TM 9-1385-51

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

IDENTIFICATION OF

AMMUNITION (CONVENTIONAL) FOR EXPLOSIVE ORDNANCE DISPOSAL

This publication supersedes TM 9-1385-51, February 1966; and applicable portions of TM 9-1980, 7 December 1950; and TM 9-1385-200, 16 May 1962; and with TM 9-1385-50, February 1967 supersede the following in their entirety; TB ORD 764, 14 July 1954; TB ORD 781, 22 September 1954; TB ORD 783, 22 September 1954; TB ORD 785, 22 September 1954; TB ORD 794, 10 February 1955; TB ORD 802, 1 August 1955; TB ORD 814, 21 December 1955; TB ORD 825, 5 March 1956; TB ORD 827, 5 March 1956; TB ORD 832, 14 March 1956; TB ORD 833, 14 March 1956; TB ORD 835, 1 November 1961; TB ORD 836, 25 March 1956; TB ORD 7069, 9 January 1961; TB ORD 7087, 26 September 1961; TB ORD 7115, 8 May 1962; and TM 9-1385-3, 30 July 1965 (section 2-2); TB ORD 7022, 26 March 1962.

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SECTION 1

INTRODUCTION

1-1 PURPOSE.

This manual is for Explosive Ordnance Disposal (EOD) and other personnel who require general and specific technical information on identification of conventional and chemical ammunition.

1-2 SCOPE.

This manual, a companion to TM 9-1385-50, covers the identification, construction, and functioning of conventional and chemical ammunition, although bulk chemical and biological agents are not included. Refer to the TM 9-1185-series for information on nuclear munitions. TM 9-1385-50 provides render safe and disposal procedures for the munitions covered in this manual.

1-3 ARRANGEMENT OF TEXT.

Rescinded.

1-4 FORMS.

Refer to TM 38-750 for instructions on the use of forms listed in appendix A. All forms prescribed for use throughout the Department of the Army are listed in DA Pam 310-2. Submit requisitions for these forms in accordance with AR 310-1.

1-5 REPORTS.

1-5.1 FIELD REPORT OF ACCIDENT. Refer to AR 385-40 for details on using, completing, and forwarding reports necessary for compliance with requirements of the Army safety program. These reports are required whenever accidents involving injury to personnel or damage to equipment occur.

1-5.2 OTHER REPORTS. Complete other reports (listed in appendix A), as required.

1-6 ERRORS AND OMISSIONS.

Direct reporting, by the individual user, of errors, omissions, and recommendations for improving this manual is authorized and encouraged. Forward Army reports directly to: Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-DC, Dover, New Jersey, 07801. Refer to TM 38-750 for reporting procedures.

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SECTION 2

GENERAL EXPLOSIVES

2-1 EXPLOSIVES IN AMMUNITION.

2-1.1 GENERAL. Explosives in ammunition are chiefly solids or mixtures of solids and liquids formulated to be solid at normal temperatures. The characteristic effect of explosives is the result of the great pressure and heat produced when a solid or liquid explosive is suddenly converted to a much larger volume of gas.

2-1.2 CLASSIFICATION AND CHARACTERISTICS OF MILITARY EXPLOSIVES. Military explosives are divided into two basic groups: low explosives and high explosives.

2-1.2.1 Low explosives are burning explosives which contain the ingredients necessary to support combustion (oxygen and fuel). Black powder, pyrotechnic mixtures, and smokeless powder are examples of low explosives. A propellant is a type of low explosive that is suitable for effecting the controlled propulsion of a solid body such as a projectile or rocket. Propellants will detonate if confined or if the burning rate is accelerated.

2-1.2.2 High explosives decompose instantaneously and detonate when acted upon by sufficient heat, shock, or friction. High explosives are grouped as primary, secondary, and main charge.

2-1.3 EXPLOSIVE TRAIN. Both a high and low explosive train utilize a sensitive primary explosive for the primer, finally initiating the main charge by sympathetic detonation.

2-1.3.1 LOW EXPLOSIVE TRAIN.

a. Primer.
b. Igniter.
c. Propellant.

2-1.3.2 HIGH EXPLOSIVE TRAIN.

a. Primer.
b. Detonator.
c. Booster.
d. Main Charge.

2-1.3.3 LOW EXPLOSIVES.

a. Artillery ammunition propellants are designed to provide energy necessary to propel a projectile or missile. They may be classified as liquid or solid. Solid propellants as used in conventional or special ammunition are classified as nitrocellulose or composite based. Nitrocellulose based propellants are further classified as to the number of explosives they contain. Single base propellants contain nitrocellulose; double base propellants contain nitrocellulose and nitroglycerin; and triple base propellants contain nitrocellulose, nitroglycerin and nitroguanadine. Composite propellants contain an inorganic oxidizer, when mixed with an organic fuel, serves as the binder of the oxidizer particles.

b. Propellants are assigned model numbers (e.g., M1). Do not confuse these with the M numbers assigned propelling charges. Black powder (old-fashioned gunpowder), although long since superseded as a propellant, is still used in such auxiliary items as spotting charges, igniters, and delay pellets. The usual form of artillery-ammunition propellant is a cylindrical grain with one or more perforations. Ball propellant is used in small-caliber ammunition, and sheet propellant, in mortar ammunition. A propelling charge in grains of different perforations or different size is called a dual-grain charge.

c. Cartridges of certain calibers, such as 76mm, 90mm, and 105mm, are called flashless-smokeless (FLHLS-SMKLS) because of the functional characteristics of the propellant. This designation is marked on the cartridge case of these cartridges and on their packing containers.

2-1.3.4 HIGH EXPLOSIVES (HE). High explosives should be produced from raw materials that are nonstrategic and available in great quantity and manufacturing operations must be simple, safe, and inexpensive. Explosives can withstand the forces of setback found in artillery rounds, impact of bombs, and the normal shocks of handling. Because of its rapid rate of detonation, HE produces a high pressure wave front known as shattering power or brisance. Concentrating or directing the wave front, utilizing shaped charges, is called wave shaping. Factors affecting the sensitivity and velocity of detonation of military high explosives are as follows:

Factors	Sensitivity	Velocity of detonation
Increase crystal size	Increase	Decrease.
Increase density	Decrease	Increase.
Crystal coating	Decrease	Decrease.
Increase confinement	Decrease	Increase.
Increase temperature	Increase	Increase.
Moisture	Decrease	Decrease.

High explosives are grouped according to their use.

a. PRIMARY. Primary high explosives are the most sensitive and are used as initiating agents in primers and detonators. Detonation occurs through spark, friction, or impact and can initiate the detonation of relatively insensitive explosives. Examples are lead azide, lead styphnate (basic and normal), mercury fulminate, and tetracene.

b. SECONDARY. Secondary high explosives are noninitiating explosives that must be detonated by an initiating agent. They are the most powerful explosive and second in sensitivity. This relatively insensitive HE is used as explosive leads and boosters. Booster explosives, such as tetryl and PETN, are easily initiated and detonate at high rates but are not suitable for loading in large masses.

c. MAIN CHARGE. This class of HE is used for main charge filler and is the least sensitive and the second most powerful explosive. Included in this class are bursting charge explosives, such as TNT and Explosive D that must be initiated, usually by means of a booster explosive, and which can be loaded en masse. Included also are explosives that are too sensitive to be used alone, such as nitroglycerin, and substances which are too insensitive to explode when used alone, such as ammonium nitrate. For more comprehensive information on explosives, refer to TM 9-1910.

2-2 CHEMICAL FILLERS.

Chemical ammunition fillers are either solids, liquids or gases. A military chemical agent, through its chemical properties, produces lethal, injurious or irritant effects resulting in casualties. It can be used as a screening and signaling smoke or as an incendiary agent. Chemical agents are classified by physical state (including degree of volatility), use and physiological action. Refer to FM 3-5, TM 3-215, and TM 9-1900 for further information on chemical agents.

SECTION 3

GENERAL IDENTIFICATION MEASURES

3-1 STANDARD NOMENCLATURE.

Standard nomenclature is established to give an item specific identification. For ammunition, this nomenclature consists of the complete item name, a colon (:), and then enough modifiers (descriptive information) to identify the item of supply among other items of the same name (e.g., CARTRIDGE, 76-MILLIMETER: HE, COMP B, M352, steel-case, w/fuze, PD, M51A5, 0.05-sec delay, for Guns M32 and M48). Unless the modifiers following the colon are standardized capital-letter abbreviations, such as HE, COMP B, and PD, they are listed in lower case letters, as in "steel-case" and "0.05-sec delay."

3-2 FEDERAL STOCK NUMBER.

The 11-digit Federal Stock Number (FSN) (e.g., 1315-028-4790) has replaced the Ammunition Identification Code (AIC) and Ordnance stock number. Each item of supply, as packed, has a different FSN. The first four digits always represent the Federal Supply Classification (FSC). The remaining seven digits represent the Federal Item Identification Number (FIIN), and have the hyphen inserted to reduce errors in transmission. Each item in a Department of the Army supply catalog or manual or U.S. Air Force stock list has a different FIIN.

3-3 DEPARTMENT OF DEFENSE AMMUNITION CODE.

A Department of Defense Ammunition Code (DOD Ammunition Code) has been developed to indicate interchangeability of ammunition and explosive items in FSC Group 13. This 8-character code is separated by a hyphen into two parts (e.g., 1315-C650). The first four digits represent the FSC; the second part consists of a capital letter and three numerals (DODIC) assigned to items that are interchangeable in function and use.

3-3.1 The 8-character DOD Ammunition Code (e.g., 1315-C650) is used for such ammunition operations as worldwide stock status reporting and requisitioning when specific items are not required.

3-3.2 The 11-digit FSN and the second part of the DODIC (e.g., 1315-028-4790-C650) is used for such operations as marking and the requisitioning of specific items. Refer to TB 9-AMM-5 and pertinent SM's and SC's.

3-4 IDENTIFICATION OF AMMUNITION.

3-4.1 GENERAL. Ammunition is identified by information painted or marked (stamped or stenciled) on items, containers, and packing boxes. For record purposes, item nomenclature and lot number identify the ammunition completely. Removed from its packing, ammunition may be identified by the painting and marking on the items. Ammunition data cards are prepared for each lot of ammunition and provide a complete listing of the lot. Information given is type and composition of the ammunition, handling instructions and identification of components by lot number and manufacturer.

3-4.1.1 Item marking and standard nomenclature both include the type name (or abbreviation thereof); the caliber, weight, or size; and the model designation.

3-4.1.2 Included where required, is such additional information as model and type of fuze, the model of the weapon in which the item is fired, and the muzzle velocity. Also, the weight of the projectile for which a separate-loading propelling charge is suited.

3-4.1.3 The lot number, not a part of the nomenclature, is marked on the ammunition or shipping container. In field reports, however, when referring to a specific item, cite standard nomenclature and lot number.

3-4.2 MARK OR MODEL. A model designation is assigned when the item is adopted. This designation, which becomes an essential part of the nomenclature and is included in the marking, consists of the letter M followed by an Arabic numeral (e.g., M1). Modifications are indicated by adding the letter A and the appropriate Arabic numeral. Therefore, M1A1 indicates the first modification of an item for which the original designation was M1. A B suffix to a model designation indicates an item of alternative design, material, or manufacture. A T or XM model designation shows that the item is under development; and E and an Arabic numeral suffix indicates modification of the development item. Ammunition made in Japan has the prefix J added to the model number.

3-4.3 AMMUNITION LOT NUMBER. When ammunition is manufactured, an ammunition lot number is assigned in accordance with pertinent specifications. As an essential part of the marking, the lot number is stamped or stenciled on the item, size permitting, and on all packing containers. The lot number is required for all record purposes, including ammunition condition reports, stock status reports and reports of accidents and malfunctions. To provide the most uniform functioning, all the components in any one lot are manufactured under as nearly identical conditions as practicable. The best firing accuracy from fixed or semi-fixed ammunition is attained when successive rounds are of the same lot number; when firing separate-loading ammunition, successive rounds should consist of projectiles, propelling charges, fuzes, and primers, respectively, of one lot number. Ammunition made in Japan has the prefix J added to the manufacturer's symbol and to component lot numbers of metal or plastic parts, explosives, fuzes, boosters, primers, and propelling charges. An X appearing after the lot number indicates a steel cartridge case.

3-4.4 PAINTING AND MARKING.

3-4.4.1 PAINTING. The primary purpose of painting ammunition is to prevent rust and corrosion. In addition, painting provides identification by color code. TM 9-1900 has detailed information on color-coding of ammunition in accordance with the old U.S. Army system of painting and marking. Paragraph 3-4.7 of this manual outlines the newly adopted Department of Defense color-coding standard (MIL-STD-709-Ammunition Color Coding) to identify ammunition.

3-4.4.2 MARKING. Marking is used as a ready means of identification, especially among items of the same name, when complete nomenclature and lot, or FIIN, number are required. The color of the letter or numerals is a part of the color-coding system.

3-4.4.2.1 PROJECTILE FUZE. When a projectile has a deep cavity for receiving a proximity fuze and does not contain a supplementary charge, the marking is: FOR PROXIMITY FUZE, FOR FUZE M504 (T75E6), or FOR FUZE M513 (T226), as applicable.

3-4.4.2.1.1 SPOTTING CHARGE. When a spotting charge is present, the marking is W/ SPOTTING CHARGE. The letter S stenciled immediately above the bourrelet on large-caliber projectiles indicates that a smoke producer is mixed with the high explosive, to enable observation of fire.

3-4.4.2.1.2 LOT NUMBER OF LOADED PROJECTILE. On fixed and semifixed rounds, the lot number is stenciled below the rotating band, in which position it is covered by the neck of the cartridge case.

3-4.4.2.1.3 WEIGHT ZONE. The weight zone (squares) or weight to nearest pound of loaded projectile is marked on 75mm and larger caliber projectiles, except on armor-piercing projectiles that are components of fixed or semifixed rounds and on base-ejection smoke projectiles.

3-4.4.2.1.4 ROTATING BAND. Marking stamped on or forward of the rotating band consists of:

a. Lot number of empty shell.

b. Manufacturer's initials or symbol.

c. Caliber and model of projectile or cartridge.

d. Year of manufacture.

3-4.4.2.2 CARTRIDGE CASE.

3-4.4.2.2.1 BASE. The ammunition lot number and loader's initials are stenciled on the base of each cartridge. (On 37mm and 40mm cartridges, the lot number is stenciled on the projectile.)

a. TYPE AND MODEL. Marking on 75-mm and 76-mm cartridges includes the word NORMAL below one diametral stripe; or REDUCED and two diametral stripes at right angles, indicating reduced charge; or SUPER, indicating supercharge.

b. FUNCTIONAL MARKING. Marking on 76-mm and 90-mm cartridges includes one of three classifications: FLASHLESS (or FLHLS), SMOKELESS (or SMKLS), or FLASHLESS-SMOKELESS (or FLHLS-SMKLS).

3-4.4.2.2.2 SIDE. On 75-mm and 76-mm cartridge case sides, the word NORMAL is marked below one band, indicating a normal propelling charge; or REDUCED between two bands, indicating reduced charge; or SUPER, indicating supercharge. On HVAP-T rounds, HYPERVELOCITY MV is marked in red.

3-4.4.2.2.3 BASE STAMPING. The caliber and model of the cartridge case is stamped in the metal on the base. B1, after the model designation, indicates a steel case. Base metal stamping also includes the lot number of the case, the manufacturer's initials, and year of manufacture.

3-4.4.2.3 PROPELLING CHARGE.

3-4.4.4.2.3.1 CHARGE OR SECTION OF CHARGE. Stenciling on each charge or charge section includes the section designation (e.g., 1/8 CHG; BASE: INCR or INCREMENT; CHARGE 2. Other marking consists of:

a. Model of charge (e.g., CHARGE M1A1).
b. Caliber and models of cannon for which adapted.
c. Weight of charge or section of charge.
d. Weight or weights of projectiles with which charge may be used.
e. Propellant lot (includes propellant type, the word LOT, initials of manufacturer, serial number of lot, and year of manufacture).
f. Charge number of each section, on the top end.

3-4.4.2.3.2 IGNITER. Igniter stenciling includes weight, grade, and kind of igniter powder, the word IGNITER, caliber and model of cannon in which fired, and month and year of loading.

3-4.4.2.4 FUZE. Stamped on the fuze body are the type and model, manufacturer's initials, lot number, year of manufacture, and the fuze action (e.g., DELAY and length of delay in seconds), and SQ (superquick), or time in seconds on a graduated time ring, are also part of the marking.

3-4.4.2.5 PRIMER. The model designation, loader's initials, lot number, and year of loading are stamped on the base of each primer.

3-4.5 WEIGHT OR WEIGHT-ZONE MARKINGS.

3-4.5.1 VARIATIONS. Weight variations are inherent in manufacture of projectiles containing explosives or chemical agents. Therefore, when a high degree of artillery-firing accuracy is required, projectiles are marked to indicate the weight; firing tables list data for making ballistic corrections. The weight is stamped on the body of projectiles for 8-inch howitzer cannon. Projectiles are grouped within limits and the corresponding weight-zone marking is stenciled on the projectiles. Fixed and semifixed rounds are grouped similarly in weight zones. These zones are indicated by one or more squares marked on the projectile, in the same color used for the other marking. Composition B-loaded ammunition for 105-mm howitzers is marked with an additional zone, two squares, and a triangle.

3-4.5.2 SMALL-CALIBER CARTRIDGES. Except for the training cartridge, cartridges of less than 75-mm, high-explosive antitank rounds, and armor-piercing rounds of less than 105-mm do not require weight-zone markings.

3-4.6 DUMMY AMMUNITION. This ammunition is identified by marking, stenciled or stamped on the item. Some dummy rounds are fabricated from metal parts of service ammunition. To identify these parts as being positively inert, holes are drilled in any section that, as a component of service ammunition, contained an explosive. Holes may be drilled into the following sections of fixed and semifixed dummy rounds: Projectile, fuze, booster, cartridge case, and base of primer. For further identification of inert ammunition and ammunition components, refer to AR 385–65.

3–4.7 AMMUNITION COLOR CODE.

3–4.7.1 GENERAL. MIL–STD–709 establishes a uniform color coding system for identification of the various types of ammunition used by Army, Navy, and Air Force.

CAUTION

Ammunition marked in accordance with the system used prior to MIL–STD–709 will be on hand for many years. EOD personnel should be extremely cautious when relying on color codes for identification of ammunition.

3–4.7.2 COLORS AND SYMBOLS FOR INDICATING TRACER AND COLOR BURST. A tracer and its color are indicated by TTT in the color of the trace; a color burst, by CCC in the color of the burst produced.

3–4.7.3 COLORS OF THE CODE. Typical ammunition colors are indicated in table 1.

