are supplied to the using arms for field replacement of those parts most likely to become broken, worn, or otherwise un-serviceable. Parts may be requisitioned individually or may be issued in sufficient quantity for 4, 12, or 36 mortars. The parts available and the authority for requisitioning are based on Army Service Forces, Chemical Warfare Service Catalog CW 7-410618.

<i>Item</i>	SPARE PARTS	<i>CWS</i> <i>stock number</i>
<i>Barrel group</i>		
BARREL, M2, assembly		C8-3-43
BOLT, slide, assembly		E8-25-6
NUT, castle, S., $\frac{7}{16}$ "-20NF.....		H22-93-4
GUIDE, spring		A8-2-33
PIN, cotter, split, S., $\frac{3}{32}$ " x $\frac{3}{4}$ ".....		H22-19-3
PIN, striker		E8-2-44
SPRING, front, C3.....		E8-2-146
SPRING, rear, C4.....		E8-2-147
WASHER, base-cap		A16-2-8

Note: PIN, striker (E8-2-44) and WASHER, basecap (A16-2-8) are replaceable on the M2 barrel but not on the revised M2 barrel.

Standard group

HANDLE, traversing screw, assembly.....	E8-25-5
NUT, mach., screw, hex., S., No. 10-24NC.....	H22-93-11
PIN, barrel, assembly	R8-4-133
PIN, stop	A8-4-52
PIN, taper, S., No. 2" x 1".....	H22-18-1
SCREW, bearing	A8-4-46
SCREW, cap, oval fil. hd., S., $\frac{1}{2}$ "-13NC x $1\frac{1}{4}$ ".	H22-16-1

¹Consists of six boxes of ammunition, two rounds per box.

<i>Item</i>	SPARE PARTS	<i>CWS stock number</i>
SCREW, elevating		E8-4-91
STANDARD, M2, assembly		C8-4-60
WASHER, lock, reg., S., $\frac{5}{16}$ "		H22-56-55
WASHER, lock, reg., S., $\frac{1}{2}$ "		H22-56-51
<i>Baseplate group</i>		
BASEPLATE, M2A1, assembly		C8-3-98
CHAIN, sash, galv. steel, No. 40 (8 links)		H22-65-5
FORK, cup		E8-3-78
HOOK		E8-3-101
NUT (for cup bolts and hooks)		A8-3-85
NUT, mach. screw, hex., S., No. 10-24NC		H22-93-11
RETAINER, fork		A8-3-92
SCREW, mach., rd. hd., S., No. 10-24NC x $\frac{3}{4}$ "		H22-15-8
SCREW, mach., rd. hd., S., No. 10-24NC x $\frac{7}{8}$ "		H22-15-7
WASHER, lock, reg., S., No. 10 x $\frac{3}{32}$ " x $\frac{3}{64}$ " ..		H22-56-49
<i>Fire control equipment group</i>		
KIT, sight, 4.2-inch chemical mortar, M1		R8-8-126
RULE, mil, M1		B8-27-1
STAKE, aiming		B8-9-69

TOOLS

FILE, American Std., flat, second-cut, 8"	H22-108-25
HANDLE, mattock (pick), 36"	H22-46-3
HATCHET, broad	E22-34-1
MATTOCK, pick, handled, 5-lb.	E22-26-2
PLIERS, lineman's, side-cutting, 8"	H22-29-4
SCREWDRIVER, common, heavy duty, 4" blade	H22-50-4
SETTER, fuze, M14	R8-9-125
SPADE	E22-27-1
WRENCH, base-cap	E8-9-20
WRENCH, engineers', 15°, single-head, normal-duty $\frac{5}{8}$ "	H22-49-21
WRENCH, engineers', 15°, single-head, normal-duty, $\frac{15}{16}$ "	H22-49-27
WRENCH, fuze	E8-9-55

ACCESSORIES

BAG, sand, duck, cotton	H18-65-5
CLOTH, abrasive, aluminum-oxide, No. 2/0-100 sheets	H100-15-2
CLOTH, wiping ($\frac{1}{2}$ -lb. bundle)	H100-2-10
COVER, muzzle	B8-9-19
LANYARD	E8-9-39
OIL, lubricating, gun, med. grade (1-qt. can)	H99-4-2
OILER, steel, push-button, double cap spout, $\frac{1}{2}$ -pt.	E22-51-1

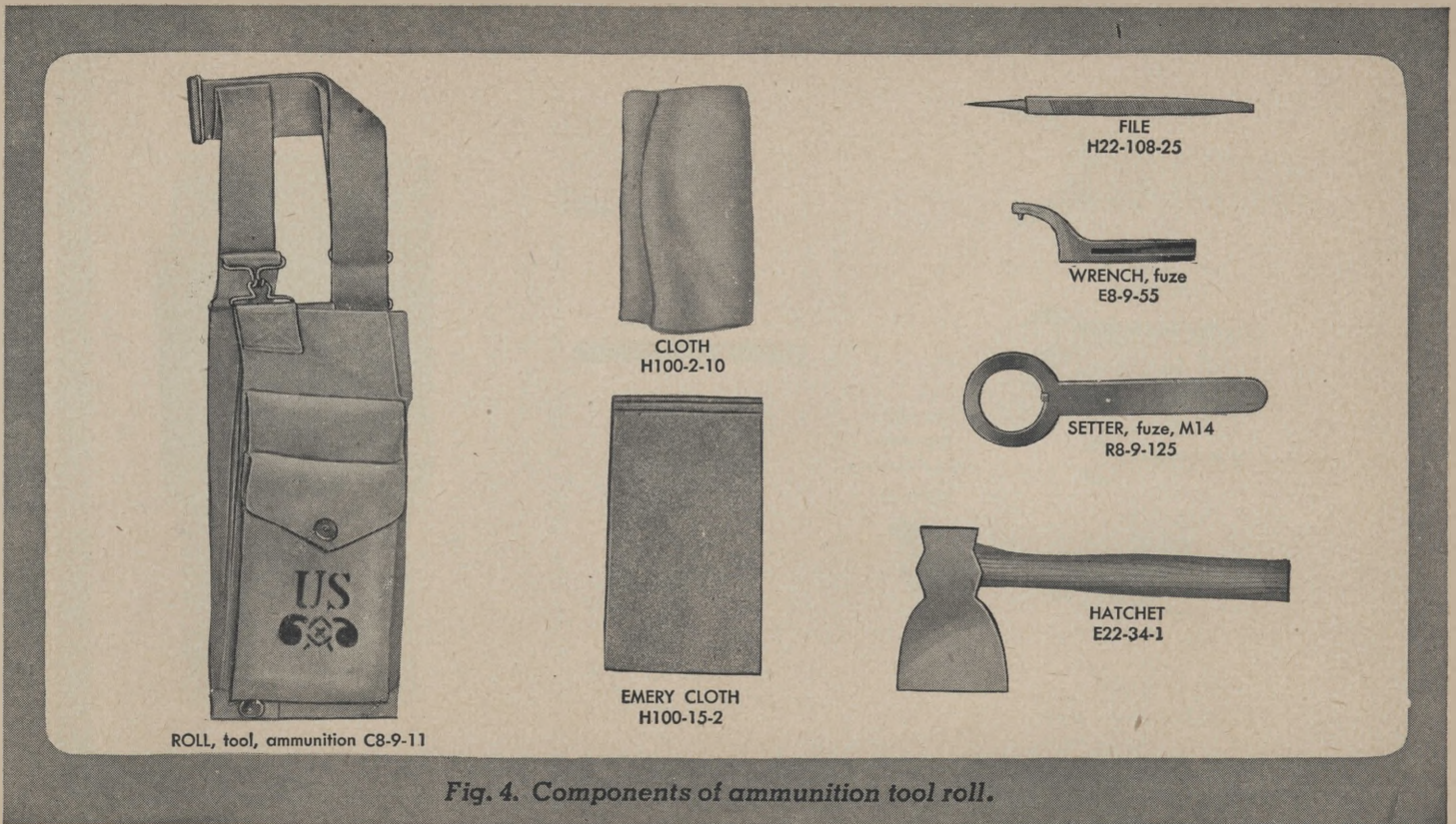
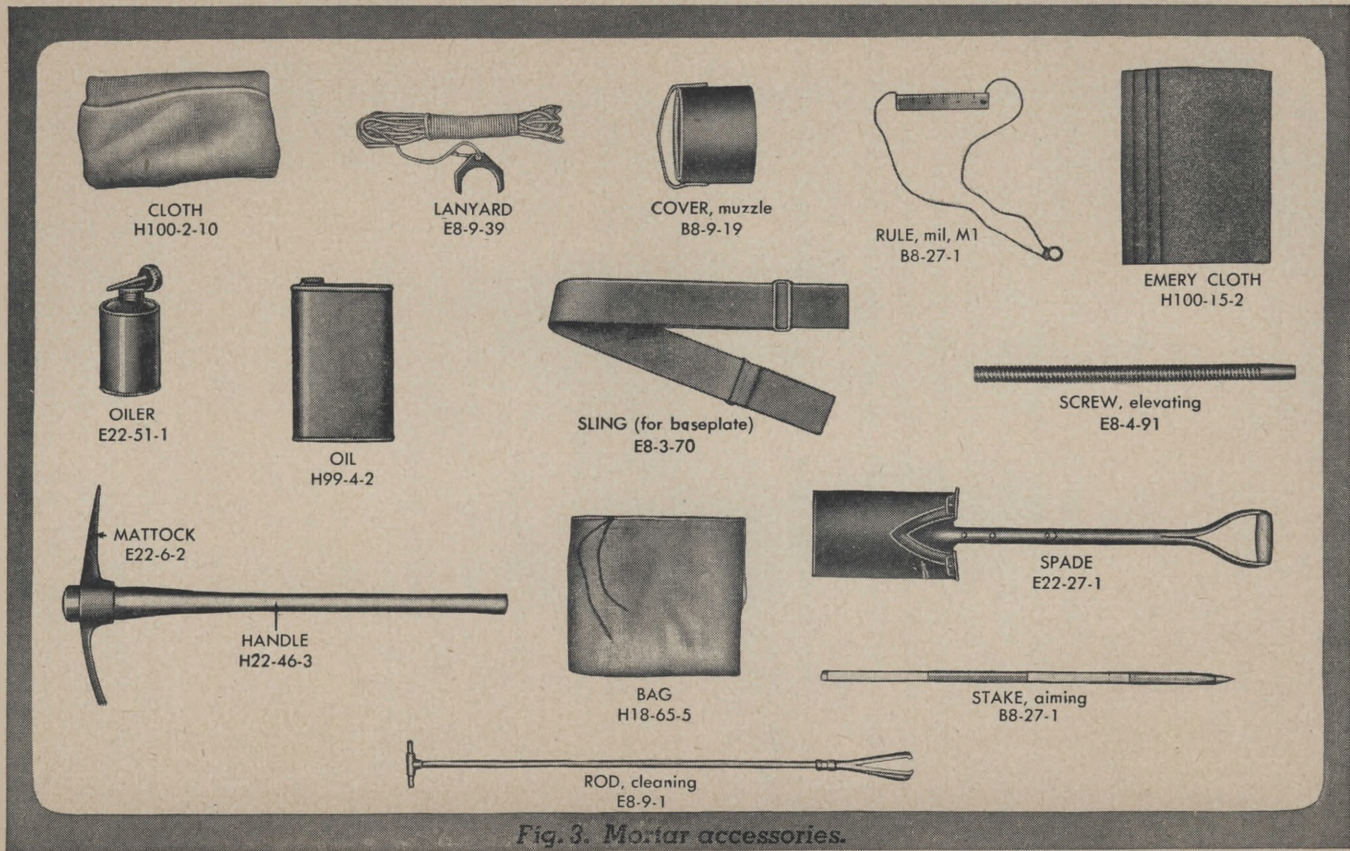
<i>Item</i>	ACCESSORIES	<i>Quantity</i>	<i>CWS</i> <i>stock number</i>
ROLL, tool, ammunition, assembly (less contents)			C8-9-11
ROLL, tool, ammunition, complete assembly			R8-9-123
ROLL, tool, gunner's, assembly (less contents)			C8-9-71
ROLL, tool, gunner's, complete assembly			R8-9-124
ROD, cleaning			E8-9-1
SLING (for baseplate)			E8-3-70

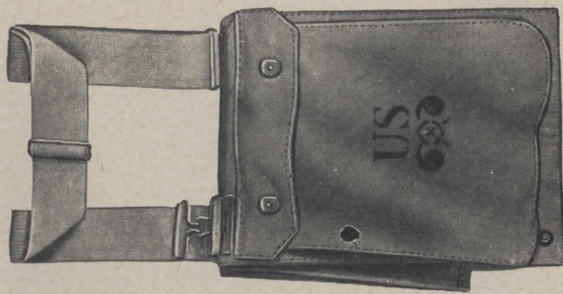
8. Accessories

a. Accessories (figs. 3, 4, and 5) include tools and equipment required for such disassembling and assembling as the using arms are authorized to perform, and for the cleaning and preservation of the mortar, cart, sighting and fire control equipment, and ammunition. They also include chests, covers, tool rolls, and other items necessary to protect the matériel when it is not in use or when traveling. Accessories should not be used for purposes other than as prescribed and, when not in use, should be properly stored.

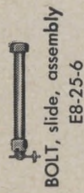
b. The set, accessories and spare parts for the 4.2-inch chemical mortar, is listed below:

<i>Item</i>	<i>Quantity</i>	<i>CWS</i> <i>stock number</i>
BAG, sand, duck, cotton	12	H18-65-5
BAG, wiping cloths	1	E8-9-112
CHEST, packing, assembly	1	C8-9-79
CLOTH, abrasive, aluminum-oxide No. 2/0-100 sheets	6	H100-15-2
CLOTHS, wiping (½-lb. bundle)	1	H100-2-10
COVER, muzzle	1	B8-9-19
LANYARD	1	E8-9-39
MATTOCK, pick, assembly includes:	1	E22-26-2
HANDLE, pick	1	H22-46-3
MATTOCK, pick	1	H22-26-3
OIL, lubricating, gun, med. grade (1-qt. can)	1	H99-4-2
OILER, ½-pt.	1	E22-51-1
ROD, cleaning	1	E8-9-1
ROLL, tool, ammunition, complete assembly includes:	1	R8-9-123
CLOTH, abrasive, aluminum-oxide, No. 2/0-100 sheets	6	H100-15-2
CLOTHS, wiping (½-lb. bundle)	1	H100-2-10
FILE, American Std., flat, second-cut, 8"	2	H22-108-25
HATCHET, broad	1	E22-34-1
SETTER, fuze, M14	1	R8-9-125
WRENCH, fuze. assembly	1	E8-9-55





ROLL, tool, gunner's
C8-9-71



BOLT, slide, assembly
E8-25-6



PIN, striker
E8-2-44



SPRING, rear, C4
E8-2-147



SPRING, front, C3
E8-2-146



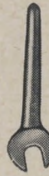
CLOTH
H100-2-10



SCREW DRIVER
H22-50-4



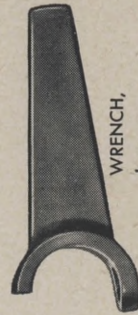
PLIERS
H22-29-4



WRENCH
H22-49-21



WRENCH
H22-49-27



WRENCH,
base-cap
E8-9-20



HANDLE,
traversing screw,
assembly
E8-25-5

Fig. 5. Components of gunner's tool roll.

<i>Item</i>	<i>Quantity</i>	<i>CWS stock number</i>
ROLL, tool, gunner's, complete assembly includes:	1	R8-9-124
BOLT, slide, assembly.....	2	E8-25-6
CLOTHS, wiping (½-lb. bundle).....	1	H100-2-10
HANDLE, traversing screw, assembly....	1	E8-25-5
PIN, striker	1	E8-2-44
PLIERS, lineman's, side-cutting, 8".....	1	H22-29-4
SCREW DRIVER, common, heavy-duty, 4" blade	1	H22-50-4
SPRING, front, C3.....	2	E8-2-146
SPRING, rear, C4.....	2	E8-2-147
WRENCH, base-cap	1	E8-9-20
WRENCH, engineers', 15°, single-head, normal-duty, 5/8"	2	H22-49-21
WRENCH, engineers', 15°, single-head, normal-duty, 15/16"	1	H22-49-27
RULE, mil, MI.....	1	B8-27-1
SCREW, elevating	1	E8-4-91
SLING (for baseplate).....	2	E8-3-70
SPADE	1	E22-27-1
STAKE, aiming	3	B8-9-69

c. For mortar and ammunition cart accessories set, see paragraph 82.

d. For 3-inch subcaliber mortar accessories and spare parts set, see paragraph 88c.

9. Care of Organizational Spare Parts and Accessories

All organizational spare parts, tools, and accessories should be kept in an orderly manner in the chests and containers provided, so that they can be quickly located when required. Items susceptible to rust or corrosion must be cleaned thoroughly after use, or at regular intervals, and coated with a film of oil.

PART TWO

OPERATING INSTRUCTIONS

Section IV. GENERAL

10. Scope

Part two contains information for the guidance of personnel responsible for operation of this equipment. It contains information on operation of equipment and controls.

Section V. SERVICE UPON RECEIPT OF EQUIPMENT

11. General

a. Upon receipt of new or used matériel, it is the responsibility of the officer in charge to ascertain whether it is complete and in sound operating condition. A record should be made of any missing parts and malfunctions, and such conditions should be corrected as quickly as possible.

b. Attention should be given to small and minor parts as these are the most likely to become lost and may seriously affect the proper functioning of the matériel.

c. The matériel should be cleaned and prepared for service in accordance with instructions given in paragraph 12. The matériel should be lubricated in accordance with section XII.

12. New Equipment

Upon receipt of new equipment, the following procedure is carried out:

a. Remove component parts of the mortar and accessories and spare parts from their respective packing boxes.

b. Check completeness of contents.

c. Remove rust-preventive materials, clean, and lubricate equipment (figs. 28, 29, sec. XII, and par. 3, app. I).

d. Examine all parts for serviceability.

e. Assemble equipment and inspect for serviceability.

13. Used Equipment

Check used or reconditioned equipment as described in paragraph 11. In addition, replace any worn or damaged parts; repaint areas where paint has worn off (par. 5, app. I).

Section VI. CONTROLS

14. Elevating and Traversing Mechanisms

There are two control mechanisms used in firing the mortar—the elevating mechanism and the traversing mechanism.

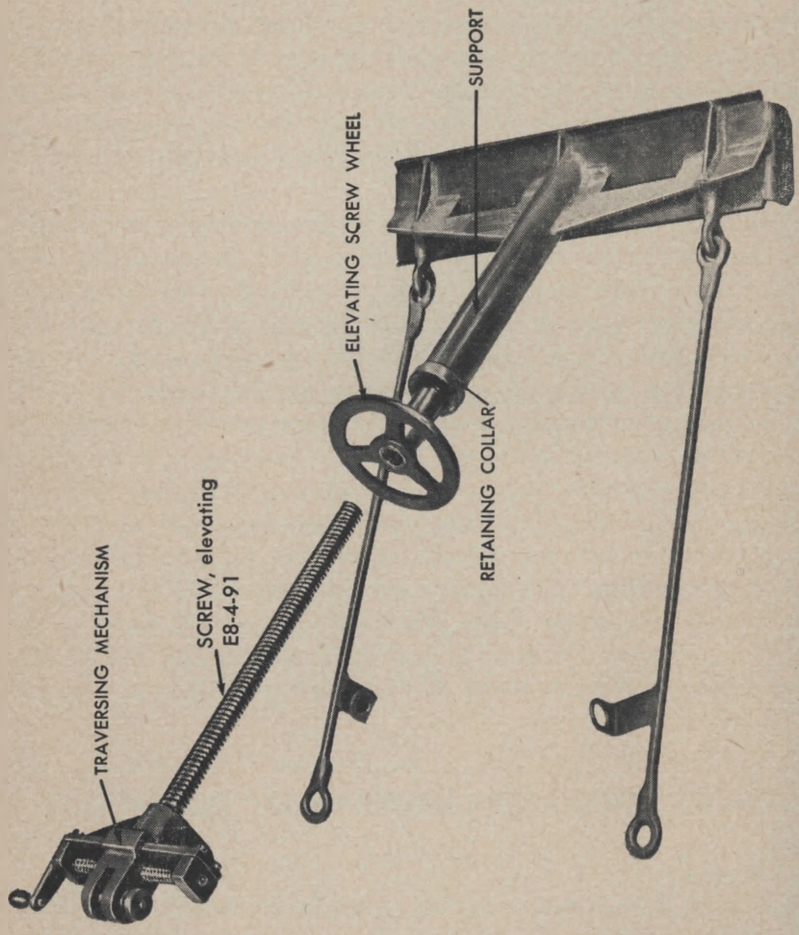


Fig. 6. Exploded view of elevating and traversing mechanisms in relation to standard.

a. Elevating mechanism (fig. 6) consists of an elevating screw made of chromium-nickel molybdenum steel in a sleeve $15\frac{5}{8}$ inches long, upper end of which is threaded on the inside for a distance of 2 inches. The sleeve has a shoulder of $4\frac{3}{4}$ inches from the top, fitting freely in the support. Outer diameter of the sleeve below this shoulder is designed to leave room between sleeve and support for a compression spring, lower end of which rests on a stop or bearing in the support. When the mortar is fired, this spring allows downward motion of the barrel in the direction of axis of the support, thus reducing stress on the standard. Elevating screw is raised or lowered by turning the elevating screw wheel. To prevent backlash of the spring when the wheel is turned, small ball bearings between thrust washers are provided at upper end of the spring. The elevating mechanism allows the mortar barrel to be adjusted to elevations of 800 mils to 1,065 mils.

b. Traversing mechanism (fig. 6) consists of a traversing screw which passes through the traversing nut that rides along the traversing slide when the screw is turned by the crank. Upper end of elevating screw fits into a tapered socket in the traversing slide on which the traversing screw is mounted. 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 standard is assembled to the barrel, or to take connector brackets when connectors are folded for carrying. The barrel pin thus passes through the traversing nut and barrel coupling when the mortar is assembled and through traversing nut and connector brackets when the mortar standard is folded. A stop pin in upper part of the traversing nut engages a longitudinal groove in the barrel pin, which is reamed eccentrically to take a latch, which locks pin in place. Latch is kept closed by a spring and is released by pushing in on latch knob and turning. The traversing mechanism allows 250 mils traverse, 125 mils right and 125 mils left of center.

Section VII. OPERATION UNDER USUAL CONDITIONS

15. General

The operations listed herein are published only as an outline for personnel concerned with maintenance of the mortar. They are supplemental to those included in FM 23-92 and are not to be construed as conflicting with the normal service of the mortar as described therein.

16. Mounting the Mortar

a. PREPARATION OF GROUND. (1) Select with care location for emplacing the mortar. The ground should be as level and firm as practicable.

(2) Clear underbrush, stones, and roots from space approximately 3 feet wide and 7 feet long, in line with aiming stakes.

(3) Remove loose or sandy topsoil from cleared space. If ground is uneven, level the space for baseplate and base of standard.

b. EMPLACEMENT OF BASEPLATE (FM 23-92). (1) Place baseplate on cleared space, with a line through the aiming stakes bisecting the baseplate cup.

(2) Two men stand on baseplate, rocking it from side to side, until an impression of the **Y**-shaped spade is made on the ground.

(3) Move baseplate to one side and dig groove with pick mattock to a depth of approximately 5 inches along **Y**-shaped impression.

(4) Place spade of baseplate in groove and drop baseplate into position, being careful that both spade and baseplate rim fit snugly into their respective crevices.

(5) Stand on baseplate and force it down until bottom surface rests firmly on ground.

(6) Dig a trench for the standard, the forward slope of which inclines toward the baseplate at about 45°.

c. CONNECTION OF BARREL TO STANDARD. (1) Release upper ends of connector rods (tie rods) by releasing barrel pin (par. 14*b*). Hook standard onto baseplate.

(2) Place base of standard on the forward slope of the trench. Assemble base-cap end of barrel into cup on baseplate and lock in place with cup fork.

(3) Raise support of standard and connect to barrel coupling.

(4) Align barrel and standard approximately on aiming stakes and force spades on base of standard into ground.

(5) Fill sandbags with loose earth or sand for use in holding baseplate and standard firmly in position during firing.

d. TYPES OF MORTAR EMPLACEMENTS. For detailed information on mortar emplacements, see FM 23-92.

17. Laying and Firing Mortar

For computation of firing data and information on laying of mortar and service of the mortar, see FM 23-92.

18. Dismounting Mortar

a. REMOVE SANDBAGS.

b. DISMOUNT BARREL FROM STANDARD. (1) Lower barrel to minimum elevation.

(2) Withdraw barrel pin which connects standard to barrel.

(3) Lift barrel from standard.

c. DISMOUNT BARREL FROM BASE-CAP CUP. (1) Remove cup fork from base-cap cup.

(2) Lift barrel out of base-cap cup.

d. DISCONNECT CONNECTING RODS FROM BASEPLATE. (1) Raise stand-

ard in a rotary motion toward baseplate until eyelets of connecting rods are free.

(2) Turn elevating screw to minimum elevation.

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

(4) Secure connecting rods in slot provided at head of standard by replacing barrel pin.

e. RAISE BASEPLATE FROM FIRING POSITION. (1) Clean around sides of baseplate with pick and pry under rear edge until baseplate can be thrown over (forward) on its face.

(2) Lift baseplate by handles.

Section VIII. OPERATION OF AUXILIARY EQUIPMENT

19. General

This section contains information on the operation of the mortar and ammunition cart, the landing craft mount, and mule pack. For a discussion of sighting equipment, see section XX; for subcaliber equipment, see section XXII.

20. Cart M1A1

a. GENERAL. The cart, 4.2-inch chemical mortar and ammunition, M1A1 (figs. 7 and 8) is designed to carry mortar accessories and spare parts set (par. 8) (except ammunition tool roll and contents), barrel, standard, baseplate, ammunition, and mortar and ammunition cart accessories set M1A1 (par. 82).

b. PLACING LOAD ON CART. Place load on the cart in the following order:

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

(2) Place spade in spade support under front frame angle on left side of the cart, handle extending to rear where it is held by the spade clip (fig. 9). Insert large end of pick mattock handle in pick mattock clip located under front frame angle on right side of the cart, and fit hole in small end of pick mattock handle over pin on rear angle of the cart chassis (fig. 10).

(3) Lay standard on chassis frame (fig. 11), front side up, with connector rods between standard clips on rear frame angle.

(4) Load baseplate with front of plate facing front of cart and rear notch in the baseplate spade entering the baseplate guide on rear angle of cart frame (fig. 12). These notches prevent any lateral movement of the baseplate, and baseplate in turn prevents any movement of the spade, pick mattock handle, and standard.

(5) Place barrel rack on baseplate (fig. 13) with the four pins in the feet of the supporting bracket entering drilled holes in the baseplate.

(6) Put aiming stakes, two on the right and one on the left side, in the barrel rack with points forward. They are retained in place by lock pins passing through holes in the stakes (fig. 14).

MORTAR CART M1A1

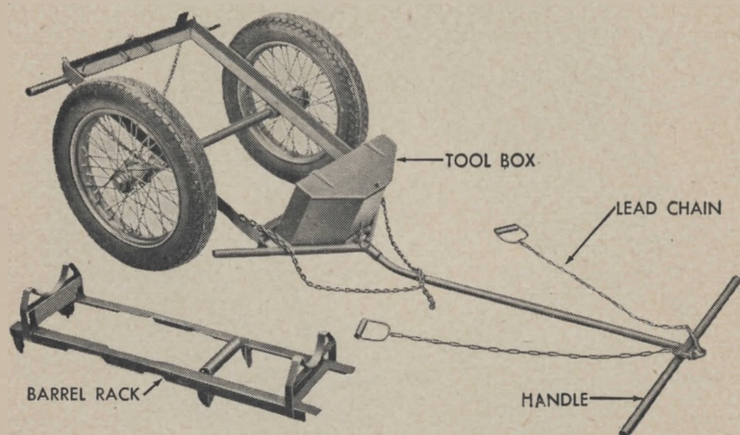


Fig. 7. Mortar and ammunition cart.

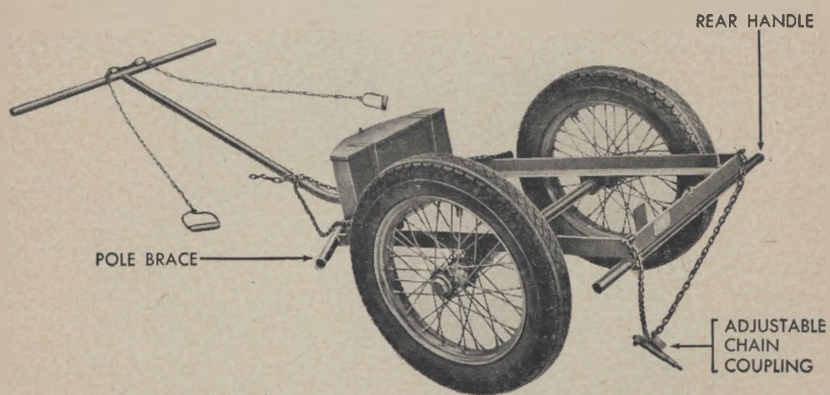


Fig. 8. Mortar and ammunition cart (left rear view).

LOADING THE CART

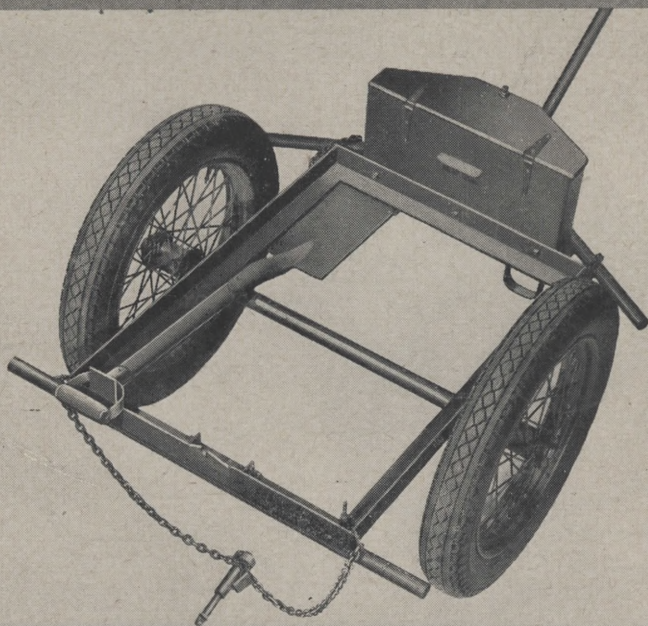


Fig. 9. Spade in spade support.

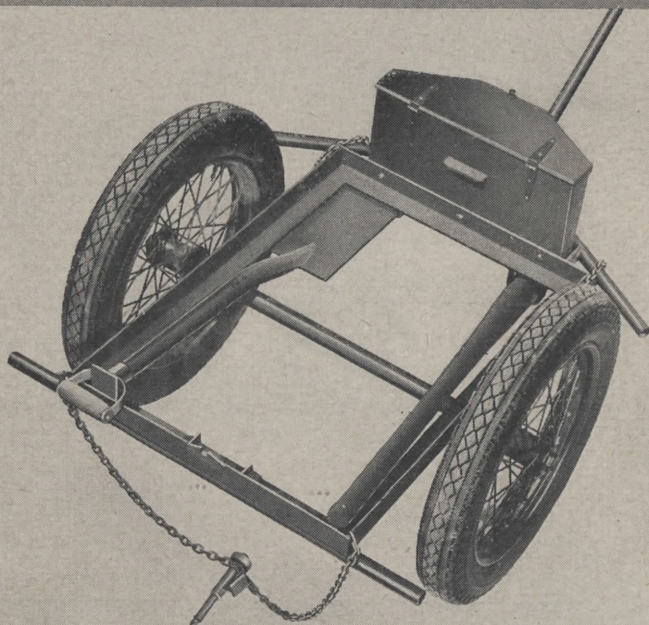


Fig. 10. Pick mattock handle secured to cart chassis.

LOADING THE CART

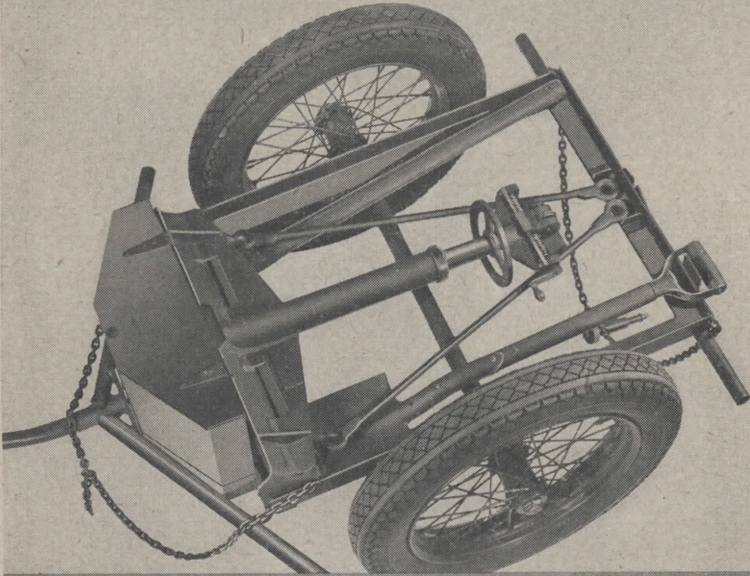


Fig. 11. Standard on chassis frame.