Table 1. Painting and Marking of Ammunition Colors

Ammunition	Color of ammunition of earlier manufacture	Color of ammunition of recent manufacture
HE	Olive drab w/yellow marking	Olive drab w/yellow marking.
HEAT	Olive drab w/yellow marking	Black w/yellow marking.
HEP (over 40 mm)	Olive drab w/yellow marking	Olive drab w/black band and yellow marking.
Smoke (except WP or PWP)	Gray w/one yellow band and yellow marking.	Light green w/black marking.
Smoke (WP or PWP	Gray w/one yellow band and yellow marking.	Light green w/yellow band and light red marking.
Illuminating	Gray w/one white band and white marking.	White w/black marking.
Separate loading, projectile illuminating.	Gray w/one white band and white marking.	Olive drab w/white band and white marking.
Practice w/o explosive filler	Blue or black w/white marking	Blue w/white marking.
Practice w/high explosive	Blue or black w/white marking	Blue w/yellow band and white marking.
Practice w/low explosive	Blue or black w/white marking	Blue w/brown band and white marking.
Chemical:		
Persistent toxic agent	Gray w/two green bands and green marking.	Gray w/two green bands and green marking. (One yellow band w/ explosive burster.)
Nonpersistent toxic agent	Gray w/one green band and green marking.	Gray w/one green band and green marking. (One yellow band w/explosive burster.)
Persistent irritant agent	Gray w/two red bands and red marking.	Gray w/two red bands and red marking. (One yellow band w/ explosive burster.)
Nonpersistent irritant agent	Gray w/one red band and red marking.	Gray w/one red band and red marking. (One yellow band w/explosive burster.)
"G" and "V" series agents	Gray w/one green band for "G" series; two green bands for "V" series, and green marking.	Gray w/three green bands and green marking. (One yellow band w/explosive burster.)
AP&APDS w/o filler	Black w/white marking	Black w/white marking.
AP w/high explosive filler	Black w/yellow marking	Black w/yellow marking.
Cartridge, APERS w/flechettes	Black w/white marking	Olive drab w/yellow band, white marking and white diamonds.
Canister w/slugs	Black w/white marking	Olive drab w/white marking.
Canister w/flechettes	Black w/white marking	Olive drab w/white marking and white diamonds.
Dummy	Black or blue w/white marking	Bronze w/white marking.

Table II. Deleted.

3–5 BOMB FUZES

3–5.1 CLASSIFICATION.

a. Bomb fuzes may be classified by their location in the bomb-nose, tail, or transverse (body), by method of arming, or by type of final action. Principal methods of arming are arming vane rotation, pin ejection (jump-out), clockwork, electric, or a combination of the above.

b. When classified according to type of final action, bomb fuzes are grouped as impact inertia, time (mechanical or pyrotechnic), hydrostatic, influence (also called proximity or VT), long delay, or antidisturbance. Certain fuzes incorporate a combination of final actions such as influence, impact or time-impact to insure reliability of functioning.

3–5.2 FUZE SERIES. A fuze series, or family, is a group of fuzes having the same basic internal mechanisms and action, but designed for bombs of different sizes, with differences in length of air travel to arm, or with differences in length of delay between impact and detonation. The fuzes in a fuze series are usually numbered consecutively. All fuzes which belong to one fuze series are covered in one paragraph of the section on bombs.

3–5.3 MARKING AND PAINTING.

a. The fuze designation and manufacturing date usually are stamped (stenciled or engraved) on the body of the fuze and and may or may not be visible after the fuze is installed in the bomb. The manufacturing data most commonly stamped on fuzes are the fuze lot number, manufacturer's code, inspector's initials, and date of inspection.

b. Fuze firing delays, arming delays, or other functioning characteristics, such as time-setting scales, are marked on the fuze. In some cases, the fuze or a fuze component is painted in a conspicuous manner to indicate a particular feature of the fuze or to distinguish it from a similar fuze or component.

c. All markings and painting which are deemed pertinent to identification of a fuze are described and illustrated appropriately in the paragraph applicable to the fuze.

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SECTION 4

ARTILLERY AMMUNITION

4–1. POINT DETONATING FUZES.

Point detonating fuzes M2, M3, M8, M9, M46, M47, M48 Series, M51 Series, M52 Series, M53 Series, M56, M57 Modified, M71, M74, M78A1 (or M78), M81A1 (or M81), M82 Series, M83, M85, M86, M89, M503 Series, M505A1 (or M505), M507, M508 Series, M519, M521, M524 Series, M525 Series, M526 Series, M527 Series, M535, M557 Series, M572, M593 Series, XM–716, XM717, XM719, XM720 Series and T287E1 are covered in this paragraph.

4–1.1 IDENTIFICATION.

4–1.1.1 TYPE. These fuzes require setback and/or centrifugal force for arming. They may be either delay or nondelay.

4–1.1.2 PAINTING AND MARKING. The fuzes are unpainted and are stamped with the fuze designation and loading information. If the fuze contains a delay mechanism, the appropriate marking to allow setting is stamped the fuze. Some of the nondelay type have tip painted solid white. Fuze M47 (0.05 sec. delay) has the tip painted black. Fuze M56 has the surface above the body flange coated with orange-tinted clear lacquer.

4–1.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 4–1 through 4–16. The M56, M78, M78A1, M83, M85, Mk 100 Series have a wrench hole in the side. The M48 Series, M51 Series, M57 Modified, M81 Series, M507, M508 Series, M521, M524 Series, M535, M557 Series, M572, M593 Series, XM720 and T287E1 have wrench slots. Fuze M524A5 is further distinguished by two safety pins (plunger and setback) connected to the pull wire. Fuze M557E1 is distinguished by four equally spaced holes in the head and a recessed nose. The M46, M47, M71 and M74 have wrench flats. The M52 Series, M53 Series, M82 Series, M519, M525 Series, M526 Series, M527 Series, XM716, XM717 and XM719 have a slider plug, spanner wrench hole, safety or bore riding pin, and a striker protruding from the head. The M51A4 Mod 3 and M51A5 Mod 3 are installed under a windshield. The remaining fuzes have no distinguishing features other than those shown in figures 4–1 through 4–33.

4–1.1.4 WEIGHTS. The weight of these fuzes varies from a few ounces up to approximately three pounds, depending on size.

4–1.1.5 MATERIALS. The fuze bodies are made of aluminum, steel, brass, and metal or plastic as indicated below.

4–1.1.5.1 ALUMINUM. M2, M3, M8, M9, M56, M71, M85, M86, M89, M503 Series, M505, M505A1, M524 Series, M593 and T287E1.

4–1.1.5.2 STEEL. M48 Series, M51 Series, M53 Series, M57 Modified, M78, M78A1, M81, M81-A1, M83, M507, M508 Series, M521, M535, M557 Series, M572, and XM720.

4–1.1.5.3 METAL OR PLASTIC. M52 Series, M74, M82 Series, M519, M525 Series, M526 Series, M527, Series, XM716, XM717 and XM719 may be all plastic or composed of plastic components.

4–1.1.5.4 BRASS. M46 and M47.

4–1.2 HAZARDOUS COMPONENTS.

4–1.2.1 DETONATORS.

4–1.2.1.1 Tetryl, primer mixture, and lead azide: M2, M3, M8, M9, M46, M47, M48 Series, M51 Series, M56, M57 Modified, M71, M74, M85, M86, M89, M503 Series, M508 Series, M557 Series, M572, XM720 and T287E1.

4–1.2.1.2 Fulminate of mercury: M78, M78A1, and M83.

4–1.2.1.3 Primer mixture, lead azide and RDX: M505, M505A1, M524 Series, and M593 Series.

4–1.2.1.4 Black powder, delay charge and lead azide relay: M51 Series, M53 Series, M524 Series, M557 Series, M572, and M593 Series.

4–1.2.1.5 M44: M52 Series, M82 Series, M519, M525 Series, M526 Series, M527 Series, XM716, XM717 and XM719.

4–1.2.1.6 Lead azide relay M11 and a stab detonator M55 containing NOL primer mixture and RDX: XM720.

4–1.2.2 BOOSTERS.

4–1.2.2.1 Tetryl: M2, M3, M8, M9, M51 Series, M52 Series, M53 Series, M56, M71, M78, M78A1, M82 Series, M83, M85, M86, M89, M503 Series, M508 Series, M519, M524 Series, M525 Series, M526 Series, M527 Series, M557 Series, M572, M593 Series, XM716, XM717, XM719, XM720 and T287E1.

4–1.2.2.2 RDX: M505 and M505A1.

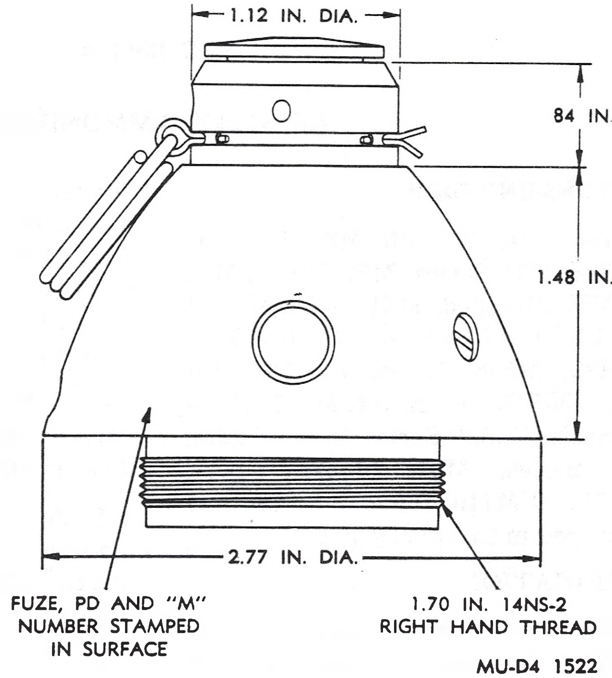

Figure 4–1.1. External Characteristics of Fuzes M2, M3, M8 or M9.

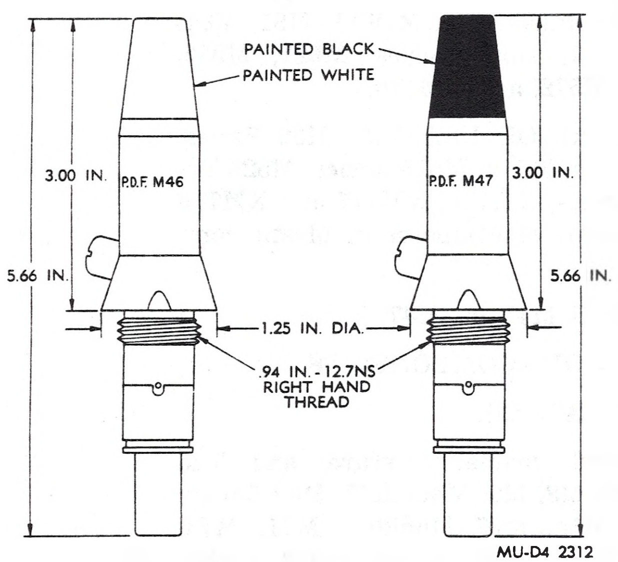

Figure 4–1. Dimensional Characteristics of the M48 and M47 Fuzes.

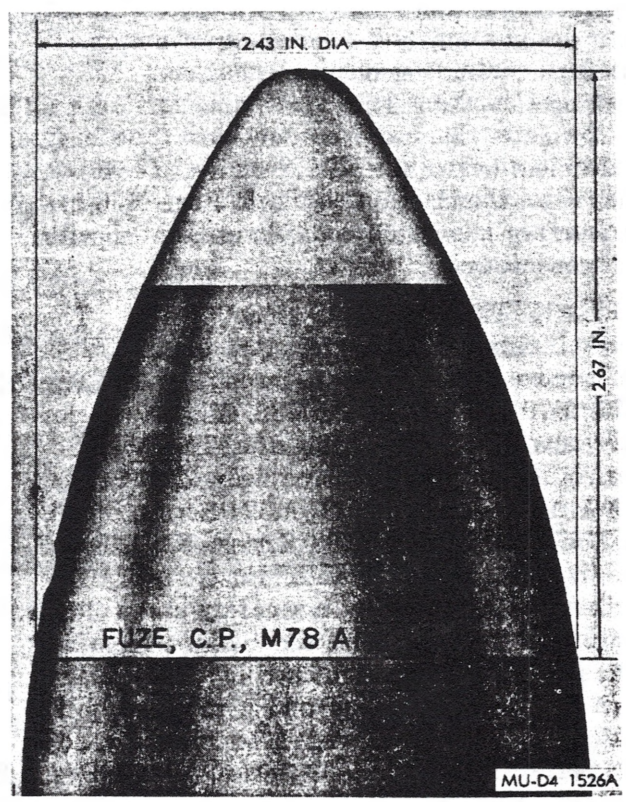

Figure 4–2. External Characteristics of Fuze M78, M78A1 or M83.

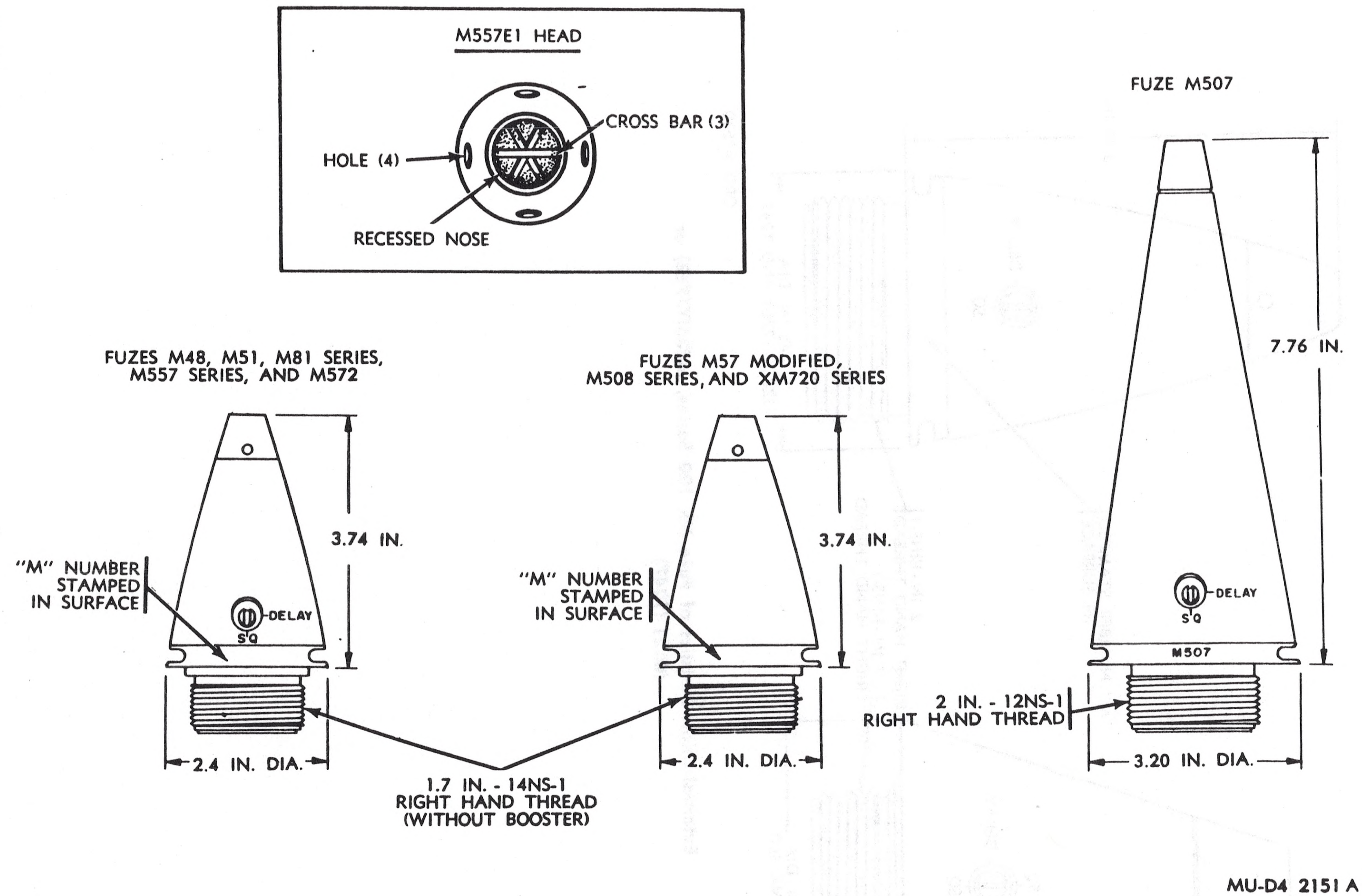

Figure 4–3 External Characteristics of Fuzes M48 Series, M51 Series (other than Mod 3), M57 Modified, M81 Series, M507, M508 Series, M557 Series, M572 and XM720 Series

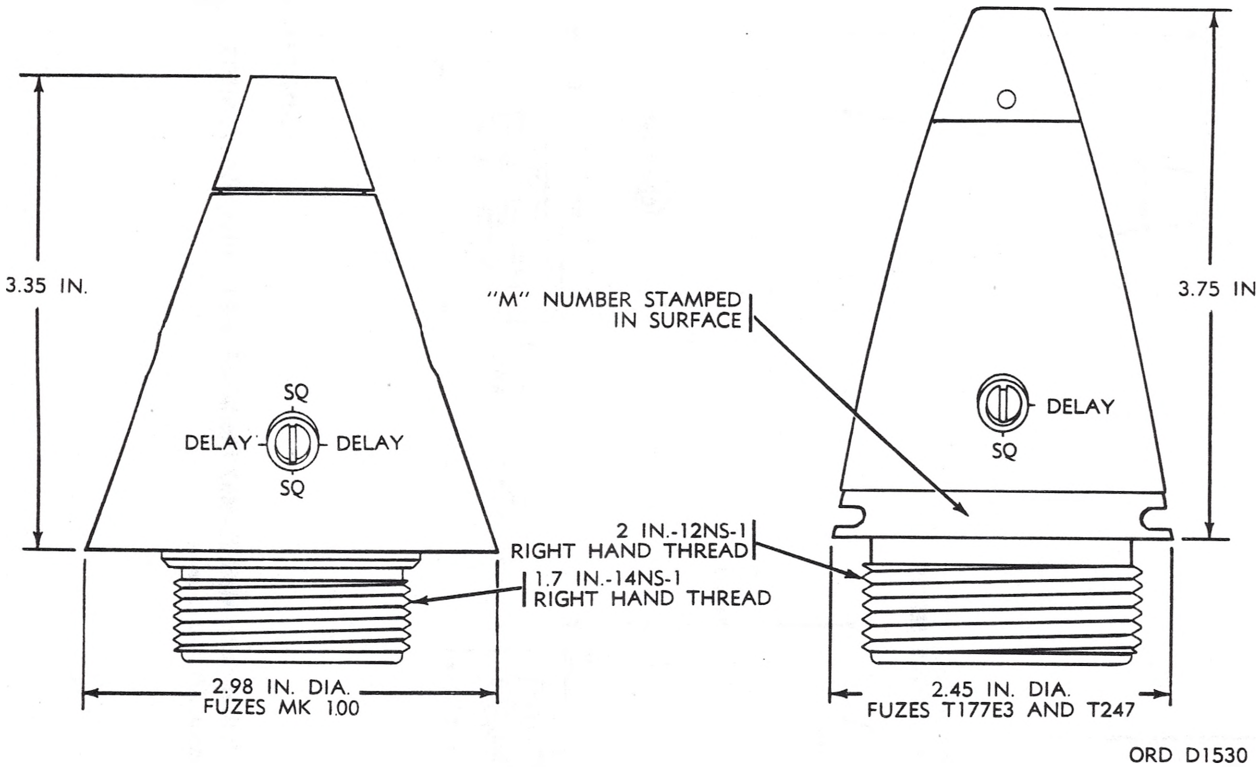

Figure 4-4 External Characteristics of Fuze Mk 100 Series, M535(T77E3) or M521 (T247)

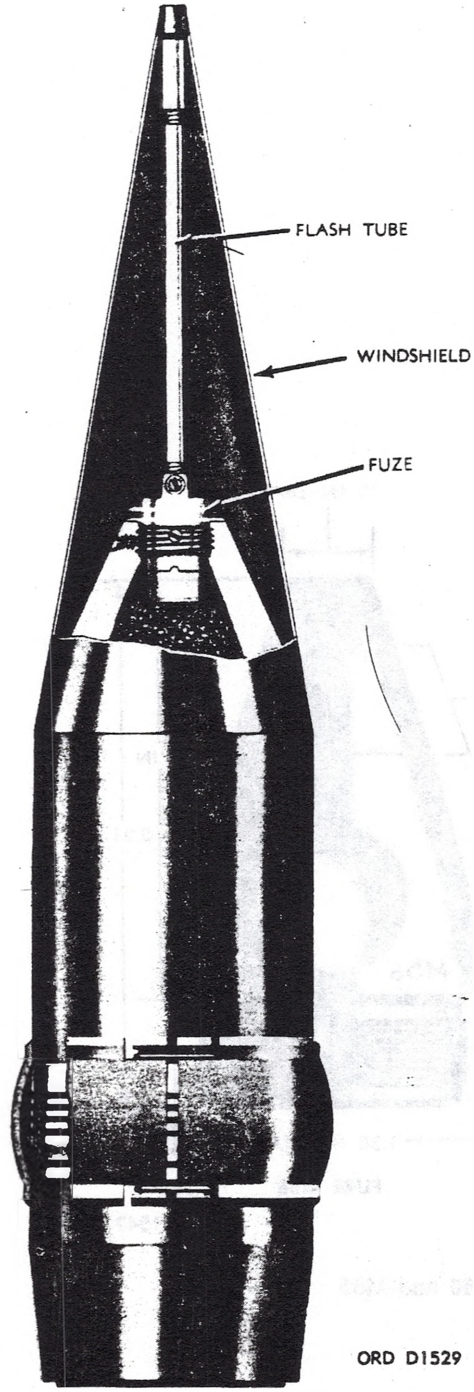

Figure 4-5 Characteristics of Fuze M51 Series Mod 3

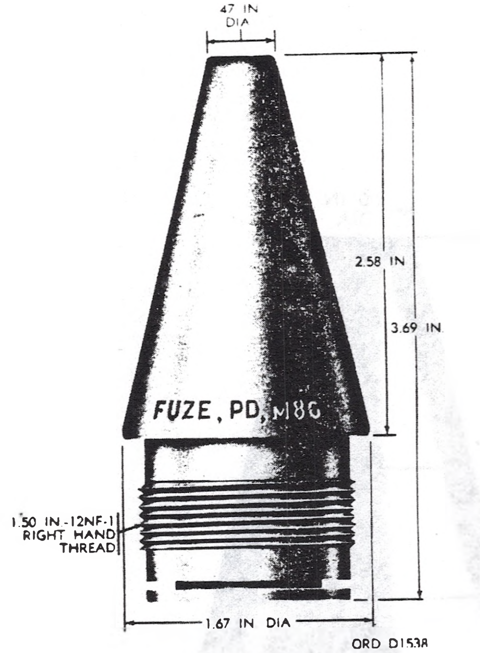

Figure 4-6 External Characteristics of Fuze M86

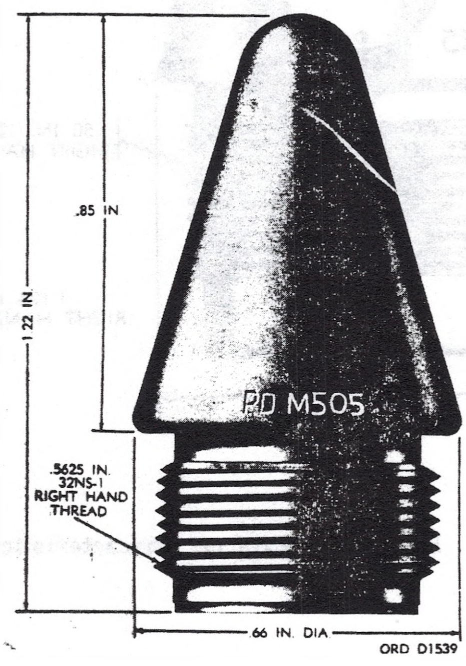

Figure 4-7 External Characteristics of Fuze M505 or M505A1

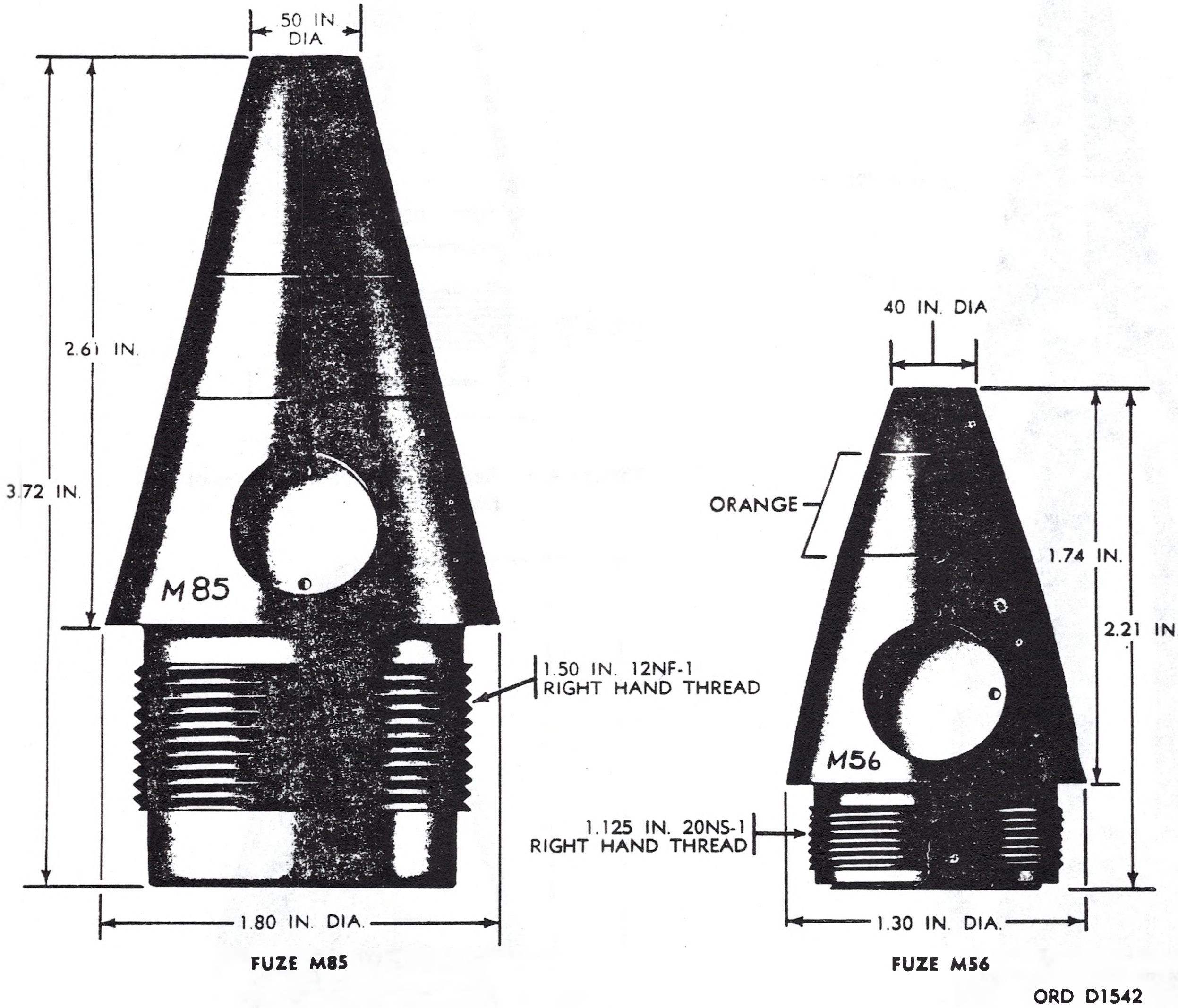

Figure 4-8 External Characteristics of Fuzes M56 and M85

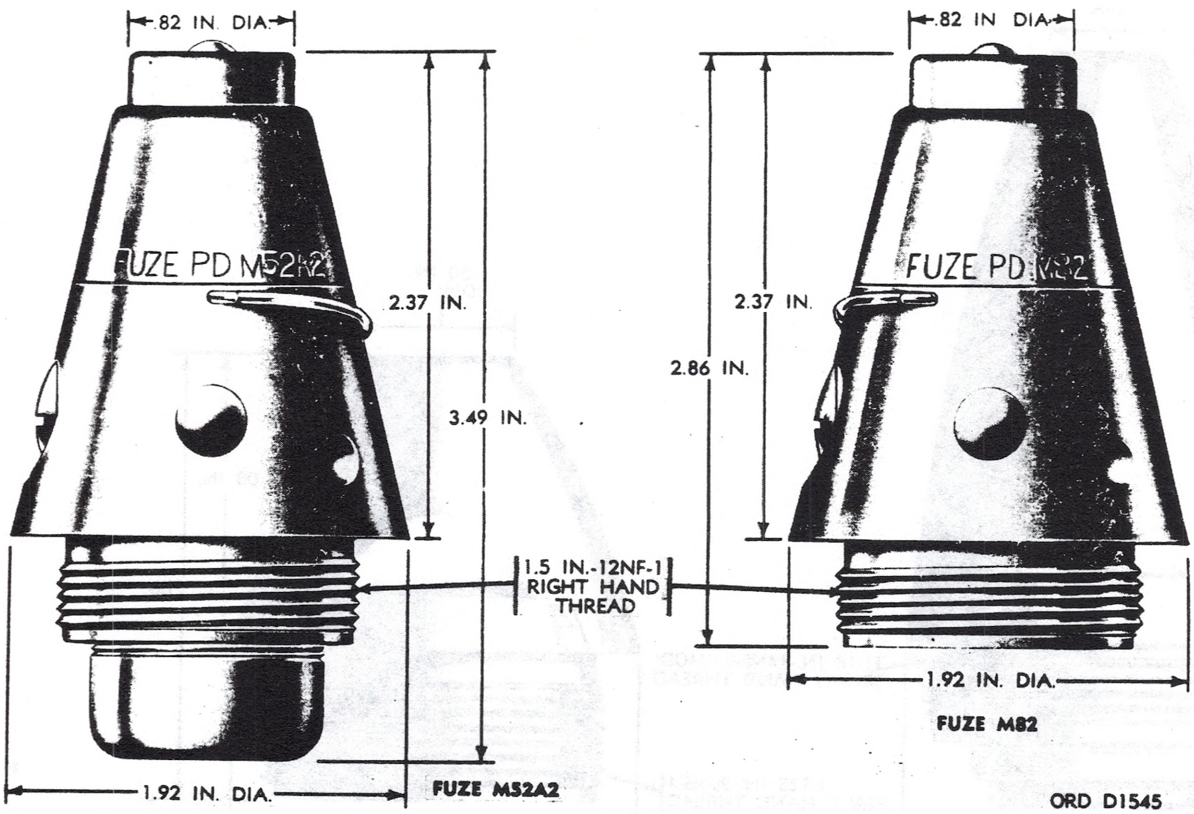

Figure 4-9 External Characteristics of Fuzes M52 Series and M82 Series

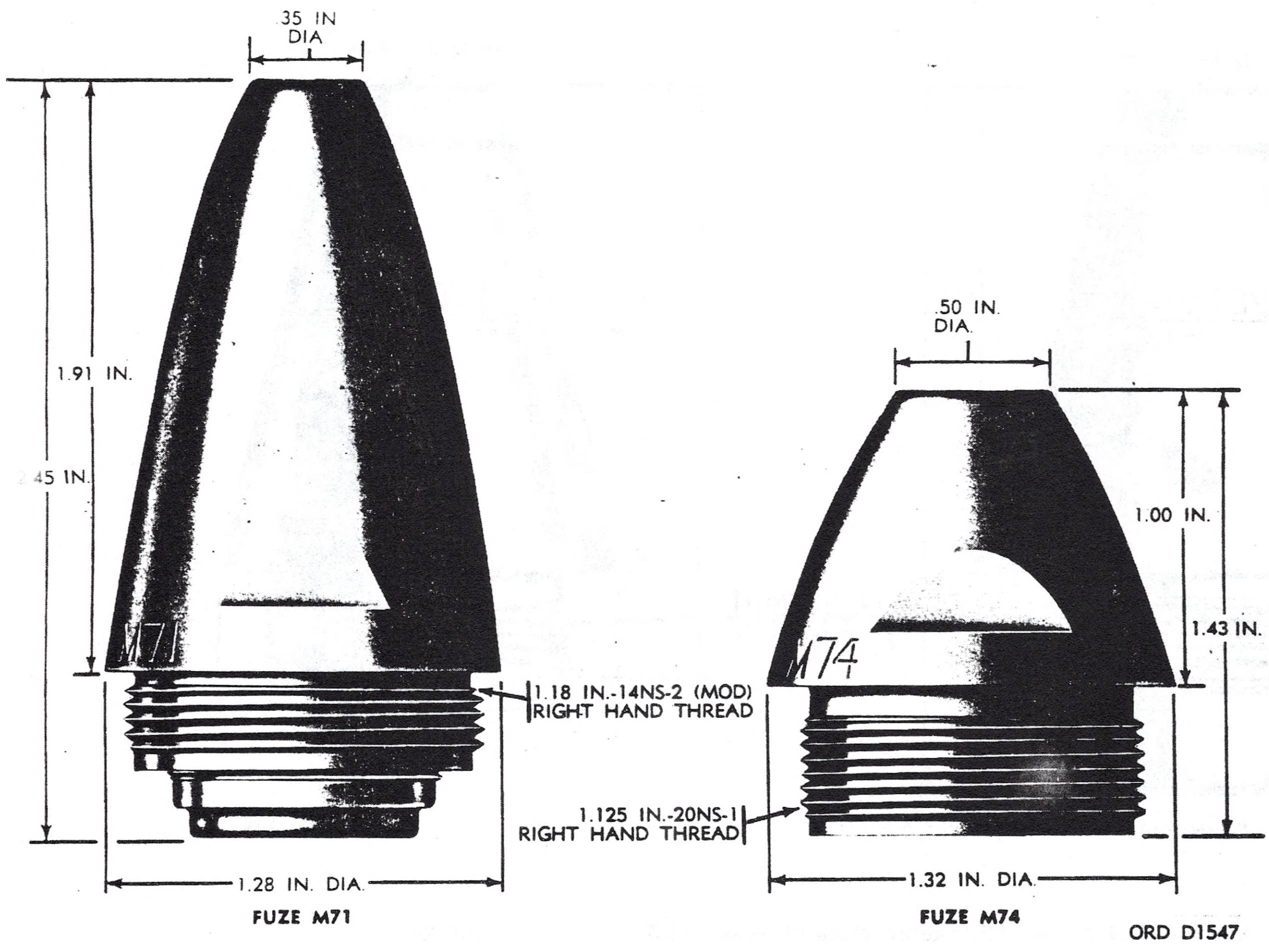

Figure 4-10 External Characteristics of Fuzes M71 and M74

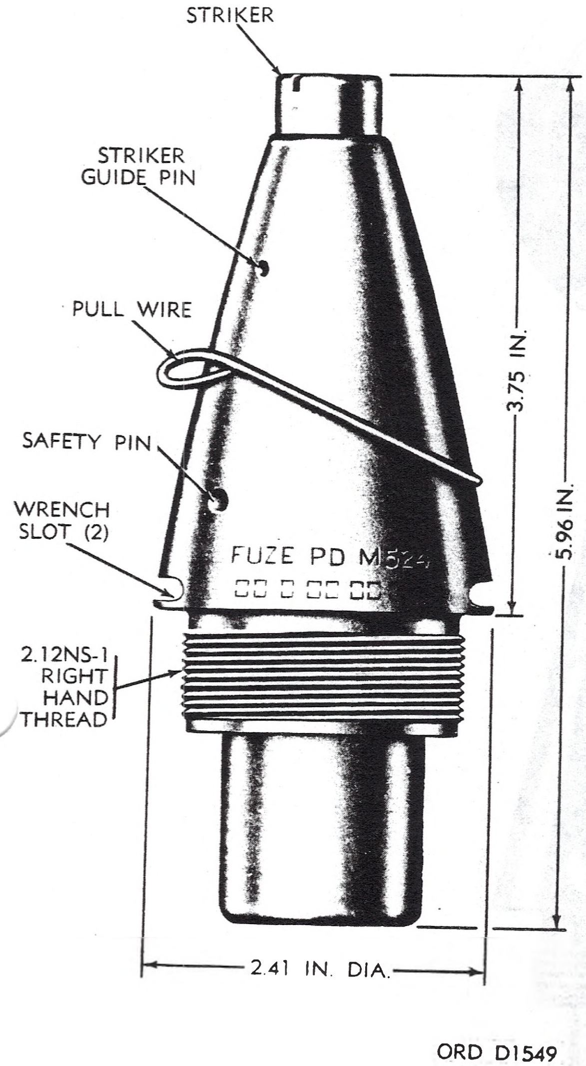

Figure 4-11. External Characteristics of Fuze M524 Series, except M524A5

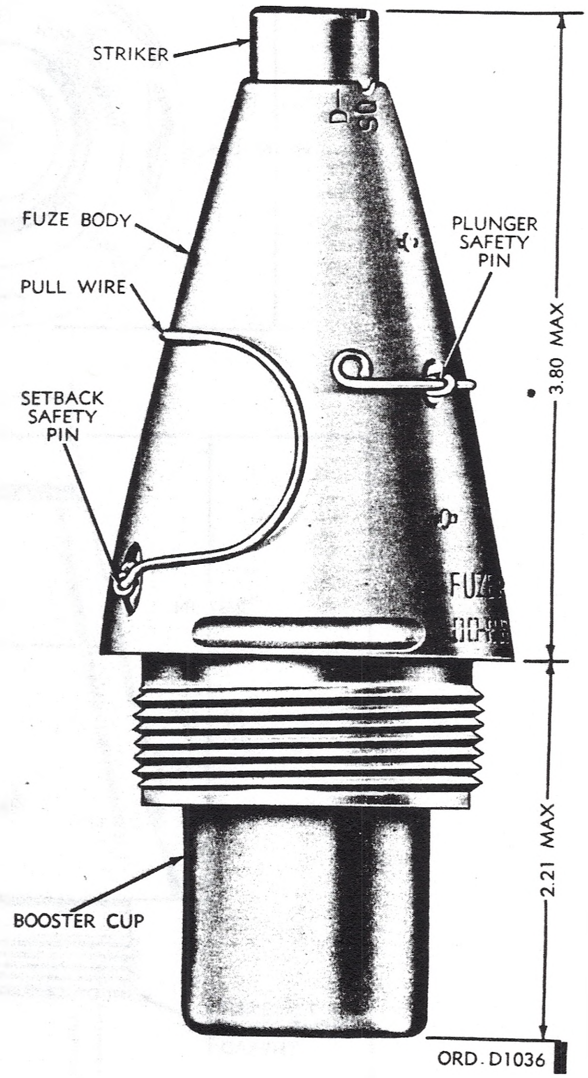

Figure 4-11-1. External Characteristics of Fuze M524A5

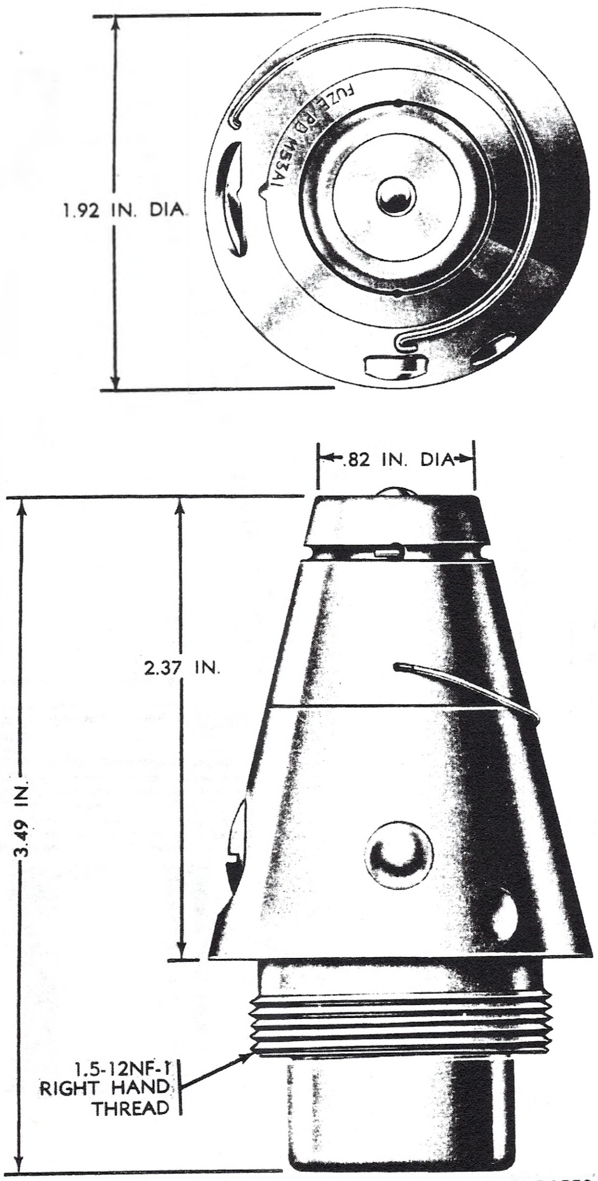

Figure 4-12. External Characteristics of Fuze M53 Series

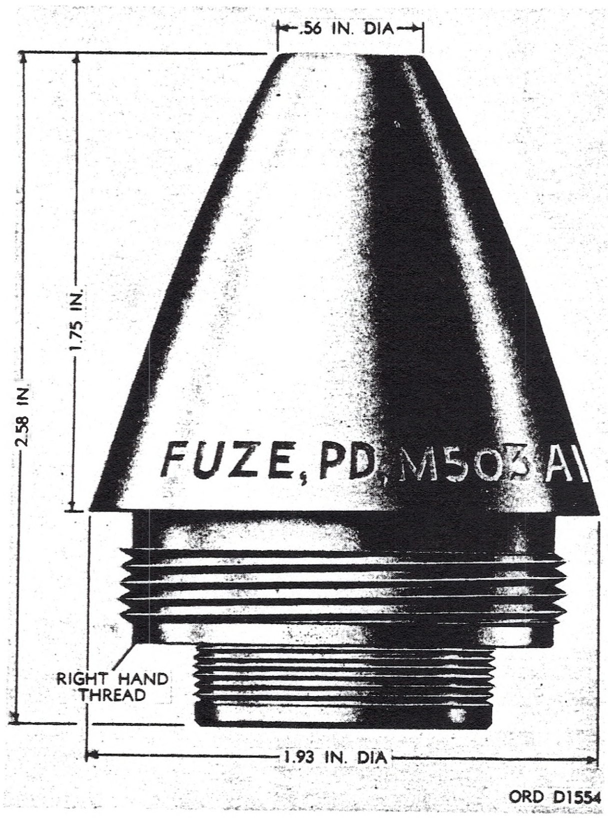

Figure 4-13. External Characteristics of Fuze M503 Series

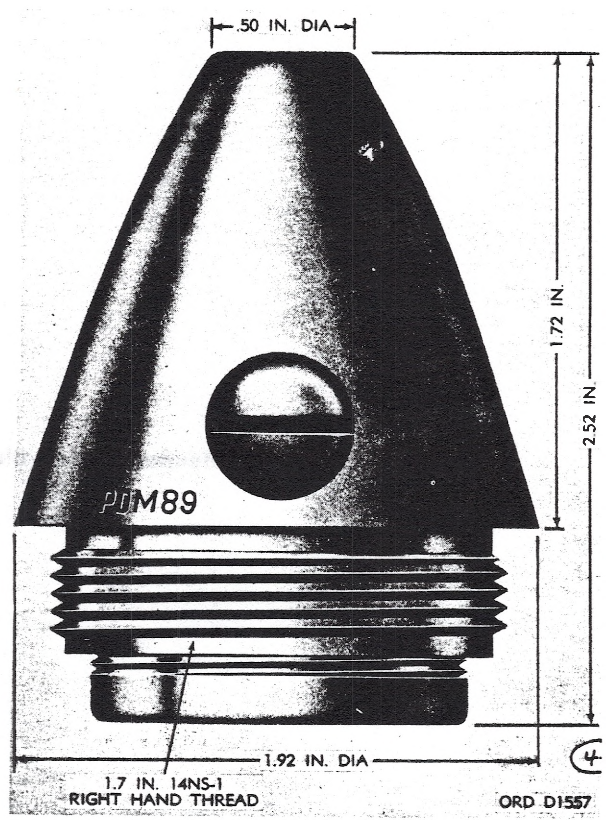

Figure 4-14. External Characteristics of Fuze M89

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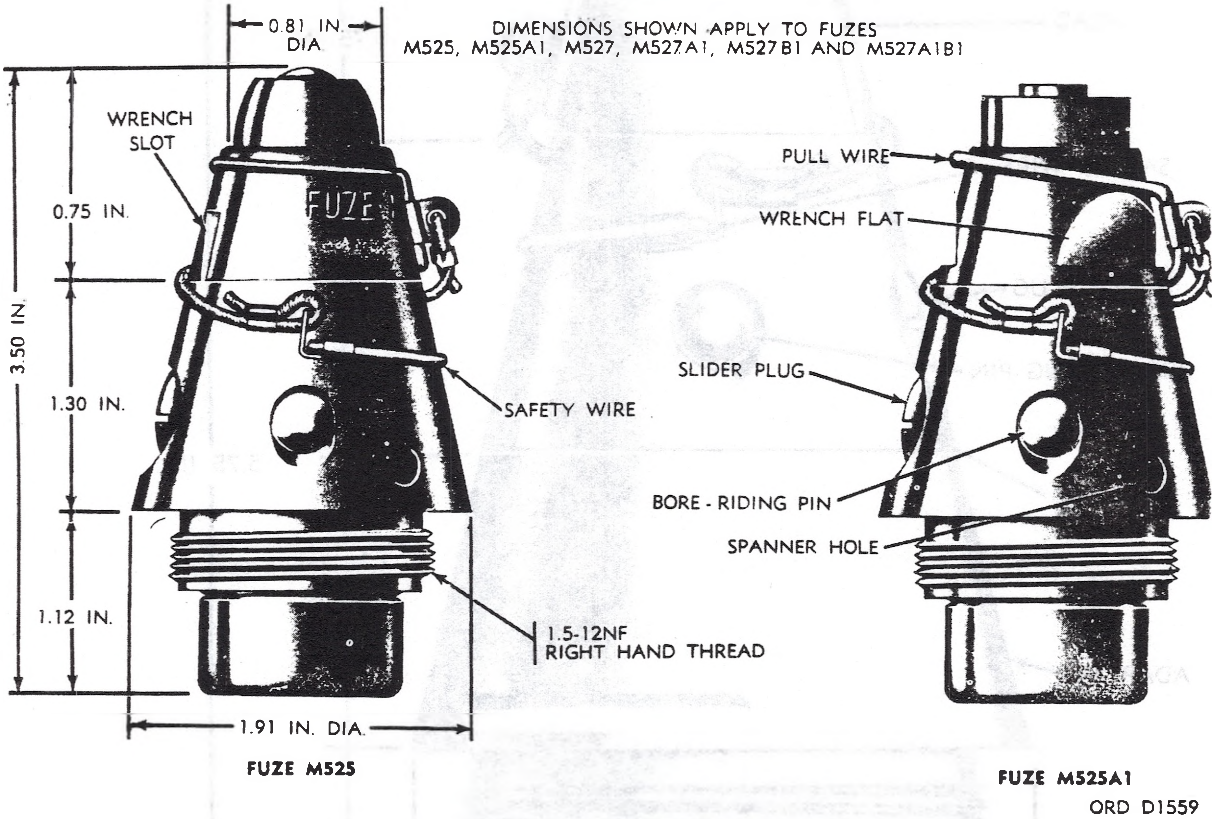
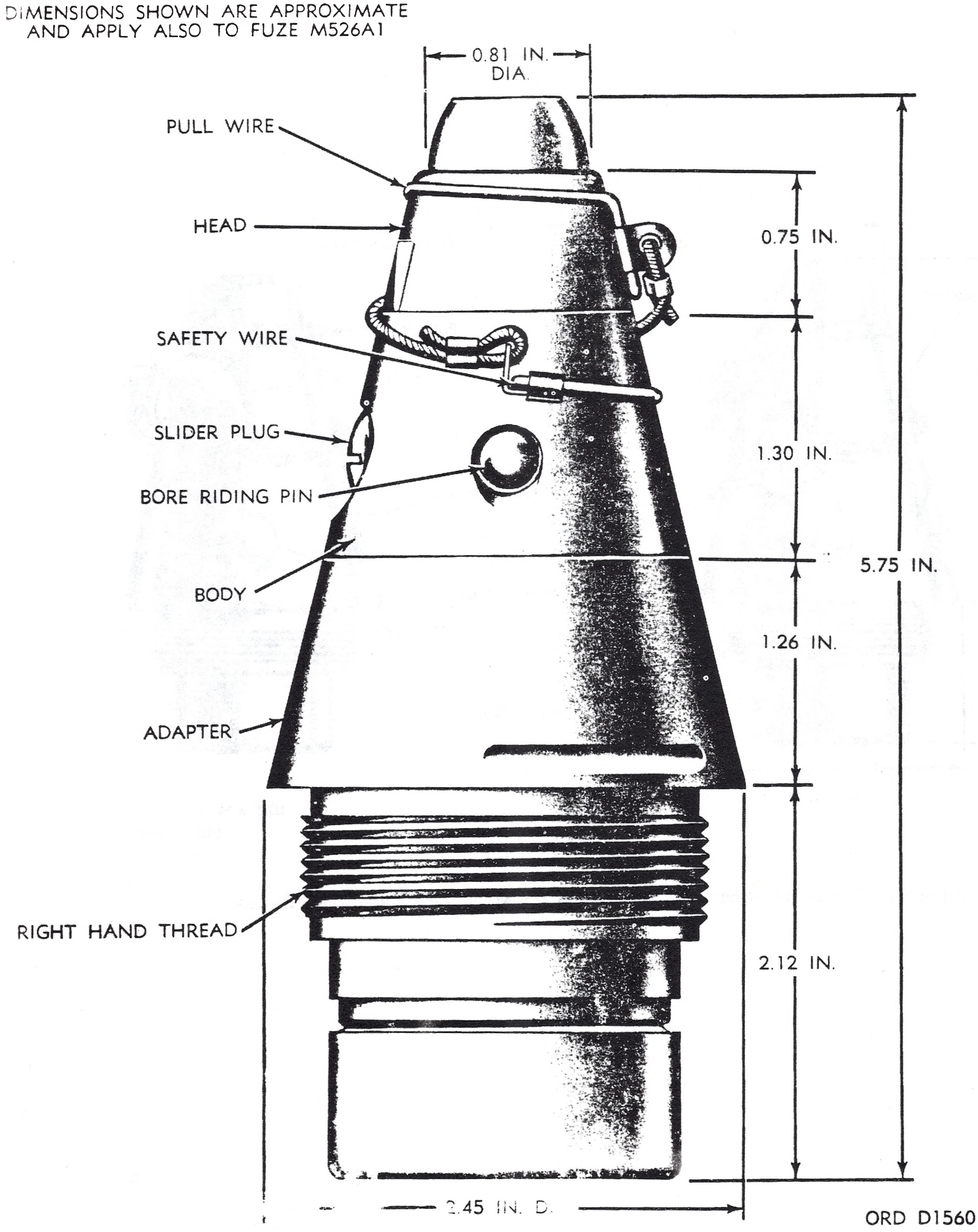


Figure 4-15 External Characteristics of Fuzes M525 Series and M527 Series



[illegible] 13. External Characteristics of Fuze M526 Series

4–1.3 FUNCTIONING.

4–1.3.1 FUZES M2, M3, M8, and M9 (figures 4–17 and 4–18). Upon setback, the retainer shears the shear wire and moves rearward, allowing the balls to be cammed outward by the spring-loaded striker. Setback also withdraws the setback pin and unlocks the slider. As the striker moves forward, it frees the slider, allowing it to move to the armed position when sufficient centrifugal force is obtained. Upon impact, the striker is driven into the detonator, initiating the explosive train.