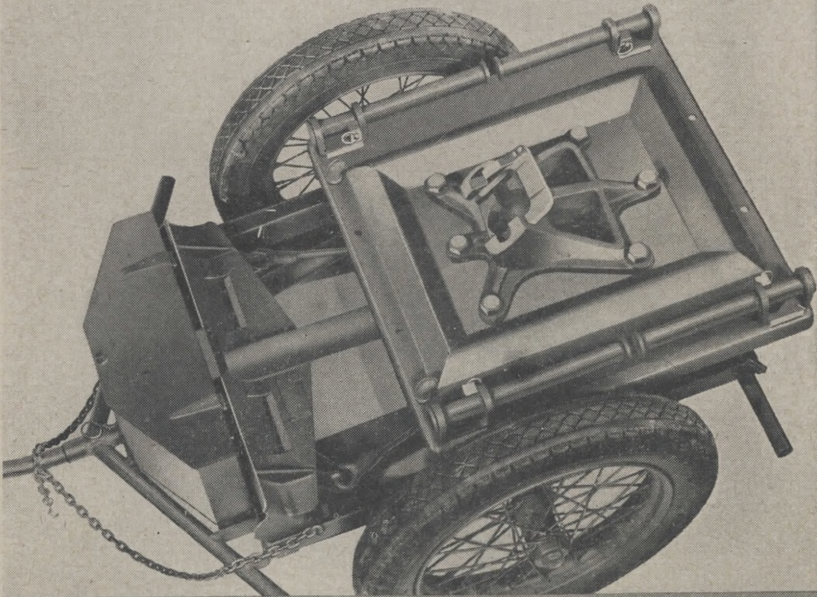


Fig. 12. Baseplate on cart.

LOADING THE CART

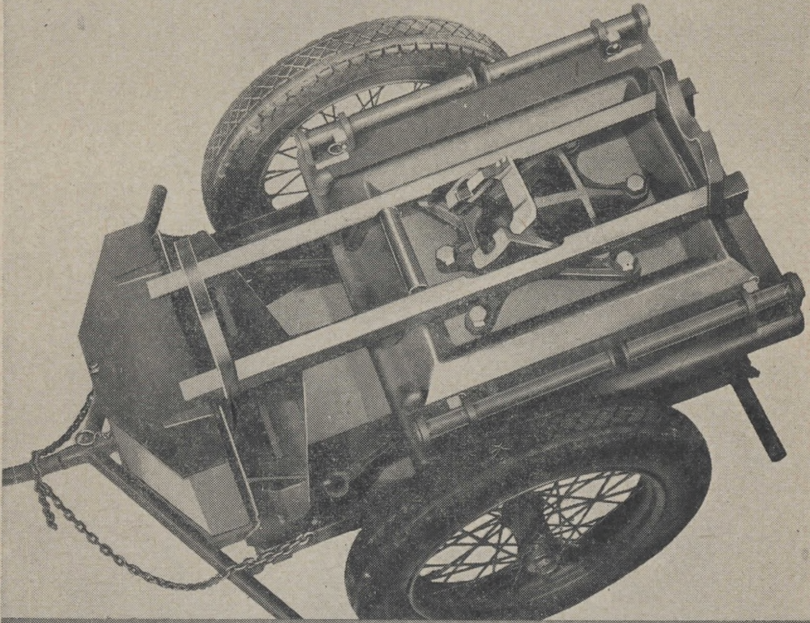


Fig. 13. Barrel rack placed on baseplate.

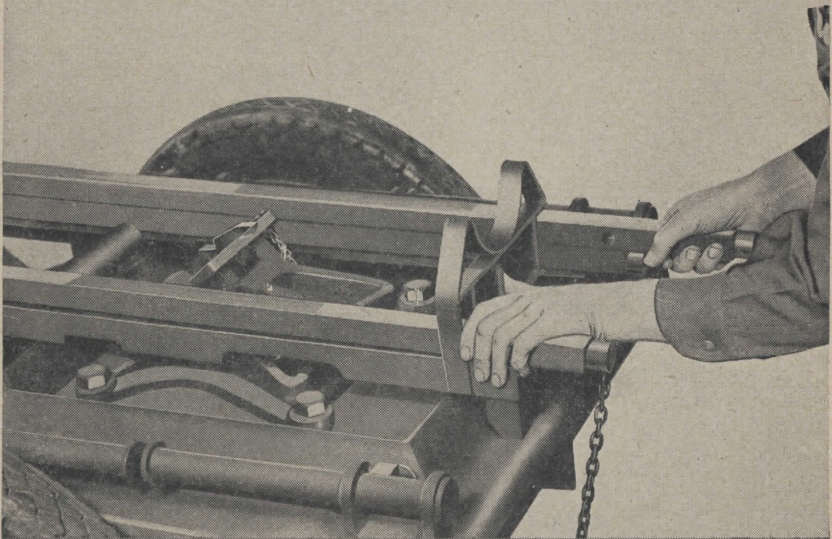


Fig. 14. Releasing lock pin to secure aiming stake.

LOADING THE CART

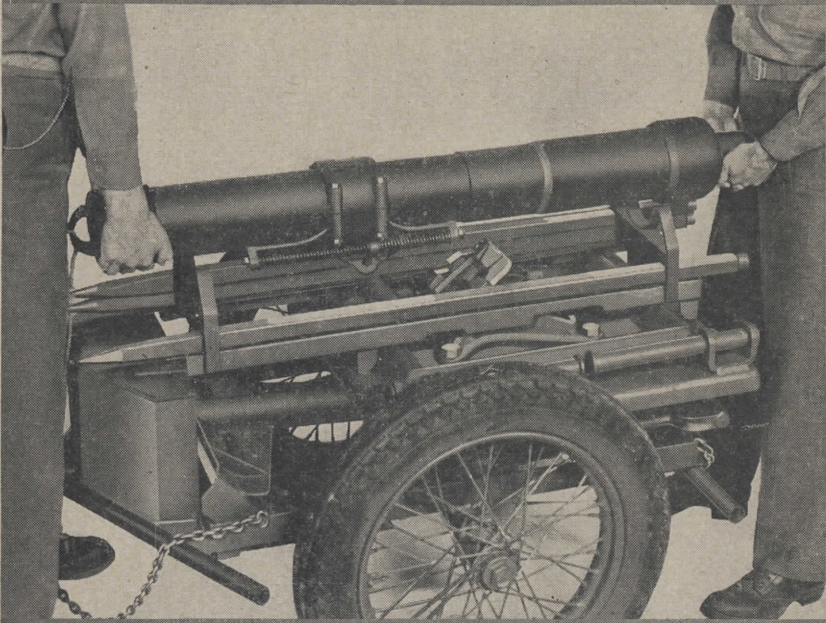


Fig. 15. Loading barrel on rack.

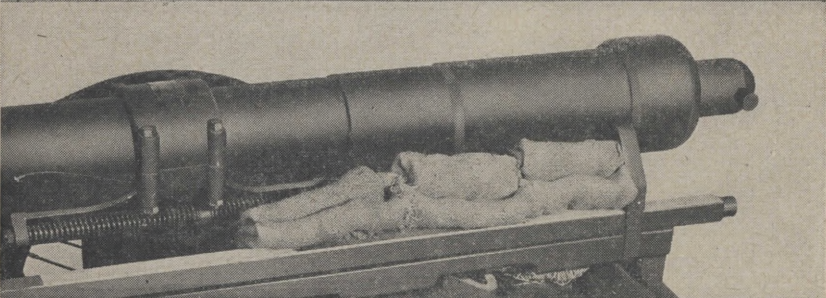


Fig. 16. Stowing sandbags.

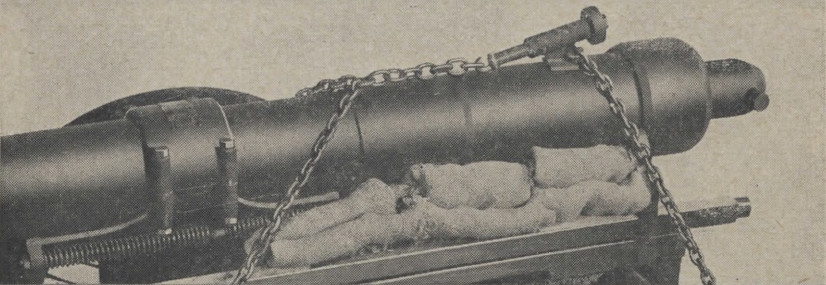


Fig. 17. Chain coupling secured.

(7) Place mortar barrel, with cleaning rod inside barrel and muzzle cover in position, in barrel support with muzzle toward front and move it forward until shock absorber slide is against the front barrel support (fig. 15).

(8) Fold and stow eight sandbags between side angles of rack at rear of baseplate cup. Fold other four sandbags and put them in front of the cup (fig. 16).

(9) Put chain over mortar barrel and tighten chain coupling, thus holding the entire load securely (fig. 17).

c. MAINTENANCE. For maintenance of the cart, see paragraph 83.

21. Landing Craft Mortar Mount E2R2

a. DESCRIPTION See paragraph 85.

b. ASSEMBLY. (1) Remove metal retaining straps from outside of packing crate (fig. 18) by unscrewing bolts holding sub-base assembly and lift sub-base assembly out of base-and-cradle assembly. Turn sub-base assembly right side up (sub-base block up). Unscrew bolts holding standard supports to retaining straps and shipping supports. Bolt standard supports to front end of base-and-cradle assembly by passing bolts through the front liner so that the nut is screwed on from the outside.

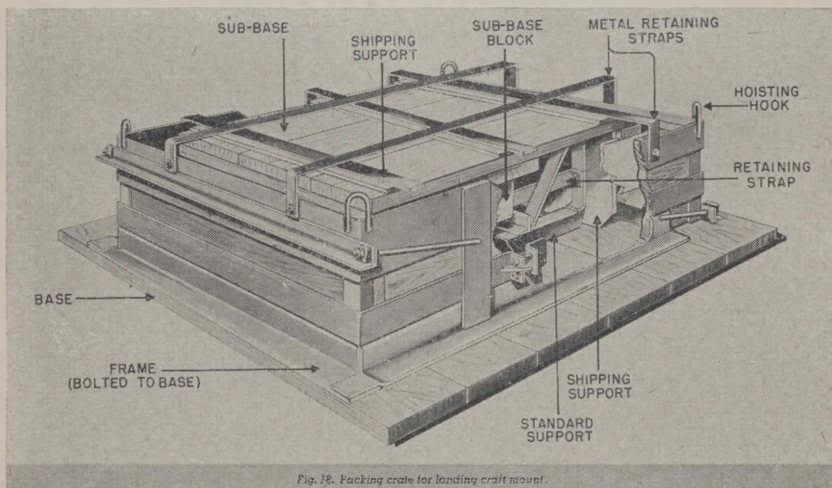


Fig. 18. Packing crate for landing craft mortar.

(2) Place base-and-cradle assembly in the boat by manhandling or by a crane or rollers. Approximately 10 men are required to emplace mount. If rollers or manhandling are employed, lower ramp of landing craft and bring mount onto boat over ramp. Place base-and-cradle assembly, standard support toward bow, so that center of the mortar is approximately 3 feet to rear of center of the landing craft, and so that axis of bore is on an imaginary line running down the middle of the craft from bow to stern. After base-and-cradle assembly is in position, nail 2- by 4-inch or 2- by

6-inch spacers between sides of base and sides of boat in order to prevent shifting of entire mount during its use.

(3) After base-and-cradle assembly is properly located and secured by spacers, pour filling (sand-sawdust mixture) into cradle and tamp thoroughly until it is at a level to support sub-base assembly and so that upper surface of sub-base is flush with top surface of the front and side liners.

(4) After filling has been placed in cradle, lower sub-base assembly to surface of filling (sub-base block to rear) by lowering rear end of sub-base slightly and pressing it against previously emplaced cushion. As soon as rear edge of sub-base is against cushion, lower front end of sub-base to surface of filling. Firmly press sub-base assembly into position so that it is flush with top surfaces of the front and side liners.

(5) Pass 1-inch diameter rope around rear of mount and tie ends tightly to cleats at the forward end of the craft.

(6) Fit mortar baseplate to sub-base block. Make certain that spades fit into grooves firmly. Fit is of extreme importance in keeping mount from shifting while mortar is being fired and to prevent damage to sub-base.

Note. Although MIIA2 baseplate is the only one which fits this sub-base, many MIIA2 baseplates now in service are mislabeled MII. Baseplates labeled MII which fit may be distinguished by a fiber pad under base-cap cup.

(7) Connect connecting rods of standard to baseplate and place base of standard on standard support, as shown in figure 19.

(8) Place barrel in base-cap cup and hold manually until standard is connected to barrel.

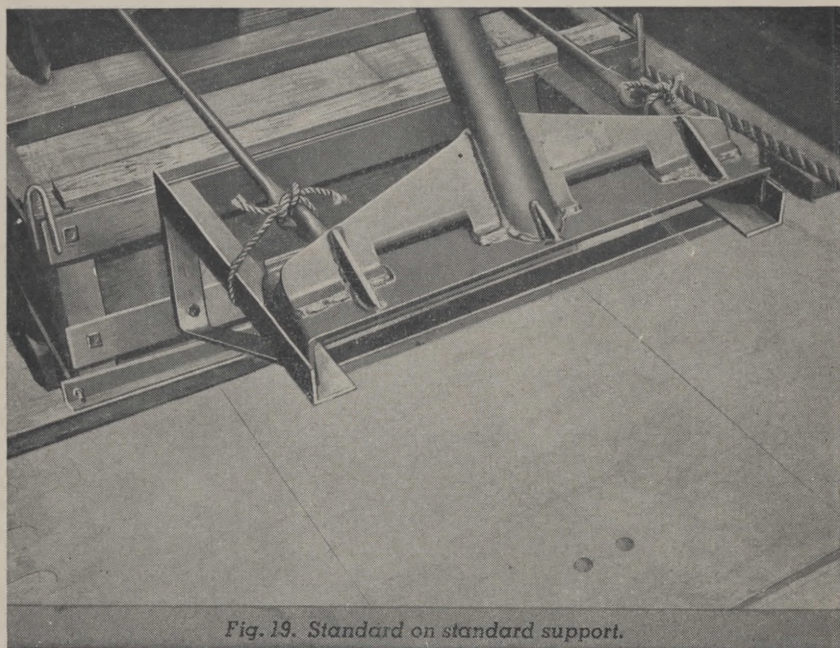


Fig. 19. Standard on standard support.

(9) After standard is connected to barrel with barrel pin, tie base of standard with two pieces of rope. This tying is necessary to keep base of standard from jumping off the support when the mortar is fired. The lines should be fairly loose, however, to prevent cracking of tie rods when mortar is fired.

c. PRECAUTIONS. (1) Make certain filling is firmly tamped and level before placing sub-base on it.

(2) Check barrel pin to make certain it is locked.

(3) Keep constant check on the cushion during firing to be sure it is not forced out of position.

(4) Check rope holding standard to the support and make certain it is sufficiently tight to keep standard from jumping clear of the support.

22. Mule Pack M2

a. GENERAL. The procedure described below is only a guide ; variations may be utilized, depending upon circumstances and available equipment. Description of the mule pack is given in paragraph 86.

b. SADDLING MULES. See FM 6-110.

c. LOADING BARREL AND STANDARD MULE. (1) After the mule is saddled, hook near side and offside accessory hangers (the latter with spade attached) to the hanger bars.

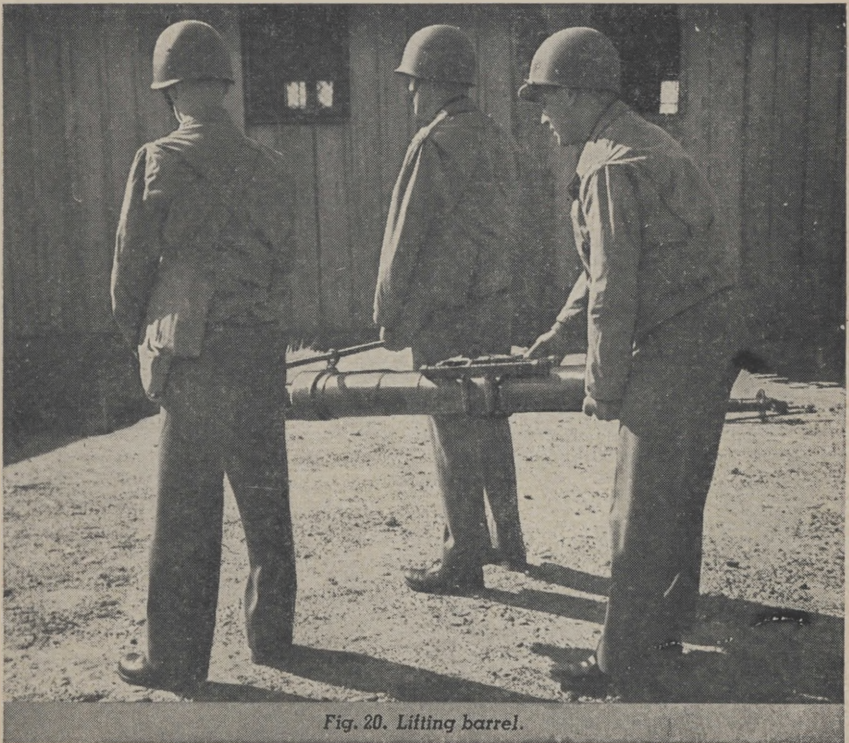


Fig. 20. Lifting barrel.

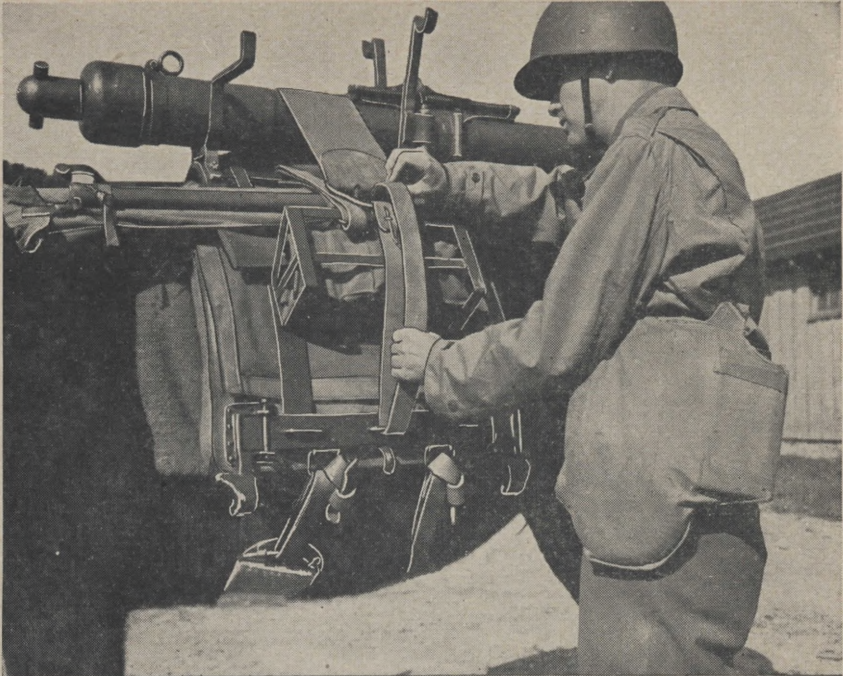


Fig. 21. Fastening cincha.



Fig. 22. Fastening standard straps.

(2) Pass the lifting bar through the lifting eye. Two men are required to lift the tube-cap end of the barrel, and a third is required to lift the muzzle end (fig. 20). Raise the barrel and place it in the adapters on the saddle. The man at the muzzle end steadies the shock absorber slide with one hand in order that the barrel coupling and shock absorber slide are to the top of the barrel when it is placed in the adapters. Withdraw lifting bar and place on the ground 5 feet from offside of animal.

(3) Place cincha M7 over barrel and accessory hangers and fasten to the center bottom bar staple on either side of the saddle (fig. 21).

(4) Two men place standard on standard adapters and secure by means of four standard tie-down straps (shorter straps in front), fastening them to the outside bottom bar staples on each side of the saddle (fig. 22).

(5) Place lifting bar behind straps on near side of mule and between cincha and saddle and pull down as far as possible with both hands.

(6) Figure 23 shows mule loaded with the barrel and standard.

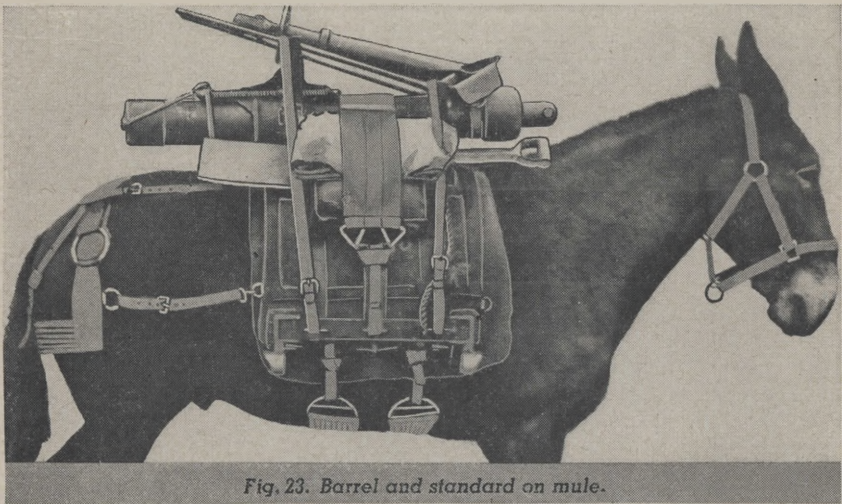


Fig. 23. Barrel and standard on mule.

d. LOADING BASEPLATE ON MULE. (1) After the mule is saddled, place ammunition hanger on saddle (fig. 24) and secure to center staples on bottom bars of saddle frame by means of straps on the hanger. Fasten two rounds of ammunition (in individual containers) to ammunition hanger by small straps attached to the hanger.

(2) Lift baseplate by retractable handles, raise overhead, and place in adapter. Four men are required to place baseplate in position (fig. 25). Retract handles and secure baseplate by means of four baseplate tie-down straps. Fasten all straps simultaneously so that baseplate may not be dislodged by uneven pressure.

e. LOADING MULE WITH AMMUNITION. (1) Attach four ammunition load straps to saddle hanger bars and fasten at buckle ends; also fasten with two straps at the front of the saddle and two at the rear.

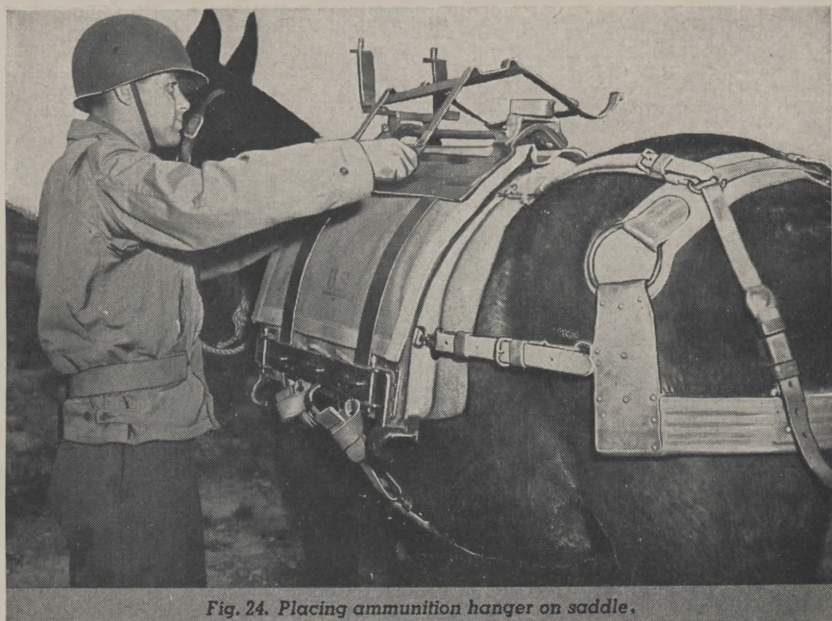


Fig. 24. Placing ammunition hanger on saddle.

(2) Thread straps through the bottom staples on their respective sides and draw them up. One round is cradled in the straps on the near side, and one round in the straps on the offside. Loop the straps around each of these two rounds and cradle a second round on each side on top of the first round rolled. This operation is continued until five rounds are loaded on each side. Fasten front and rear buckles on each side simulta-

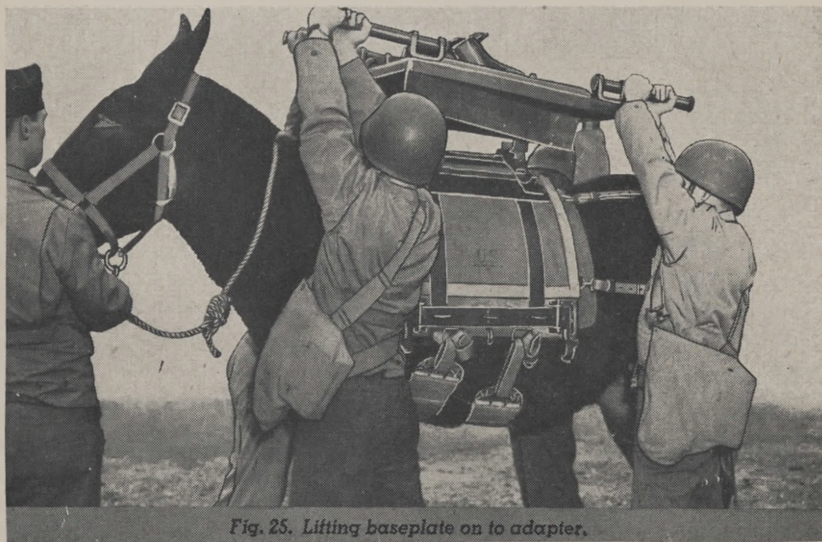


Fig. 25. Lifting baseplate on to adapter.

neously to balance the load properly. Fuzes of shell should point forward to obtain maximum stability. Figures 26 and 27 show complete load of 10 rounds lashed to the saddle.



Fig. 26. Ten rounds of ammunition lashed to saddle.

f. UNLOADING MORTAR MULES. (1) Place mules with baseplate load approximately 6 feet in front of the desired mortar position and facing direction of fire.

(2) Face mule with barrel and standard load in opposite direction, 6 feet to the right and 6 feet to the rear of the desired mortar position.

(3) Unfasten straps holding the baseplate and extend retractable handles. Four men are required to lift baseplate from the saddle, to carry it 6 feet to the rear, and to lower it to the ground.

(4) Remove the strap which secures ammunition hanger to the saddle and remove hanger from saddle and place on the ground approximately 3 feet to the left of the baseplate. Unfasten straps holding ammunition on hanger.

(5) Remove the four straps holding standard on adapters, lift standard from adapters, and place on the ground approximately 3 feet to the right of the baseplate.

(6) Remove M7 cincha.

(7) Using lifting bar, have three men remove barrel from barrel



Fig. 27. Ten rounds of ammunition lashed to saddle.

adapters, reversing procedure used to place it in the adapters. Barrel is placed on the ground 3 feet to the right of the standard.

(8) Remove sandbags from the hanger and place on the ground 2 feet in rear of the standard.

(9) Place spade and offside accessory hanger and contents on the ground 2 feet to the left of the barrel.

(10) Place near side accessory hanger and contents on the ground 2 feet to the right of the barrel.

(11) When equipment has been unpacked, move animals from vicinity of mortar position.

Section IX. OPERATION UNDER UNUSUAL CONDITIONS

23. Operation in Cold Climates

a. GENERAL. Cold weather limits the operation of the mortar. The mortar cannot be fired at long ranges when emplaced in frozen ground without causing mechanical damage. Also, high pressures developed with the full charge at low temperatures do not permit use of the full charge (25½ rings) below 0° F.

b. LUBRICATION. Section XII discusses lubrication under frigid conditions.

c. BARREL CLEANING SOLUTION. Cleaning a cold mortar after firing cannot be accomplished in the normal manner at temperatures below 32° F., because water freezes in the barrel. If cleaning can be done with the barrel hot, and if hot water is available, soap, soda ash, or sal soda solution can be used; otherwise, it is necessary to add alcohol, glycerine, or ethylene glycol to the solution. To 10 parts by volume of cleaning solution, add the number of parts of one of the antifreezes shown below.

<i>Temperature</i>	<i>Glycerin</i>	<i>Alcohol</i>	<i>Ethylene glycol</i>
20° F	2½	2	2
10° F	5	4	3⅓
0° F	6½	6½	5
—15° F	10	9	7¼
—30° F	13	16	10
—40° F	16	27	12

24. Operation in Hot Climates

a. No special lubricant is required when operating in hot climates.

b. Since sand and dust in combination with oil produce a cutting compound, operating mechanisms of the mortar should be carefully cleaned and operated dry, where conditions are such that sand and dust are likely to get into these parts. At frequent intervals, wipe off any accumulation of sand or dust. At conclusion of firing operations, clean matériel, apply usual lubricant, and cover matériel.

c. Keep sand and dust out of bore, since the presence of foreign matter results in rapid erosion of the bore when the mortar is fired. An accumulation of dirt in the bore may cause expansion of the tube after only a few rounds have been fired. Keep close-fitting muzzle cover on at all times during transport and when mortar is not actually firing.

d. Where temperature and humidity are high or where salt air is present, inspect all parts thoroughly at frequent intervals and use proper care and maintenance to guard against rusting and corrosion.

Section X. DEMOLITION TO PREVENT ENEMY USE

25. General

a. The destruction of matériel when subject to capture or abandonment in the combat zone will be undertaken by the using arm only when, in the judgment of the military commander concerned, such action is deemed necessary and as a final resort to keep the matériel from reaching enemy hands.

b. Adequate destruction of matériel means damaging it in such a way that the enemy cannot restore it to usable condition in the combat zone either by repair or by cannibalization. Adequate destruction requires that—

(1) Enough parts essential to the operation of the matériel must be damaged.

(2) Parts must be damaged beyond repair in the combat zone.

(3) The same parts must be destroyed on all matériel so that the enemy cannot make up one operating unit by assembling parts from several partly destroyed units.

26. Procedures

a. Render barrel useless by puncturing with .30-caliber bullets or by inserting three M14 incendiary grenades. Drop two unarmed grenades into barrel. Drop in a third grenade with safety pin removed; this grenade ignites the first two. Incendiary grenades M14 are not explosive and have a 2-second delay in fuze functioning. They may be safely placed at a desired point, armed by removing the safety pin, and ignited by releasing the lever. Apply another grenade to that point of the baseplate at which it joins the barrel. Damage standard by use of incendiary grenade or by smashing elevating and traversing screw threads with a heavy hammer or wrench. Run out elevating screw fully before smashing it.

b. Stack mortar and ammunition cart and all accessories, including tools, shell carrier, and powder. Puncture cart tires. Ignite matériel by placing an M14 incendiary grenade over a crack at the top of the stack.

c. Carry out demolition of ammunition as described in TM 9-1901.

d. For a description of TNT blocks and accessories, methods of using them, and precautions requisite to their safe handling, see FM 5-25 and TM 9-1904. The M14 incendiary grenade is described in FM 23-30.

PART THREE

MAINTENANCE INSTRUCTIONS

Section XI. GENERAL

27. Scope

Part three contains information for guidance of personnel of the using organizations responsible for first and second echelon maintenance of this equipment. It contains information needed for performance of scheduled lubrication and preventive maintenance services, as well as descriptions of major systems and units and their functions in relation to other components of the equipment.

Section XII. LUBRICATION

28. Lubrication Orders

a. Lubrication instructions for this matériel are consolidated in lubrication orders. These specify points to be lubricated, periods of lubrication, and lubricants to be used.

b. War Department Lubrication Order LO 3-320-1 (mortar) and LO 3-320-2 (cart) prescribe first and second echelon lubrication maintenance (figs. 28 and 29).

c. Lubrication instructions on the order are binding on all echelons of maintenance, and there shall be no deviations from these instructions.

Section XIII. PREVENTIVE MAINTENANCE SERVICES

29. General

a. SCOPE. Preventive maintenance services prescribed by Army Regulations are a function of using organization echelons of maintenance. This section contains preventive maintenance service allocated to the squad and scheduled preventive maintenance service allocated to organizational maintenance (second echelon).

b. GENERAL CARE. Keep the bore of the barrel and all unpainted surfaces clean and free from rust. Always keep bore lightly oiled with a light oil when not in actual use and keep muzzle covered with muzzle cover. Use of the muzzle cover is especially important in rainy weather, since water, in addition to causing rust, may seriously decrease range of the mortar. Muzzle cover should be held in place by cord. Take care that mortar barrel is not dropped; such an occurrence may deform the tip of the muzzle.

WAR DEPARTMENT LUBRICATION ORDER LO 3-320-1

20 Mar 1945

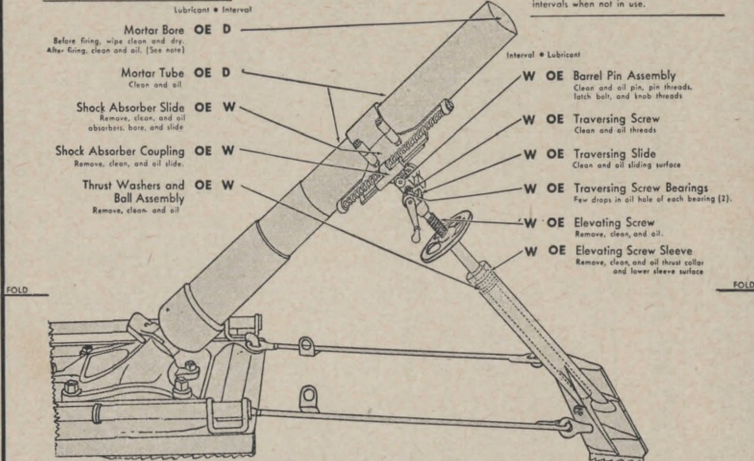
MORTAR, CHEMICAL, 4.2 INCH, M2

References, TM 3-320.