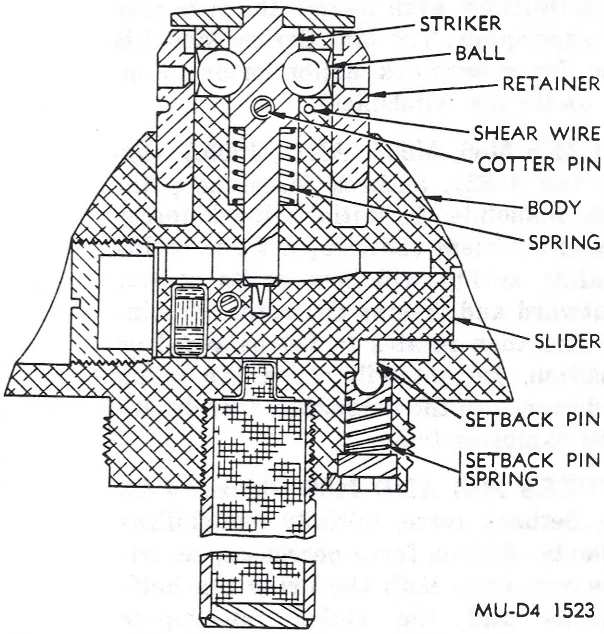


Figure 4–17 Fuze M8 or M9, Cutaway View Showing Unarmed Condition

4–1.3.1A FUZES M46 and M47 (figs. 4–1 and 4–17.1). These fuzes are a point detonating, centrifugal-arming, inpact-firing type, and are identical except the M46 produces superquick action and the M47 has a 0.05-second delay element. The interrupter remains in the unarmed condition until the initial setback force has decreased and sufficient centrifugal force is developed to overcome the resistance of the interrupter spring. The interrupter then moves outward until it no longer blocks the flash hole, and remains in this position until impact. Upon impact, the firing pin is driven into the upper detonator, and the resulting flash initiates the lower detonator of the M46 fuze, or the 0.05-second delay element of the M47 fuze, which in turn initiates the lower detonator.

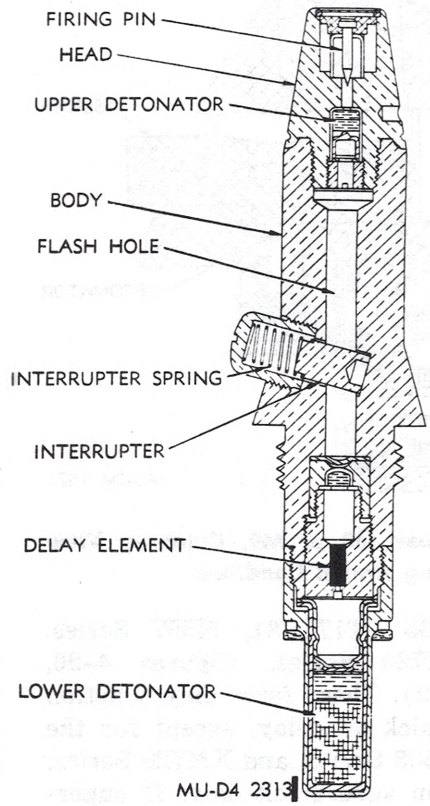


Figure 4–17.1 Fuze M47, Cutaway View Showing Unarmed Condition

4–1.3.2 FUZES M78, M78A1, AND M83 (figure 4–19). The fuze operates on an impact-inertia concept. Initial setback keeps the detents in place and prevents the fuze from arming. Once this initial force has decreased and sufficient centrifugal force is obtained, the detents will move outward, lock, and free the plunger. The plunger is held back by the anticreep spring until impact. Upon impact, the plunger (containing the primer, delay pellet, and detonator) moves forward and impinges the stationary firing pin.