Clean parts with SOLVENT, dry cleaning, or CLEANER, rifle bore. Dry before lubricating. Lubricate after exposure to extreme moisture.

THIS WDLO MAY BE FASTENED TO INSIDE LID OF PACKING CHEST, OR FOLDED INTO TM 3 - 320.

Intervals are based on actual operation under normal conditions. Reduce intervals under extreme conditions, such as dusty atmosphere or extreme humidity. Extend intervals when not in use.



NOTES

MORTAR BORE—After firing, and on 3 consecutive days thereafter, clean with CLEANER, rifle bore. After 4th cleaning, wipe dry and oil. If mortar will not be fired within next 24 hours. Daily, when active but not firing, renew the oil film—every 5 days, clean with CLEANER, rifle bore, dry and reoil.

Copy of this lubrication order will remain with the equipment at all times; instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 20 Mar 1945. [A.G. 300.8 (20 Mar 1945)]

By Order of the Secretary of War:

G. C. MARSHALL,
Chief of Staff.

Official:
J. A. ULIO,
Major General,
The Adjutant General.

KEY

LUBRICANTS	EXPECTED TEMPERATURES			INTERVAL
	above 32° F.	32° F. to 0° F.	below 0° F.	
OE—OIL, engine	SAE 30	SAE 10	PS	D—Daily
PS—OIL, lubricating, preservative, special				W—Weekly

Requisition additional lubrication orders in conformance with instructions and lists in FM 21 - 6.

Fig. 28. Lubrication order.

30. Maintenance Before Firing

- a. Remove coat of rust-preventive compound by use of burlap or waste dipped in a solvent such as gasoline.
- b. Remove all oil from the bore and any excess oil on outside of barrel and on standard.
- c. See that the striker pin is screwed firmly in base cap if M2 barrel is used, and see that base cap is screwed tightly on barrel, insuring a gastight fit. Use base-cap wrench for tightening base cap.
- d. See that all nuts, bolts, and screws are in position and securely tightened.

31. Maintenance During Firing

- a. Swab out barrel after every five rounds, except in rapid fire.
- b. Examine base cap and striker pin at every opportunity; clean and tighten (when M2 barrel is used).

WAR DEPARTMENT LUBRICATION ORDER

LO 3-320-2

15 APR 1945

CART, 4.2 INCH CHEMICAL MORTAR AND AMMUNITION, M1A1

References: TM 3-320

Interval • Lubricant

	W	CG	Pole & Pole Pin Socket Clean and coat
	W	OE	Tool Box Latch
	W	OE	Tool Box Hinges
	M	CG	Wheel Bearings
	W	OE	Coupling Remove screw and slide, Clean and oil
	W	OE	Mortar Rack Stake Lock Pins

KEY

LUBRICANTS	EXPECTED TEMPERATURES		INTERVALS
	Above +32°F.	+32°F. to 0°F. Below 0°F.	
OE—OIL, engine	OE 30	OE 10	W—Weekly
CG—GREASE, general purpose	CG 1	CG 0	M—Monthly
PS—OIL, lubricating, preservative, special			

NOTES

Clean fittings before lubricating. Lubricate after washing or deep water fording.

Clean parts with SOLVENT, dry cleaning, or OIL, fuel, Diesel. Dry before lubricating.

Reduce intervals under severe operating conditions.

These instructions are mandatory and supersede all conflicting lubrication instructions prior to 15 Apr 1945

[A.G. 300.8 (15 Apr 1945)]
By Order of the Secretary of War:
G. C. MARSHALL,
Chief of Staff.

Official: J. A. ULIO,
Major General,
The Adjutant General.

Requisition additional Lubrication Orders in conformance with instructions and list in FM 21-6.

Fig. 29. Lubrication order.

32. Maintenance After Firing

- a. Unscrew base cap and clean and sponge out barrel, removing all residue.
- b. Clean striker pin.
- c. Clean base cap.
- d. Oil traversing, elevating, and shock absorbing mechanisms according to lubrication order (fig. 28).

- e. Extract barrel pin and lubricate sliding surface.
- f. Clean baseplate.
- g. Tighten all nuts and screws.

Section XIV. MALFUNCTIONS AND CORRECTIONS

33. Misfire

a. DEFINITION. A misfire is failure of the mortar to fire or fire properly.

b. FACTORS WHICH MAY FIRE MISFIRED ROUND UNEXPECTEDLY. (1) Dislodging of round hung up in the tube, with subsequent striking on striker pin.

(2) Dislodging of obstructions that may have prevented initial firing.

(3) Ignition of powder from hot or smoldering residues left from previous rounds.

(4) Ignition of powder from heat of the clean barrel.

(5) Delayed functioning of primer.

c. GENERAL PRECAUTIONS. (1) If possible, isolate all misfires of mortar and round until barrel is cool. **Caution:** Do not attempt to cool barrel by artificial methods.

(2) Jar barrel thoroughly but safely by either of the following methods:

(a) With a rope wrapped around the barrel, two men, one on each side of the barrel, hold the free ends of the rope and alternately pull the rope.

(b) The squad leader, standing at side of barrel, strikes the barrel several sharp blows with a heavy blunt object. If barrel is cool, allow at least 1 minute to elapse after jarring, before handling misfire. If barrel is hot, *allow barrel to cool.*

(3) If circumstances do not permit waiting for the barrel to cool, jar the barrel thoroughly and allow a minimum of at least 10 minutes to elapse before attempting removal of misfire.

d. REMOVING MISFIRE. (1) A minimum of personnel (preferably not more than two) should approach the mortar, keeping away from the front and rear of the barrel.

(2) To remove the round, the base of the barrel is raised by one man. Take care so that base of barrel is elevated steadily and that round moves only toward the muzzle. The misfired round will slide out of the muzzle easily and must be caught by the second man. Do not touch the striker.

(3) Immediately replace the safety pin in the fuze.

(4) If shear wire is broken and shell is armed, disarm fuze assembly according to instructions in paragraph 38b.

34. Mortar Malfunctions

<i>Cause</i>	<i>Remedy</i>
(1) Eccentric tube.	Replace tube.
(2) Obstruction in tube.	Remove obstruction and refire round.
(3) Dirty tube.	Clean tube (par. 4, app. I).
(4) Defective or missing striker pin.	Replace striker pin (par. 41).
(5) Damaged rifling.	Replace tube.

35. Round Malfunctions

<i>Cause</i>	<i>Remedy</i>
(1) Eccentric shell body or components.	Remove and replace round.
(2) Burs, rust, paint, or dirt on round.	Remove any burs, rust, or paint with very fine emery or crocus cloth.
(3) Oversized shell body.	Remove and replace round.
(4) Obstruction covering striker nut.	Remove and replace round.
(5) Defective cartridge container (for example, threads).	Remove and replace round.
(6) Failure to insert ignition cartridge in cartridge container.	Unscrew striker nut, insert cartridge, and reassemble with new striker nut.
(7) Defective striker point on striker nut.	Replace striker nut.
(8) Defective primer or cartridge.	Replace cartridge.
(9) Striker nut assembly not screwed tightly against primer.	Replace striker nut.
(10) Defective striker nut (for example, threads or concentricity).	Replace striker nut.

36. Malfunctions Affecting Assembly

a. EXCESSIVE MOVEMENT OF COUPLING ON SLIDE.

<i>Cause</i>	<i>Remedy</i>
Broken recoil springs or broken front or rear springs.	Replace broken springs (par. 44).

b. NO MOVEMENT OF COUPLING ON SLIDE.

<i>Cause</i>	<i>Remedy</i>
Deformed slide or coupling.	Replace.

c. INABILITY TO ELEVATE OR DEPRESS BARREL.

<i>Cause</i>	<i>Remedy</i>
(1) Bent or broken elevating screw.	Replace elevating screw.

To remove elevating screw:

(1) Unscrew slide and elevating screw assembly from standard support by turning screw in counter-clockwise direction until the assembly is free of the standard support.

(2) Remove the four bearing screws holding the two traversing screw bearings to the traversing slide (fig. 30).

(3) Slide traversing mechanism off the traversing slide (fig. 31).

(4) Remove cap screw on top of the traversing slide (fig. 32).

(5) Using hammer, tap traversing slide until it falls free of the elevating screw (fig. 33).

To replace elevating screw, reverse above procedure.

(2) Defective cup fork.	Replace (par. 53).
-------------------------	--------------------

d. LACK OF FREEDOM IN COLUMN OF STANDARD.

<i>Cause</i>	<i>Remedy</i>
Broken standard spring or deformed parts.	Replace standard.

37. Malfunctions Affecting Operation

a. SHORTENED RANGE.

<i>Cause</i>	<i>Remedy</i>
(1) Oil or water in barrel.	Remove oil or water and dry barrel.
(2) Wet propelling charge.	Use new charge or dry powder in warm, dry air.

b. EXCESSIVE MOVEMENT OF MORTAR DURING FIRING.

<i>Cause</i>	<i>Remedy</i>
(1) Improper seating.	Emplace properly (FM 23-92).
(2) Insufficient number of sandbags.	Add sufficient number of sandbags.
(3) Broken cup fork.	Replace (par. 53).

REPLACING ELEVATING SCREW

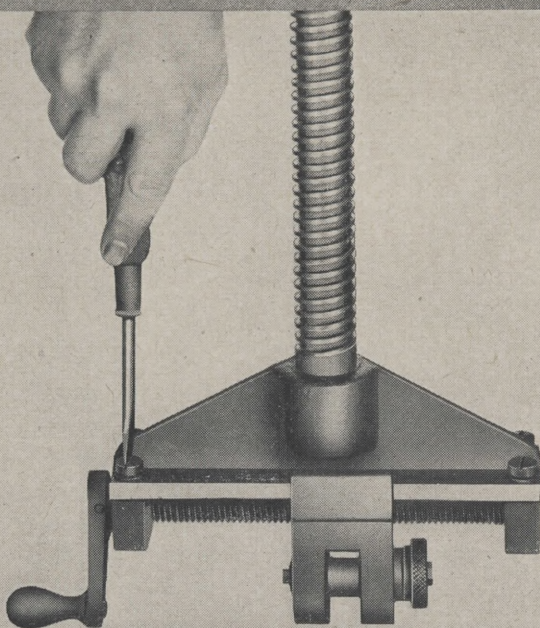


Fig. 30. Removing bearing screw.

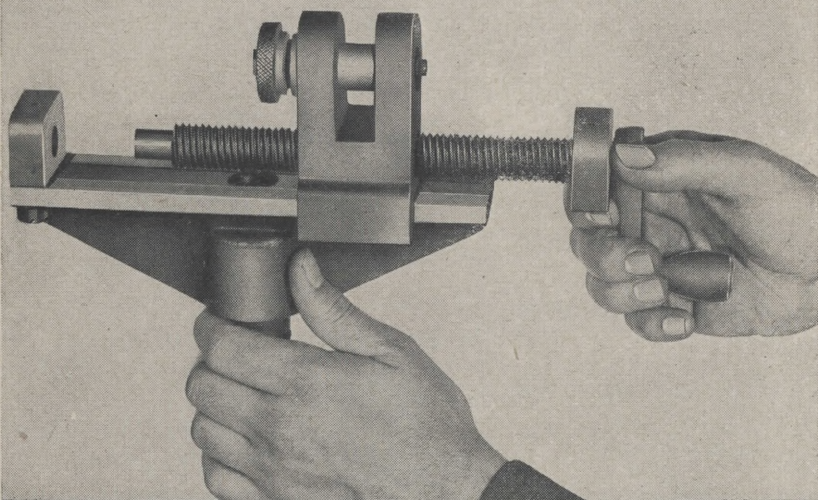


Fig. 31. Sliding off traversing mechanism.

REPLACING ELEVATING SCREW

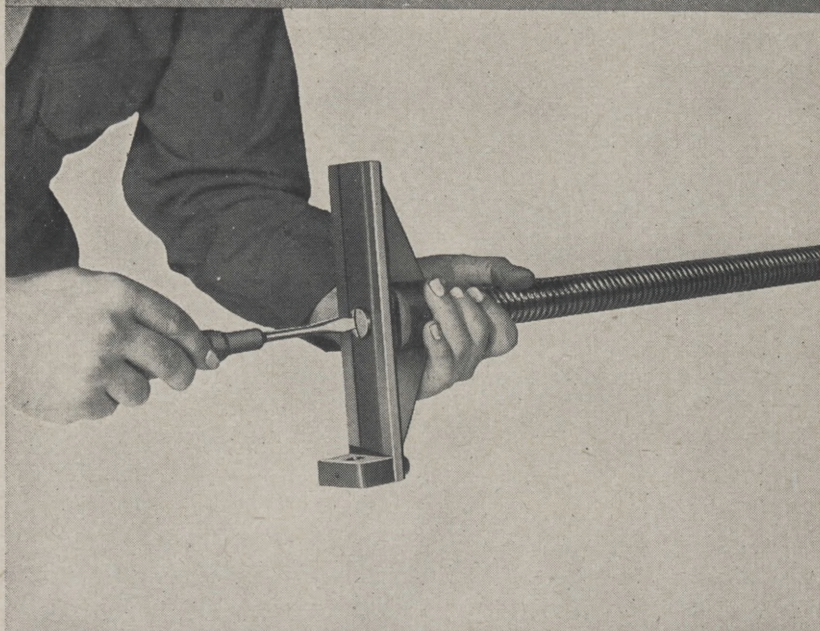


Fig. 32. Removing cap screw.

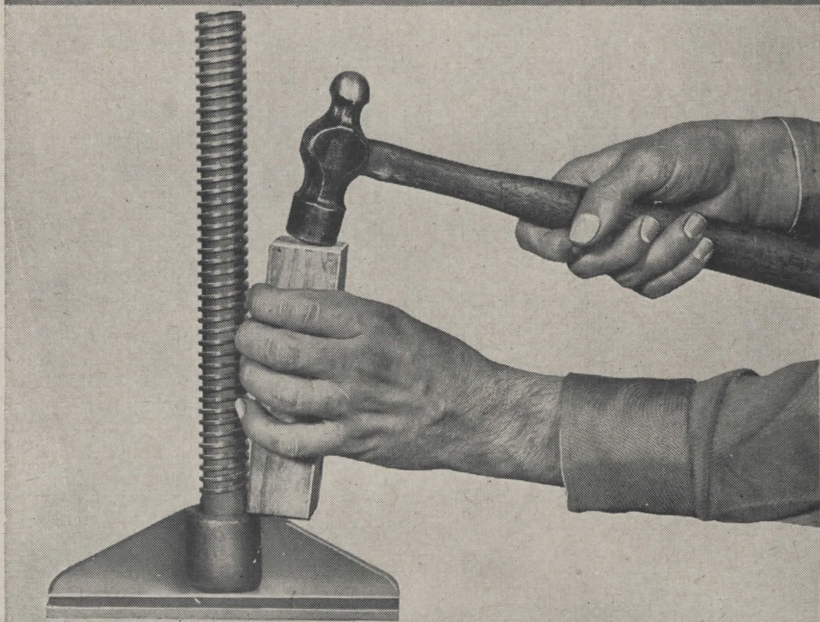


Fig. 33. Disconnecting traversing slide from elevating screw.

38. Fuze Malfunction

a. FAILURE OF ROUNDS TO BURST ON IMPACT.

<i>Cause</i>	<i>Remedy</i>
(1) Failure to pull pin.	Pull pins on future rounds.
(2) Defective fuze.	If pins are pulled and duds occur, change fuze lot and report defective fuzes on appropriate form (par. 2).

b. PREMATURE ARMING OF FUZE.

<i>Cause</i>	<i>Remedy</i>
(1) Steel balls in fuze defective or missing.	If fuze is armed, the round must not be fired, since it will be certain to burst inside barrel through force of impact and shock caused by propelling charge. An armed fuze may be disarmed by loosening setscrew (fig. 34) until striker flies off (fig. 35). In zone of interior, the two steel balls are also removed (fig. 36), and these, together with striker and shell, are sent for examination to Chemical Warfare Service Technical Command, Edgewood Arsenal, Md. If no balls are found, a notation to that effect should be inclosed. In a theater of operations, an armed fuze must first be disarmed and then removed carefully from the shell, using a fuze wrench. The faulty fuze is destroyed by proper authorities, in accordance with TM 9-1900. Extreme care must be exercised in handling armed fuzes. They must <i>not</i> be disassembled.
(2) Missing or defective shear wire.	Disarm fuze according to procedure described above.

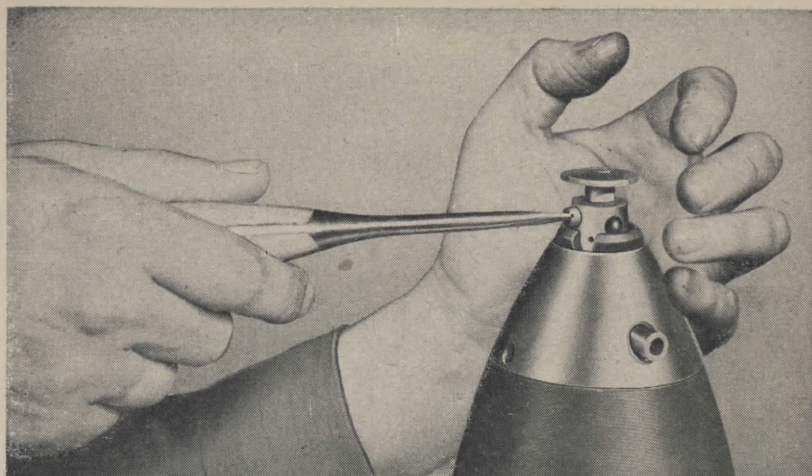


Fig. 34. Loosening the set screw.

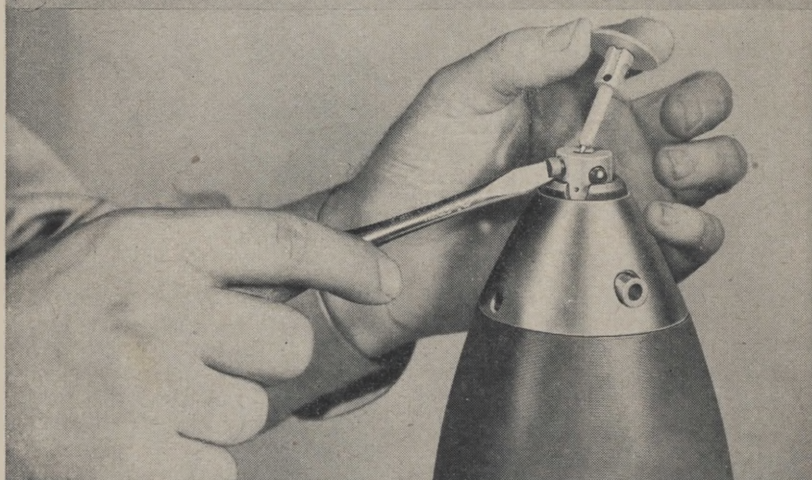


Fig. 35. Striker being removed.

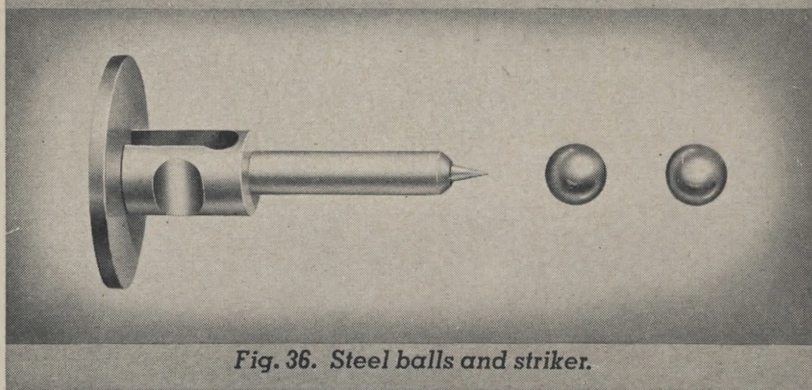


Fig. 36. Steel balls and striker.

Section XV. BARREL M2

39. General

a. The barrel, 4.2-inch chemical mortar, M2, is a steel barrel 48 inches long, having an outside diameter graduated 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 between lands. To facilitate rifling, the tube is made with both ends open. With the M2 barrel (fig. 37), the tube cap screws onto the base end, and a base cap screws onto the tube cap. On inside of the base cap is a $\frac{3}{4}$ -inch hole threaded to receive the striker pin, which projects inside the barrel. A copper base-cap washer is placed in base cap to insure a gastight joint between base cap and barrel. With the revised M2 barrel (fig. 38), the tube cap, base cap, and striker pin are cast in one piece and are screwed on the tube as a unit. A single base-cap pin is pressed into base cap and secured by a cross pin driven in. When mortar is assembled, the pin fits into slots in base-cap cup of the baseplate and prevents rotation of the barrel during firing.

b. The barrel is rifled with 24 lands and grooves. Depth of groove is 0.03 inch, and width is 0.486 inch; width of land is 0.062 inch. Length of pitched rifling is 42 inches; pitch increases from 0 at the breech to 1 turn in 20 calibers (84 inches) at the muzzle.

c. A leather muzzle cover is placed over muzzle end of the barrel when not in use to protect interior surfaces from grit and moisture.

40. Removing and Replacing Base Cap

a. M2 BARREL. (1) To remove base cap, use special wrench provided for this purpose, applying wrench to the radial pins on the base cap (fig. 39). Sharp blows with a hammer on the handle of the wrench may be necessary to start the threads. If this procedure is not successful, send barrel to higher echelon to have base cap removed.

(2) To replace base cap, use special wrench. See that base-cap washer is in place. To avoid gas leaks, be sure there is a tight fit on face of base-cap washer, between base cap and barrel.

b. REVISED M2 BARREL. Base cap is not replaceable. Entire tube cap assembly must be replaced by higher echelon.

41. Removing and Replacing Striker Pin

a. M2 BARREL. (1) To remove striker pin, remove base cap from barrel and apply a wrench to the flat milled section of the striker pin (figs. 40 and 41). Base cap may be kept from rotating during this operation by the base-cap wrench or the base-cap cup.

(2) To replace striker pin, proceed in reverse order to that prescribed in (1) above. Put a drop of oil on the threads before screwing striker pin firmly into base cap.

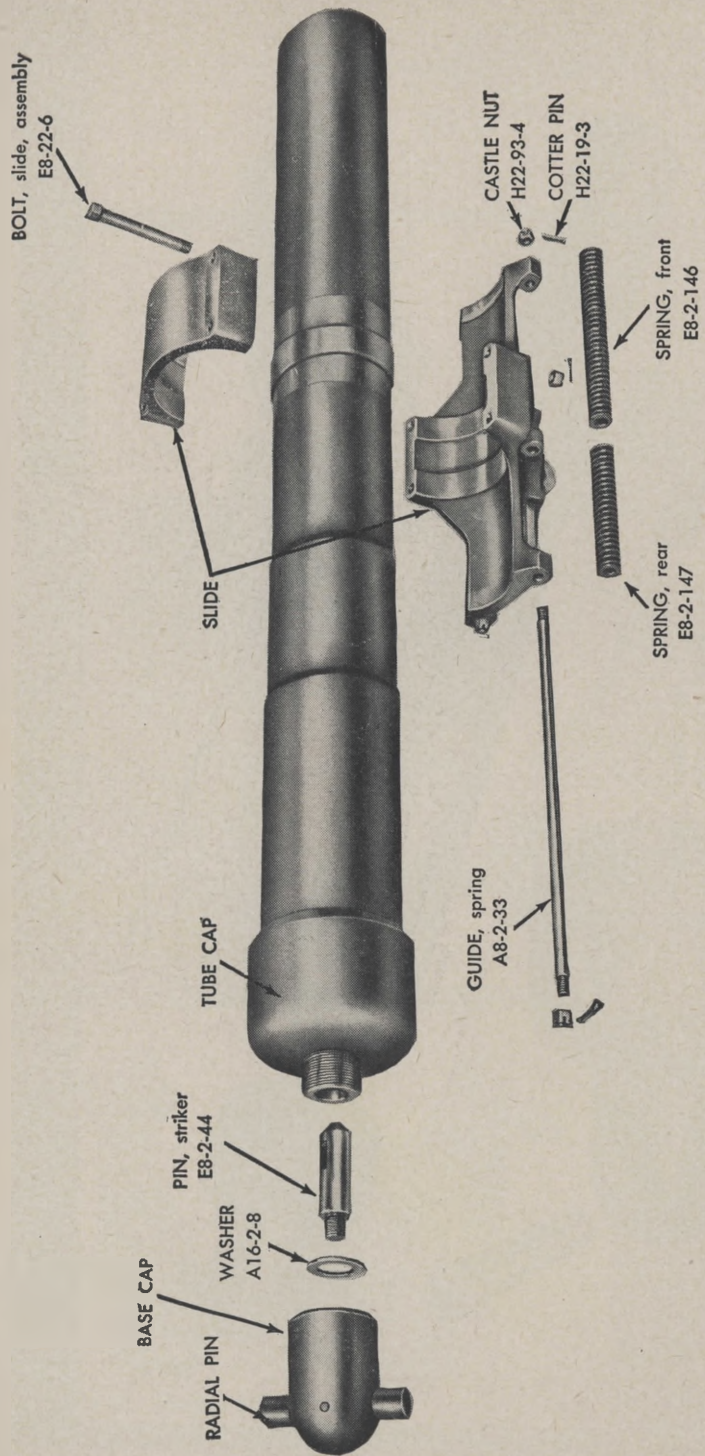


Fig. 37. Exploded view of barrel M2.

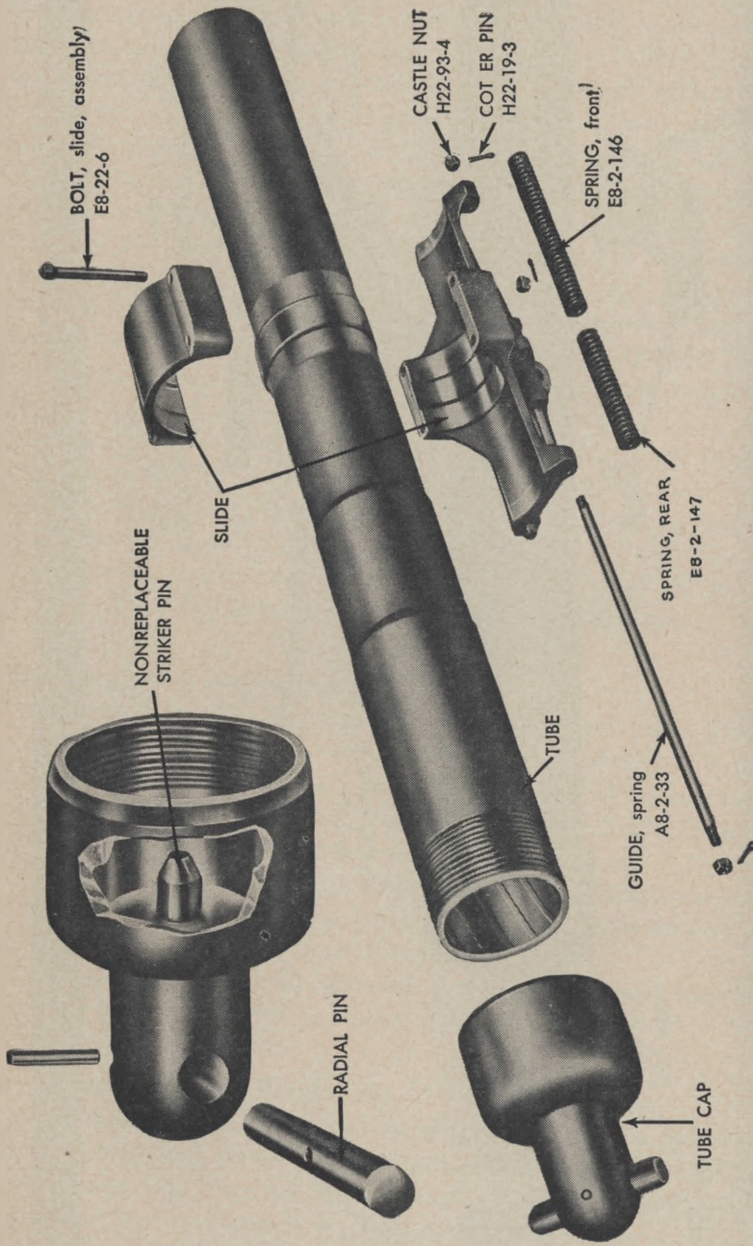


Fig. 38. Exploded view of barrel M2 (revised) showing sectioned tube cap.

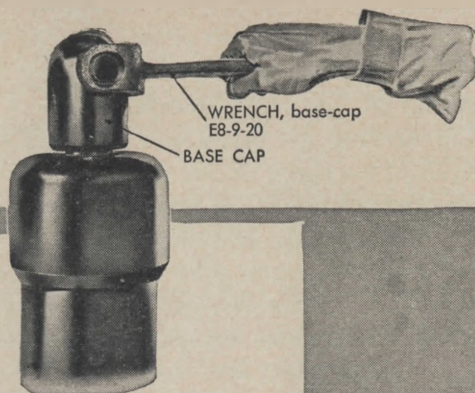


Fig. 39. Unscrewing base cap.

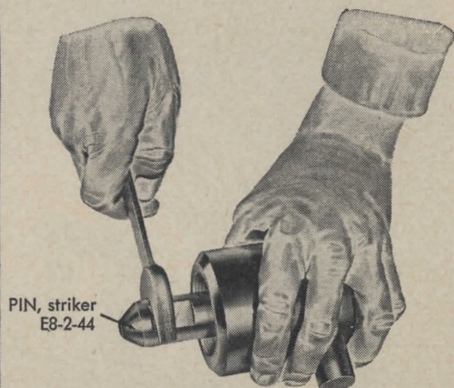


Fig. 40. Removing striker pin.

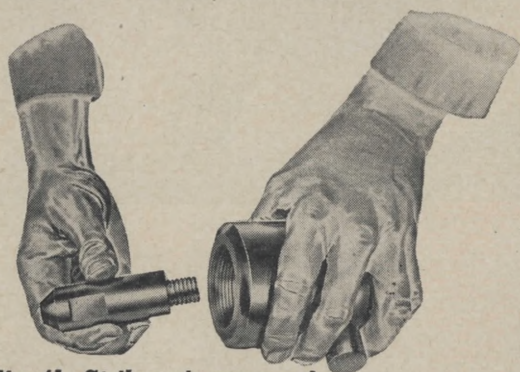


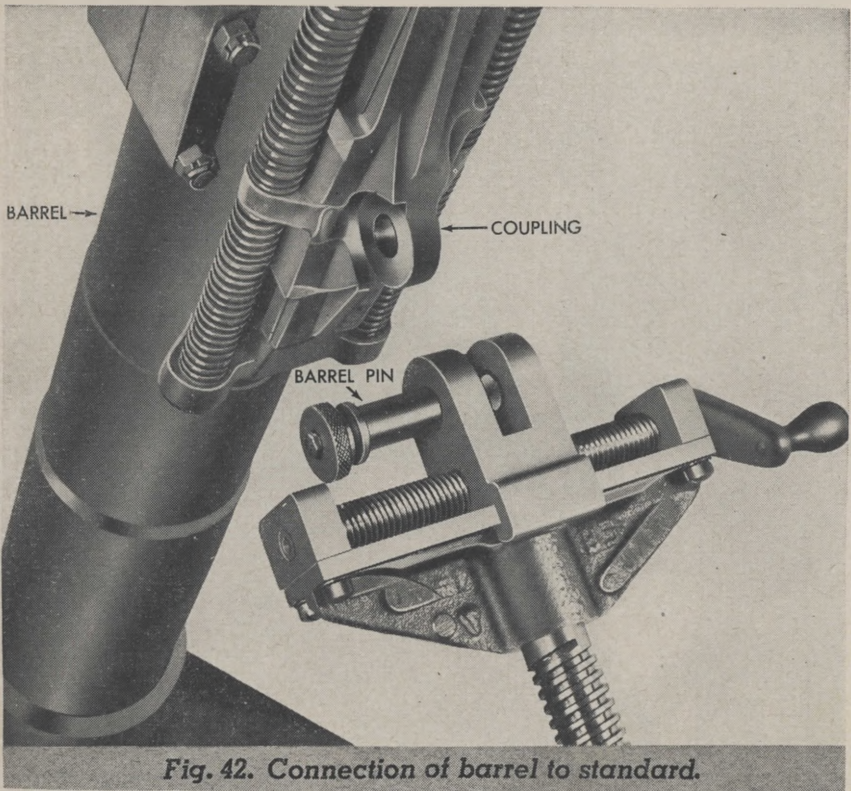
Fig. 41. Striker pin removed.

b. REVISED M2 BARREL. Striker pin is not replaceable; entire tube cap assembly must be replaced by higher echelon.

42. Connection of Barrel to Standard

a. Connection between the barrel and standard is so designed that shock from recoil of the barrel during firing is cushioned by coil springs instead of being transmitted to the standard through a rigid connector. This feature decreases strain on barrel and standard components and adds to the stability of the mortar while in action.

b. The connection is a large two-piece bronze clamp (shock absorber slide), fastened to the barrel by steel bolts (slide assembly bolts) and a steel coupling (fig. 42). 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 lower part of clamp, extends about 2 inches beyond front pair of bolts and $3\frac{1}{2}$ inches beyond rear pair. A coupling, 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 ends of two coil springs. Springs and coupling lugs are held in place by spring guide rods which in turn are supported by and bolted to lugs or ears on ends of the clamps. Under side of the coupling has an ear projecting downward which fits into a slot on top of the traversing nut on the standard and is assembled to the standard by a barrel pin passing through holes in traversing nut and ear of coupling. Diameter of the hole in the coupling is sufficiently large to allow coupling to rotate about barrel pin which acts as an axis.

43. Removing and Replacing Slide Assembly Bolt

a. To remove slide assembly bolt, remove cotter pin holding castle nut (fig. 43) and apply a wrench to the nut and another wrench to the bolt head (fig. 44). Unscrew nut and withdraw bolt (fig. 45).

b. To replace slide assembly bolt, proceed in reverse order to that given in *a* above.

44. Removing and Replacing Springs and Spring Guide

a. To remove either or both the front and rear springs, the castle nuts on each end of the spring guide must be removed. To do this, remove cotter pins in each castle nut and unscrew nut, using a wrench (fig. 46). Withdraw the spring guide; springs can then be pulled out of position (figs. 47, 48, and 49).

b. To replace springs and spring guide, proceed in reverse order to that given in *a* above.

Section XVI. STANDARD MI

45. General

The standard, 4.2-inch chemical mortar, MI (fig. 50) consists of a support welded at the lower end to a base, an elevating mechanism which is housed in the support, and a traversing mechanism, mounted on the upper end of the elevating screw, which also serves as the connection between the standard and barrel.

46. Base

The base is an oblong plate of alloy steel with the longer sides turned up $\frac{5}{8}$ inch and 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, welded to the lug ribs on the base, are provided for the connector rods (tie rods or connectors), which are used to connect standard to baseplate. For carrying purposes, a connection bracket is welded to each connector rod. A hole

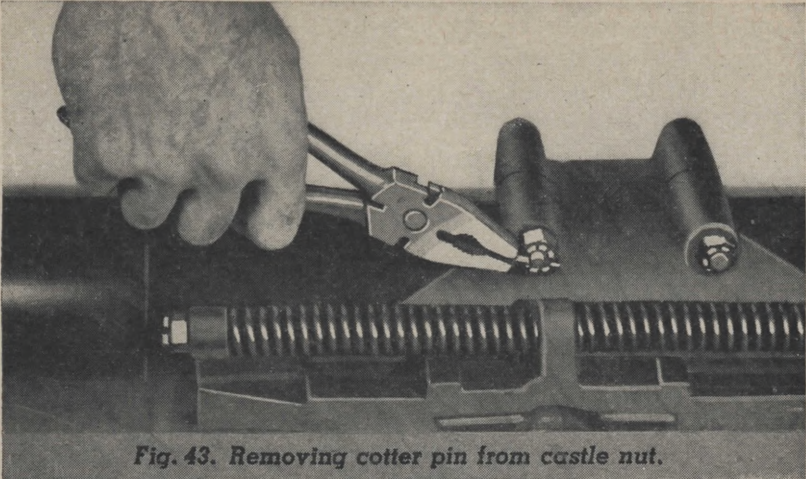


Fig. 43. Removing cotter pin from castle nut.

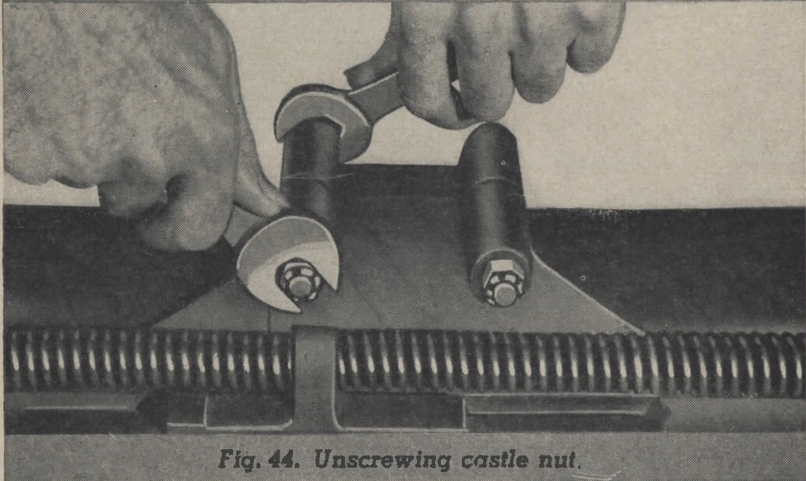


Fig. 44. Unscrewing castle nut.

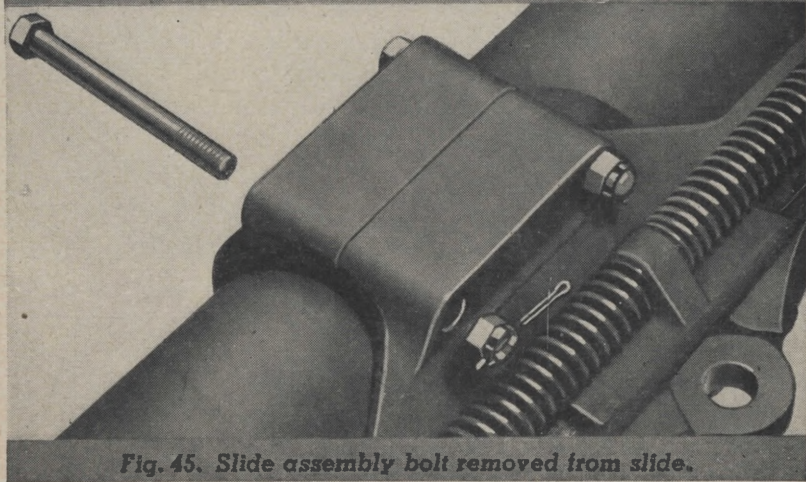


Fig. 45. Slide assembly bolt removed from slide.

REMOVING SPRING AND SPRING GUIDE

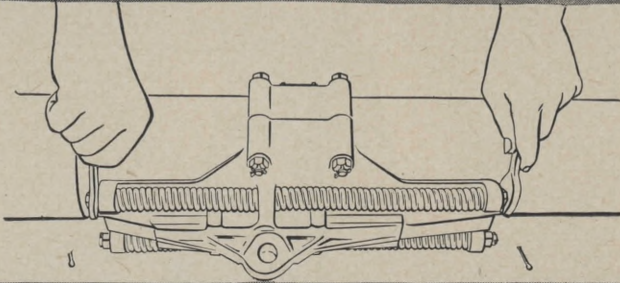


Fig. 46. Un-screwing castle nuts on ends of spring guide.

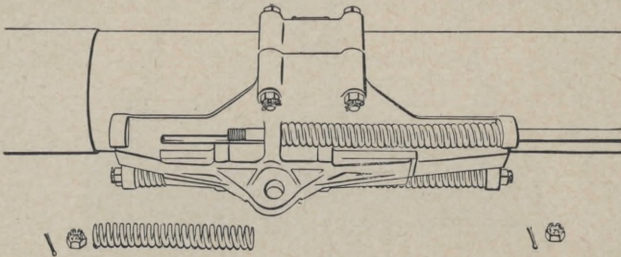


Fig. 47. Rear spring removed.

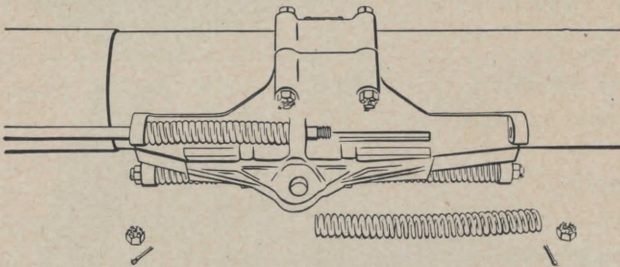


Fig. 48. Front spring removed.

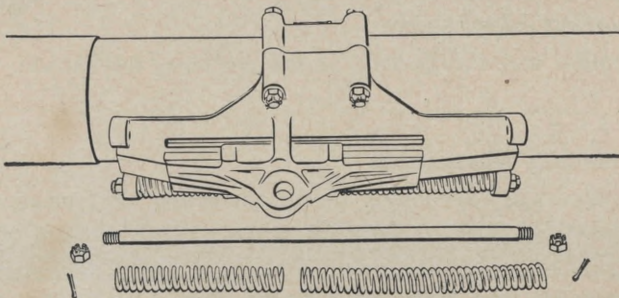
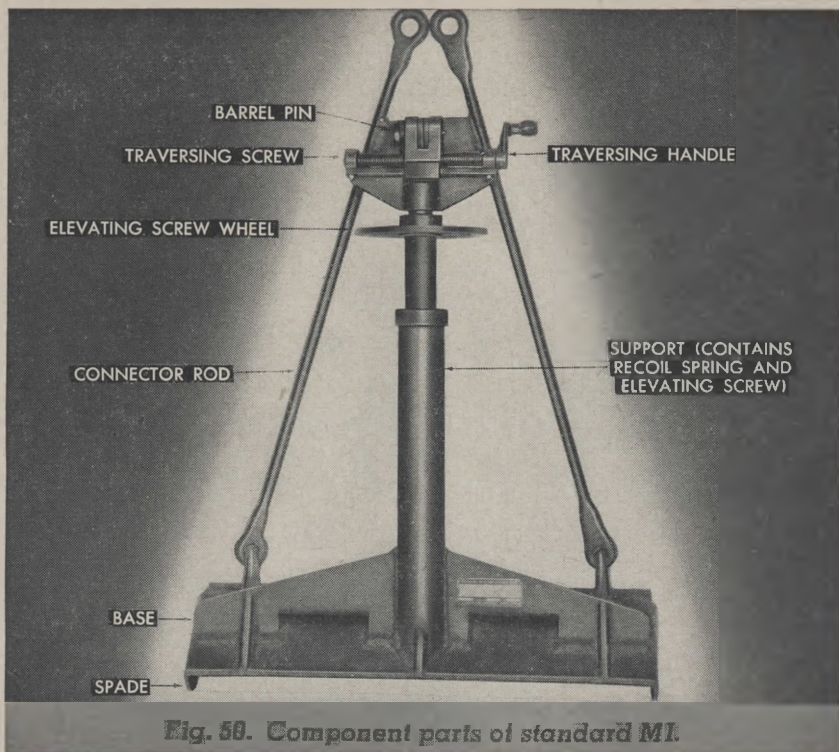


Fig. 49. Front and rear springs and spring guide removed.



is drilled through each bracket so that the connectors may be brought up and brackets inserted in the slot in the traversing nut, brackets being held in position by barrel pin.

47. Support

The support is a seamless steel tube, welded at the bottom to base of standard and provided at the top with a retaining collar. The union with the base is reinforced by ribs.

48. Elevating Mechanism

For description and functioning of the elevating mechanism, see paragraph 14a.

49. Traversing Mechanism

For description and functioning of the traversing mechanism, see paragraph 14b and figure 51.

50. Removing and Replacing Barrel Pin

a. To remove barrel pin, loosen stop pin (fig. 52) on top of traversing nut and, after opening latch, slide out the barrel pin (fig. 53).

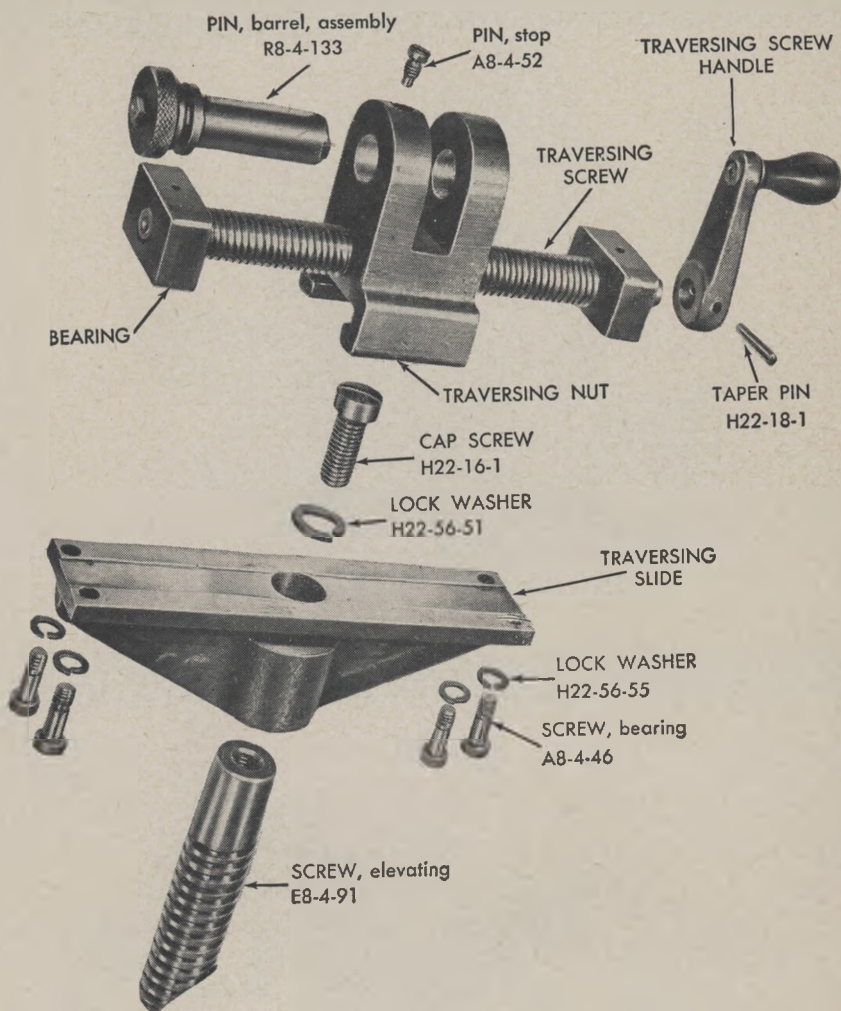


Fig. 51. Exploded view of traversing mechanism

REMOVING BARREL PIN

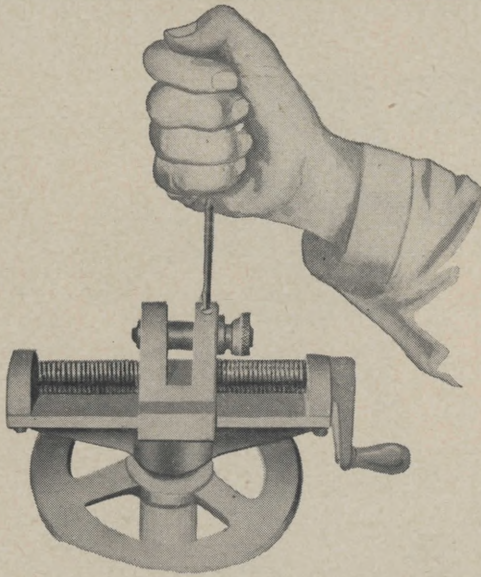


Fig. 52. Loosening stop pin.

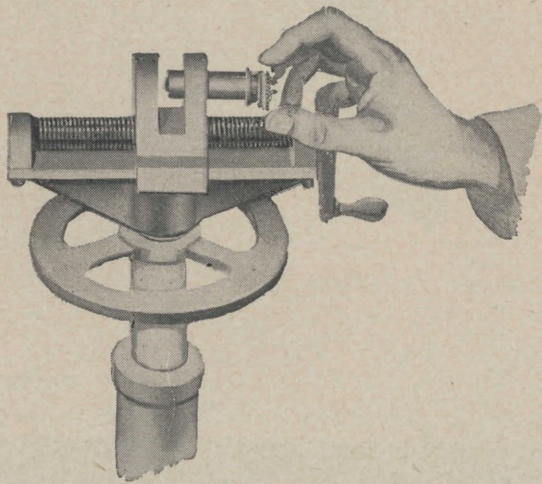


Fig. 53. Sliding out barrel pin.

REMOVING TRAVERSING SCREW HANDLE

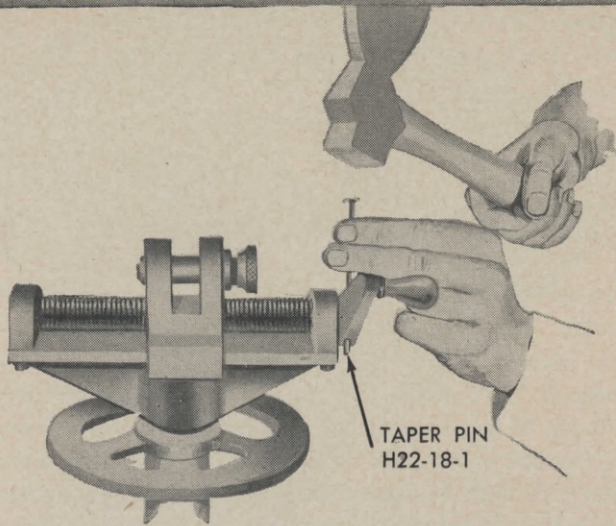


Fig. 54. Driving out taper pin.

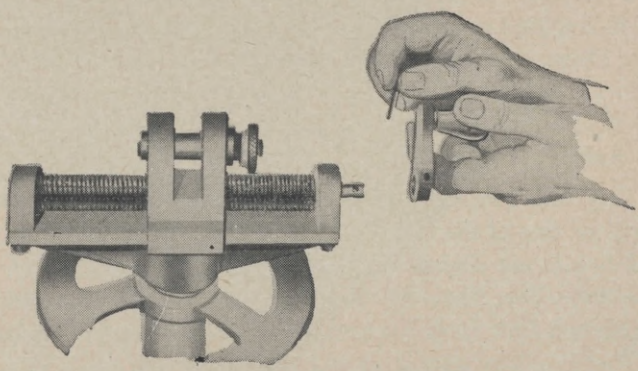


Fig. 55. Handle removed after removing taper pin.

b. To replace barrel pin, reverse procedure in *a* (page 50).

51. Removing and Replacing Traversing Screw Handle

a. To remove traversing screw handle, drive out the taper pin (fig. 54) in handle of traversing screw, using another pin as a punch. Slide off handle (fig. 55).

b. To replace traversing screw handle, proceed in reverse order to that prescribed in *a* above.

Section XVII. BASEPLATE M2A1

52. Description

a. Baseplate, 4.2-inch chemical mortar, M2A1 (figs. 56 and 57) is a rectangular plate made of $\frac{1}{4}$ -inch nickel-chromium steel with edges turned down at right angles about $1\frac{1}{2}$ inches. The dimensions of the plate are 26 by 28 inches. On the surface, in form of a rectangle about $16\frac{1}{2}$ by 21 inches, is a bead $1\frac{1}{2}$ inches high with an inverted **V**-shaped cross section. A large **Y**-shaped spade is welded to the under side of the plate. It is 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 welded to the under side of the baseplate. Two ribs of nickel-chromium steel 2 inches wide, $\frac{1}{4}$ inch thick, and $13\frac{3}{4}$ inches long are welded to the under side of the plate. *The apex of the Y-spade is to the rear.* This location of the large spade assists in causing baseplate to move uniformly to the rear, and small inside gusset plates restrain rearward movement.

b. Cast steel base-cap cup is bolted on upper surface of baseplate within rectangle formed by **V**-shaped bead. Base-cap end of the barrel rests in rounded portion of the cup, with base-cap pins in the **U**-shaped slots. These prevent rotation of barrel when mortar is fired. Legs on cup fork engage in square grooves in slotted uprights of the cup, straddling base cap above base-cap pins. Legs prevent base-cap end of barrel from jumping out of cup.

c. Cup fork (fig. 58) is attached to base-cap cup by a short length of chain. One tine of the fork is provided with a flat spring or fork retainer, which bulges out slightly and has a hump about $2\frac{1}{4}$ inches from the end of the tine. This hump fits under shoulder of slots for base-cap pins and prevents cup fork from jumping out of slots during firing of the mortars.

d. Brackets are welded at the corners of the plate to hold two-piece retractable handles of seamless steel tubing. Normally, handles are retracted and held in that position by spring catches, but they may be extended to the front and rear of the baseplate, litter fashion, to facilitate transportation. Slings of heavy cotton webbing are also provided to assist in carrying baseplate. At the front of the plate, near the corners,

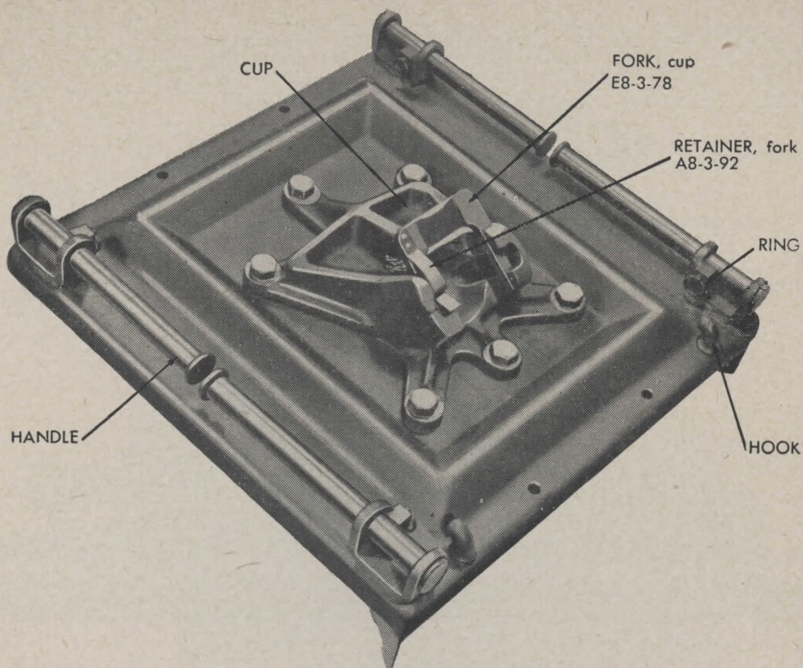


Fig. 56. Baseplate M2A1 (top view).

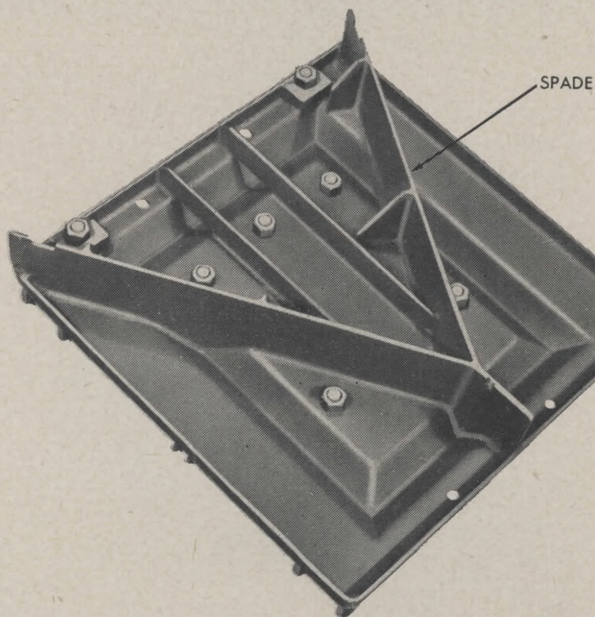


Fig. 57. Baseplate M2A1 (bottom view).

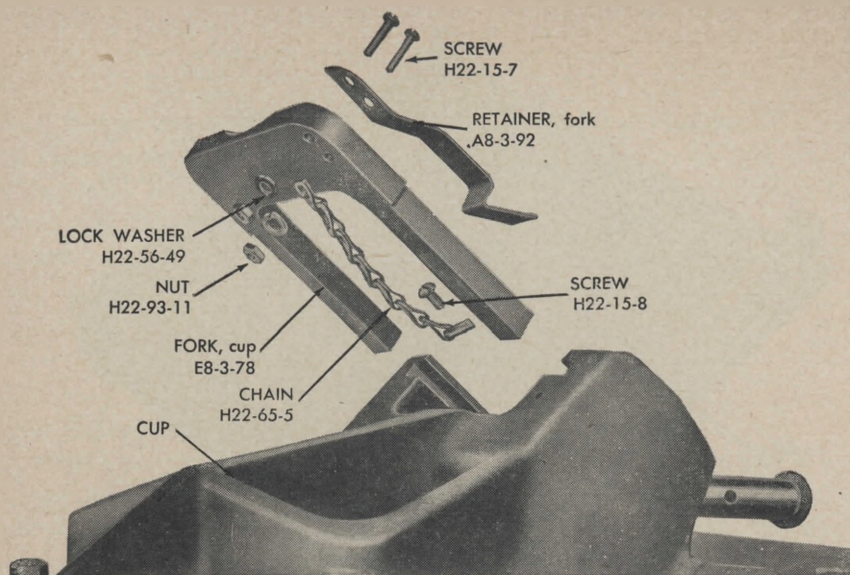


Fig. 58. Exploded view of cup fork assembly in relation to cup.

two replaceable hooks are provided for attachment of the connectors. These are secured by nuts.

53. Removing and Replacing Cup Fork

a. To remove cup fork, unscrew chain attached to cup-fork end where it is held to base-cap cup (fig. 59). After end of chain is free, pull cup fork from base-cap cup (fig. 60).

b. To replace cup fork, reverse procedure in *a* above.

54. Removing and Replacing Retainer Fork

a. To remove retainer fork, pull cup fork out of base-cap cup, turn it over, and replace in base-cap cup. Remove the two machine screws holding retainer fork to cup fork (fig. 61) and lift off retainer fork (fig. 62).

b. To replace retainer fork, reverse procedure given in *a* above.

55. Removing and Replacing Sling Assembly

a. To remove sling assembly, slide it off end of handle brackets, after loosening slide fastener on the sling.

b. To replace sling assembly, reverse order of that given in *a* above.

REMOVING CUP FORK

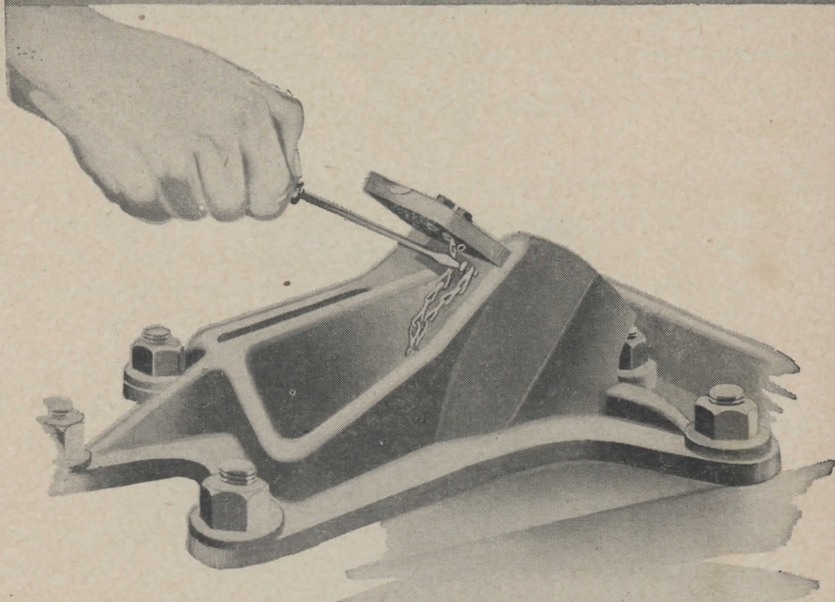


Fig. 59. Disconnecting chain from cup fork.

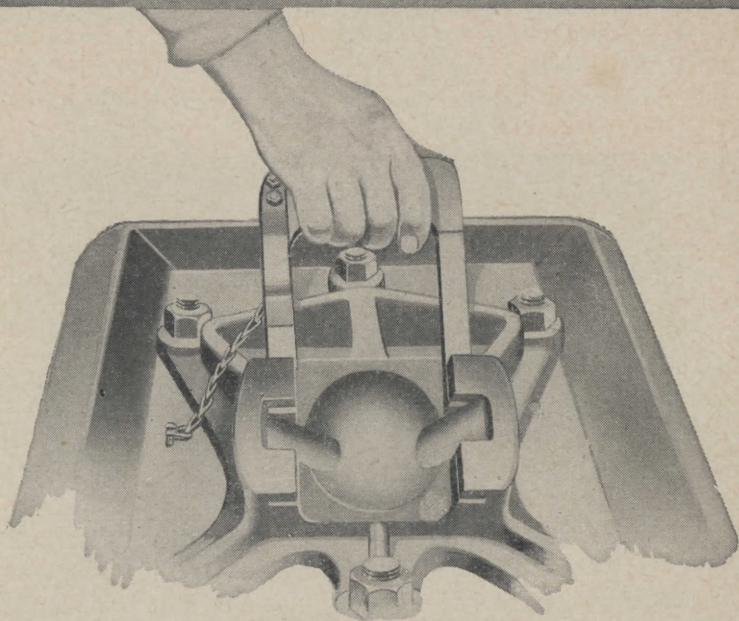


Fig. 60. Pulling cup fork free of cup.

REMOVING RETAINER FORK

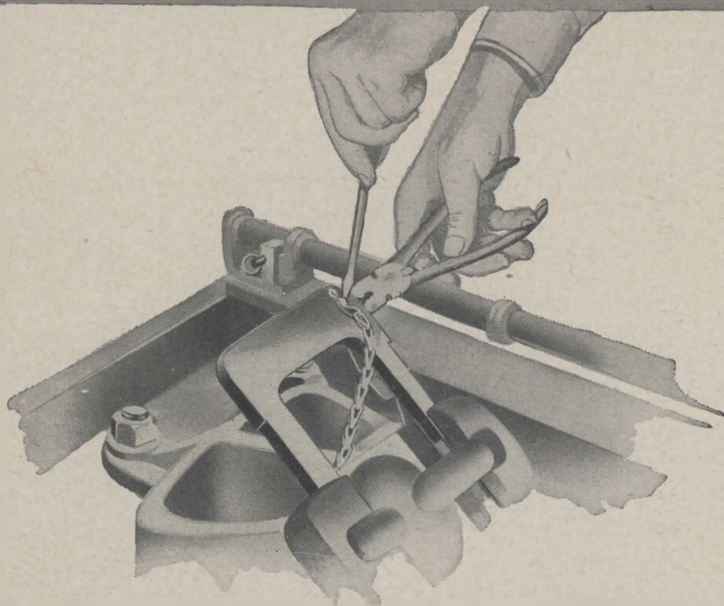


Fig. 61. Removing machine screws holding chain to cup fork.

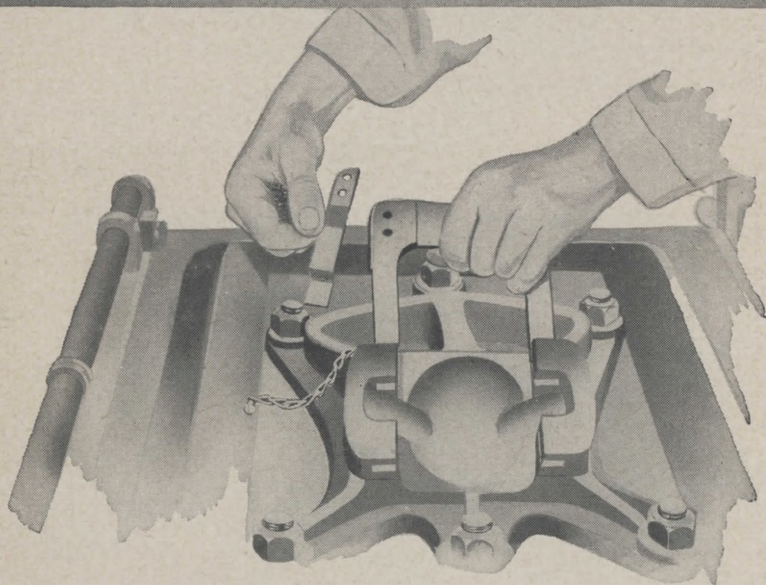


Fig. 62. Retainer fork disconnected from cup fork.

PART FOUR

AUXILIARY EQUIPMENT

Section XVIII. GENERAL

56. Scope

Part four contains information for guidance of personnel responsible for operation of this equipment. It contains information necessary to using personnel to identify properly, to operate, and to protect auxiliary equipment being used or transported with the main equipment.

Section XIX. AMMUNITION

57. General

a. COMPLETE ROUND (fig. 63). Ammunition for the 4.2-inch chemical mortar is of the semifixed type. All components of the round are loaded in the mortar as a unit and in one operation, but the propelling charge may be varied for different range zones. A complete round consists of a filled shell, fuze, and a propelling charge consisting of an ignition cartridge and a number of rings of powder serving as the propellant. The ignition cartridge is inserted in a cartridge container fastened to the base of the shell, and the rings of powder are placed on the outside of the container and held in place by an adjustable propellant holder and a striker nut, which screws onto the open end of the cartridge container. This affords a support for both the rings of powder and the ignition cartridge.

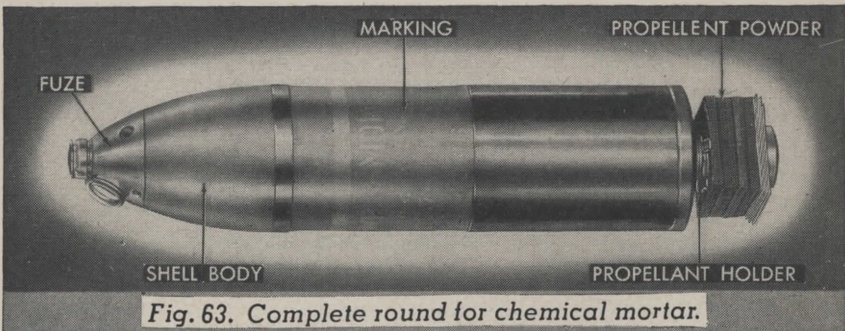


Fig. 63. Complete round for chemical mortar.