4–1.3.3 FUZES, M48 Series, M51 Series, M57 Modified, M81, M81A1, M507 Series, M508 Se-

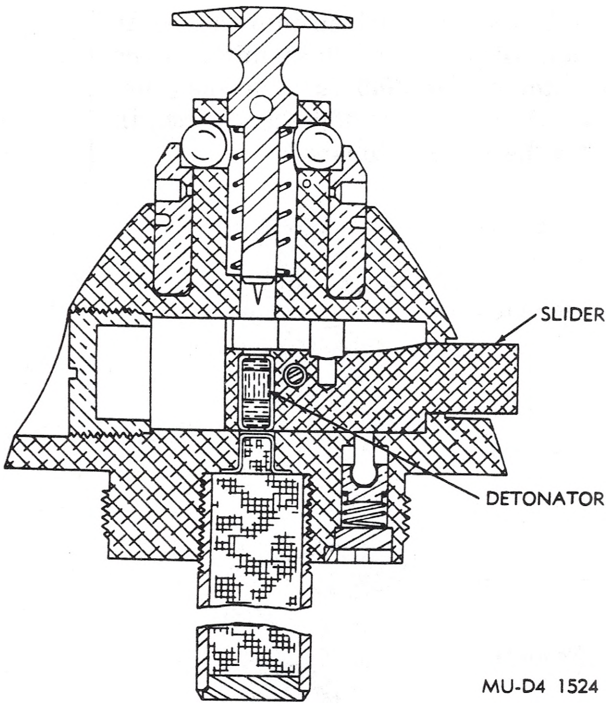


Figure 4–18 Fuze M8 or M9, Cutaway View Showing Armed Condition

ries, M521, M535 (T177E3), M557 Series, M572, and XM720 Series. (figures 4–20, 4–20.1, and 4–20.2). These fuzes may function on either superquick or delay, except for the M57 Modified, M508 Series, and XM720 Series, which function on superquick only. If superquick action is desired, the slot in the setting sleeve is turned to the "SQ" marking on the ogive. This causes the setting sleeve, which is eccentrically bored, to rotate so that it does not interfere with the movement of the interrupter. When the projectile or rocket is fired, setback force combined with the pressure exerted by the various springs holds the fuze parts in the unarmed condition. As setback force decreases, centrifugal force increases and causes the interrupter to overcome the pressure exerted by its spring and move outward, clearing the superquick passage in the body. Upon impact, the superquick firing pin is driven into the detonator, thereby initiating it. Flash from the detonator passes through the clear flash hole directly to the detonator in the booster, thereby instantaneously initiating the explosive train. Setting the fuze for delay action locks the interrupter so it will not move, keeping the flash hole closed. The delay train functions identically with that of the fuzes covered in paragraph 4–1.3.2. The delay train will always function, even though the fuze may be set for superquick. The M51 Series, Mod 3 is always set for superquick action prior to installation under the windshield.

4–1.3.4 FUZES M86, M505, AND M505A (figures 4–21 and 4–22). Setback forces keep the components immobile. As initial setback forces decrease and sufficient centrifugal force builds up, the safety spring will bow at its center, moving outward and freeing the rotor. The inbalanced rotor then rotates to the balanced or armed position. Impact will cause the firing pin to be driven into the detonator, thereby initiating the explosive train.

4–1.3.5 FUZES M56 AND M85 (figures 4–23 and 4–24). Setback force, initially immobilizes all components. As this force decreases, centrifugal force acts upon both the firing pin halfblock detents and the slider interrupter assembly, overcoming their respective springs. These components will then move outward, freeing the firing pin as it is carried forward, and aligning the flash channel in the slider. Impact drives the firing pin into the detonator assembly, thereby initiating the explosive train.

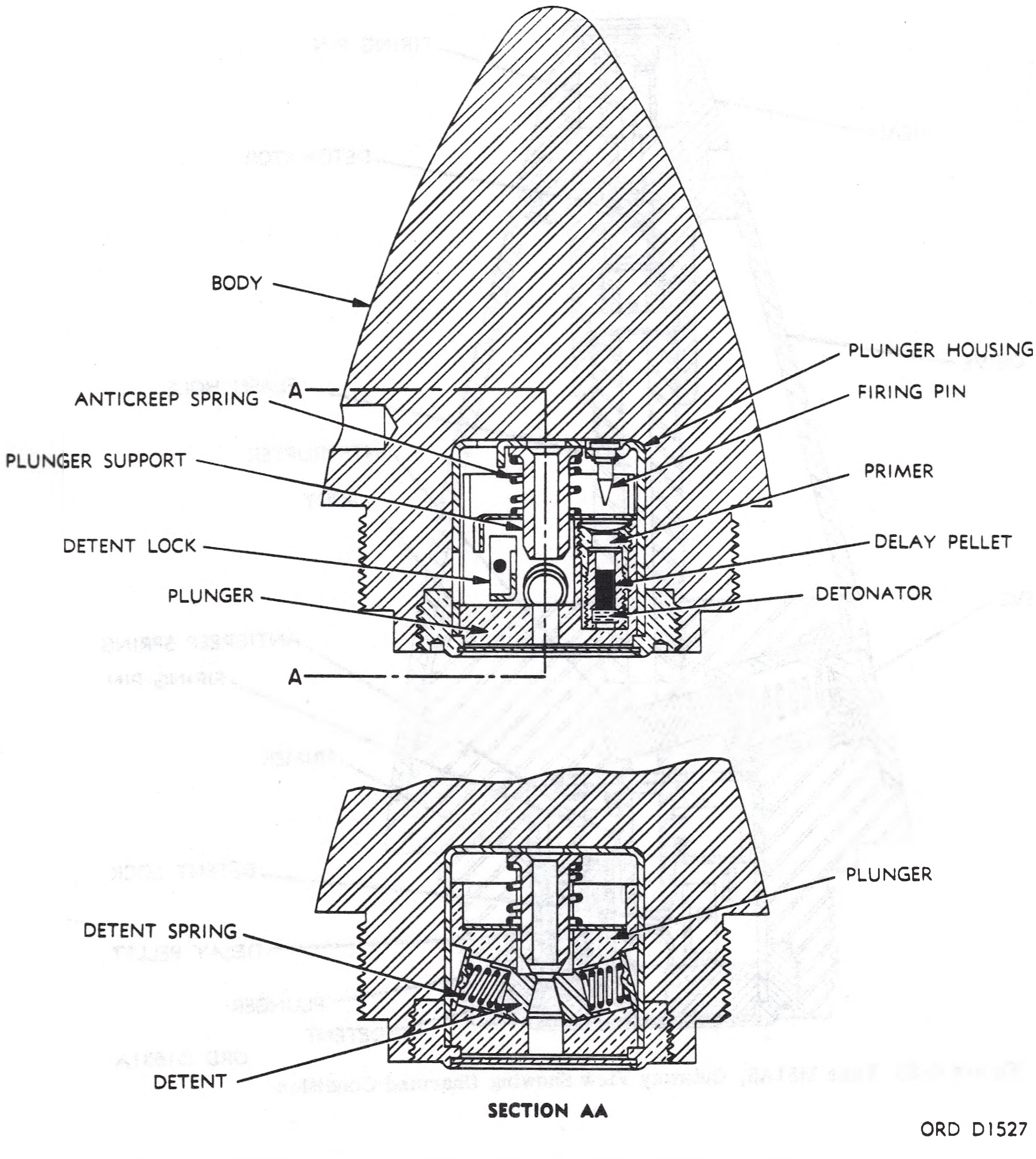


Figure 4-19 Fuze M78A1, Cutaway View Showing Unarmed Condition

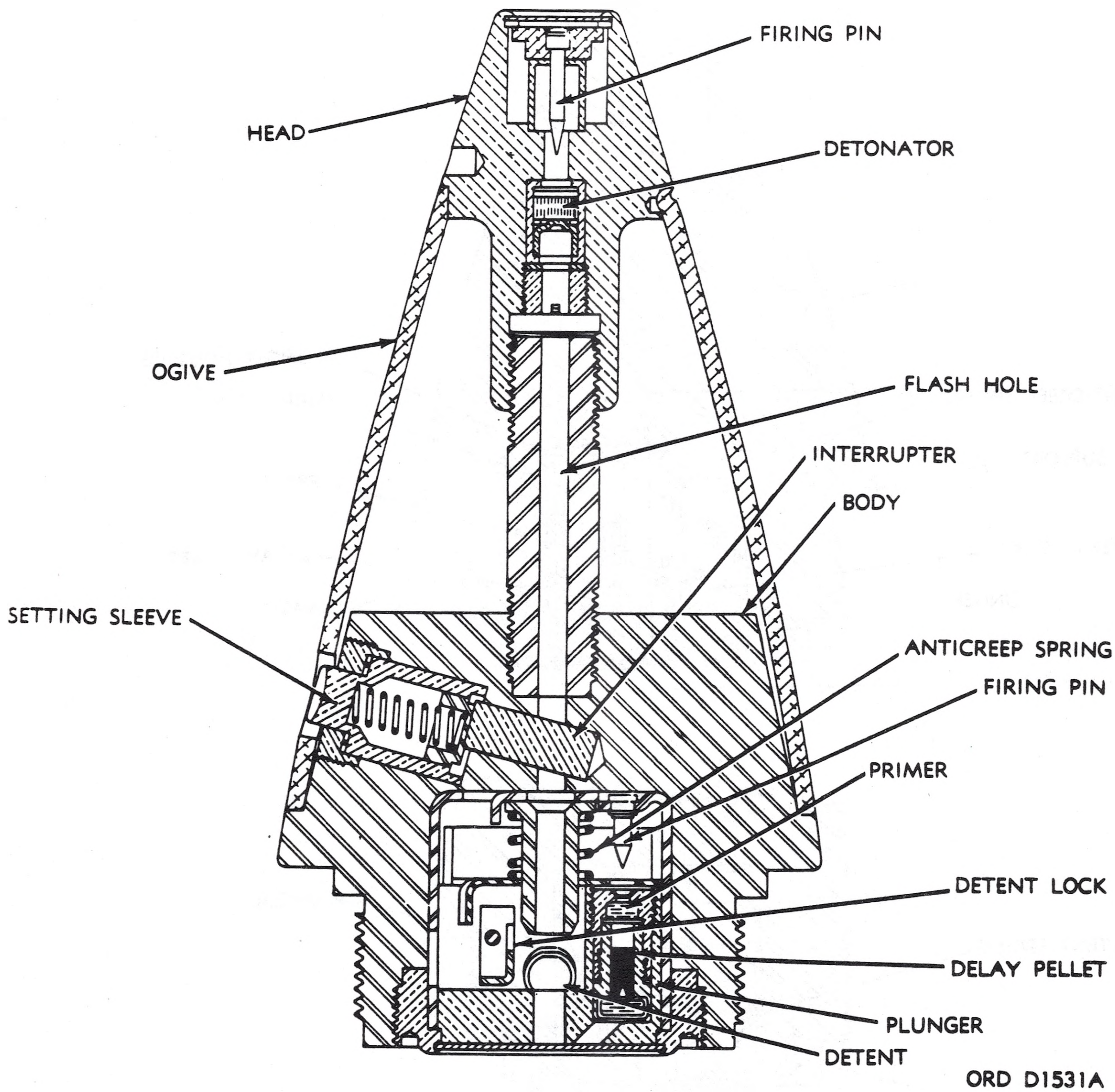
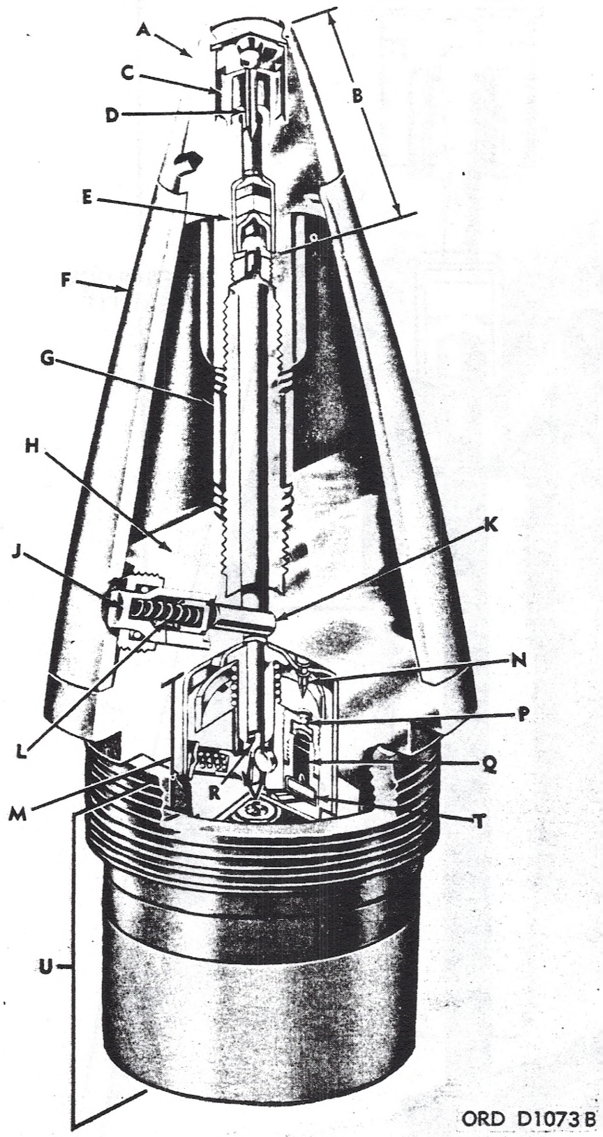


Figure 4-20 Fuze M51A5, Cutaway View Showing Unarmed Condition



A—Head
B—Superquick element
C—Firing pin support
D—Firing pin (SQ)
E—Detonator M24
F—Ogive or windshield
G—Flash tube
H—Body
J—Setting sleeve
K—Interrupter
L—Interrupter spring
M—Delay plunger assembly
N—Firing pin (delay)
P—Primer M54
Q—Delay charge
R—Plunger pin lock
S—Plunger pins
T—Relay M7
U—Booster M125A1