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 striker pin in the base of the barrel, the striker in the nut is driven into the primer in the ignition cartridge. This fires the cartridge which ignites the propellant. Pressure of the gases from the burning propellant expels the projectile from the mortar and at the same time actuates the pressure plate and

expands the rim of the rotating disk, thus engaging the rifling of the barrel. This imparts rotation to the shell, giving true flight and insuring nose impact of the shell. The force of impact causes the fuse to function.

58. Firing Tables

For applicable firing tables, see FT-4.2-B-1 and FT-4.2-B-1 (abridged).

59. Classification

Dependent upon the type of projectile, ammunition for the 4.2-inch chemical mortar is classified as high explosive, chemical, or dummy.

a. High explosive projectiles are comparatively thin-walled projectiles containing high explosive. They are intended principally for fragmentation or mining effect.

b. Chemical projectiles contain a chemical filler for producing either a toxic or irritating physiological effect, a screening smoke, an incendiary action, or any combination of these.

c. Dummy projectiles are completely inert and are intended for practice in loading and handling.

60. Identification

a. GENERAL. Ammunition and ammunition components are completely identified by means of painting and marking (including ammunition lot number). Other essential information is marked on the components; for example, the kind of filler is marked on the projectile. The muzzle velocity may be obtained from firing tables. The various rounds may be identified by the following painting and marking:

(1) *Shell colors.* Shell for the 4.2-inch chemical mortar, like all other chemical munitions, bear certain standard markings for identification purposes. Types of munitions are indicated by the following color code:

Chemical filling: Blue-gray body with identifying markings as indicated in (2), (3), and (4) below.

High explosive: Olive-drab body with yellow markings.

Dummy or drill: Black body with white markings.

(2) *Tactical classification.* Identifying marks are painted in one of the four following colors to designate the tactical type of chemical agent:

Green: Casualty

Yellow: Screening smoke

Red: Harassing

Purple: Incendiary

(3) *Persistency.* A single green band of color around the munition designates a nonpersistent casualty agent, and a double green band signifies a persistent casualty filling. Bands are $\frac{1}{2}$ inch wide and $\frac{1}{4}$ inch apart; the top band is always $\frac{3}{4}$ inch below the upper guide of the shell.

(4) *Lettered information.* Each shell bears identification letters. Immediately below the color bands, in $\frac{3}{4}$ -inch letters, are shown the agent symbol and designation (examples: HD-GAS, WP-SMOKE). Below this, in $\frac{1}{2}$ -inch letters, appear the caliber marking and weapon designation (example: 4.2-IN. CM); loader's identification mark and dates (example: EA-8-40); and lot number (example: LOT NO. 370).

b. AMMUNITION LOT NUMBER. A lot number is assigned all ammunition at the time of manufacture. This lot number is stamped or marked on the components and on all packing containers. It is required for all purposes of record, including reports on condition, functioning, and accidents in which the ammunition is involved. All components in any lot of separate loading ammunition are manufactured under as nearly identical conditions as possible to insure uniform functioning. Consequently, to obtain greatest accuracy in firing, successive rounds should consist of projectiles of one lot number, propelling charges of one lot number, and, in the case of the M5 fuze, fuzes of one lot number.

c. WEIGHT-ZONE MARKINGS. It is not practicable to manufacture projectiles within the narrow weight limits required for accuracy of fire; therefore, they are grouped into weight zones, and appropriate ballistic corrections are given in the firing tables for the variation in weight. The weight zone of the projectile is indicated thereon by squares of the same color as the original markings. There are one, two, or three squares, depending upon the weight of the projectile. Two squares are standard. At present, TNT-filled shells are the only 4.2-inch chemical mortar shell zoned.

61. Care, Handling, and Preservation

a. Complete rounds and ammunition components are packed to withstand conditions usually found in the field. Complete rounds are shipped in individual moisture-resistant fiber containers inclosed in a wooden packing box. Since explosives are adversely affected by moisture and high temperature, observe the following precautions:

- (1) Do not break moisture-resistant seal until ammunition is to be used.
- (2) Protect ammunition, particularly fuzes, from high temperature, including direct rays of the sun. More uniform firing is obtained if the rounds are at the same temperature. In the case of WP-filled shells, if the filling melts and then hardens in any position other than on its base, a great percentage of the shells fired will be duds. To remedy this, keep WP-filled shells stored in upright position.

b. Do not remove protection or safety devices from fuzes until just before use.

c. Explosive ammunition must be handled with care at all times. The explosive elements in primers and fuzes are particularly sensitive to shock and high temperatures.

PROJECTILE

Col. No.	Complete Round Nomenclature	BODY					FILLING			PROPELLING CHARGE				Complete Assembly Wt. (lbs.)			
		Type and Kind	Designation	Av. Wt. Shell Casting (lbs.)	Wt. Base Components	Diameter (approx.)	Length (approx.)	Type	Wt. Filling (lbs.)	Minimum Void (0/0)	Designation	Type	Weight (lbs.)		Designation	Cartridge (5)	Total Charge Wt. (lbs.)
1	Shell, Smoke, WP, 4.2-inch Chemical Mortar, M2	2 Shell Smoke	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 30.4"	8 WP	9 7.5	10 14.7	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 25.5
2	Shell, Smoke, FS, 4.2-inch Chemical Mortar, M2	2 Shell Smoke	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 20.4"	8 FS	9 7.5	10 23.0	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 25.5
3	Shell, Gas, Nonpersistent, CG, 4.2-inch Chemical Mortar, M2	2 Shell Gas	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 30.4"	8 CG	9 6.25	10 14.3	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 24.25
4	Shell, Gas, Persistent, HD, 4.2-inch Chemical Mortar, M2	2 Shell Gas	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 20.4"	8 HD	9 5.8	10 10.0	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 24.2
5	Shell, Gas, Irritant, CNR, 4.2-inch Chemical Mortar, M2	2 Shell Gas	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 20.4"	8 CNR	9 5.45	10 5.7	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 23.5
6	Shell, Gas, Irritant, CNS, 4.2-inch Chemical Mortar, M2	2 Shell Gas	M2 M2-ALT	4 13.86 13.86	5 1.84 1.84	6 4.19"	7 20.4"	8 CNS	9 7.0	10 4.5	11 M2	12 Impact	13 1.5	14 M6(4)	15 M2	16 .51	17 25.0
7	Shell, 4.2-inch Chemical Mortar, (HE), M3 (W/M3 Fuze)	2 Shell HE	M3 M3-ALT	4 12.72 12.72	5 1.84 1.84	6 4.19"	7 20.4"	8 HE	9 8.5	10 None	11 M3	12 Impact	13 1	14 M6(4)	15 M2	16 .51	17 24.5
8	Shell, 4.2-inch Chemical Mortar, (HF), M3 (W/M4 Fuze)	2 Shell HE	M3 M3-ALT	4 12.72 12.72	5 1.84 1.84	6 4.19"	7 21.0"	8 HE	9 8.5	10 None	11 M3(1)	12 Delay	13 1	14 M6(4)	15 M2	16 .51	17 24.5
9	Shell, 4.2-inch Chemical Mortar, (HE), M3 (W/M5 Fuze)	2 Shell HE	M3 M3-ALT	4 12.72 12.72	5 1.84 1.84	6 4.19"	7 22.0"	8 HE	9 8.5	10 None	11 M5(1)	12 T & S	13 2.0	14 M6(4)	15 M2	16 .51	17 25.5
10	Shell, Sub-caliber, 3-inch, M5 (For 4.2-inch Chemical Mortar)	2 Shell Dummy	M5	6.0	--	3.0"	12.5"	--	--	--	11 M1(2)	12 Impact (FM - Nose)	13 Approx. 1/4	14 M8	15 M5A1	16 .14	17 6.0

(1) Fuze packed and shipped separately. To be added to shell at point of use.

(2) Smoke charge, shipped separately.

(3) Standard nomenclature for fuzes.

4. Fuze, shell, 4.2-inch chemical mortar, M2

5. Fuze, shell, 4.2-inch chemical mortar, (HE), M3

6. Fuze, delay, shell, 4.2-inch chemical mortar, M4

7. Fuze, time and superquick, shell, 4.2-inch chemical mortar, M5

8. Charge, smoke, 3-inch, sub-caliber shell, M1

(4) Standard nomenclature for propelling charges:

a. Charge, propelling, 4.2-inch chemical mortar, M6

b. Charge, propelling, 3-inch sub-caliber shell, M8

(5) Standard nomenclature for cartridge: Cartridge, ignition, 4.2-inch chemical mortar, M2

FIGURE 64. Authorized rounds for 4.2-inch chemical mortar.

d. Keep cartridge and propelling charges dry. Moisture reduces range; therefore, moist propelling charge increments should be separated from dry ones so as to eliminate the possibility of short rounds when firing over friendly troops.

e. When it is necessary to leave ammunition in the open, place it on dunnage at least 6 inches from the ground and cover with a double thickness of paulin. Suitable trenches should be dug to prevent water from flowing under the pile. For further precautions in storage, see TM 9-1900.

f. Complete round should be free of foreign matter—sand, mud, grease, etc.—before loading into the mortar.

g. Propelling charges of rounds prepared for firing should be protected by slipping one end of laminated shell container over base of round.

h. Rounds prepared for firing but not fired will be returned to their original condition by reinserting safety pins, replacing packings, and appropriately marking. Fuzes will be inspected prior to repacking. Such components will be used first in subsequent firing, in order that stocks of opened packings may be kept at a minimum.

i. Do not handle duds. Because their fuzes may be armed, duds are extremely dangerous. Do not move or turn them, but destroy them in place, in accordance with directions contained in TM 9-1900.

62. Authorized Rounds

The standard ammunition authorized for use in the 4.2-inch chemical mortar is described in figure 64. Note that the nomenclature completely identifies the ammunition.

63. Shell

a. GENERAL. Four shell, similar except for minor construction differences, are issued for the 4.2-inch chemical mortar. These shell are known as the M2, M2 alternate, M3, and M3 alternate.

b. FILLING. The M3 and M3 alternate are high explosive shell with TNT filling. They differ from the M2 and M2 alternate (chemical-filled) in that they contain solid filling with no steel vane inside the body and a booster which is one-third the length of the burster in the M2 shell.

c. CONSTRUCTION. (1). The M2 and M3 shell (fig. 65) have a body made from a steel forging with base and walls integral, the casing being swaged to form the ogive.

(2) The M2 alternate and M3 alternate shell, designed to simplify manufacturing operations, are made of seamless steel tubing. The base is slip-fitted and silver-soldered to the end of the tubing.

(3) In the M2 and M2 alternate shell, a perforated sheet steel vane is welded inside the body. This aids in stabilizing flight of the shell by forcing the liquid filling to rotate with it. Holes in the vanes are designed to facilitate distribution of liquid in the shell.

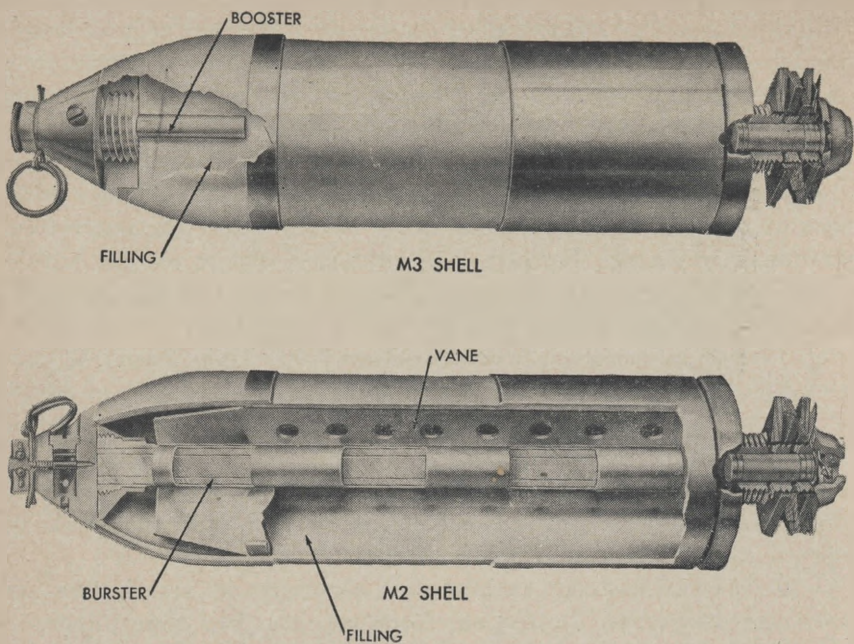


Fig. 65. Comparison between M2 and M3 chemical mortar shell.

(4) A steel adapter is welded in the nose of the M2 and M3 shell. In the M2 alternate and M3 alternate shell, the adapter is silver-soldered. The M2 shell has a smooth finished central opening into which the burster tube well is pressed after the shell has been filled, thus forming a gastight seal. The M3 shell has a ringlike adapter to receive fuze.

(5) On the base of all the shell is a threaded stud to which the cartridge container is secured. The cartridge container is a tube of machine steel, threaded on the inside to screw onto the stud on the base of the shell. It is also threaded externally and has a wire propellant holder and a striker nut to hold the propellant over the ventholes. After removing the undesired rings, the propellant holder is pushed down against the remaining rings in order to hold them tightly between the holder and the striker nut. The ventholes are drilled radially through the walls of the cartridge container and serve to transmit the flash of the ignition cartridge to the rings of powder, thus igniting them. The striker nut, in addition to holding the propelling charge and ignition cartridge in place, also carries a striker plate and striker point to fire the primer of the ignition cartridge. It prevents 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 being blown out the rear end of the cartridge container.

(6) The rotation unit of all the shell consists of a brass rotating disk and a steel pressure plate. In the surfacing of the rotating disk is a groove 1.5 inches wide and 0.062 inch deep, fitting over a key on the base of the shell and transmitting rotation to the shell. Diameter of rotating disk is approximately equal to that of the shell, while the pressure plate is slightly smaller and fits into rotating disk. When assembled, disk and plate form a hollow ring. Under the pressure of the propellant gases, the plate is pressed into the disk, expanding the disk in such manner that the rim of the disk engages the rifling of the barrel.

64. Propelling Charge

a. CHARGE, PROPELLING, 4.2-INCH CHEMICAL MORTAR, M6. The M6 propelling charge consists of an ignition cartridge and 25½ rings of non-hygroscopic disk powder. The full propelling charge comes affixed to the shell (fig. 66). Ranges varying from 4,397 yards down to 565 yards may be obtained by removing rings as required to conform with appropriate firing tables. The basic unit of propelling powder is a ring which consists of two sheets sewn together. The M6 propelling charge includes one half-ring, five one-ring bundles, and four five-ring bundles (fig. 67).

b. IGNITION CARTRIDGE (fig. 68). The ignition cartridge used with the M6 propelling charge is designated as follows: *cartridge, ignition, 4.2-inch chemical mortar, M2*. It is similar in exterior appearance to a commercial 12-gauge shotgun shell.

PROPELLING CHARGE

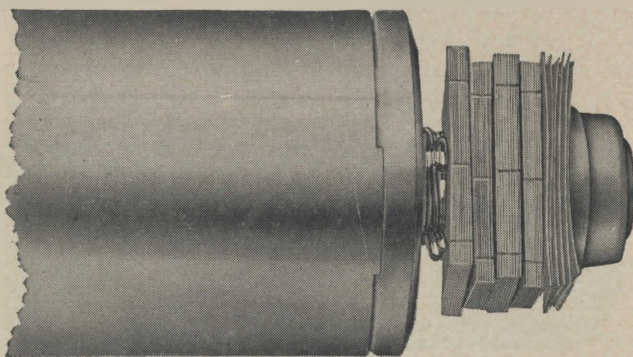


Fig. 66. Propelling charge M6 attached to shell.



Fig. 67. Propellant powder showing three sizes of increments.

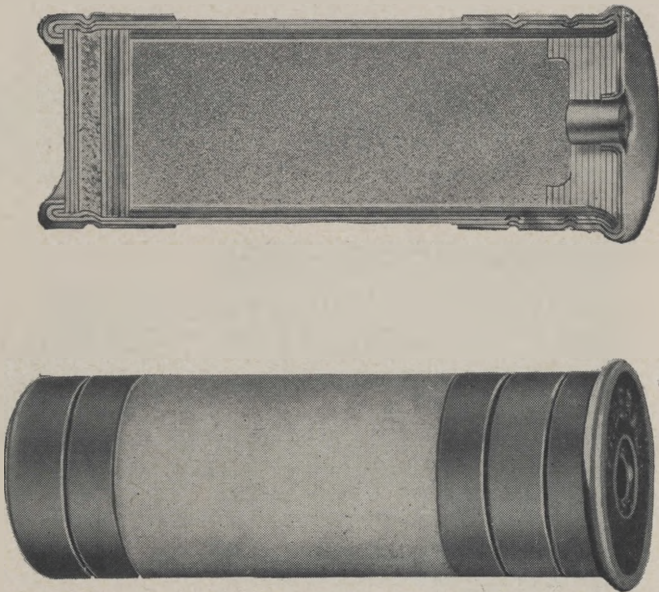


Fig. 68. Ignition cartridge.

c. Propellant powder. (1) The propellant powder is practically non-hygroscopic and smokeless, but not flashless. It is in the form of thin, square sheets, $2\frac{3}{4}$ inches square and about 0.026 inch thick. A circular hole 1.35 inches in diameter is cut in the center of each square.

(2) The sheets of powder weigh approximately 60 grains each. Each square is slit radially from the circular hole to one of the edges. The size of units may be identified by their thickness.

65. Preparation for Firing

When shell are delivered to mortar position packed in waterproof containers, prepare ammunition in an orderly sequence for purposes of safety and economy of effort as follows:

a. Remove shell from its waterproof container.

b. Clean by removing all rust-preventive compound and remove any dirt from guides, body, cartridge container, and flash outlet holes. Use emery cloth to remove rust from guides.

c. Pull safety pin and examine fuze. See that shear wire is in place and bent over at both ends, and that two steel balls are present. Replace safety pin.

d. Examine guides for burrs which might cause shell to stick in the barrel. Burrs must be filed down.

e. Remove rings of propellant as required for range.

f. Propellant must be fastened firmly between striker nut and propellant holder. This is accomplished by first tightening the striker nut against the propellant and then the propellant holder against the powder.

g. When necessary, ends of safety pin in fuze may be straightened with a pair of pliers to facilitate rapid removal by mortar squad.

66. M2 and M3 Fuzes

a. GENERAL (fig. 69). The fuze, shell, 4.2-inch chemical mortar, M2 is an impact fuze of the point detonating type, weighing about $1\frac{1}{2}$ pounds. The complete assembly consists of the fuze proper with an aluminum body, its various components, and a seamless steel burster tube. The bursting charge consists of about 65 grams of tetryl pellets in the burster tube and the cup. 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. This fuze is furnished with the M2 shell. The fuze, shell, 4.2-inch chemical mortar, (HE), M3 is furnished with the M3 shell. *The M2 and the M3 fuze heads are identical, but the M2 fuze has a burster tube, while the M3 fuze has a booster.* The burster tube of the M2 fuze (fig. 70) is about three times the length of the seamless steel booster tube of the M3 fuze (fig. 71). This difference is necessary because the M2 burster must contain a sufficient amount of tetryl

MORTAR SHELL FUZES

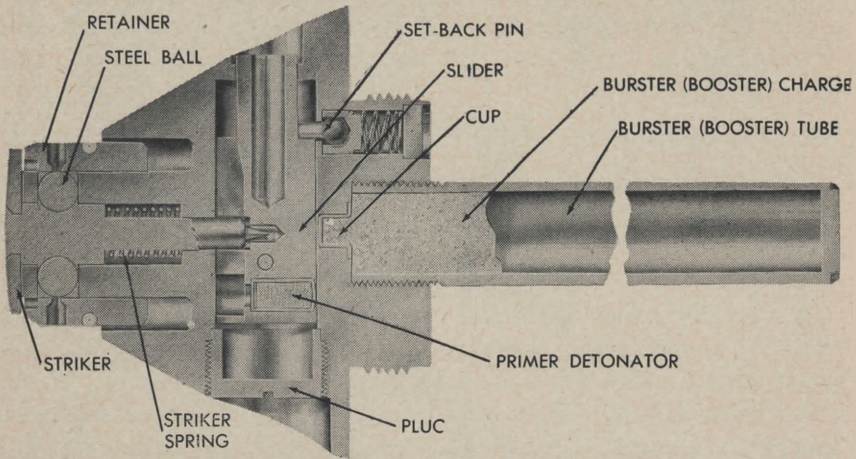


Fig. 69. Phantom views of M2 (M3) fuze body.

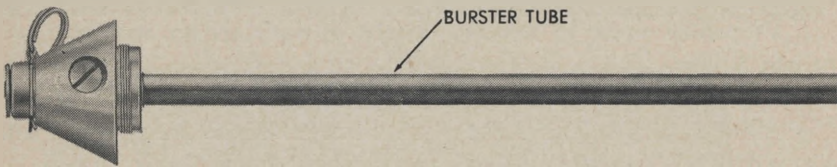


Fig. 70. M2 fuze.

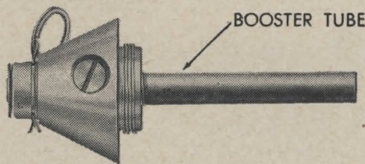


Fig. 71. M3 fuze.

to rupture the shell body, while in the M3 the booster merely conducts the shock action to the high explosive (TNT) filling which, in turn, bursts the shell. The M3 fuze has the same safety features as the M2 and functions in exactly the same manner.

b. SAFETY FEATURES. The M2 and M3 fuzes have four safety features :

(1) The *safety pin* is a cotter pin passing through (off center) the body of the fuze and the retainer. The pin secures the retainer firmly to the body of the fuze and prevents its movement. Its function is to act as a reinforcement for the shear wire. Just before firing, the safety pin is pulled from the fuze by means of the ring attached to the pin.

(2) The *shear wire* passes through the retainer and the fuze body. This 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 enables the fuze to arm itself by cutting the shear wire inside the retainer only.

(3) The *retainer* is a brass ring which holds two steel balls in cylindrical holes 180° apart in the upper part of the fuze body. When the striker 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 than the diameter of the balls but their depth is less. 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. The other two-thirds remains in the cylindrical hole in the body of the fuze. The balls prevent movement of the striker. Immediately below the retainer is a well in the fuze body into which the retainer drops when the shear wire is cut. The retainer has either two slots or two holes through which the two steel balls can be seen. For safety, every fuze must contain the two steel balls.

(4) The *slider* is a cylindrical brass piece. Holes are cut in the slider to take the primer detonator, the striker point, and the lock pin, and there is a groove for the guide screw. 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.

(5) The *set-back pin assembly* consists of set-back pin, socket, and spring. In the unarmed position, the slider is held safe by the set-back pin which is held in place by force of the spring. This serves as an additional safety feature in preventing alignment of the primer detonator with bursting charge before firing.

c. FUNCTIONING. (1) The safety pin is pulled out of the fuze just before the shell is inserted in the barrel. After striking the striker pin at

the base of the barrel and igniting the propellant, the shell 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 balls are forced out into the additional space in the recessed portion of the retainer by a combination of two factors: centrifugal force set up by the rotating shell, and pressure against the balls by the striker which is forced by the striker spring. The striker is thus shoved up into the armed position, with the striker head projecting 0.25 inch above the fuze body. The entire fuze is armed when the shell is at a point within approximately 5 feet from the muzzle of the barrel.

(2) The striker is prevented from being forced entirely out of the fuze by a setscrew passing 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 setscrew 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 setscrew projects from the fuze body, permits the retainer to fit around the head of the setscrew 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 the set-back forces the set-back pin to the rear and the centrifugal force, caused by the rotating shell, moves the slider outward until its shoulder meets a shoulder in the fuze body. At the same time, the set-back pin is locked in place. On completion of this movement, the slider is held fast in the armed position by the lock pin, which also functions by centrifugal force and prevents backward movement of the slider. The guide screw in the fuze body fits into a groove in the slider and prevents rotation of the slider about its own axis until the lock pin functions, thus insuring vertical alignment of the detonator when coming into the armed position. During flight of the shell, 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. This, in turn, detonates the bursting charge of the shell.

d. SAFETY PRECAUTIONS. Observe the following precautions:

(1) Exercise extreme care in handling and assembling fuzes to shell. All fuzes should be treated as delicate mechanisms; forces that arm a fuze when a round is fired can also be introduced by rolling or dropping the fuzes. Arming may result from improper handling, and functioning may occur from impact of a blow or by dropping, if fuze is armed.

(2) Inspect body, threads of fuze and adapter, and cavity of shell for

foreign material when assembling fuzes to shell. Assemble with proper seating.

(3) Do not attempt to alter or disassemble fuzes in the field.

(4) Do not remove plugs or fuzes from shell except when a new fuze is to be inserted immediately.

(5) Protect fuzes against shock, heat, and fire. Take special care to avoid blows to nose and base of fuze.

(6) Leave safety pin in fuze until ready to fire. Replace immediately if round is not fired.

67. Delay Fuze M4

a. GENERAL. The fuze, delay, shell, 4.2-inch chemical mortar, M4 (figs. 72 and 73) consists of three subassemblies: head assembly, body assembly, and booster assembly. The head assembly consists of head and firing pin assembly, a delay element assembly which contains a percussion primer, a 0.15-second delay charge, and a relay charge assembly. The body assembly consists of a body, a booster lead charge and safety pin assembly, a detonator slider containing a detonator and a slider lock, a slider spring, a closing cup, a guide screw, and a set-back element and spring. The booster assembly consists of a tube and a 22-gram tetryl booster charge. Total weight of a fuze, loaded and completely assembled, is 1 pound.

b. FUNCTIONING. (1) The fuze is a point detonating, delayed action fuze, designed to produce demolition effect by initiating detonation of the HE in the shell 0.15 second after impact.

(2) The fuze is detonator safe in that the tetryl booster charge does not explode from the force of the detonator if it functions in the offset, unarmed position. The fuze is not armed until detonator is aligned with explosive train by centrifugal force and/or spring action.

(3) After fuze is assembled to shell, the first step in arming, preparatory to firing, is to remove the safety pin. If the round is not fired, the safety pin should be replaced. When shell is fired, the force delivered to base of shell by the burning propelling charge causes the set-back element in the fuze, which holds the slider in the unarmed position, to move to the rear; this frees slider so that it moves to armed position under centrifugal force and/or spring action. The slider is locked in armed position by slider lock.

(4) Upon impact, the striker in the head of the fuze is driven in, cutting the shear wire and allowing point of firing pin to strike the percussion primer, causing it to ignite delay charge. The delay charge burns for 0.15 second after which it ignites the relay charge which initiates functioning of the detonator. The detonator sets off the booster charge which in turn explodes HE in the shell.

c. USE. This fuze may be used in any existing type of 4.2-inch chemical mortar HE-loaded shell. In the event that shell are already equipped with

MORTAR SHELL FUZES

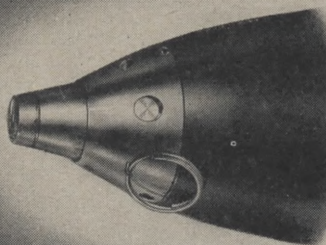


Fig. 72. Delay fuze M4.

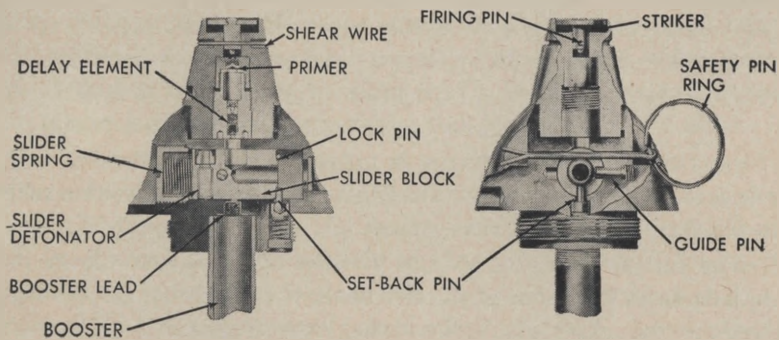


Fig. 73. Mechanism of delay fuze M4.

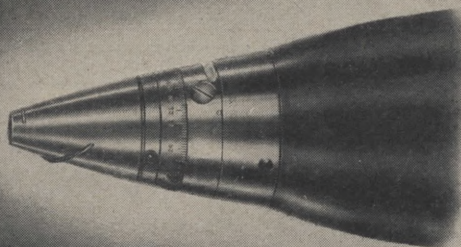


Fig. 74. Time and superquick fuze M5.

the point detonating fuze M3 (instantaneous action), the M3 fuze may be safely removed from the shell and the M4 fuze substituted by means of a fuze wrench.

d. SAFETY PRECAUTIONS. See paragraph 66d.

68. Time and Superquick Fuze M5

a. GENERAL. The fuze, time and superquick, shell, 4.2-inch chemical mortar, M5 (fig. 74) is a modified ordnance M54 powder train type. It is provided with an adapter-boostor or an adapter-burster assembly to fit the 4.2-inch chemical mortar shell. The M54 fuze portion consists of a body assembly, time train ring assembly (two rings), and a closing cap assembly with a lead annulus. The adapter-boostor (burster) has internal threads to receive the M54 fuze and external threads for assembly into the shell. The adapter-boostor (burster) contains a detonator which is initiated by the flash produced by functioning of the fuze, and a boostor or burster charge detonated by functioning of the detonator.

b. FUNCTIONING. The fuze is a combination time and superquick type containing two separate mechanisms for producing these actions.

(1) The *superquick mechanism* is contained in the closing cap assembly. When nose of fuze is crushed, a firing pin is driven into a detonator, causing it to function. The flash from this upper detonator passes through an axial hole through closing cap and body assemblies and functions the detonator in the adapter-boostor (burster).

(2) The *time mechanism* is initiated by plunger contained in the closing cap assembly. An internal safety feature prevents instantaneous action. The plunger is supported by two small shear wires until fired; to insure safety in handling, the plunger is locked in place by a spiral safety wire. The safety wire is removed immediately before firing. When shell is fired, inertia of plunger causes it to cut shear wires and move downward against a primer striker in the fuze body. The primer striker bends until it fires a primer in the fuze body. This primer ignites one end of a pressed black powder time train contained in upper (fixed) time train ring. The upper time train burns completely and, if fuze is not set safe, ignites lower time train after approximately one-half of set time. A magazine charge of black powder is ignited after lower time train has burned the remainder of the set time, and flame from the magazine charge causes lower detonator in adapter-boostor (burster) to detonate.

(3) Whether initiated by superquick element or time element, the lower detonator in the adapter-boostor (burster) detonates and causes boostor (burster) charge to detonate. Detonation of boostor charge in HE shell causes detonation of HE filling; detonation of the burster charge in chemical shell ruptures the shell case. The superquick action is always operative after arming and functions on impact unless prior functioning has been caused by time action.

c. USE. (1) This fuze is used to give air burst action to the shell. Antipersonnel effect can be secured by such action.

(2) The fuze is always shipped set at "S" (safe), with a safety wire or pin in place in closing cap assembly. Immediately before firing, remove safety wire or pin, and set fuze as desired.

(3) To set for time action, set graduated time train to desired time by means of the fuze setter (fig. 75).



Fig. 75. Using fuze setter to set time interval on fuze M5.

(4) To set for superquick action, set fuze at "S."

(5) If fuze has been prepared for firing and is not used, reset at "S" and replace safety wire or pin before returning fuze to its container.

d. SAFETY PRECAUTIONS. See paragraph 66d.

69. Packing

a. COMPLETE ROUND. (1) *Packing box* (fig. 76). All the components of two complete rounds are packed in a wooden box approximately $25\frac{1}{4}$ inches long, $11\frac{1}{2}$ inches wide, and $6\frac{3}{4}$ inches high, including top and bottom cleats. The box is hinged, closed with hasps and latches, and bound at each end with a nailless metal strapping. The two shells each have a complete propelling charge and cartridge assembled. An extra cartridge, wrapped in paper, is furnished on the basis of 1 per 10 shell and is packed in a box of shell. Each complete round is inclosed in a

cylindrical, waterproof container in which the shell may be brought up to the mortar. Displacement of the box is approximately 1.12 cubic feet. Weight of the box packed with two complete rounds in their waterproof containers varies with the type of filling of the shell as follows:

Complete round nomenclature		Packing	
		Gross shipping weight two rounds (pounds)	Gross shipping volume two rounds (cu. ft.)
Col. No.	1	2	3
1	Shell, smoke, WP, 4.2-inch chemical mortar, M2	68.5	1.12
2	Shell, smoke, FS, 4.2-inch chemical mortar, M2	68.5	1.12
3	Shell, gas, nonpersistent, CG, 4.2-inch chemical mortar, M2	66.0	1.12
4	Shell, gas, persistent, HD, 4.2-inch chemical mortar, M2	65.2	1.12
5	Shell, gas, irritant, CNB, 4.2-inch chemical mortar, M2	64.4	1.12
6	Shell, gas, irritant, CNS, 4.2-inch chemical mortar, M2	67.5	1.12
7	Shell, 4.2-inch chemical mortar, (HE), M3 (W/M3 fuze)	68.6	1.12
8	Shell, 4.2-inch chemical mortar, (HE), M3 (W/M4 fuze)	68.6	1.12
9	Shell, 4.2-inch chemical mortar, (HE), M3 (W/M5 fuze)	68.6	1.12
10	Shell, sub-caliber, 3-inch, M5 (for 4.2-inch chemical mortar)	(10 rds.) Approx. 90.0	(10 rds.) 1.5

(2) *Marking for shipment.* Packings for shipment and shipping plates are marked as follows:

- (a) Name and address of consignee (or code marking).
- (b) List and description of contents.
- (c) Gross weight in pounds and displacement in cubic feet.
- (d) The letters "U.S." in several conspicuous places.
- (e) Order number, contract number, or shipping number.
- (f) Chemical Warfare Service insignia.
- (g) Name or designation of consignor preceded by word "From."
- (h) Service color painted as three triangles on adjacent faces on diagonally opposite corners.
- (i) Lot number.
- (j) Month and year packed.
- (k) Inspector's stamp.

PACKING FOR SHIPMENT

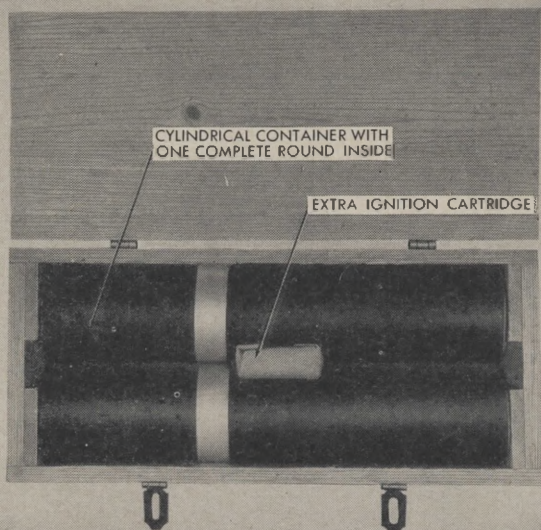


Fig. 76. Two complete rounds in packing box.

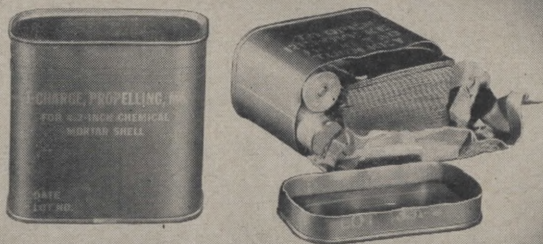


Fig. 77. Packing additional M6 propelling charge.

b. PROPELLING CHARGE. (1) When propelling charges are shipped in bulk, one complete propelling charge and two cartridges are packed in a vacuum type can (fig. 77). This container, olive drab with yellow markings, has a key opener welded or soldered to the bottom. The dimensions of the can are approximately $3\frac{3}{8}$ inches wide, 2 inches thick, and $3\frac{3}{8}$ inches high.

(2) Fifty of these cans are shipped in a wooden box which is nailed shut and bound with flat metal strapping or round wire. The dimensions of the box are approximately 12 by 21 by 18 inches.

c. FUZE M3. When the M3 fuze assemblies are shipped in bulk, they are packed 50 to a wooden box. The fuzes are packed in 2 horizontal rows, the bottom row containing 30 fuzes, and the top row holding 20 fuzes. Dimensions of the box are approximately 20 inches long, 16 inches wide, and 11 inches high.

d. FUZE M4. (1) Twenty M4 fuzes are packed in a wooden box approximately $16\frac{1}{2}$ inches long, 14 inches wide, and 10 inches high.

(2) Each fuze is packed separately in a cylindrical vacuum type can approximately 3 inches in diameter and 8 inches high. A key opener is attached to the bottom of the can. The container is painted olive-drab and has yellow markings.

e. FUZE M5. Twelve M5 fuzes are packed in a manner similar to the M4 fuze. The individual containers are approximately 3 inches in diameter and $10\frac{1}{2}$ inches high.

70. Subcaliber Ammunition

a. SHELL, SUBCALIBER, 3-INCH, M5 (fig. 78). The shell is $12\frac{3}{16}$ inches long and weighs 6 pounds. It has a cast iron nose, steel backbone shaft, hardwood body, and steel tail vanes. The nose and lower ends of the vanes are turned to a 3.017-inch and 2.035-inch caliber, respectively. A well $\frac{3}{4}$ inch in diameter is drilled $1\frac{3}{16}$ inches into the nose to receive the smoke charge. The vanes are slotted to accommodate the powder rings.

b. CARTRIDGE, IGNITION, M5A1. This cartridge is used as the basic propelling force, fitting into a container inside the tail vane assembly.

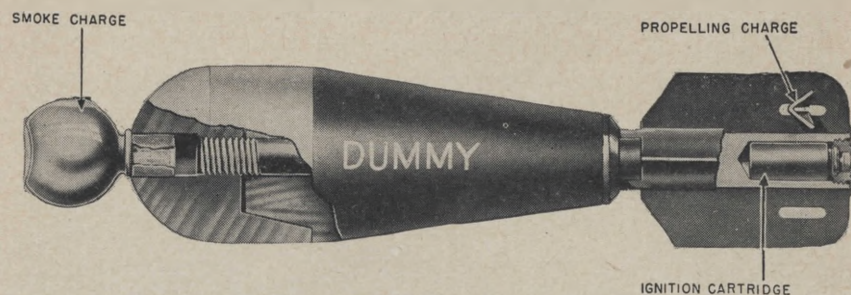


Fig. 78. Shell M5 used with sub-caliber mortar.

This is the same cartridge used with the 60-millimeter mortar shell. An M32 percussion primer is screwed into place behind it.

c. CHARGE, PROPELLING, 3-INCH SUBCALIBER SHELL, M8. The charge consists of sheets 1 inch square, assembled five sheets to a ring.

d. CHARGE, SMOKE, 3-INCH, SUBCALIBER SHELL, M1. The charge is a 50-cubic centimeter resistant glass boiling flask filled with FM (titanium tetrachloride). The flask has an $\frac{11}{16}$ -inch lipless neck and takes a rubber stopper which is dipped in sodium silicate solution before insertion. The neck is then dipped in sealing wax, and a laminated protective sleeve is fitted over it.

e. PACKING. (1) Ten subcaliber shell (less smoke charge, propelling charge, and cartridge) are packed in a wood chest approximately 20 inches long, 18 inches wide, and $13\frac{1}{2}$ inches high. The box, which has a hinged cover fitted with a hasp, is divided into 10 compartments, 1 for each shell.

(2) Two propelling charges are packed in a cylindrical fiber container. The contents of the container are two ignition cartridges, two percussion primers, eight one-bundle units of powder, and two five-bundle units of powder. The container is approximately $2\frac{1}{4}$ inches in diameter and $2\frac{1}{2}$ inches high. For shipment in bulk, 50 fiber containers (100 propelling charges) are packed in 2 layers, 25 to a layer. Dimensions of the box are approximately 13 inches wide, 13 inches long, and 6 inches high.

(3) Fifty subcaliber shell smoke charges are packed in a nailed wood shipping box. The charges are packed in 2 layers (25 to a layer) and protected against breakage by corrugated fiberboard. The shipping box is approximately 12 inches wide, $23\frac{3}{4}$ inches long, and $7\frac{3}{4}$ inches high.

Section XX. SIGHTING AND FIRE CONTROL EQUIPMENT

71. General

a. SIGHTING EQUIPMENT. Mount, telescope, M59 with telescope, elbow, M62, light, instrument, M42, and case, carrying, M48 comprise the standard sighting equipment used with the 4.2-inch chemical mortar. All components are officially designated as the kit, sight, 4.2-inch chemical mortar, M1 (fig. 79). This equipment is designed to lay the mortar in azimuth and elevation and is used for fire at angles from 800 mils to 1,065 mils elevation. The substitute standard sight is the MII model. The setter, fuze, M14 is also furnished for setting the time and superquick fuze M5.

b. FIRE CONTROL EQUIPMENT. (1) Fire control equipment includes the following:

Range finder M7

Mil rule MI

Binocular M13

Compass M2

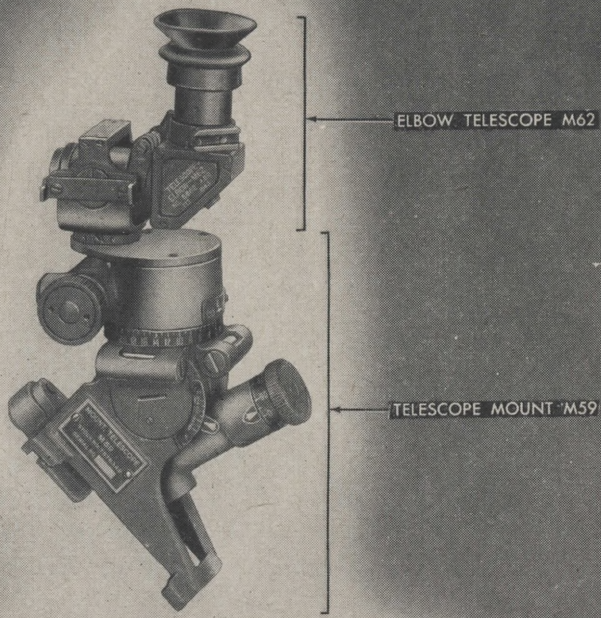
Firing table (FT 4.2-B-1)

Aiming circle M1

Observation telescope M48

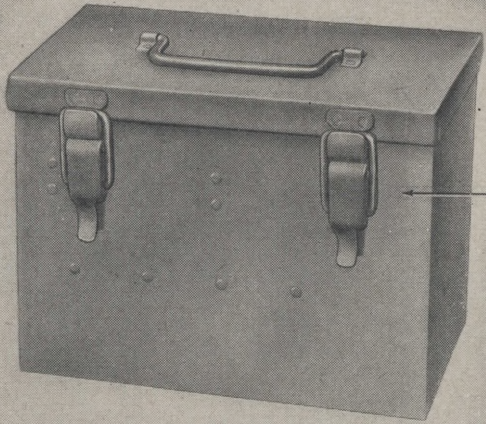
Wrist watch, 7 jewels

Wrist watch, 15 or more jewels

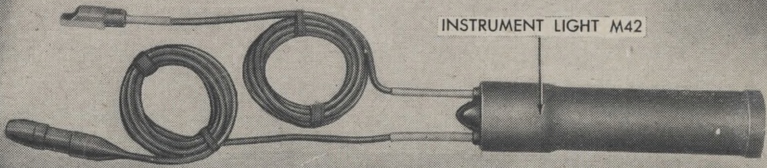


ELBOW TELESCOPE M62

TELESCOPE MOUNT M59



CARRYING CASE M48



INSTRUMENT LIGHT M42

Fig. 79. Component parts of sight kit.

(2) The equipment listed above except the mil rule is not covered in this manual. For detailed description of the other items, refer to TM 9-575.

72. Telescope Mount M59

a. DESCRIPTION. Elbow telescope M62 attached to telescope mount M59 (fig. 80) is the sight designed to replace sight MII previously used on the 4.2-inch chemical mortar. Elbow telescope M62 is a 3-power instrument with a field of view of $12^{\circ} 12'$.

b. POSITION. The sight fits on upper end of the barrel of the mortar when in sighting position and is removed during firing.

73. Components of Mount

The M59 mount consists principally of the following units or assemblies:

a. SUPPORTING BRACKET ASSEMBLY. This assembly consists of a supporting bracket (fig. 80) and a clamp with its holding spring. The bracket has a forked section which forms a support for the collar. On the base of this bracket are four machined curved locating surfaces which fit the curved surfaces at the muzzle end of the mortar barrel. A machined shoulder at the forward end of the bracket serves as a locating surface to align sight on the barrel. The clamp, held to the front end of the bracket by a screw and a spring, fits inside curved surface of the mortar. The sight can be attached to and removed from the mortar by pulling down on the clamp, expanding the spring, and slipping sight over front end of mortar.

b. ELEVATION MECHANISM. (1) This unit consists essentially of the elevation gear housing (main housing), elevation gear, collar, and elevation worm with its micrometer and knob. The elevation scale is attached to the supporting bracket.

(2) The elevation gear housing is mounted on the elevation gear which, in turn, is mounted on the collar. The collar is mounted in and keyed to the supporting bracket and forms the support for the elevation mechanism. A key which fits into a keyway in the bracket holds collar and gear rigidly to the bracket. A cap, screwed into the collar, holds collar in bracket and covers key.

(3) Two indexes are engraved on lower part of main housing: elevation micrometer index, which registers against elevation micrometer; and elevation scale index, which registers against elevation scale. The elevation scale, which is attached to the supporting bracket, is graduated every 100 mils and marked every 200 mils from 600 to 1,200 mils. This scale is supplemented by a micrometer on the elevation worm (fig. 80).

(4) An elevation level and a cross-level, used for setting elevation and for cross-leveling, are attached to the main housing.

(5) An azimuth scale is engraved on cylinder part of the housing.

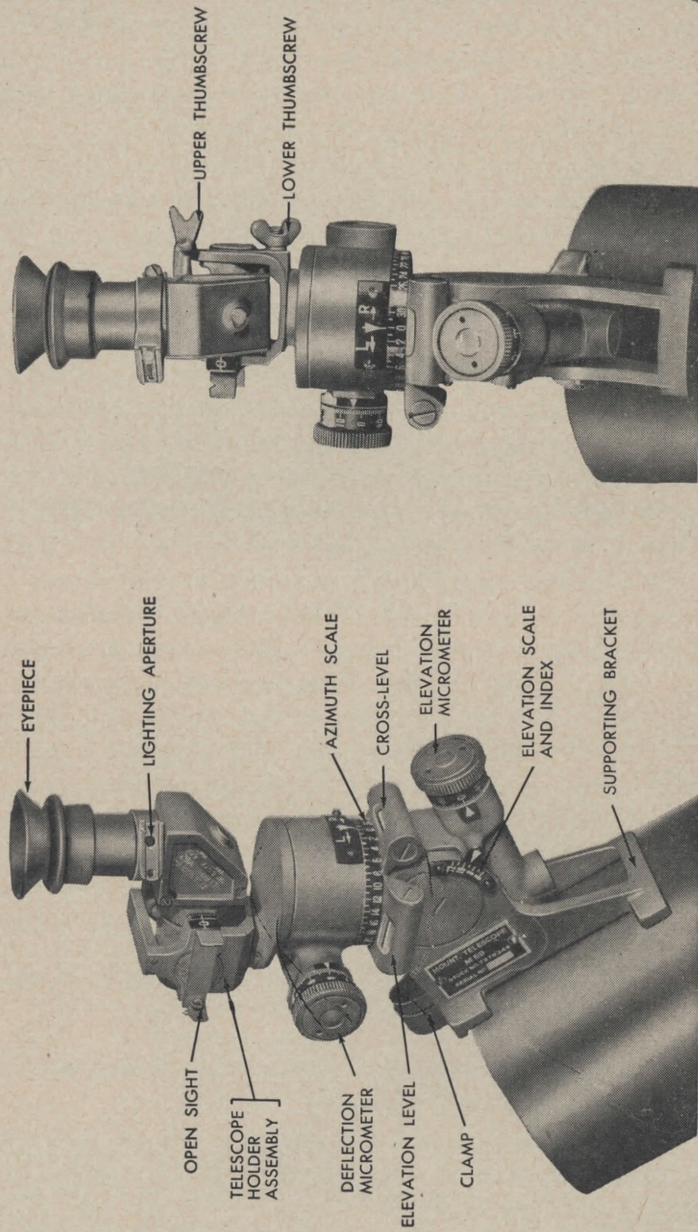


Fig. 80. Side and rear view of sight M59.

(6) The elevation worm fits into lower part of main housing and engages the teeth on the elevation gear. On outer end of elevation worm are mounted the elevation micrometer and knob. The micrometer is graduated in 1-mil increments and marked every 10 mils. One complete revolution of the micrometer is equal to 100 mils or one graduation on the elevation scale. Since the elevation gear and collar are keyed to the supporting bracket, rotation of the elevation worm causes main housing to rotate about elevation gear, setting the sight for elevation.

(7) Stops are provided in the elevation mechanism to limit the turning motion of the main housing, and this instrument may be damaged if an attempt is made to turn it beyond the stops provided.

c. DEFLECTION MECHANISM. (1) This mechanism consists essentially of the main housing, deflection worm housing, and deflection worm with its micrometer and knob. It includes parts which cause the line of sight to be moved to right or left of normal position to set off deflections.

(2) Gear teeth are cut in cylindrical portion of the main housing, and an azimuth scale is engraved on a flange below these teeth. These are the only items on the main housing associated with deflection mechanism. The azimuth scale is graduated in 64 100-mil steps and marked every second division from 0 to 30 to the left and from 30 to 0 to the right.

(3) The deflection worm housing fits down over gear of main housing and contains the deflection worm which meshes with this gear. At center of the housing is the azimuth scale index. On this index are engraved the letters "L" and "R" with arrows to show directions of motion for left or right deflections. This index registers against azimuth scale engraved on main housing. Deflection motion permits 6,400-mil traverse to right or left.

(4) The deflection worm with its micrometer and knob make up remaining portion of this mechanism. This worm is contained in the housing; the micrometer and knob fit over end of the worm. A mechanism is provided to permit disengaging the worm from its mating gear in order to provide fast motion for making large changes in deflection. Deflection micrometer is graduated in 1-mil increments from 0 to 100 mils and numbered every 10 mils. Deflection micrometer index is on worm throw-out shoe and registers against the micrometer.

d. TELESCOPE HOLDER ASSEMBLY. The telescope holder assembly consists of a support and a bracket assembly.

(1) *Support.* The support is the supporting element for the bracket assembly and is attached by screws to the top of the deflection worm housing.

(2) *Bracket assembly.* Elbow telescope M62 is mounted in the bracket assembly. By loosening upper thumbscrew (fig. 80), telescope can be rotated about axis of objective, allowing a range of positions for the telescope. If lower thumbscrew (fig. 80) is loosened, elbow telescope can be

moved in elevation. Indexes on left side of telescope holder can be matched to help set telescope in level position.

(3) *Assembly band.* Around upper portion of the elbow telescope is the assembly band, milled to receive reticle light of instrument light M42 (par. 74), which is used for illuminating cross hairs.

74. Illuminating Sight

The reticle may be illuminated at night with instrument light M42 for the telescope mount M59. The light is attached to the assembly band on the elbow telescope M62. A finger light on a flexible cord is used to illuminate scales and bubbles, and two BA-30 cells in a battery case furnish current. A rheostat switch on top of the battery case turns reticle and finger lights on or off. By turning switch to the right, lights are turned on; by continuing to turn to the right, reticle light becomes more intense because of action of the rheostat. This provides a method whereby illumination of the reticle may be made more or less intense, depending upon how much light is desired. The instrument light should be turned off except when in actual use. When instrument light is in the carrying case, BA-30 cells should be removed from the battery case and placed in the space provided for them.

75. Operation of Sight (FM 23-92).

- a. Remove sight from carrying case and place in position on muzzle of mortar. Make certain that all locating surfaces are properly positioned.
- b. Set elevation and deflection scales to desired values. Range-elevation data may be obtained from appropriate firing table. Angular units employed in elevation and deflection are mils.
- c. Operate elevating screw wheel on mortar, centering bubble in elevation level on the sight. Traverse mortar until vertical hair of the telescope cross hairs is laid on the aiming point. Make sure that sight is cross-leveled. Mortar is now properly laid in elevation and direction.
- d. When traversing during actual laying of the mortar, gunner should keep line of telescope in vertical position, checking on centering of cross-level on sight when necessary.
- e. To remove sight, slide it forward. Place it in carrying case provided.

76. Care and Preservation

This sight is rugged and suited to the purpose for which it was designed. It does not, however, stand abuse or rough handling; inaccuracy or malfunctioning results from such mistreatment. The following precautions must be observed:

- a. Avoid striking or otherwise injuring any part of the sight, particu-

larly burring or denting locating, surfaces of sight bracket. Avoid bumping micrometer knobs and telescope adapter.

b. When not in use, keep sight in carrying case provided. Keep sight as dry as possible and never place in carrying case while wet or damp.

c. Turn in for repair, by ordnance personnel, any sight which fails to indicate or function correctly.

d. Disassembly of sight by using arm is not permitted.

e. Keep optical parts of telescope clean and dry. For wiping these parts, use lens cleaning tissue. *Do not* use polishing liquids, pastes, or abrasives on optical parts.

f. Oil moving parts of sight occasionally, using a small quantity of light (PL) preservative lubricating oil. To prevent accumulation of dust and grit, wipe off excess lubricant that seeps from the moving parts.

77. Calibrating Sight

a. ELEVATION SCALES. (1) Set up mortar on level ground with traversing screw centered and elevation 900 mils. Sandbag the mortar for stability.

(2) Set elevation of mortar barrel with gunner's quadrant; for example, 800, 900, or 1000 mils.

(3) Level deflection bubble first; then level elevation bubble by turning elevation micrometer knob.

(4) If reading of elevation scale of sight is not the same as the elevation set with gunner's quadrant, the correction is made as follows:

(*a*) Loosen locking nut of elevation micrometer knob with spanner wrench.

(*b*) Hold elevation micrometer knob with one hand and turn micrometer scale to desired reading with the other hand.

(*c*) Tighten locking nut of elevation micrometer knob with spanner wrench.

(*d*) Recheck readings of gunner's quadrant and sight. If the two readings do not correspond, repeat operations listed in (2), (3), and (4) above.

b. DEFLECTION SCALES. (1) Set up mortar on level ground with traversing screw centered and elevation 900 mils. Sandbag mortar for stability.

(2) Set up aiming circle 100 yards to the rear of the mortar and in line with the barrel, as close as can be approximated.

(3) Zero the scales of the aiming circle.

(4) Lay vertical hairline of aiming circle on center of mortar tube cap with lower motion. If a pencil is held on the center of the mortar tube cap, which is located by measuring from the radial pins, the aiming circle

operator can lay the vertical hairline of the aiming circle on the center of the tube cap more easily.

(5) With vertical hairline of the aiming circle laid on the center of the mortar tube cap, traverse mortar until center of muzzle is in coincidence with vertical hairline of aiming circle.

(6) Re-lay vertical hairline of aiming circle on center of mortar tube cap with lower motion. Traverse mortar until center of muzzle is in coincidence with vertical hairline. Repeat this operation until both the center of the mortar tube cap and center of the muzzle are in coincidence with vertical hairline of the aiming circle.

(7) Place sight on mortar; level bubbles. Refer to center of telescope lens of the aiming circle.

(a) If reading of deflection scale is zero, the sight is in alignment.

(b) If reading of the deflection scale is not zero, the sight must be aligned by the following procedure:

1. Loosen locking nut of azimuth micrometer knob with spanner wrench.
2. Hold micrometer knob with one hand and turn micrometer scale with the other hand until zero is aligned with the index.
3. Repeat operation outlined in (6) above, until zero reading of the deflection scale aligns sight on center of telescope lens of the aiming circle.
4. Tighten locking nut of micrometer knob with spanner wrench.
5. Recheck reading of the deflection scale. If reading is not zero, repeat operations outlined in this paragraph.

78. Sight MII

Sight, chemical mortar, MII (substitute standard) (fig. 81) consists essentially of three major parts (each a bronze casting): body, elevation indicator, and sighting arm. It is used to lay mortar on the line of sight and to indicate when barrel has been brought to desired angle of elevation. Sight fits on upper end of muzzle of mortar when in firing position and is removed during firing. The elevation indicator pivots around a sleeve at front end of the body and may be clamped by a thumbscrew in position corresponding to desired elevation as indicated by the elevation scale engraved on the side of the body. The elevation indicator is provided with a level glass so mounted that the bubble occupies center position when barrel is elevated or depressed to the angle at which the indicator has been set. On the sighting arm at rear end are mounted a cross-level glass, traversing indicator (a movable notch which travels on traversing indicator screw), and traversing scale. Luminous material is applied to the face of the traversing indicator and bead on front end of sighting arm. The sight is carried in a leather case with the shoulder strap.

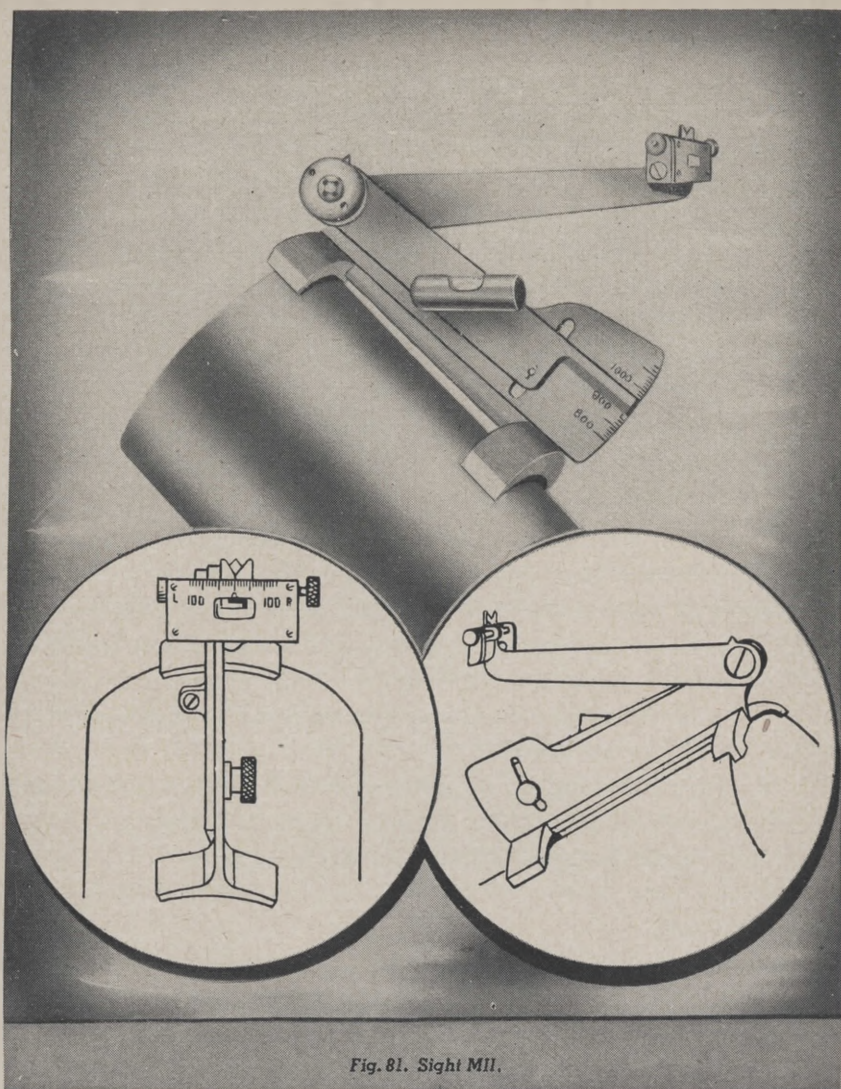


Fig. 81. Sight Mil.

79. Mil Rule

The rule, mil, 4.2-inch chemical mortar, MI is a simple, wood device used to determine, in mils, width or height of an object (fig. 3). It consists of—

a. Rule proper, graduated in units of 10 mils up to 100 mils on both sides of the 0 graduation at center of the scale.

b. Two cords, each tied to the rule proper $\frac{1}{2}$ inch from the ends, by an overhand knot.

c. A brass ring, with $\frac{3}{4}$ -inch inside diameter, to which other ends of the two cords are attached by slip knots.

Section XXI. MORTAR TRANSPORT EQUIPMENT

80. Shell Carrier MI

The carrier, shell, chemical mortar, MI, which is used to carry two chemical mortar shells, 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 $2\frac{1}{8}$ pounds (fig. 82).

81. Cart M1A1

a. GENERAL. The cart, 4.2-inch chemical mortar and ammunition, M1A1 (fig. 7), which is used for transportation of the 4.2-inch chemical mortar and accessories, spare parts, and ammunition (par. 20), is a two-wheeled man-drawn cart consisting of a chassis and a barrel rack. When employed for transporting ammunition, the barrel rack is not used.

b. CHASSIS (fig. 7). (1) The frame of the chassis is constructed from 2- by 2- by $\frac{3}{16}$ -inch angle steel, and is $26\frac{1}{8}$ inches wide and 37 inches long. The axle is welded near the center and is fitted with motorcycle wheels. The tires are 4.00 by 18 inches in size, with an outside diameter of 26 inches. The cart has a tread of $33\frac{3}{4}$ inches and an over-all length, including the pole, of 7 feet $3\frac{9}{16}$ inches.

(2) At the front end of the frame are welded **U**-shaped brackets. To these are welded pole braces 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 also 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 pull-handle is a ring (approximately $1\frac{1}{4}$ inches in diameter) to which two lead chains with handles are attached by round eye snaps.

(4) A tool box is located between the pole braces and front angle of the chassis. Clips for the spade and pick mattock handle are welded to this angle. On the rear angle of the chassis frame are located clips for the spade, standard, baseplate, and pick mattock handle. Under the rear of the chassis is a seamless steel tube, $1\frac{1}{4}$ inches in diameter, extending entire width of the frame and projecting at either end to form guards for the wheels. The tube also provides a handle for lifting the cart on or off trucks.

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

c. Barrel rack. The barrel rack (fig. 7) is $40\frac{3}{8}$ inches long, $10\frac{1}{8}$ inches wide, and $9\frac{1}{8}$ inches high. Longitudinal members are constructed from $1\frac{1}{2}$ - by $1\frac{1}{2}$ - by $\frac{1}{8}$ -inch angle steel. The front and rear cross members are channel-shaped and of $\frac{1}{8}$ -inch steel plate; the middle cross member is



Fig. 82. Shell carrier M1.

of 1½-inch steel tubing. Above the channels is a steel strap 1 inch wide and 3/16-inch thick, bent 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 barrel rack. The rack is supported on four brackets made of 1½- by 1½- by 1/8-inch structural steel. At lower end of each, and projecting down from it, a 1/2-inch pin is welded. These pins enter drilled holes in the baseplate when the cart is loaded, locating rack and preventing any movement of it.

82. Mortar and Ammunition Cart Accessories Set

The set, accessories, 4.2-inch chemical mortar and ammunition cart, M1A1 consists of the following components (fig. 83):

<i>Item</i>	<i>Quantity</i>	<i>Stock number</i>
BAG, tool, assembly.....	1	E8-9-109
CORE, valve (box of 5).....	1	H18-66-1
IRON, tire (flat type, 15" max. length, steel)....	1	H18-66-2
KIT, repair, rubber tube.....	1	H18-66-3
PUMP, motorcycle-tire, hand (max. over-all length 15½")	1	H18-66-7
TUBE, rubber cement (1 oz.).....	1	H18-66-4
WRENCH, automotive, adjustable, 9".....	1	E22-49-3

83. Cart Maintenance

a. POLE PIN ASSEMBLY. (1) To remove pole pin assembly, grasp loop of pin (fig. 84), pull pin from hole, and unscrew machine screw at end of chain. This allows pole pin assembly to fall free.

(2) To replace pole pin assembly, reverse procedure described in (1) above.

b. PULL-HANDLE ASSEMBLY. (1) To remove pull-handle, pull the pole pin from its hole as described in *a* above and, with a twisting and pulling action on the handle, pull handle free of the cart (fig. 85).

(2) To replace pull-handle assembly, reverse procedure described in (1) above.