Figure 4-20.1 Fuze M557, Cutaway View

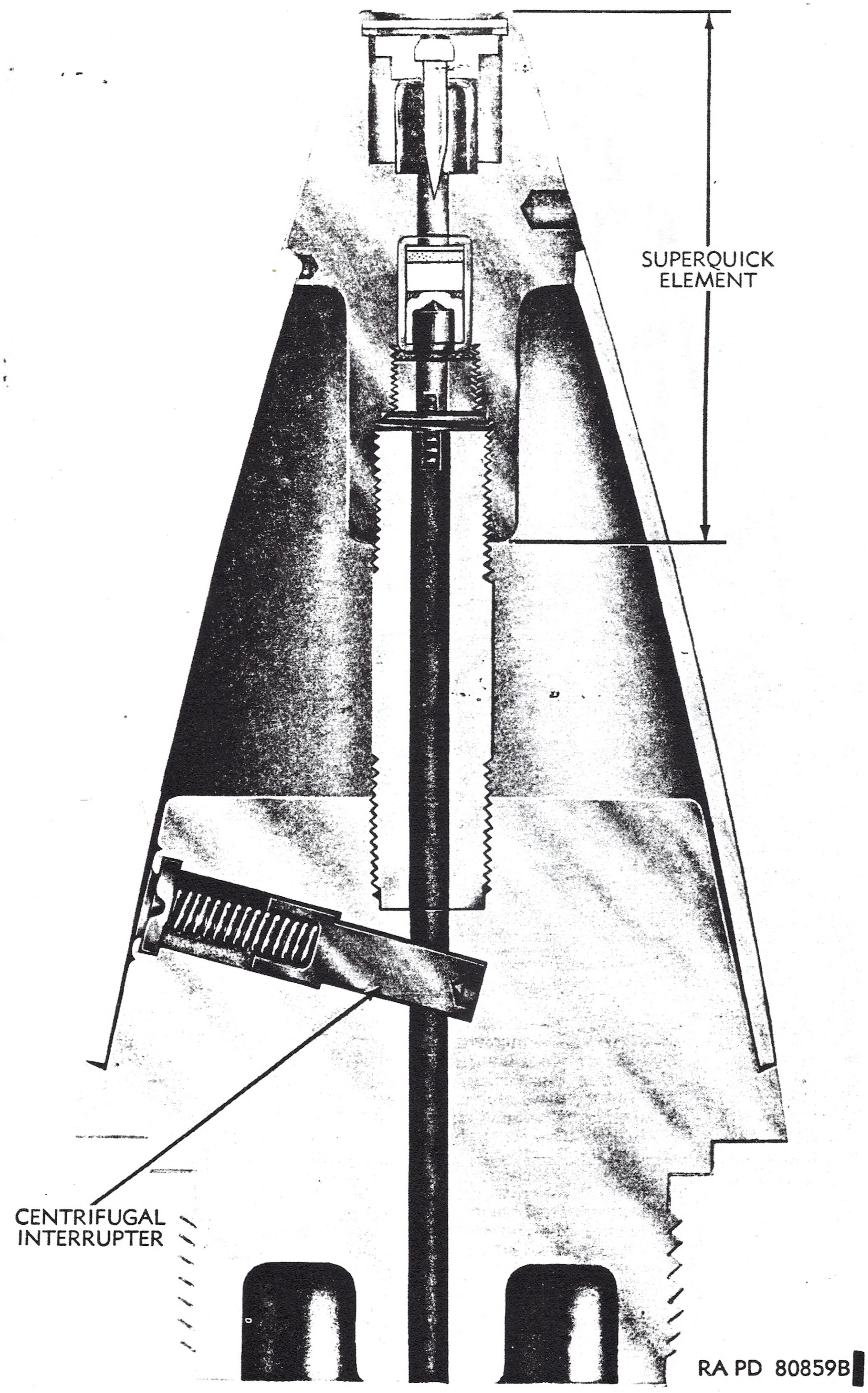


Figure 4-20.2. Fuzes M57 Modified and M508 Series w/o Booster, Cutaway View

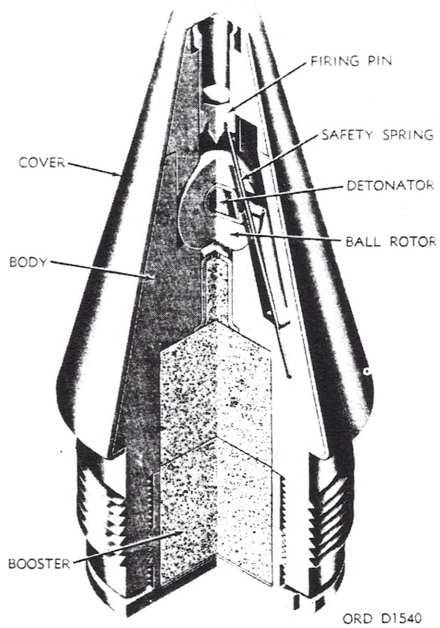


Figure 4–21 Fuze M86, Cutaway View Showing Unarmed Condition

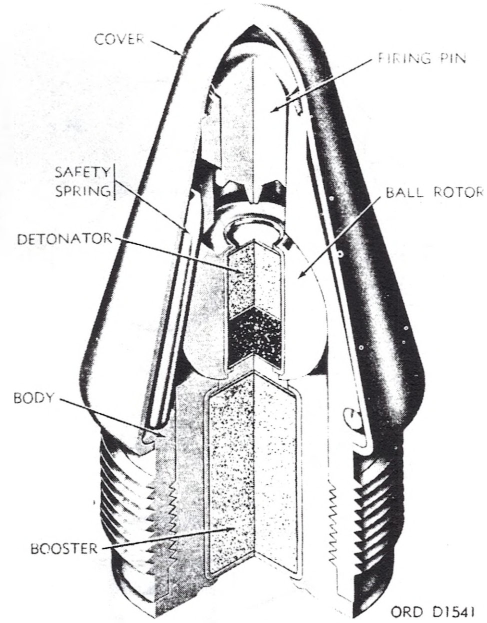


Figure 4–22 Fuze M505 or M505A1, Cutaway View Showing Armed Condition

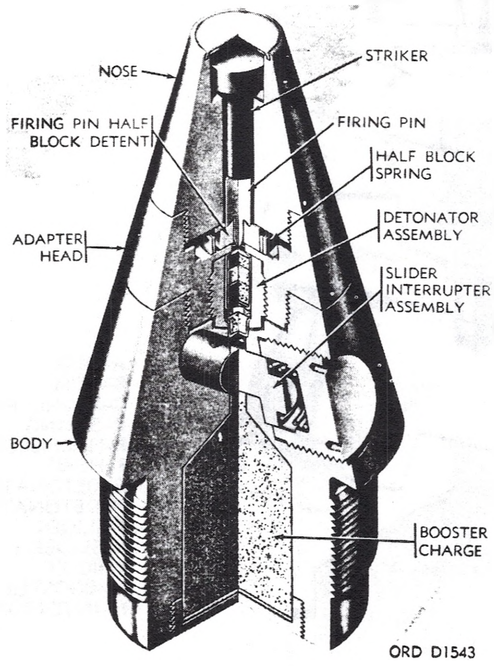
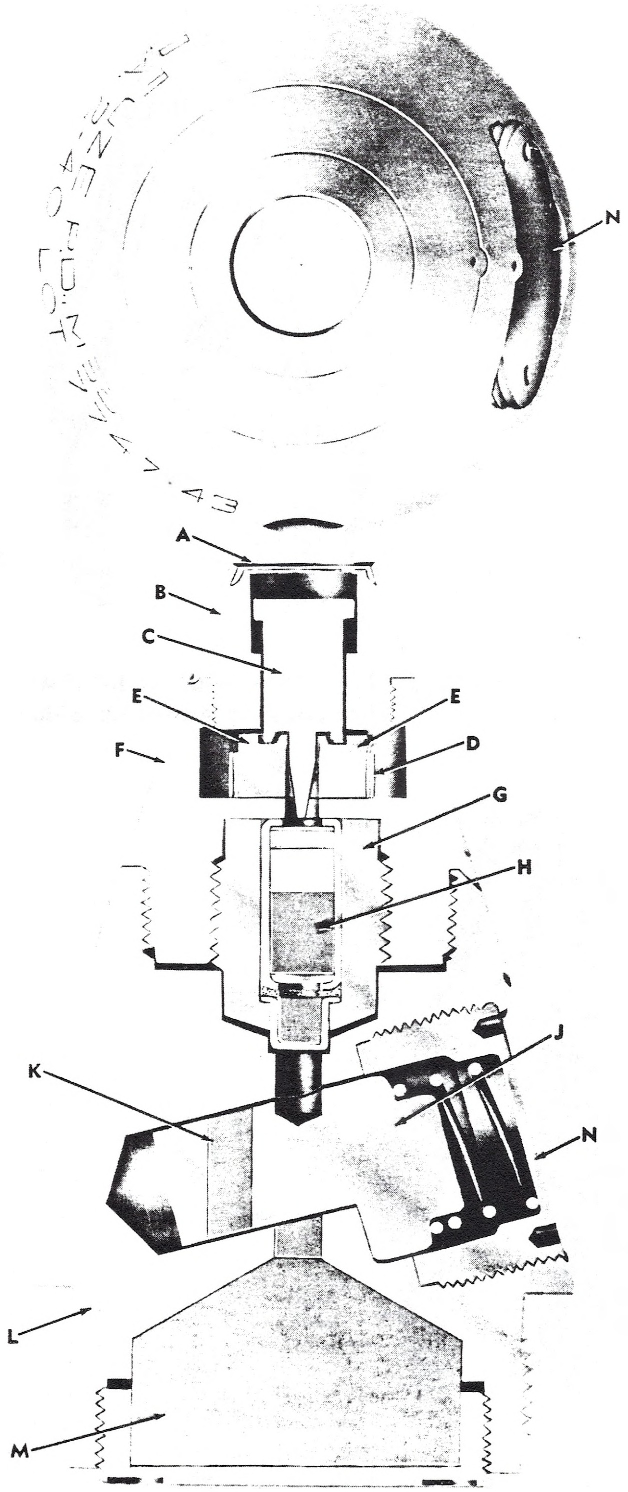


Figure 4–23 Fuze M85, Cutaway View Showing Unarmed Condition



A–DISK
B–NOSE
C–FIRING PIN
D–SPRING
E–HALF-BLOCKS
F–HEAD
G–DETONATOR ASSEMBLY
H–DETONATOR
J–SLIDER
K–SLIDER CHARGE
L–BODY
M–BOOSTER CHARGE
N–INTERRUPTER

RA PD 80858B

Figure 4–24 Fuze M56, Cutaway View Showing Unarmed Condition

4-1.3.6. FUZES M52 SERIES, M53 SERIES, M82 SERIES, M519, XM716, XM717 AND XM719 (figs. 4-25, 4-26, and 4-27.1). Setback forces cause the setback pin to move rearward, releasing the safety (bore-rider) pin which is ejected when projectile leaves the tube. This frees the slider allowing it to be pushed into the armed position thereby aligning the detonator with the firing pin and booster lead in. In some models, a guide pin is employed to assure correct alignment of the slide and lock it in place. Impact drives the firing pin into the detonator, thereby initiating the explosive train. In fuzes XM716, XM717, and XM719 slider movement is slowed by the restriction of air flow into the space between the slider and the cap assembly.

4-1.3.7 FUZES M71 AND M74 (fig. 4-27). Setback forces cause the setback pin to enter the rotor recess, unlocking the rotor. As setback forces decrease, the associated frictional forces also decrease thereby freeing the rotor. Centrifugal forces cause the imbalanced rotor to turn to the armed position, aligning the detonator with the firing pin. Impact drives the firing pin into the detonator, thereby initiating the explosive train.

4-1.3.8. FUZES M524 SERIES AND M593 SERIES (figs. 4-28 and 4-29). Setback forces cause release of the lever in the rotor allowing the spring driven rotor to rotate the plunger into the armed position. This aligns the flash channels in the rotor and plunger with the booster lead-in. For superquick action, the outer firing pin is aligned with the superquick detonator as well as the delay element primer. For delay, the outer firing pin is aligned with the cavity in the plunger. Impact functions the fuze. If the striker is not driven rearward by the impact, the plunger moves forward against the creep spring and causes the superquick detonator and/or delay element primer to impinge on the firing pins.

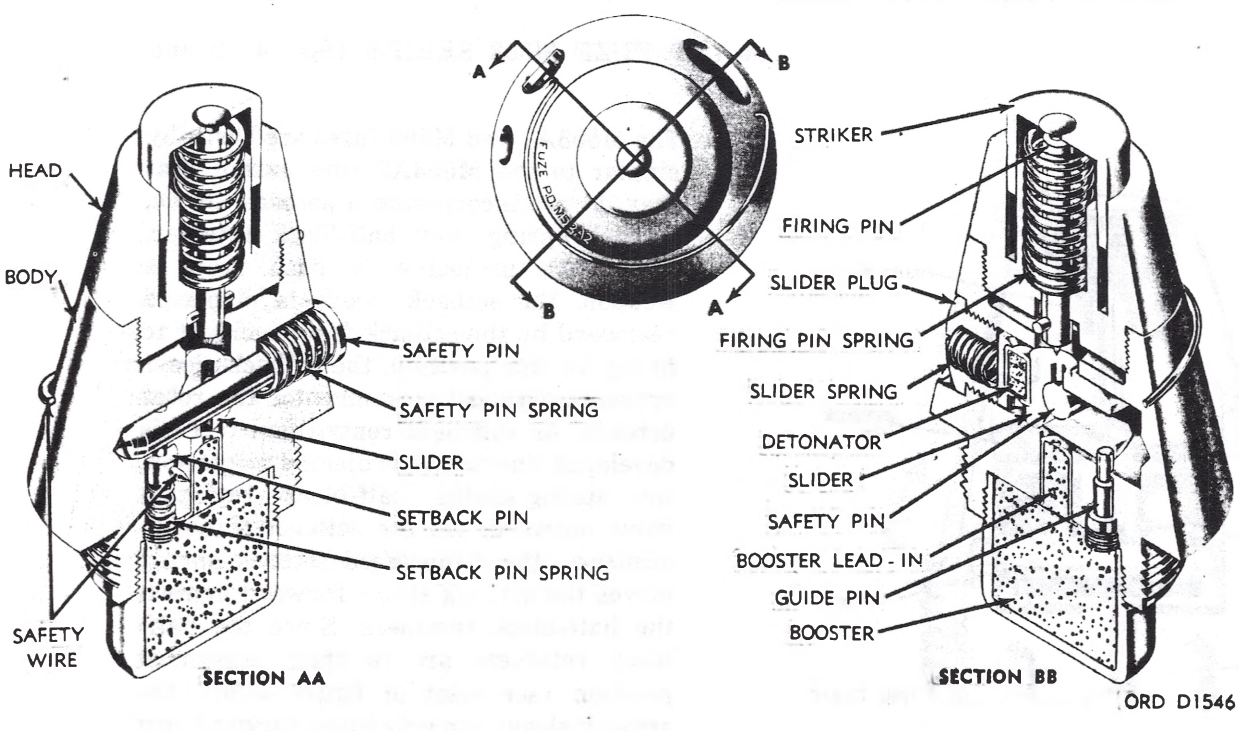


Figure 4-25. Fuze M52A2, Cutaway View Showing Unarmed Condition

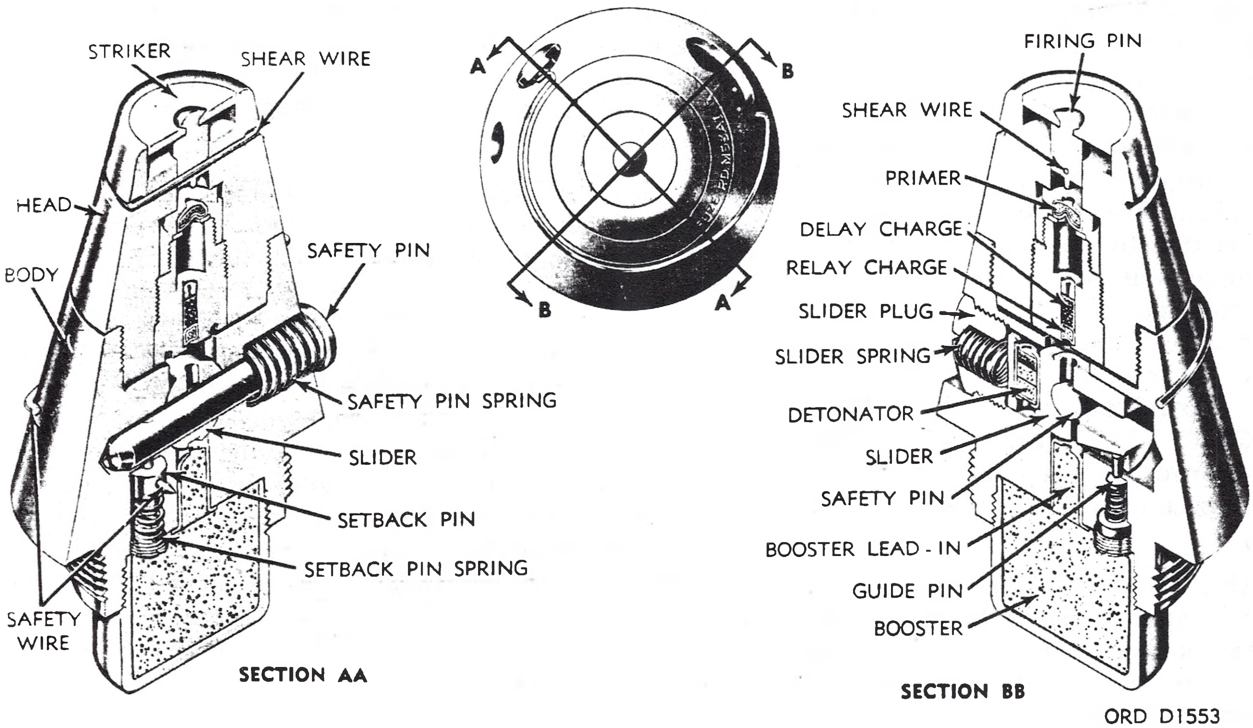


Figure 4–26. Fuze M53A1, Cutaway View Showing Unarmed Condition

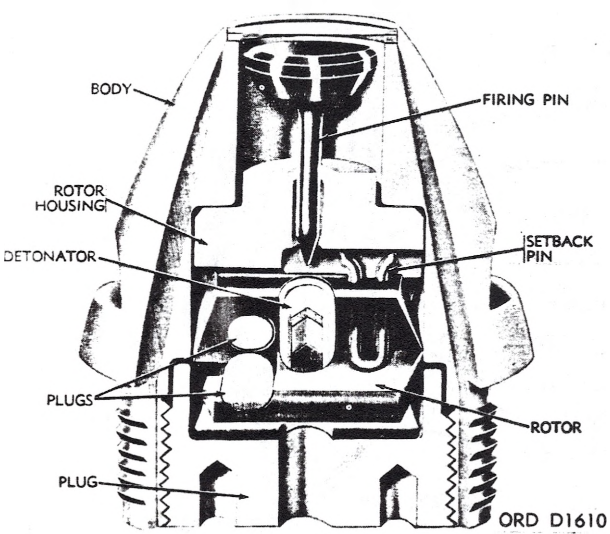


Figure 4–27. Fuze M74, Cutaway View Showing Unarmed Condition

4–1.3.9 FUZE M503 SERIES (figs. 4–30 and 4–31).

a. The M503A1 and M503 fuzes are basically similar to the M503A2 fuze except that they do not incorporate a setback sleeve, setback spring, and half-block retainer. When the projectile is fired from a weapon, the setback sleeve is displaced rearward by the setback force incident to firing. In this position, the setback sleeve prevents outward movement of the rotor detents. As sufficient centrifugal force is developed due to the projectile's rotation, the spring-loaded half-block retainers move outward. As the setback force diminishes, the compressed setback spring moves the setback sleeve forward against the half-block retainers. Since the half-block retainers are in their outermost position (see inset of figure 4–30), the setback sleeve can only move forward just enough for the groove in its wall to align with the rotor detents. The four

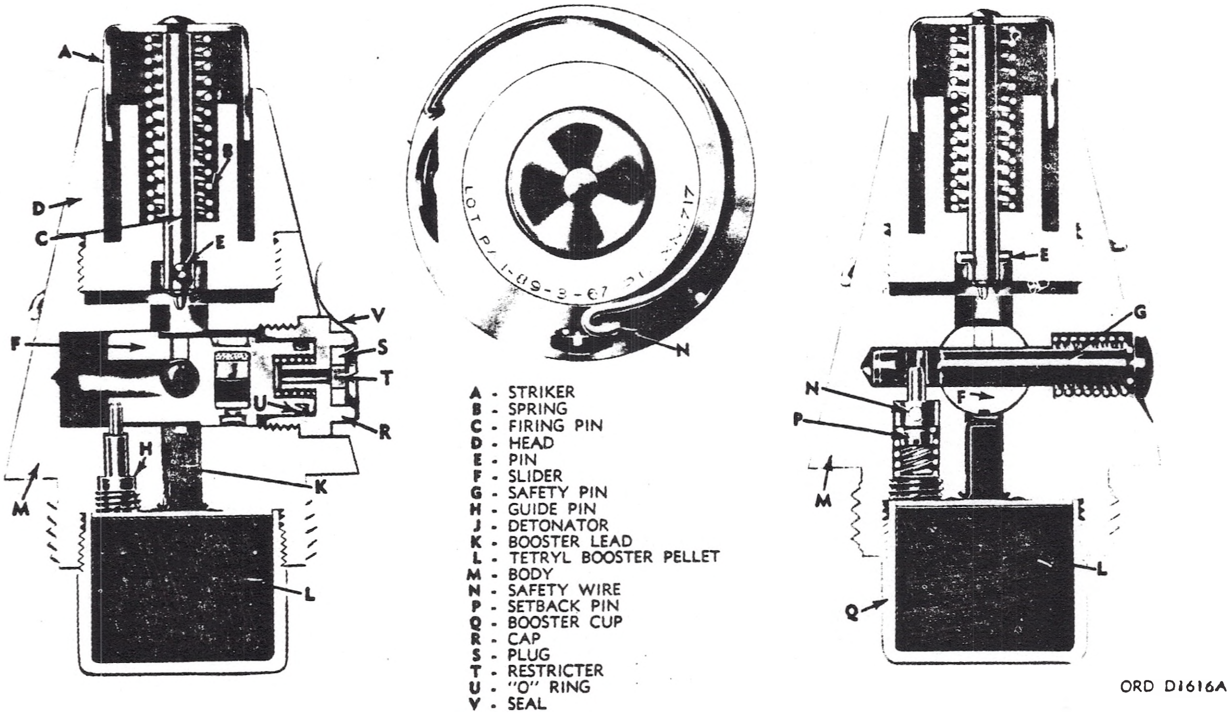


Figure 4–27.1. Fuze, Point Detonating: XM717.