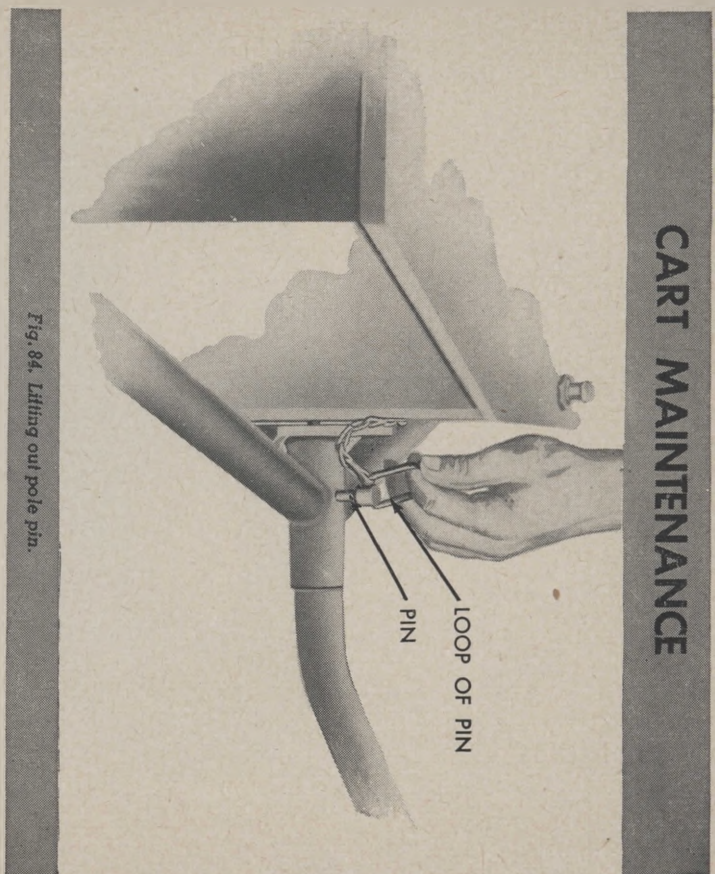
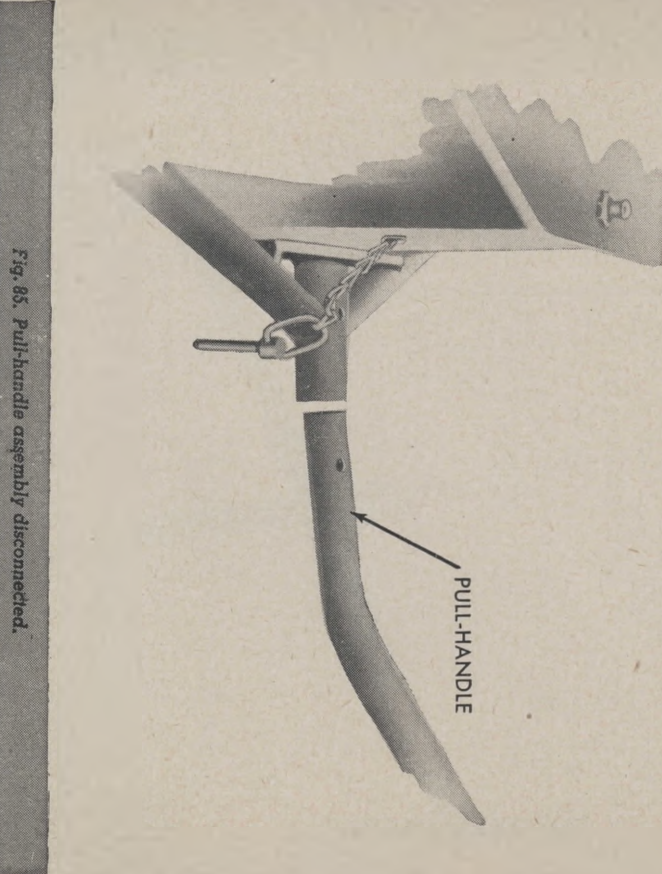
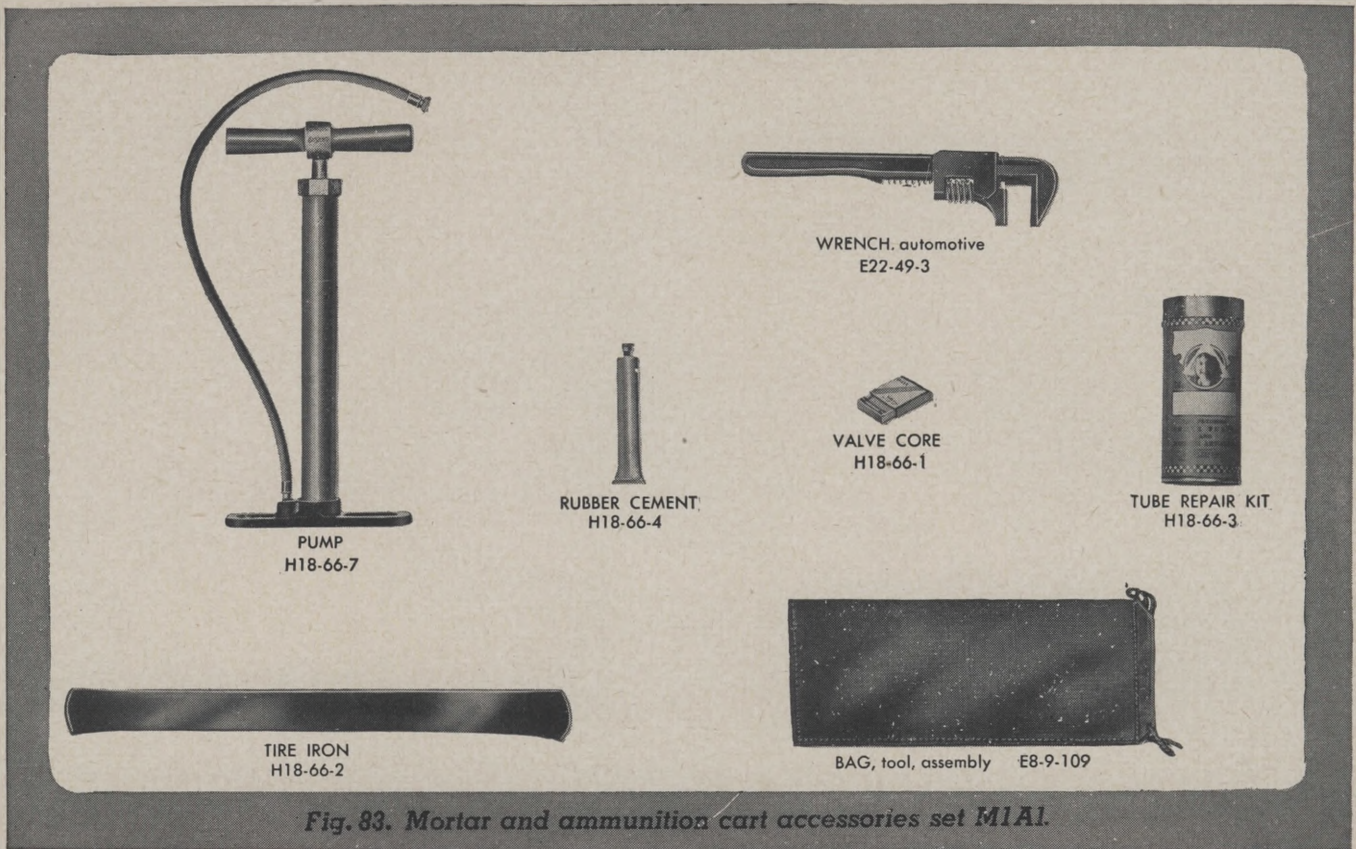
c. LUBRICATING FITTING. (1) To remove lubricating fitting, use a small adjustable wrench, which is contained in company motor maintenance chest, and unscrew fitting.

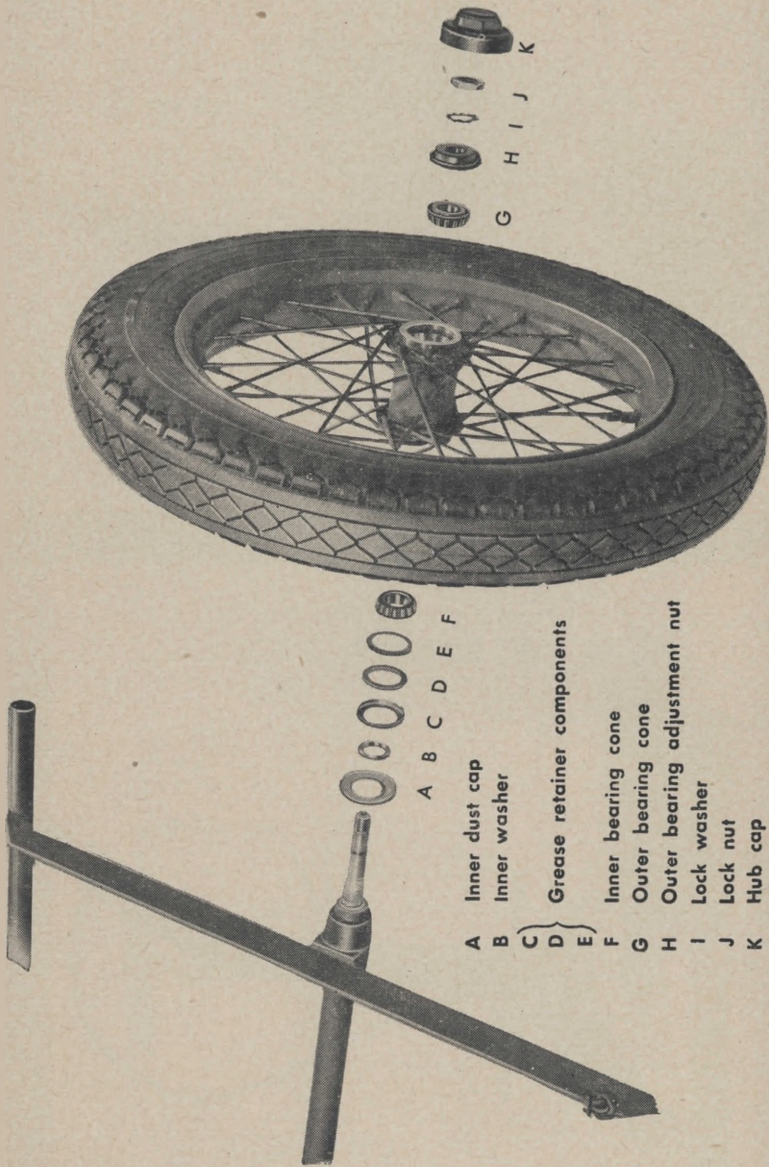
(2) To replace fitting, reverse procedure described in (1) above.

d. HUB CAP. (1) To remove hub cap from cart wheel assembly (fig. 86), use adjustable automotive wrench and unscrew cap (fig. 87).

(2) To replace hub cap, reverse procedure described in (1) above.

e. OUTER BEARING CONE. (1) To remove outer bearing cone, remove hub cap as prescribed in *d* above. Using the same wrench, unscrew lock





- A Inner dust cap
- B Inner washer
- C } Grease retainer components
- D }
- E }
- F Inner bearing cone
- G Outer bearing cone
- H Outer bearing adjustment nut
- I Lock washer
- J Lock nut
- K Hub cap

Fig. 86. Cart wheel assembly.

nut (fig. 88). Slide off lock washer, using fingers (fig. 89), and unscrew outer bearing adjustment nut (figs. 90 and 91). After removing the nut, take a screw driver and slide off outer bearing cone (figs. 92 and 93).

(2) To replace outer bearing cone, reverse procedure described in (1) above.

f. WHEEL. (1) To remove wheel, follow procedure described in *e* above. After removing outer bearing cone, slide wheel off the axle (fig. 94).

(2) To replace wheel, reverse procedure given in (1) above.

g. INNER BEARING CONE. (1) Remove wheel according to procedure given in *f* above and slide inner bearing cone off the axle (fig. 95). Inner bearing cone often comes off with the wheel because it sticks to the bearing cup. In this case, separate inner bearing cone by driving it out from opposite side, using a punch or wooden rod.

(2) To replace inner bearing cone, slide it on the axle and slide wheel up to it.

h. INNER GREASE RETAINER. (1) To remove inner grease retainer, take off inner bearing cone, as described in *g* above, and slide off retainer (fig. 96).

(2) To replace inner grease retainer, reverse procedure given in (1) above.

i. INNER BEARING SPACER. (1) To remove inner bearing spacer, separate it from grease retainer with screw driver, when they both come off together.

(2) To replace inner bearing spacer, slide it on the axle up to the inner dust cap

j. INNER DUST CAP. (1) To remove inner dust cap, remove inner bearing spacer as described in *i* above and slide off dust cap (fig. 97).

(2) To replace inner dust cap, proceed in reverse order to that given in (1) above.

k. TIRE. To remove the tire, first release air from inner tube. Remove lock nut on valve and apply tire iron to lift tire edge over edge of rim (fig. 98). After tire is completely lifted over edge of rim, push inner tube valve into space between tube and rim. Reach in and pull out inner tube (fig. 99). Remove inner tire flap.

84. Emergency First and Second Echelon Maintenance

a. ADJUSTING CHAINS, TIGHTENING CHAINS AND ADJUSTABLE CHAIN COUPLING. These chains are constructed of welded steel links. If one of the links break, open the link next to the broken one, using a hack saw, and connect the two free ends. Close link temporarily by hammering it. When time is available, weld new connection shut.

b. TOOL BOX. (1) To remove tool box, remove bolts inside box which secure it to cart chassis. Disconnect machine screw holding chain of

CART WHEEL MAINTENANCE

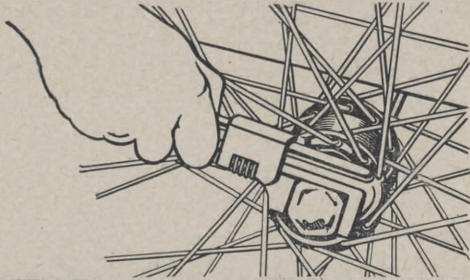


Fig. 87. Unscrewing hub cap.

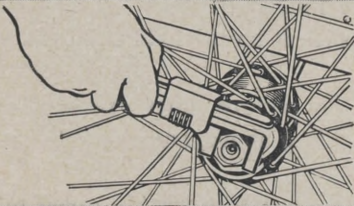


Fig. 88. Unscrewing lock nut.

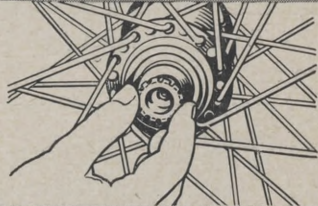


Fig. 89. Sliding off lock washer.

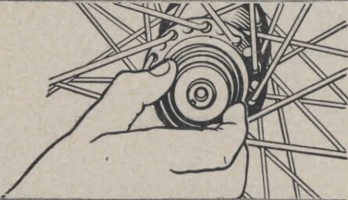


Fig. 90. Unscrewing outer bearing adjustment nut.



Fig. 91. Outer bearing adjustment nut removed.



Fig. 92. Sliding off outer bearing cone.



Fig. 93. Outer bearing cone removed.



Fig. 94. View of axle after removing wheel.

CART WHEEL MAINTENANCE

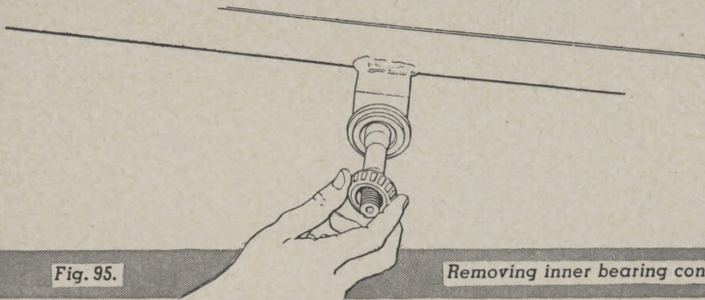


Fig. 95.

Removing inner bearing cone.

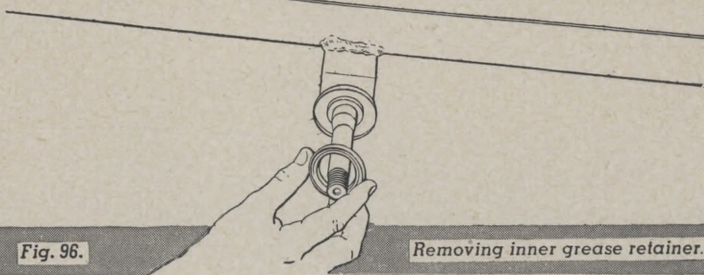


Fig. 96.

Removing inner grease retainer.

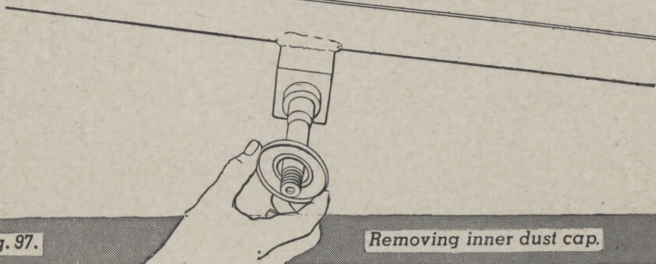


Fig. 97.

Removing inner dust cap.

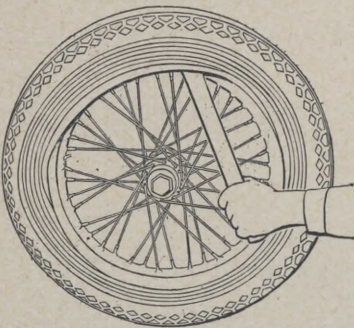


Fig. 98. Sliding tire over edge of rim, using tire iron.

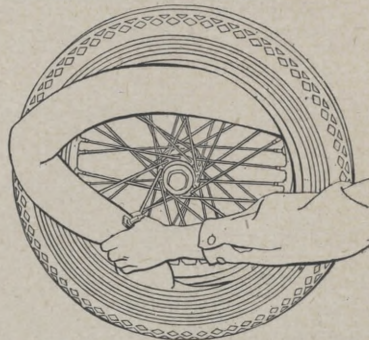


Fig. 99. Pulling tube out of tire.

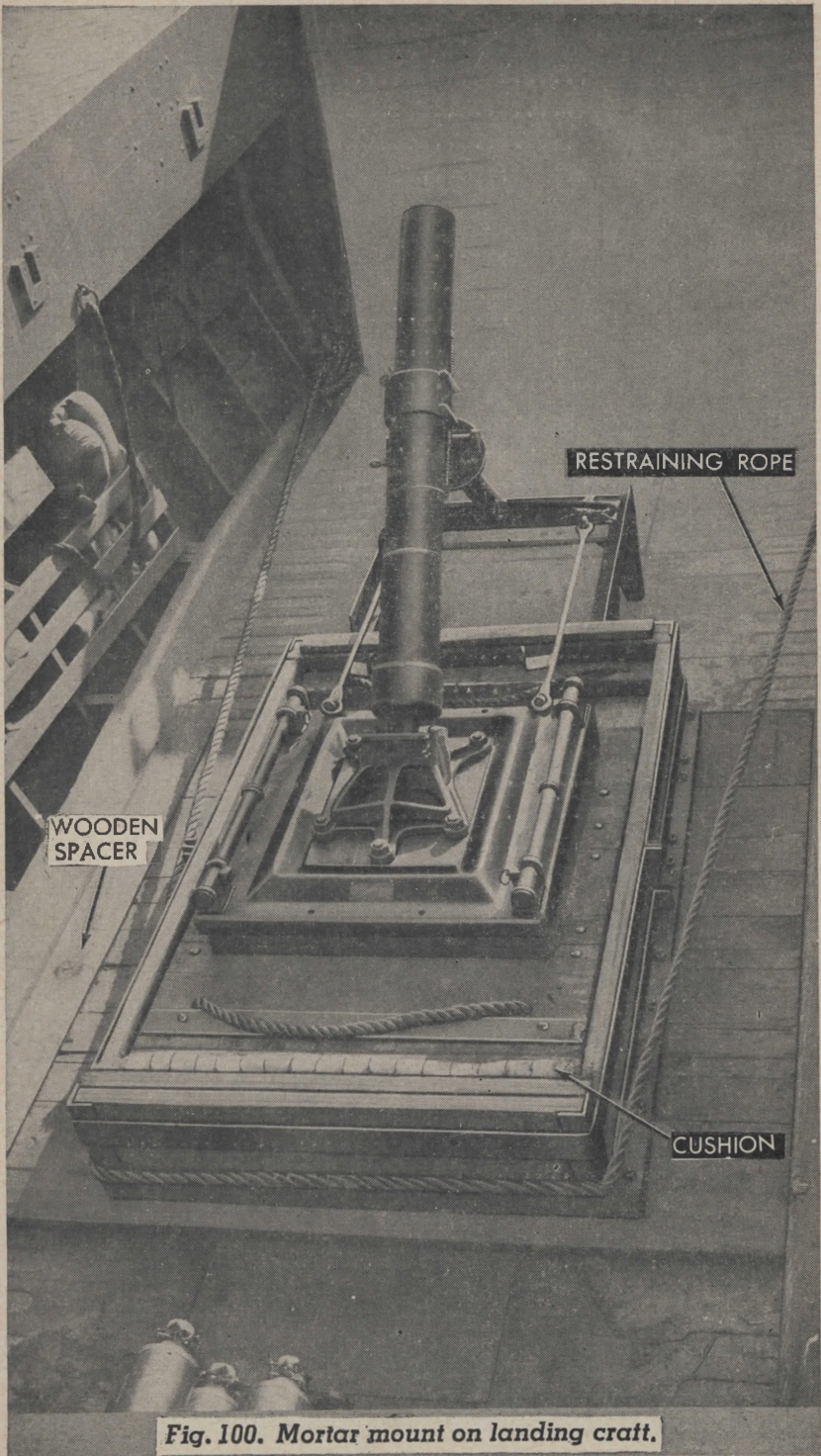


Fig. 100. Mortar mount on landing craft.

pole pin assembly. When this is accomplished lift box out of its position.

(2) To replace box, reverse procedure given in (1) above.

85. Landing Craft Mount

a. GENERAL. The E2R2 mount, consisting of a wooden structure in a steel frame, is designed to provide a secure and safe method for firing the 4.2-inch chemical mortar from an LCV (landing craft, vehicle) (fig. 100).

b. DESCRIPTION. Component parts of the E2R2 mount are base-and-cradle assembly and sub-base assembly. A filling, usually a sand-sawdust mixture, is used between the cradle and sub-base assembly to act as a shock absorber.

(1) *Base-and-cradle assembly.* Base-and-cradle assembly (fig. 101) consists of a hardwood base, a welded steel frame, wooden liners, a standard support, steel tie rods, and a specially constructed cushion.

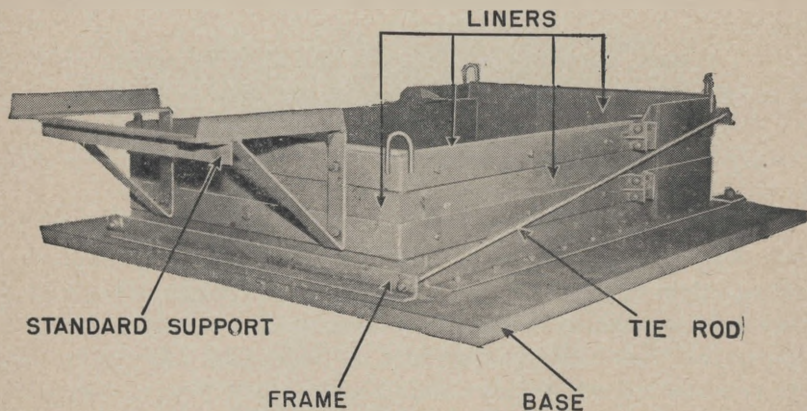


Fig. 101. Base and cradle assembly.

(*a*) **BASE.** The base (fig. 102) consists, primarily, of six hardwood planks, $1\frac{3}{4}$ inches to 2 inches thick, 12 inches wide, and 60 inches long, held together by strips of softwood (approximately 1 inch thick, 4 inches wide, and $69\frac{1}{8}$ inches long). The strips which form the bottom of the base assembly are nailed to the hardwood portion in such a manner that the holes which are drilled through the base assembly do not pass through the strips but come through at spaces between the two outer strips.

(*b*) **FRAME.** The frame is of welded steel construction and is secured to the base by machine bolts.

(*c*) **LINERS.** The liners are hardwood planks which are bolted to the inside of the frame. Front and rear liners are $3\frac{1}{2}$ to 4 inches thick, and the two side liners are approximately 2 inches thick.

(*d*) **STANDARD SUPPORT.** The support is constructed of structural steel, 2 inches wide and $\frac{1}{4}$ inch thick, designed so that it can be bolted to the

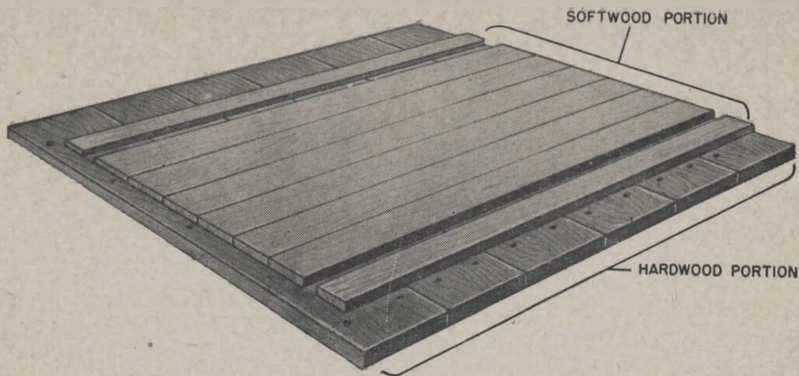


Fig. 102. Base of landing craft mount.

cradle assembly by passing bolts through holes in the frame and wooden front liner.

(e) **TIE RODS.** There are two tie rods on the E2R2 mount which are used to keep the mount rigid. The tie rods are made of cold-rolled steel, 69 inches long, and threaded for a distance of 3 inches at each end. A specially designed washer is used at each end for an equal stress and to prevent loosening of the nut.

(f) **CUSHION.** The cushion is made of olive-drab cotton duck and constructed as a series of seven pockets, each of which is filled with sand-sawdust mixture when the mount is used. The cushion, filled with the mixture, is approximately $2\frac{1}{2}$ inches thick and, when used, is placed between rear of sub-base and rear liner of cradle (fig. 100) in order for both to act as a shock absorber and to form a tight wedge between sub-base and cradle.

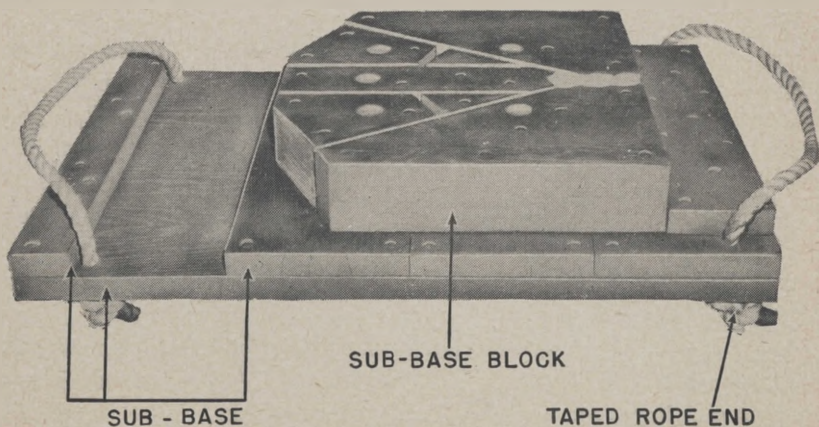


Fig. 103. Base and sub-base for landing craft mount.

(2) *Sub-base assembly* (fig. 103). Sub-base assembly is composed of a sub-base and a sub-base block.

(a) *SUB-BASE*. The sub-base, which is $33\frac{1}{4}$ inches wide by $55\frac{1}{2}$ inches long, is constructed of hardwood planks ($1\frac{3}{4}$ to 2 inches thick) and is held together by carriage bolts $5\frac{1}{2}$ inches in length. There are twenty-six $\frac{9}{16}$ -inch holes drilled in the sub-base through which bolts for holding the sub-base block are passed.

(b) *Sub-base block* (fig. 103). The block is a pentagonal structure, 5 inches thick, made of plywood. Number of plies employed is optional as long as thickness of resulting block is 5 inches. The block is cut and grooved to accommodate the spades of the mortar baseplate, thereby preventing shift of the baseplate after emplacement.

(c) *Rope*. Two pieces of 1-inch olive-drab cotton rope, each 5 feet long, are secured to the sub-base by tying simple knots at the ends after ends have been passed through the proper holes. Each end of the rope is then wrapped with 10 inches of $\frac{1}{2}$ -inch friction tape.

(3) *Filling*. The filling consists of a well-tamped mixture of equal parts of sand and sawdust. If sawdust is not available, filling may consist entirely of sand. Filling is placed in cradle, tamped well, and sub-base assembly lowered onto filling. See paragraph 21 for quantity of filling used.

c. *USE*. For use of the E2R2 mount see paragraph 21.

d. *PACKING*. The E2R2 mount, less the filling, is packed (fig. 18) with base-and-cradle assembly intact except for the standard support. Sub-base assembly is turned upside down and placed so that sub-base block is facing into interior of cradle assembly, where it is held by the shipping supports. The standard support is bolted to a shipping support and to a metal retaining strap. The rope (not shown in fig. 18), which is used for retaining the mortar standard on standard support during firing, is tied around standard support and retaining straps in order to keep support rigid during shipment. The sub-base assembly is kept from falling clear of base-and-cradle assembly during shipment by metal retaining straps which are bolted to base-and-cradle assembly. An assembly drawing is nailed on inside of mount.

86. Mule Pack M2

The pack, mule, 4.2-inch chemical mortar, M2 consists of Phillips pack-saddles (cargo type) to which welded strap metal adapters and hangers have been added to make possible transportation of the 4.2-inch chemical mortar and mortar ammunition by mules. Mortar and two rounds of ammunition are carried by two mules. Ammunition mules carry 10 rounds each.

a. ACCESSORIES FOR CARRYING MORTAR, TOOLS, AND AMMUNITION (FOR ONE PACK ANIMAL SQUAD).

Quantity	Components
1	ADAPTER, baseplate, front
1	ADAPTER, baseplate, rear
1	ADAPTER, barrel and standard front
1	ADAPTER, barrel and standard, rear
1	BAND, lifting, barrel
1	CASE, stake
1	HANGER, accessory, near side
1	HANGER, accessory, offside
1	HANGER, ammunition
4	STRAPS, tie-down, baseplate, 1½" x 64"
2	STRAPS, tie-down, standard 1½" x 66"
2	STRAPS, tie-down, standard, 1½" x 76"
4	STRAPS, hanger, ammunition, 1" x 25"
4	STRAPS, tie-down, ammunition, 1" x 44"
4	STRAPS, lower, 1" x 10"
4	STRAPS, upper, 1" x 18"
1	BAR, lifting, ¾" diameter x 54½" (consists of two pieces of pipe, each 27¼" long, threaded at one end and connected by a coupling)
16	STRAPS, load, ammunition, 1⅛" x 156"
8	BOLTS, machine, ⅜" x 1½"
8	NUTS, safety, ⅜"
8	WASHERS, lock, ⅜"

b. STANDARD PACK EQUIPMENT. In addition to accessories listed in a above, the following items of standard pack equipment are required.

Quantity	Components
6	BLANKETS
6	SADDLES, Phillips, pack, cargo (complete with cinches and cinch straps)
6	HALTERS
6	BREECHINGS
6	BITS, snaffle (complete with reins)
6	ROPES, halter
12	ROPES, lair
5	ROPES, lash
8	COVERS, pack manta, 6' x 6'
1	CINCHA, M7

c. DESCRIPTION. (1) *Baseplate adapters* (fig. 104). Front and rear baseplate adapters made of rolled steel, are bolted to the frame of the Phillips packsaddle. The front adapter has two ½-inch diameter pins for holding baseplate, welded to the support, and the rear adapter has a V-shaped retainer into which the V, formed by baseplate spades, fits.

MULE PACK

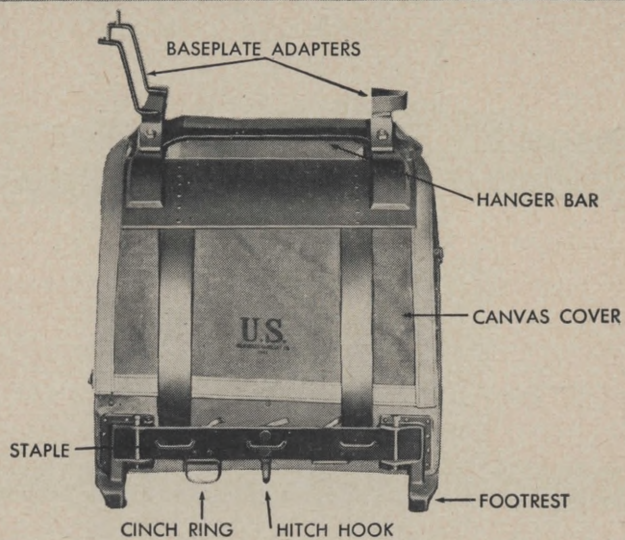


Fig. 104. Saddle with baseplate adapters.

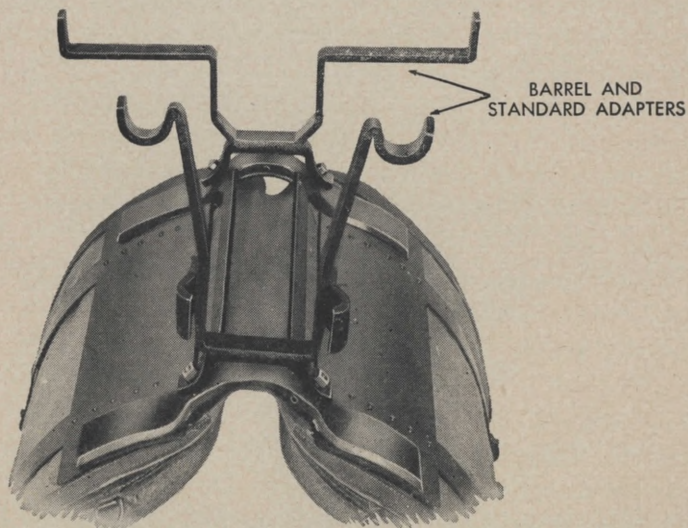


Fig. 105. Barrel and standard adapters.

(2) *Barrel and standard adapters* (fig. 105). The front and rear barrel and standard adapters are of welded steel construction. They are bolted to the respective ends of the packsaddle, using machine bolts. The barrel is held by adapters as shown in figure 106.

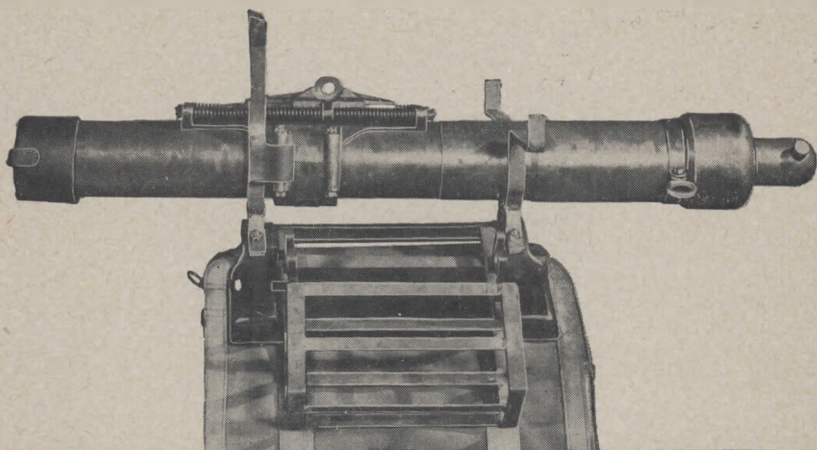


Fig. 106. Barrel held by adapters.

(3) *Barrel lifting band* (fig. 107). The barrel lifting band consists of two parts: the band and eye. The band is placed over the barrel and slid up to the tube cap where it is secured by tightening the nut. The eye, connected to the band with a machine bolt, aids in lifting the barrel. The lifting bar is passed through the eye.

(4) *Stake case* (fig. 108). The aiming stake case, constructed of hard textured duck (olive-drab), is used for carrying the aiming stakes. Sewn on the outside of the case is a cuplike pick mattock handle support into which the heavy portion of the handle is inserted. A cotton web strap keeps the handle from falling out of the support.

(5) *Near side and offside accessory hangers* (figs. 109 and 110). (a) These hangers, constructed of rolled steel, are used to carry the necessary mortar equipment. They are hung on the saddle hanger bars.

(b) The near side hanger can be distinguished from the offside hanger by small and large retainers.

(c) The offside hanger has a spring steel saddle, in place of retainers, to hold the shovel.

(d) Both hangers are approximately $13\frac{1}{2}$ inches long, $4\frac{5}{8}$ inches wide, and have over-all height of approximately 17 inches.

(6) *Ammunition hanger* (fig. 111). The ammunition hanger, constructed of welded steel, is designed to carry one shell on each side. It is placed on the packsaddle, hanger bars and secured, by straps on hanger, to center staples on bottom bars of saddle frame.

MULE PACK

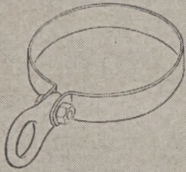


Fig. 107. Barrel lifting band.

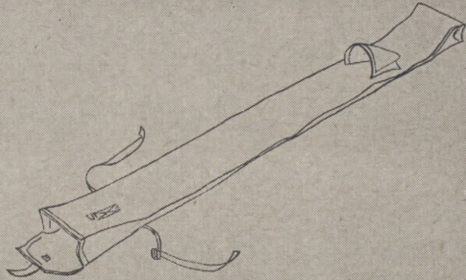


Fig. 108. Aiming stake case.

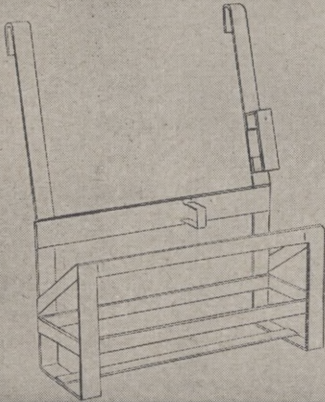


Fig. 109. Nearside accessory hanger.

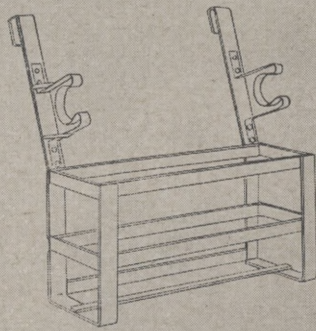


Fig. 110. Offside accessory hanger.

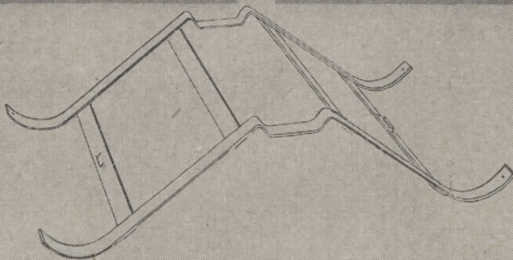


Fig. 111. Ammunition hanger.

(7) *Straps.* The straps (listed in *a* above) are constructed of olive-drab cotton webbing (heavy weight) and have tongueless bar buckles at one end and web-strap tips at the other. Lengths of the various types are given in *a* above.

(8) *Lifting bar.* The lifting bar consists of two pieces of pipe, each 27¼ inches long and threaded at one end. Metal coupling joins the pieces of pipe.

d. LOADS AND LOAD WEIGHT.

(1) <i>Load No. 1 (baseplate mule).</i>	<i>Pounds</i>
Baseplate M2A1	170
Two rounds ammunition	55
Adapters and hangers	15
Total weight, less saddle.....	240

(2) <i>Load No. 2 ((top load) barrel and barrel standard mule).</i>	<i>Pounds</i>
Barrel M2	104
Standard MI	52
Adapters	10
Total weight, less saddle.....	166

(3) <i>Near side (left side) accessory hanger.</i>	<i>Pounds</i>
Hanger, accessory	5.5
Mattock, pick (with handle).....	7.5
Rod, cleaning	2.5
Roll, tool ammunition (with four springs).....	5.5
Stakes, aiming (three with case).....	6.5
Lanyard	1.0
Total	28.5

(4) <i>Offside (right side) accessory hanger.</i>	<i>Pounds</i>
Hanger, accessory	5.5
Sandbag (empty)	4.0
Cloths, wiping	1.0
Oilcan, 1-quart	2.5
Roll, tool, gunner's	11.25
Slings (2)	0.75
Spade	5.0
Total	30.0

(5) <i>Total load weight of No. 2 mule.</i>	<i>Pounds</i>
Top load	163.0
Nearside	28.5
Offside	30.0
Cincha M7	8.0
Total	229.5

e. USE. See paragraph 22 for use of the mule pack.

Section XXII. SUBCALIBER EQUIPMENT

87. General

Subcaliber equipment is used for training purposes only and is not taken into the theater of operations. It provides training in traversing and elevation, computation of firing data, and use of the sight. Since it permits actual firing of the mortar on a miniature basis (115 to 425 yards), the trainer is customarily used on a fixed range with scale replicas of enemy observation posts, buildings, and other installations as targets.

88. Description

The trainer consists of a 3-inch barrel with a striker pin. It is inserted into the standard mortar barrel so that its muzzle protrudes about 2 inches beyond the mortar muzzle (fig. 112). The shell is made of steel and hardwood. A small glass boiling flask filled with FM (titanium tetrachloride) is inserted into the nose. Sixty-millimeter M5A1 mortar cartridges and M32 percussion primers are used, together with a special propelling charge. Shell are retrievable. Laying and changes in elevation and deflection are accomplished with the standard mortar sight and with the elevating and traversing mechanisms.

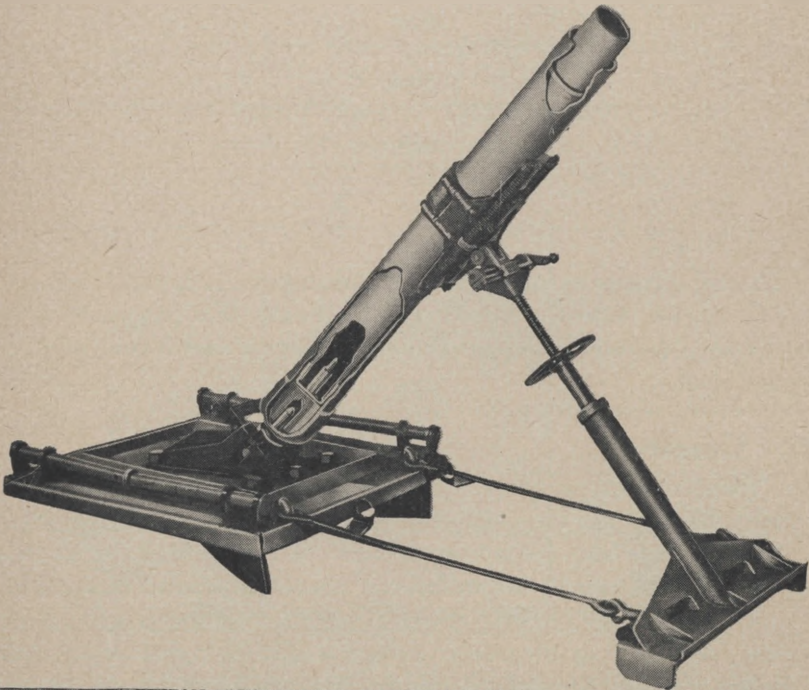


Fig. 112. Cutaway view of sub-caliber barrel installed in 4.2-inch mortar.

a. BARREL ASSEMBLY. (1) The barrel, subcaliber, 3-inch, M3 is made of seamless steel tubing. It has a 3-inch inside diameter, walls $\frac{3}{16}$ inch thick, and is $41\frac{3}{4}$ inches long.

(2) Four and one-half inches back from the muzzle is a brass barrel adapter ring with an outside diameter of 4.19 inches. This ring serves to center the forward end of the trainer barrel in the parent barrel.

(3) The butt end of the barrel is threaded to receive a steel barrel cap. This cap is 2 inches deep and 4.19 inches in diameter. (A dull-pointed striker pin is screwed into it.) The 4.19-inch outside diameter of the barrel cap centers the lower end of the subcaliber barrel in the parent barrel.

(4) A hardwood bumper block is slipped into the parent barrel before the trainer barrel is inserted. This covers the striker pin of the parent mortar and provides a rest for the trainer. The block is $4\frac{1}{8}$ inches in diameter and $4\frac{1}{2}$ inches deep, with a $1\frac{1}{4}$ -inch hole at its center extending 3 inches into the block. The parent striker pin fits inside this hole.

b. AMMUNITION. See paragraph 70.

c. ACCESSORIES. (1) The set, accessories and spare parts, for 3-inch subcaliber mortar, M3 includes the following items:

WRENCH, thin, single head, 15° angle, $1\frac{3}{16}$ -inch opening

WRENCH, barrel cap

WRENCH, primer

WRENCH, tap

BRUSH, four-row steel wire (with steel scraper)

Two pairs PLIERS, combination, slip joint, size 8-inch

Two SCREWDRIVERS, common, normal duty, 4-inch blade

HAMMER, machinists', ball peen, $1\frac{1}{2}$ -pound

CLOTHS, wiping $\frac{1}{2}$ -pound

HOOK

OILER

(2) All accessories are placed in the regular shipping chest. The primer wrench is used to tighten and loosen the M32 percussion primer cap, while the hook is designed to remove spent cartridges from a retrieved shell.

89. Operation

a. PREPARATION OF MORTAR. Install parent mortar as described in paragraph 16. Make the installation on a fixed range, with targets located 115 to 425 yards from the mortar position. A clear field of fire should be available for 500 yards, but the mortar should be located in deflade or behind a wall, thus blocking direct observation of the target from the mortar position. Lay the mortar, using the M59 sight and aiming stakes. (See FM 23-92.) Drop the wood barrel-adapter block into parent barrel and then insert subcaliber barrel.

RANGE (Yd)	ELEVATION (Mils)	RINGS
115	1030	0
125	1000	0
150	1000	1
175	800	1
	1030	2
200	920	2
225	800	2
	1030	3
250	820	3
	1030	4
275	870	4
	1030	5
300	820	5
	970	6
325	820	6
350	970	7
375	820	7
	1030	8
400	870	8
425	800	8

Fig. 113. Range table for sub-caliber mortar.

b. Preparation of shell. Place a smoke charge into nose of shell, insert ignition cartridge, and screw down primer. Finally, affix required number of propellant rings (fig. 78), inserting them flat into the slots provided in the four tail vanes of the shell so that they will not fall off when the shell is dropped into the mortar barrel.

c. CONDUCT OF FIRE. Conduct fire in the same manner as for parent mortar (FM 23-92). Establish observation post, where firing data is computed for transmission to the executive. Use figure 113 as a basis for computing data.

d. RECOVERING OF SHELL. When firing is concluded, retrieve, clean, wash, repair, and oil shell for reuse.

90. Precautions

a. Observe all safety precautions applicable to use of the 4.2-inch chemical mortar as given in list preceding text.

b. Do not squeeze flask filled with FM when pushing it into the shell; instead, apply pressure *downward* toward the shell. Wear gloves to prevent injury to hands in case flask breaks.

c. To remove misfire, follow the procedure outlined in paragraph 33, taking the additional precaution to hold the subcaliber barrel in place in the parent barrel. Do not attempt to lift subcaliber barrel out of the parent barrel while a misfire is in the subcaliber barrel.

d. Take special care to keep shell clean, since they will be recharged and fired repeatedly.

e. Make certain both subcaliber trainer barrel and wood adapter block are removed from parent barrel after firing has been completed. If adapter block is not removed, a misfire results when parent mortar is used with 4.2-inch ammunition.

91. Care and Maintenance

Clean barrel and shell thoroughly and oil them after use. Wipe mud and dirt from the shell, paying special attention to removing debris from the burster well. Use special hook to remove spent cartridges. Shell should be immersed in crankcase oil periodically to protect the metal against corrosive action of FM and to minimize drying out of wood resulting from repeated fire.

APPENDIX I

SHIPMENT AND STORAGE OF MORTAR

1. General

Preparation of the 4.2-inch chemical mortar for shipment and storage is the same for both domestic shipment and limited storage.

2. Precautions

Prior to storing the mortar, the following precautions should be observed:

a. If mortar is to remain unused for some time, thoroughly clean all bright and unpainted parts such as bore, guides, striker pin, screws, gears, or threads and apply a light coat of rust-preventive compound.

b. Inspect painted surfaces prior to storage; clean and repaint any damaged surface.

3. Lubrication

Lubrication of the 4.2-inch chemical mortar will be performed in accordance with lubrication instructions prescribed in section XII.

4. Cleaning

a. Clean matériel thoroughly, using dry-cleaning solvent or a soda ash or soap solution. Cleaning should include springs, screw threads, bushings, and similar surfaces, as well as the bore of the barrel.

b. Apply dry-cleaning solvent or Diesel fuel oil by scrubbing with a brush or wiping with a clean cloth.

c. Apply a warm soda ash solution by vigorously brushing or scrubbing the surfaces thoroughly until all traces of contamination have been removed. Rinse surfaces with clean, warm water and dry thoroughly. Soda ash solution consists of $\frac{1}{2}$ pound of soda ash dissolved in 2 gallons of warm water.

d. Avoid contacts of bare hands with cleaned surfaces.

5. Painting

Remove rust spots and repaint surfaces that have become checked, pitted, or rusted.

a. REMOVING RUST SPOTS. The following may be used in removing rust spots:

(1) Use aluminum-oxide abrasive cloth for cleaning finished or unfinished external surfaces where wear of the parts cleaned will not affect the functioning of the mechanism.

(2) Use crocus cloth for removing rust or stain and for polishing parts of firing mechanism and other finished surfaces of metal.

b. APPLICATION OF RUST-INHIBITIVE SYNTHETIC PRIMER. Apply a liberal coating of rust-inhibitive synthetic primer over the entire area of the cleaned surface to be repainted. The primer should be used on bare metal as a base coat for synthetic enamel. It may be applied either by brushing or spraying. The primer will brush satisfactorily as received or with the addition of not more than 5 percent by volume of volatile mineral spirits paint thinner. For spraying, the addition of not more than 15 percent by volume of thinner is required. Allow to dry thoroughly.

c. SANDPAPERING SURFACES. Sandpaper primed surfaces with No. 2/0-100 flint paper and wipe all particles of dust from surfaces.

d. APPLICATION OF ENAMEL. Apply a coat of lusterless, olive-drab synthetic enamel to the following parts and allow enamel to dry thoroughly before matériel is used:

- Barrel, complete with clamps and springs, except bore and slide.
- Standard, except elevating and traversing screws and bearing surfaces.
- Baseplate.

6. Application of Preservative

Application of preservative should be accomplished immediately after cleaning and drying. Rust-preventive compounds used will be brought to the proper consistency by heating before application.

7. Sealing

Seal muzzle with two layers of greaseproof wrapping paper and over-wrap with waterproof wrapping paper. Tape securely with nonhygroscopic adhesive tape and brush or spray thin film or rust-preventive compound over tape to act as sealer. If greaseproof paper is not available, use canvas or burlap treated with thin film of rust-preventive compound and tie or strap in place.

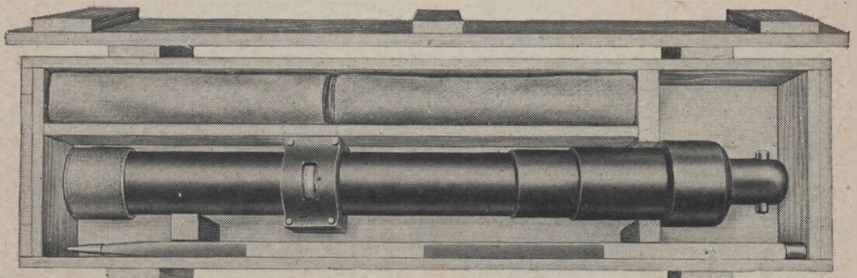
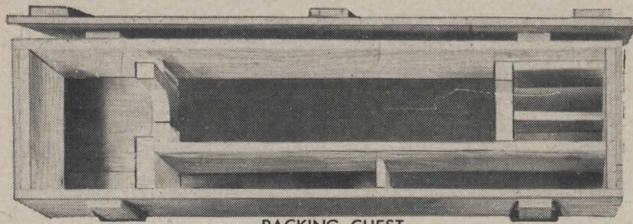


Fig. 114. Packing chest and contents.



PACKING CHEST



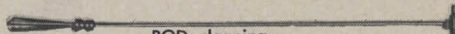
COVER, muzzle
B8-9-19



BARREL



LANYARD
E8-9-39



ROD, cleaning
E8-9-1

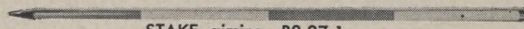


CLOTH H100-2-10

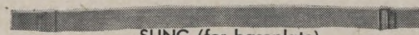


OIL
H99-4-2

OILER
E22-51-1



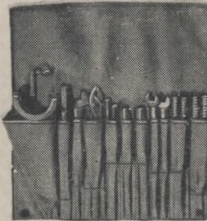
STAKE, aiming B8-27-1



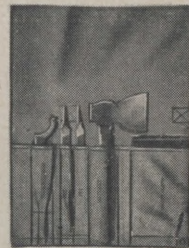
SLING (for baseplate)
E8-3-70



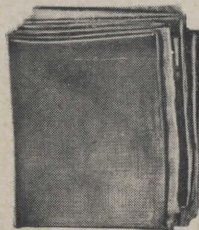
EMERY CLOTH
H100-15-2



ROLL, tool, gunner's
R8-9-124



ROLL, tool, ammunition
R8-9-123



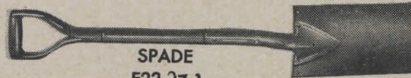
BAG
H18-65-5



HANDLE H22-46-3



MATTOCK
E22-6-2



SPADE
E22-27-1

Fig. 115. Contents of barrel packing chest

8. Mortar Barrel Record Book

During transfer or shipment, the mortar barrel record book will be kept in a waterproof envelope securely fastened to the mortar barrel with waterproof tape. Under one of the wrappings of tape, one end of a small tab will be inserted, reading, "Mortar barrel book here."

9. Packing of Mortar Components for Shipment and Storage

a. BARREL AND ACCESSORIES (figs. 114 and 115). For purposes of storage and shipment, the components of the accessories and spare parts set enumerated in paragraph 8 and the packing chest diagram are placed in a packing chest in accordance with figure 111. 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. Outside dimensions of the chest, including handles at the sides and cleats at the top, are approximately 56 by 17 $\frac{3}{4}$ by 13 $\frac{1}{2}$ inches, and displacement is approximately 7.8 cubic feet. The packed chest weighs approximately 220 pounds.

b. STANDARD. When the standard is to be stored or shipped separately, it is packed in a wooden box approximately 40 $\frac{1}{4}$ by 27 by 11 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. Displacement of the box is approximately 7.2 cubic feet, and weight of the packed box is about 110 pounds. Address markings are as shown in figure 116.

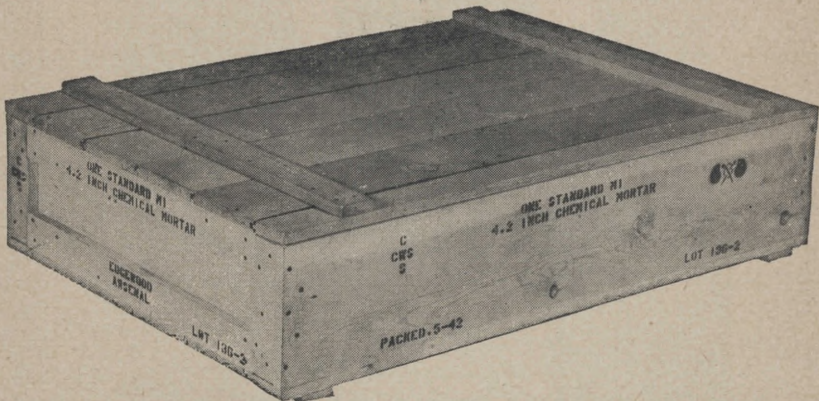


Fig. 116. Packing chest for standard.

c. BASEPLATE. The baseplate is shipped crated. The crate is approximately 32 by 32 by 14 inches and weighs about 217 pounds, packed. Displacement of the crate is approximately 8.3 cubic feet.

APPENDIX II

REFERENCES

I. Publications Indexes

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to matériel covered in this manual:

- | | |
|--|---------------------------|
| <i>a.</i> Introduction to Chemical Warfare Supply Catalog. | CW1 |
| <i>b.</i> Index to Chemical Warfare Supply Catalog..... | CW2 |
| <i>c.</i> Stock List of All Items..... | CW5 |
| <i>d.</i> Introduction to Ordnance Catalog (explaining SNL system) | ASF Catalog
ORD 1 IOC |
| <i>e.</i> Ordnance Publications for Supply Index (index to SNL's) | ASF Catalog
ORD 2 OPSI |
| <i>f.</i> List and Index of War Department Publications (listing MR's, MTP's, T/BM's, T/A's, FM's, TM's, TR's, TB's, SB's, MWO's, WDLO's, and Firing Tables) | FM 21-6 |
| <i>g.</i> List of Training Films, Film Strips, and Film Bulletins | FM 21-7 |
| <i>h.</i> Military Training Aids (Listing Graphic Training Aids, Devices, and Displays) | FM 21-8 |

2. Army Service Forces Catalogs

- | | |
|--|-----------|
| <i>a.</i> SIGHTING AND FIRE CONTROL EQUIPMENT (Ordnance catalogs). | |
| Circle, aiming, M1..... | SNL F-160 |
| Compass, M2 | SNL F-219 |
| Binocular, M13 | SNL F-210 |
| Finder, range, M7..... | SNL F-254 |
| Telescope, observation, M48..... | SNL F-173 |
| Telescope, elbow, M62..... | SNL F-262 |
| Mount, telescope, M59..... | SNL F-301 |
| Light, aiming post, M14..... | SNL F-205 |
| Watch, wrist, 7-jewel..... | SNL F-36 |
| Watch, wrist, 15 or more jewels..... | SNL F-36 |

b. CHEMICAL WARFARE SERVICE CATALOGS.

Stock List of All Items.....	CW5
Mortar, Chemical, 4.2-inch, M2.....	CW7-410618
Cart, 4.2-inch Chemical Mortar and Ammunition, M1A1	CW7-414666

3. Explanatory Publication

a. ARMY REGULATIONS.

Range regulations for firing ammunition for training and target practice	AR 750-10
--	-----------

b. TECHNICAL MANUALS

Decontamination	TM 3-220
Auxiliary Fire Control Instruments (Field Glasses, Eyeglasses, Telescopes, and Watches)..	TM 9-575
Cleaning, Preserving, Lubricating, and Welding Materials and Similar Items Issued by the Ordnance Department	TM 9-850
Ammunition, General	TM 9-1900
Preparation of Ordnance Matériel for Deep Water Fording	TM 9-2853
Maintenance and Care of Pneumatic Tires and Rubber Treads	TM 31-200

c. FIELD MANUALS.

Tactics of Chemical Warfare.....	FM 3-5
Explosives and Demolitions	FM 5-25
Hand and Rifle Grenades, Rocket, AT, HE, 2.36-inch	FM 23-30
4.2-inch Chemical Mortar	FM 23-92

INDEX

	Paragraph	Page
Accessories :		
Cart	82	89
List	8	7
Accidents, report	2b	2
Ammunition :		
Authorized	62	63
Care in handling	61	61
Classification	59	60
Identification	60	60
Lot number	60b	61
Marking for shipment	69a	74
Preparation for firing	65	67
Subcaliber	70	77
Tactical classification	60a	60
Arming, premature	38b	40
Authorized rounds	62	63
Auxiliary equipment, operation	19-22	16
Barrel :		
Cleaning solution	23b	30
Connection to standard	42	46
Description	39	42
Barrel pin :		
Description	14b	14
Removing and replacing	50	50
Barrel rack	81c	87
Barrel record book	2a	1
Base of standard	46	47
Base cap, removing and replacing	40	42
Base-cap cup, description	52b	54
Baseplate :		
Description	3a, 52	2, 54
Emplacement	16b	15
Handles	52d	54
Spade	52a	54
Calibration of sight	77	84
Carrier, shell	80	87
Cart :		
Accessories set	82	89
Barrel rack	81c	87
Chassis	81b	87
Description	81a	87
Maintenance	83	89
Operation	20	60
Tool box	81b	87
Cartridge :		
Ignition	64a	65
Subcaliber ammunition	70b	77
Charge, propelling	64a	65
Complete round :		
Description	57a	59
Packing	69	74

	Paragraph	Page
Connector rod -----	46	47
Controls -----	14	12
Cup, base-cap, description -----	52 <i>b</i>	54
Cup fork:		
Description -----	52 <i>c</i>	54
Removing and replacing -----	53	56
Delay fuze:		
Functioning -----	67 <i>b</i>	71
Safety precautions -----	67 <i>d</i>	73
Use -----	67 <i>c</i>	71
Demolition -----	25, 26	31
Differences in models -----	5	3
Disarming fuze -----	38 <i>b</i>	40
Elevating mechanism -----	14 <i>a</i>	14
Emplacement of baseplate -----	16 <i>b</i>	15
Equipment, service upon receipt -----	11-13	12
Fire, rate -----	6 <i>c</i>	4
Firing, preparation of ammunition for -----	65	67
Fire control equipment -----	71 <i>b</i>	78
Firing tables -----	58	60
Fork, cup:		
Description -----	52 <i>c</i>	54
Removing and replacing -----	53	56
Fuze:		
Disarming -----	38 <i>b</i>	40
Malfunctions -----	38	40
Point detonating -----	68	73
Premature arming -----	38 <i>b</i>	40
Fuze M2:		
Description -----	66 <i>a</i>	67
Functioning -----	66 <i>c</i>	69
Safety features -----	66 <i>b</i>	69
Safety precautions -----	66 <i>d</i>	70
Fuze M3:		
Description -----	66 <i>a</i>	67
Functioning -----	64 <i>c</i>	67
Packing -----	69 <i>c</i>	77
Safety features -----	66 <i>b</i>	69
Safety precautions -----	66 <i>d</i>	70
Fuze, delay, M4:		
Description -----	67 <i>a</i>	71
Functioning -----	67 <i>b</i>	71
Packing -----	69 <i>d</i>	77
Safety precautions -----	66 <i>d</i>	70
Use -----	67 <i>c</i>	71
Fuze, time and super quick, M5:		
Description -----	68 <i>a</i>	73
Functioning -----	68 <i>b</i>	73
Packing -----	69 <i>e</i>	77
Safety precautions -----	66 <i>d</i>	70
Use -----	68 <i>c</i>	74

	Paragraph	Page
Handle, traversing screw, removal and replacing -----	51	54
Handles, baseplate -----	52 <i>d</i>	54
Identification :		
Ammunition -----	60	60
Mortar components -----	4 <i>b</i>	3
Ignition cartridge -----	64 <i>b</i>	65
Instrument light -----	74	83
Kit, sight -----	71 <i>a</i>	78
Landing craft mount :		
Assembly -----	21 <i>b</i>	22
Components -----	85 <i>b</i>	97
Description -----	85 <i>b</i>	97
Operation -----	21	22
Packing -----	85 <i>d</i>	99
Precautions -----	21 <i>c</i>	24
Laying mortar -----	17	15
Light, instrument -----	74	83
Lubrication -----	28	32
Lubrication orders -----	28	32
Maintenance :		
After firing -----	32	34
Before firing -----	30	33
Cart -----	83	89
During firing -----	31	33
Instructions -----	27-55	32
Preventive -----	29-32	32
Sight -----	76	83
Telescope mount -----	76	83
Malfunctions :		
Affecting assembly -----	36	36
Affecting operation -----	37	37
Fuze -----	38	40
Misfire -----	33	35
Mortar -----	34	36
Round -----	35	36
Markings, weight-zone -----	60 <i>c</i>	61
Mechanism :		
Elevating -----	14 <i>a</i>	14
Traversing -----	14 <i>b</i>	14
Mil rule -----	79	86
Misfire :		
Definition -----	33 <i>a</i>	35
Precautions -----	33 <i>c</i>	35
Removing -----	33 <i>d</i>	35
Mortar :		
Assembling for firing -----	16	14
Components -----	3 <i>a</i>	2
Description -----	3	2
Differences in models -----	5	3
Disassembly -----	18	15

	Paragraph	Page
Firing -----	17	15
Identification information -----	4	3
Laying -----	17	15
Mounting -----	16	14
Operation under unusual conditions -----	23-24	30
Range -----	3c	2
Subcaliber -----	87-91	105
Tabulated data -----	6	4
Tools, parts, and accessories -----	7, 9	5, 11
Transport equipment -----	80-86	87
Mount, landing craft:		
Assembly -----	21b	22
Components -----	85b	97
Description -----	85b	97
Operation -----	21	22
Packing -----	85d	99
Mount, telescope, M59. (See Telescope Mount M59.)		
Mule pack:		
Accessories -----	86a	100
Components -----	86c	100
Description -----	86c	100
Loads and load weights -----	86d	104
Standard pack equipment -----	86b	100
Use -----	22	24
Operation:		
Cart -----	20	16
Landing craft mount -----	21	22
Mortar, in hot climates -----	24	30
Mortar, in unusual conditions -----	23, 24	30
Mortar, under usual conditions -----	15-18	14
Organizational spare parts -----	7	5
Pack, mule. (See Mule pack.)		
Packing:		
Complete round -----	69a	74
Fuze M5 -----	69e	77
Fuze M4 -----	69d	77
Fuze M3 -----	69c	77
Mortar components -----	App. I	109
Propelling charge -----	69b	77
Painting -----	App. I	109
Pin:		
Barrel, removing and replacing -----	50	50
Striker, removing and replacing -----	41	42
Pole, maintenance -----	83a	89
Powder, propellant -----	64c	67
Premature aiming -----	38b	40
Preventive maintenance -----	29-32	32
Projectiles:		
Chemical -----	59b	60
Dummy -----	59c	60
High explosive -----	59a	60

	Paragraph	Page
Propelling charge:		
Description -----	64	65
Packing -----	69 <i>b</i>	77
Propellent powder -----	64 <i>c</i>	67
Rack, barrel -----	81 <i>c</i>	87
Rate of fire -----	6 <i>c</i>	4
Record book, barrel -----	2 <i>a</i>	1
Report:		
Accidents -----	2 <i>b</i>	2
Unsatisfactory equipment -----	2 <i>c</i>	2
Rods, connector -----	46	47
Rounds:		
Authorized -----	62	63
Identification -----	60	60
Rule, mil -----	79	86
Serial numbers, on mortar components -----	4 <i>b</i>	3
Service, upon receipt of equipment -----	11-13	12
Shear wire -----	64 <i>b</i>	65
Shell carrier -----	80	87
Shell:		
Description -----	63	63
Differences in models -----	63	63
Filling -----	63 <i>b</i>	63
Subcaliber -----	70 <i>a</i>	77
Construction -----	63 <i>c</i>	63
Shipment and storage -----	App. I	109
Shock absorber slide -----	42 <i>b</i>	46
Sight MII -----	78	85
Sight:		
Calibration -----	77	84
Maintenance -----	76	83
Operation -----	75	83
Sight kit -----	71 <i>a</i>	78
Sighting and fire control equipment -----	71-79	78
Slide assembly bolt, removing and replacing -----	43	47
Slide, shock absorber -----	42 <i>b</i>	46
Sling, baseplate, removing and replacing -----	55	56
Spade, baseplate -----	52 <i>a</i>	54
Spare parts, organizational -----	7	5
Springs, front and rear, removing and replacing -----	44	47
Spring guide, removing and replacing -----	44	47
Standard:		
Base -----	46	47
Connection to barrel -----	42	46
Description -----	45	47
Support -----	47	50
Storage and shipment -----	App. I	109
Striker pin, removing and replacing -----	41	81
Subcaliber equipment:		
Accessories -----	88 <i>c</i>	106
Ammunition -----	70	77
Barrel assembly -----	88 <i>a</i>	106

	Paragraph	Page
Care and maintenance -----	91	108
Description -----	88	105
Operation -----	89	106
Precautions -----	90	108
Support, standard -----	47	50
Tables, firing -----	58	60
Telescope mount M59 :		
Calibration -----	77	84
Care and preservation -----	76	83
Components -----	73	80
Deflection mechanism -----	73 <i>c</i>	82
Description -----	72 <i>a</i>	80
Elevation mechanism -----	73 <i>b</i>	80
Illumination -----	74	83
Operation -----	75	83
Position -----	72 <i>b</i>	80
Supporting bracket assembly -----	73 <i>a</i>	80
Telescope holder assembly -----	73 <i>d</i>	82
Time and superquick fuze. (<i>See</i> Fuze, time and superquick.)		
Transport equipment -----	80-86	87
Traversing mechanism -----	14 <i>b</i>	14
Traversing screw handle, removing and replacing -----	51	54
Unsatisfactory equipment report -----	2 <i>c</i>	2
Weight-zone markings -----	60 <i>c</i>	61