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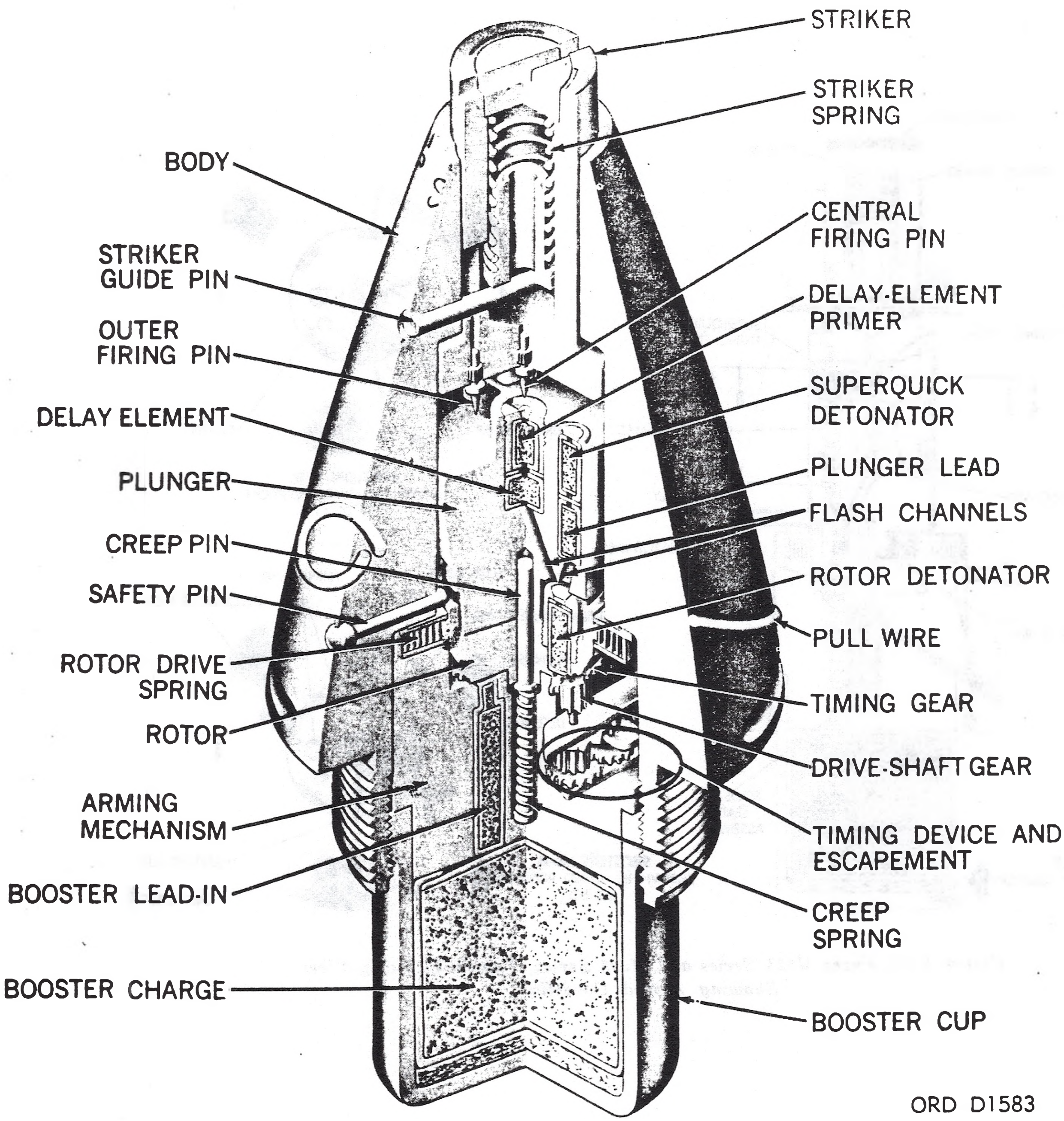

Figure 4–28. Fuze M524, Cutaway View Showing Unarmed Condition

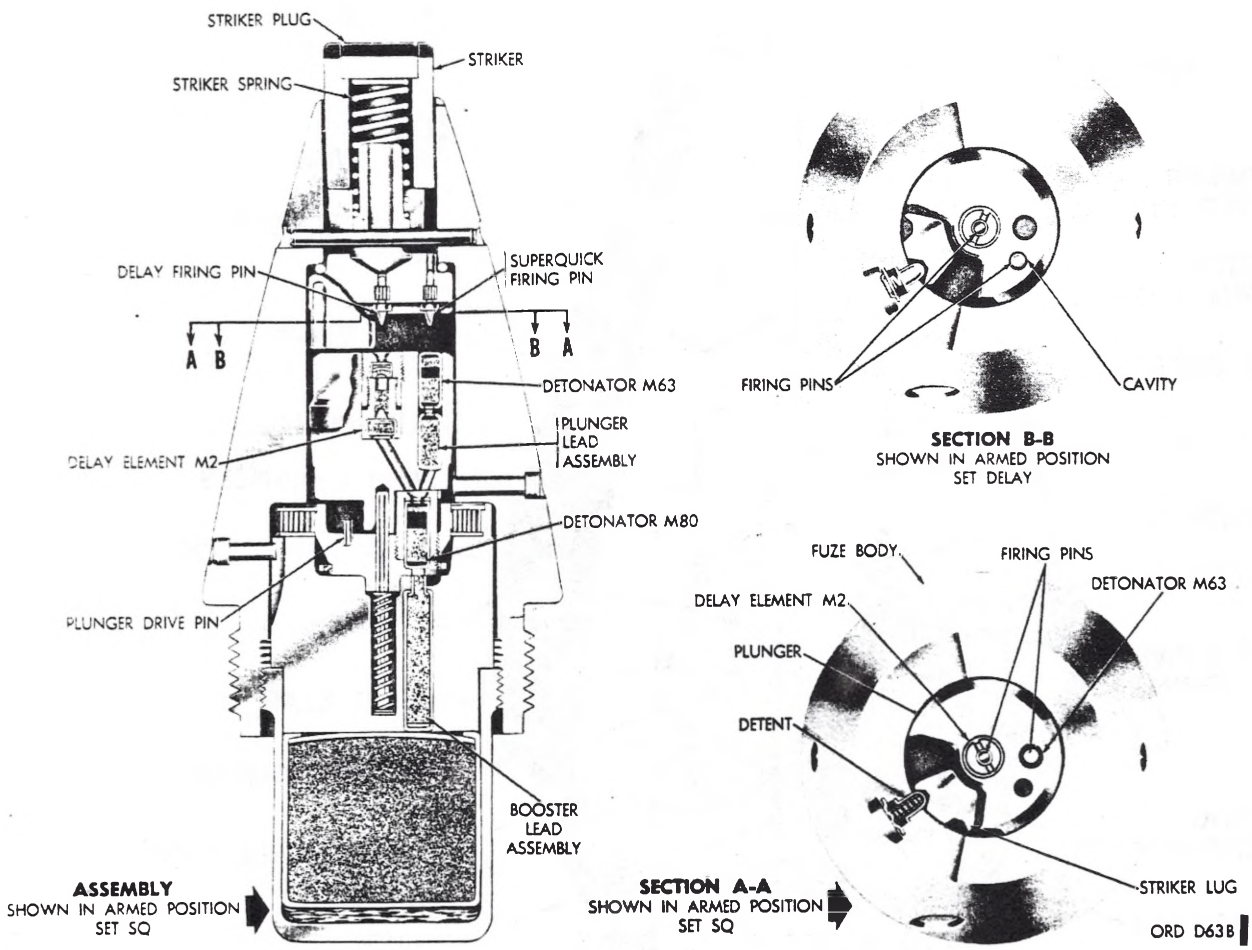

Figure 4-29. Fuzes M524 Series and M593 Series, Typical Cutaway View Showing Armed Condition

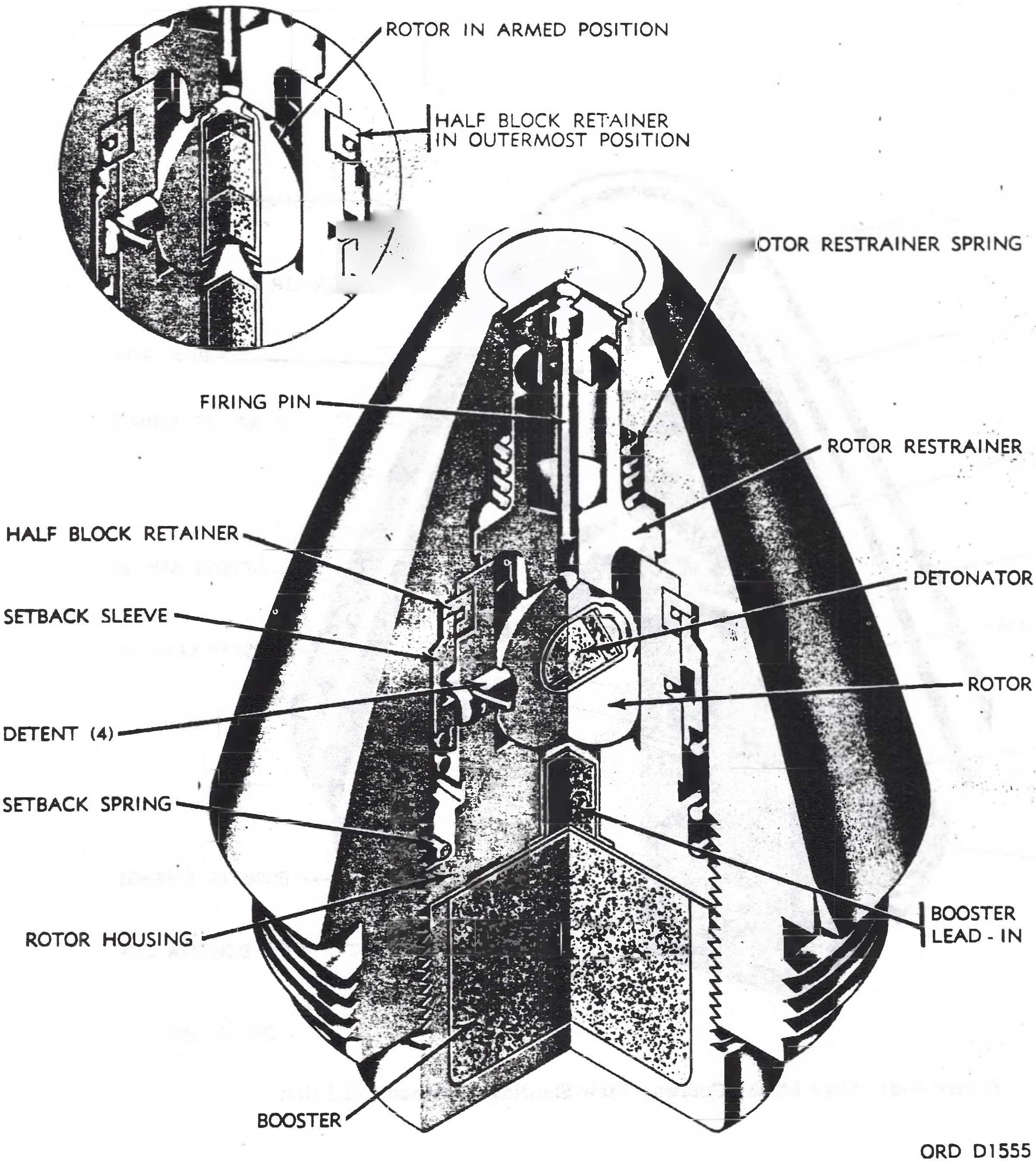

Figure 4-30 Fuze M503A2, Cutaway View Showing Unarmed Condition

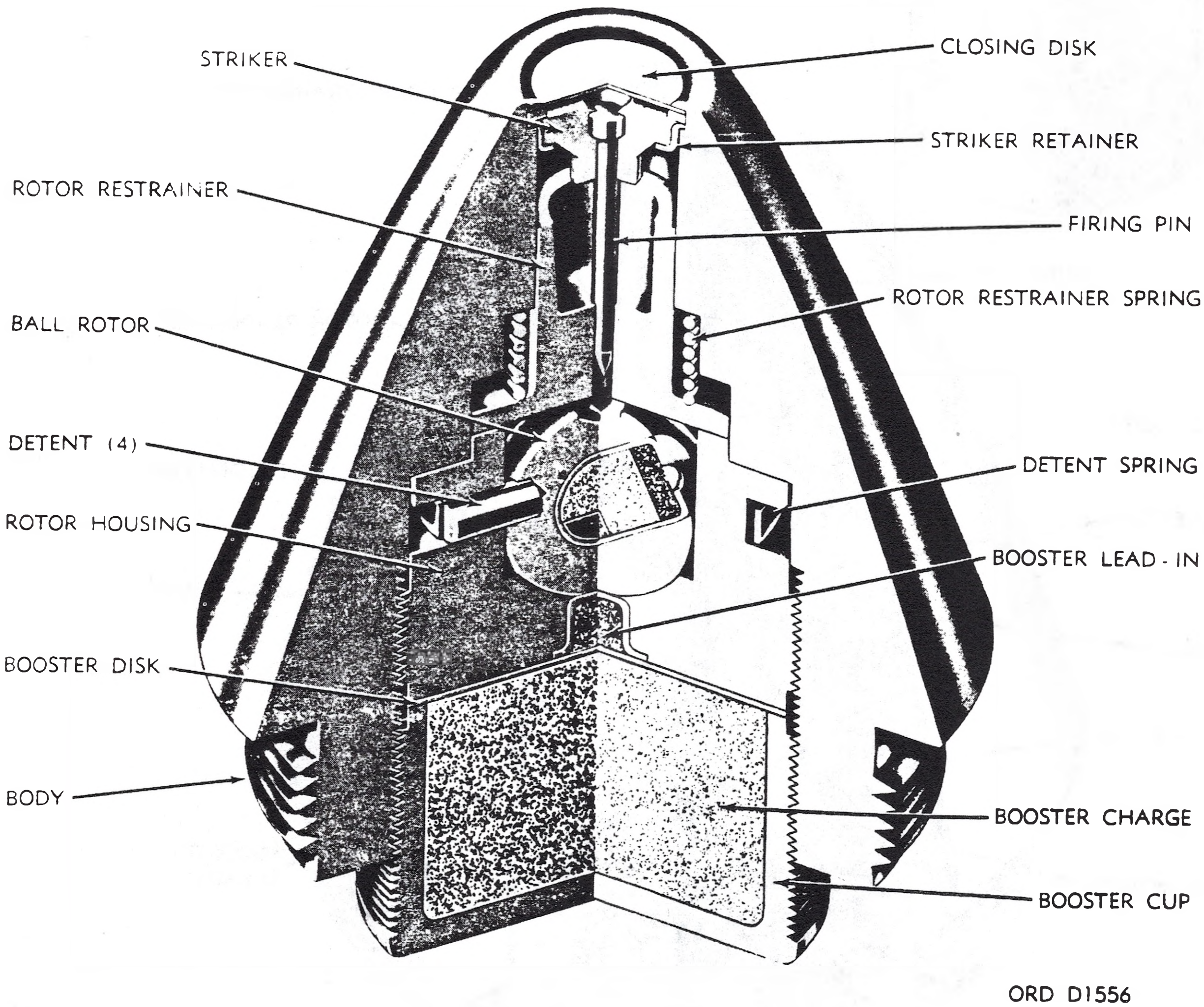

Figure 4-31 Fuze M503, Cutaway View Showing Unarmed Condition

detents move outward into the groove under the action of centrifugal force thereby releasing the ball-type rotor. Since the rotor is imbalanced in the unarmed position, centrifugal force causes it to rotate into a balanced position in which the detonator is aligned with the firing pin. The fuze is now armed. The rotor restrainer spring acting on the rotor restrainer prevents forward movement of the rotor until impact.

NOTE

The M503A1 and M503 fuzes do not utilize the setback forces to delay fuze arming. Instead, the detents are moved outward and the motor is released as soon as sufficient centrifugal force is developed.

b. Upon impact, the firing pin will be driven rearward while the rotor and rotor restrainer move forward overcoming the resistance of the rotor restrainer spring, thereby impinging the detonator and initiating the explosive train.

4-1.3.10 FUZE M89 (fig. 4-32). After firing and upon the establishment of sufficient rotational force, the rotor lock moves outward against the tension of the lock spring, releasing the rotor. Only the frictional forces, coincident with acceleration, remain to prevent the rotor from moving to the armed position at this time. Near the end of acceleration these forces decrease in magnitude, and centrifugal forces acting on the imbalanced rotor cause it to rotate to the armed position, thereby aligning the detonator with the firing pin. Upon impact, the nose of the fuze is crushed and the firing pin is driven into the detonator.

4-1.3.11 FUZES M525 SERIES, M526 SERIES, ANL M527 SERIES (fig. 4-33).

4-1.3.11.1 When the round is fired, the inertial force due to acceleration moves the setback pin in the body of the fuze rearward, overcoming resistance of the setback spring. Rearward movement of the setback pin releases the bore-riding pin and permits the bore-riding pin spring to push the bore-riding pin outward until the head of it strikes the inner wall of the mortar tube. As the fuze emerges from the mortar tube, the bore-riding pin is ejected. The slider is now detained only by the tip of the firing pin.

4-1.3.11.2 At the time the round is fired, setback action also starts the delay arming mechanism in the head of the fuze. At the end of the delay arming sequence, the firing pin is withdrawn from the slider. The functioning of the two different types of delay arming mechanisms is described as follows:

a. For fuzes M525, M526, M527 and M527A1. When the assembled round is fired acceleration produces a setback action in the head of the fuze. This setback action moves the spring-loaded setback sleeve in the delay arming mechanism rearward, thereby releasing a spring-loaded detent pin. Release of the detent pin allows the main spring of the delay arming mechanism to oscillate the pallet and drive the upper release bushing by means of the gear train. The upper release bushing, after revolving through 270°, aligns its keyways with three keys on the lower release bushing. When this occurs the withdrawal spring moves the firing pin (held in a fixed position by the spring clip washer) clear of the slider.

b. For fuzes M525A1, M526A1, M527B1, and M527A1B1. As a result of setback due to acceleration of the mortar shell, the spring-restrained setback in the head of the fuze is driven rearward. This action frees the pallet and at the same time locks the extension on the setback below the lower plate. Upon release of the pallet, the torqued firing pin spring drives the gear train which, in turn, rotates the firing pin and bushing. When the bushing aligns its tabs with slots in the lower plate, the firing pin spring withdraws the firing pin (held in a fixed position by the tubular clip) clear of the slider.

4-1.3.11.3 As the firing pin clears the slider, the slider spring forces the slider into the armed position, aligning the detonator between the firing pin and booster lead-in. The fuze is now armed. Upon impact, the striker is forced rearward, compressing the firing pin spring and driving the firing pin into the detonator located in the slider.

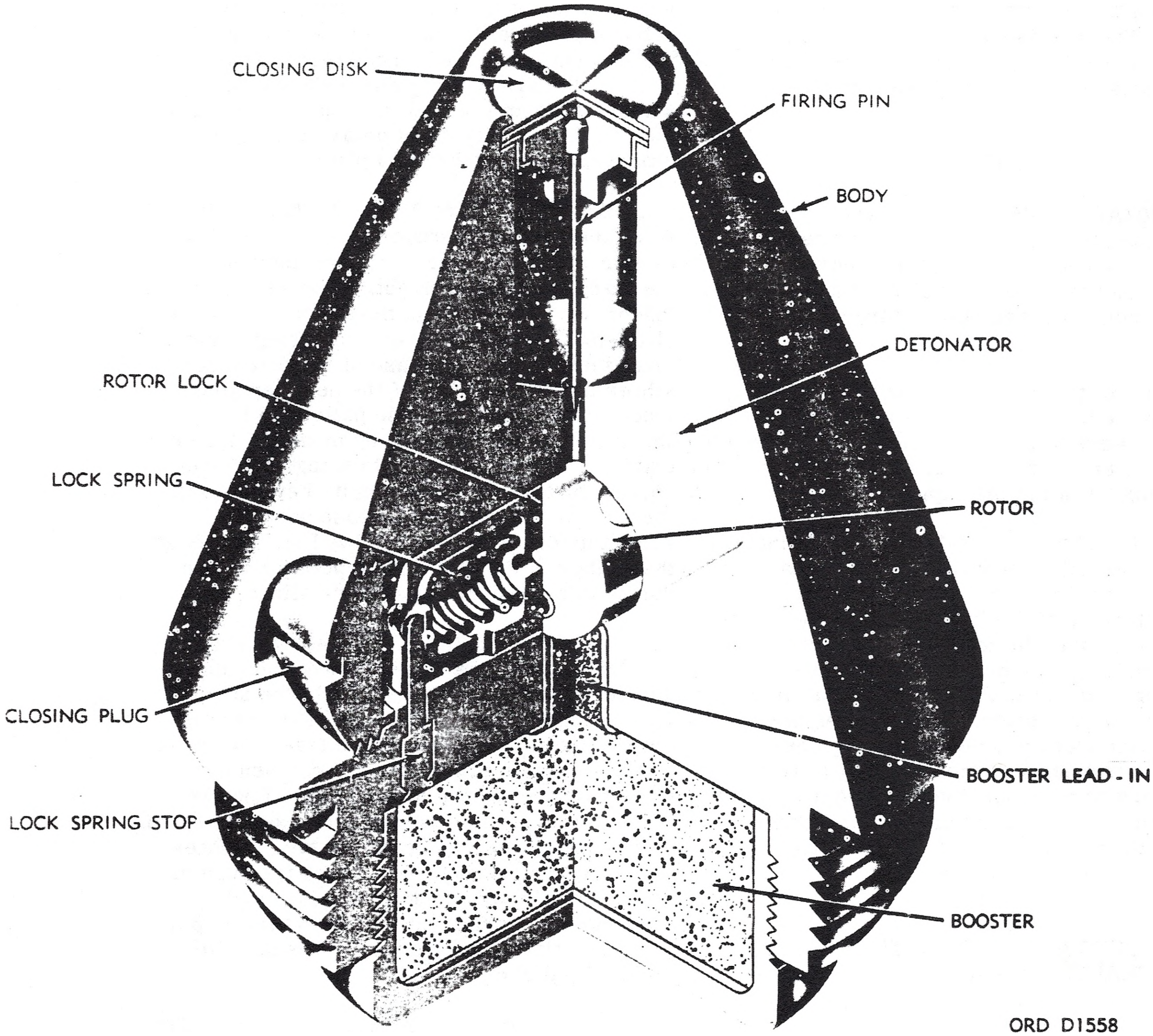

Figure 4-32 Fuze M89, Cutaway View Showing Unarmed Condition

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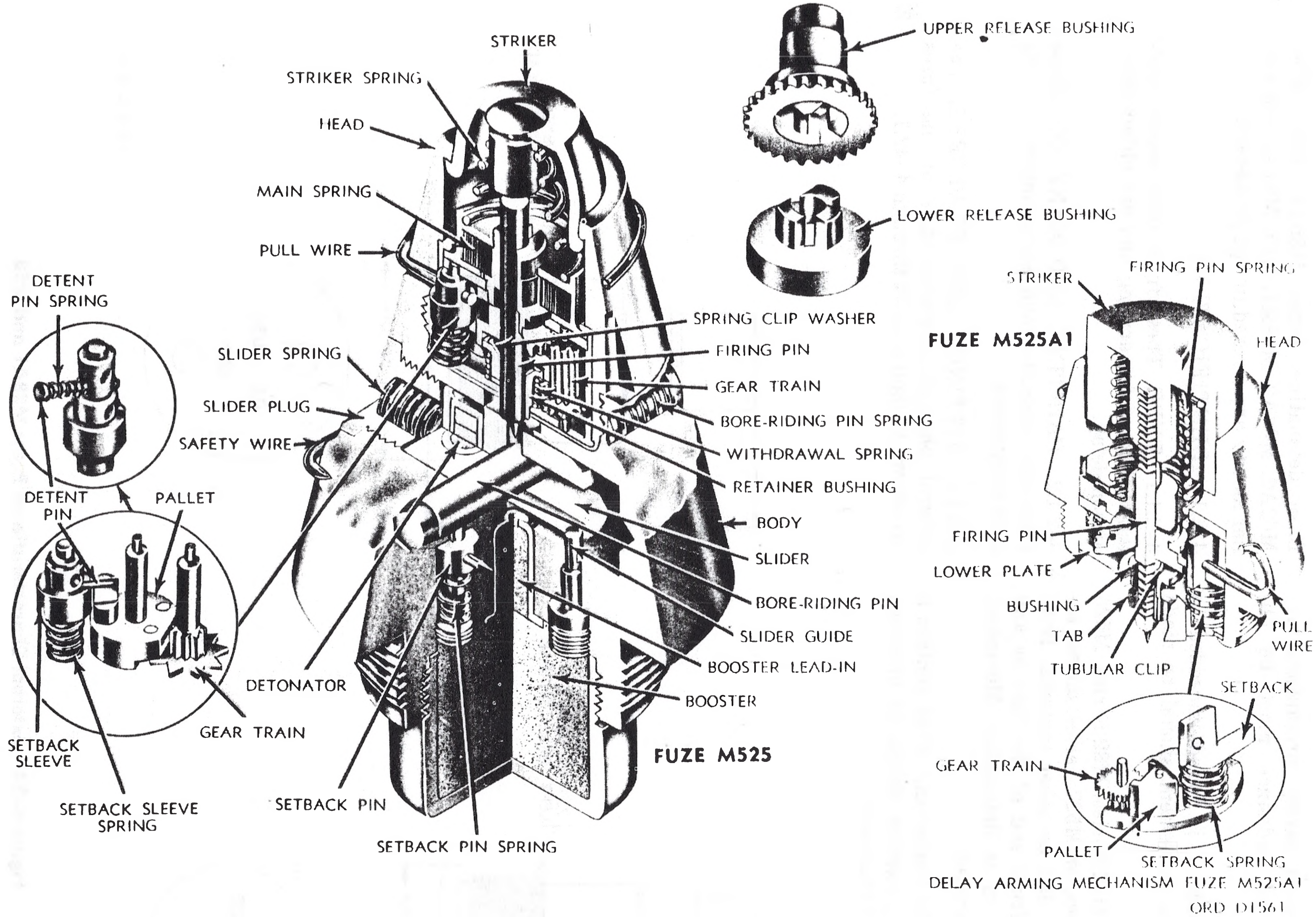

Figure 4–33 Fuze M525 Series, Cutaway View Showing Unarmed Condition

4–1.4 SAFETY PRECAUTIONS.

4–1.4.1 The general safety precautions regarding unexploded ordnance must be observed.

4–1.4.2 If a munition is found imbedded in the ground, initial movement should be made remotely.

4–1.4.3 For the M52 Series, M82 Series, M525 Series, M526 Series, or M527 Series, do not attempt to remove dirt or other material from openings of the front end of the fuze as any disturbance may cause detonation. Movement should be made remotely.

4–1.4.4 The M503 Series and M524 contain a graze feature and caution should be observed when movement is necessary.

4–2 BASE DETONATING FUZES.

Base detonating fuzes M38A1, M58, M60, M62A2, M66A2, M68A1, M72, M91A1 and earlier models are covered in this paragraph.

4–2.1 IDENTIFICATION.

4–2.1.1 TYPE. These fuzes may require centrifugal force for arming and are either delay or non-delay.

4–2.1.2 PAINTING AND MARKING. These fuzes are unpainted and are stamped with the fuze designation.

4–2.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 4–34 through 4–42.1.

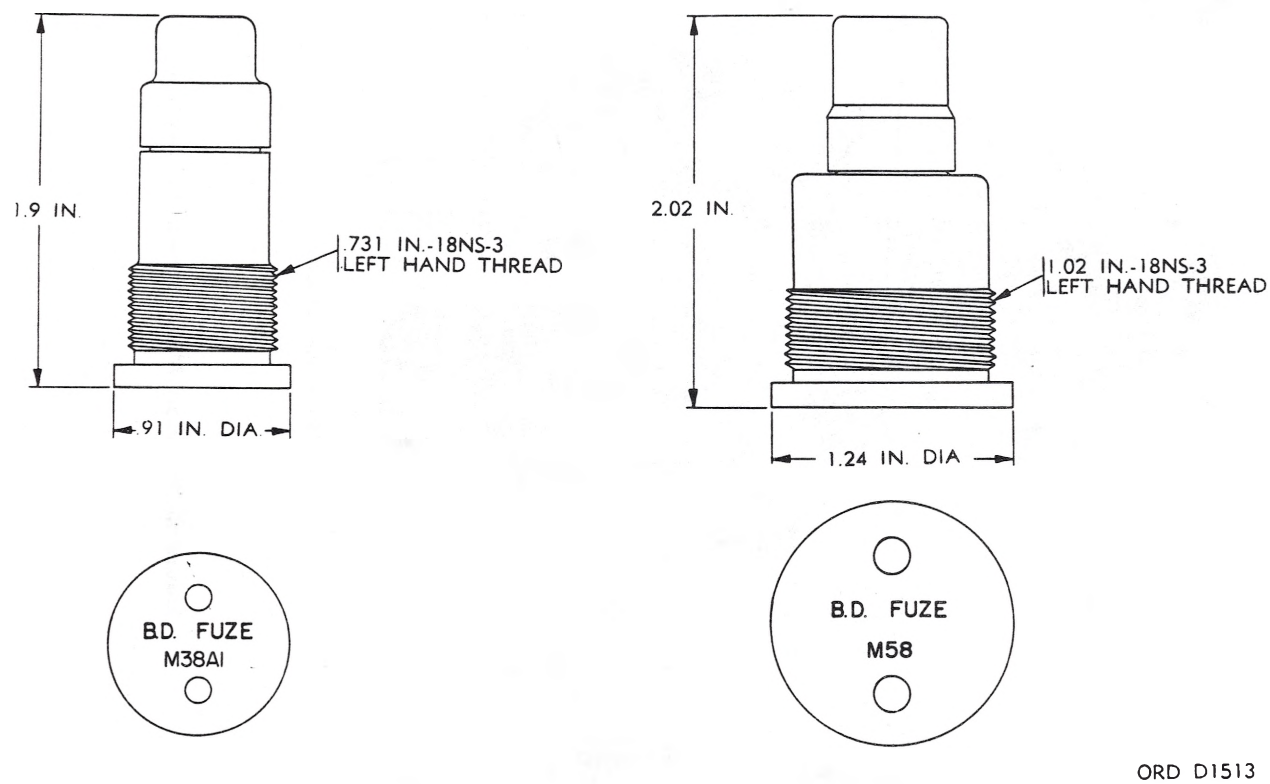

Figure 4–34 External Characteristics of Fuzes M38A1 and M58

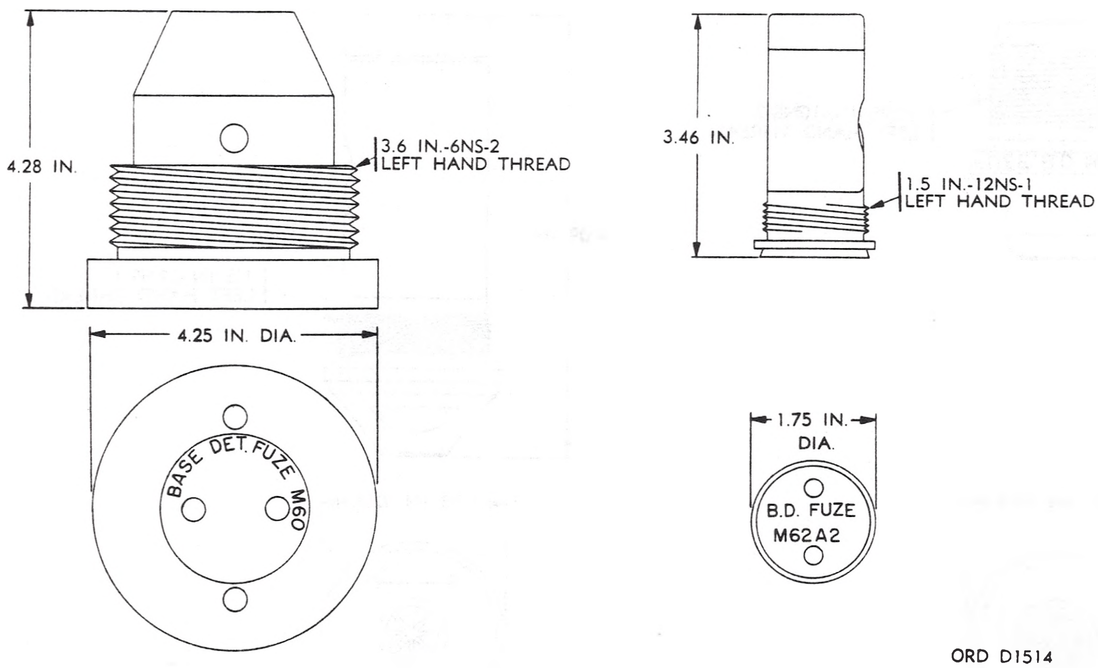

Figure 4-35 External Characteristics of Fuzes M60 and M62A2

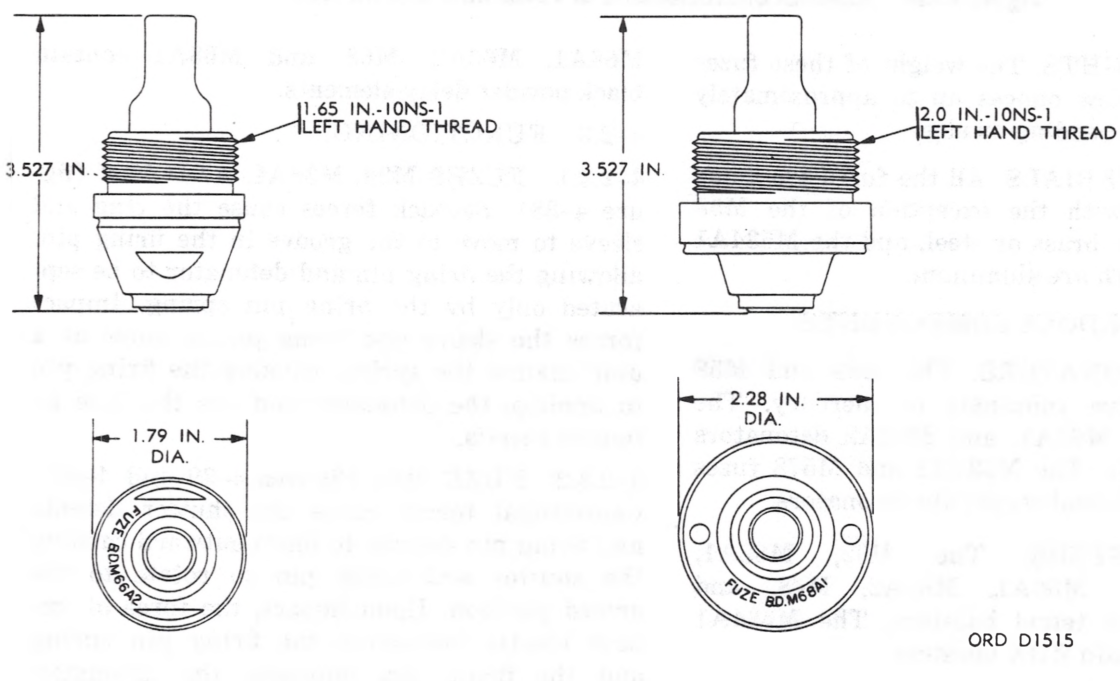

Figure 4-36 External Characteristics of Fuzes M66A2 and M68A1

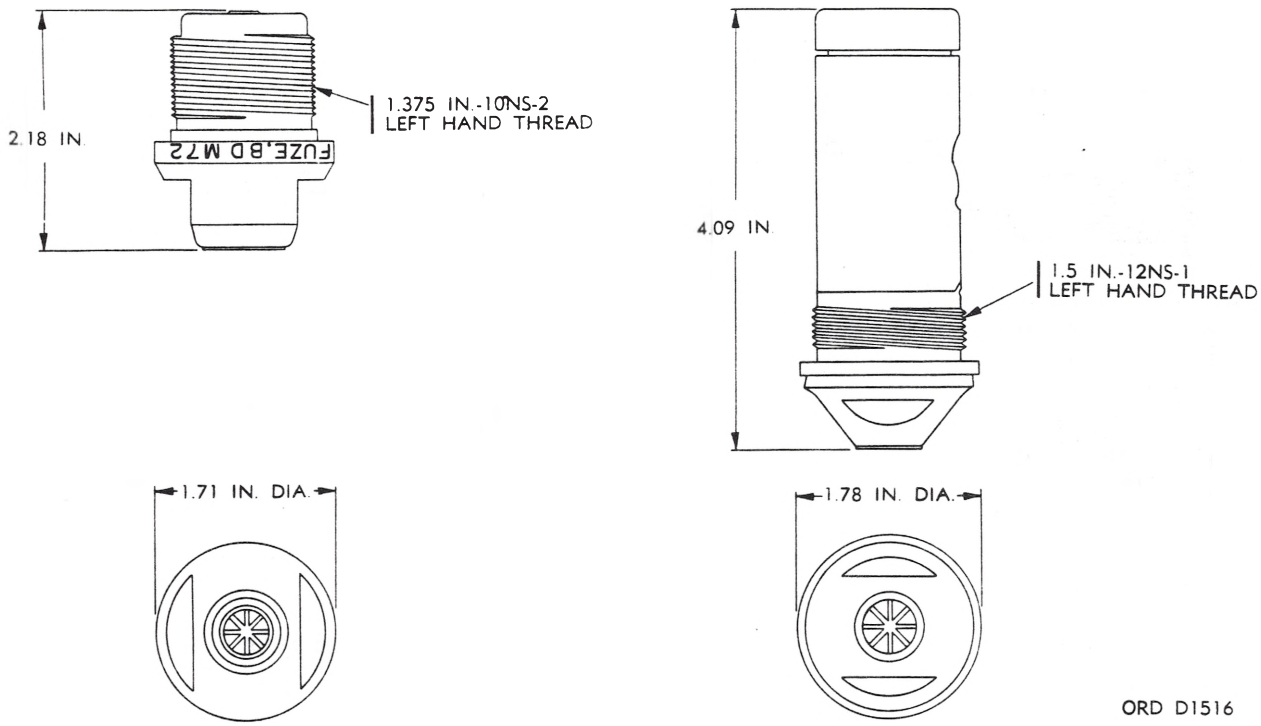

Figure 4–37 External Characteristics of Fuzes M72 and M91A1

4–2.1.4 WEIGHTS. The weight of these fuzes vary from a few ounces up to approximately two pounds, depending on size.

4–2.1.5 MATERIALS. All the fuzes are made out of steel with the exception of the M58 which is either brass or steel, and the M534A1 and M578 which are aluminum.

4–2.2 HAZARDOUS COMPONENTS.

4–2.2.1 DETONATORS. The M38 and M58 detonators have fulminate of mercury. The M38A1, M62, M62A1, and M62A2 detonators have lead azide. The M534A1 and M578 fuzes have lead azide-lead styphnate detonators.

4–2.2.2 BOOSTERS. The M62, M62A1, M62A2, M66, M66A1, M66A2, M68, and M68A1 contain tetryl boosters. The M534A1 and M578 contain RDX boosters.

4–2.2.3 DELAY ELEMENT. The M66, M66A1, M66A2, M68, and M68A1 contain black powder delay elements.

4–2.3 FUNCTIONING.

4–2.3.1 FUZES M38, M38A1, AND M58 (figure 4–38). Setback forces cause the ring and sleeve to move to the groove in the firing pin, allowing the firing pin and detonator to be separated only by the firing pin spring. Impact forces the sleeve and firing pin to move as a unit against the spring, causing the firing pin to impinge the detonator and fire the fuze by impact inertia.

4–2.3.2 FUZE M60 (figures 4–39 and 4–40). Centrifugal forces cause the shutter detents and firing pin detents to move outward causing the shutter and firing pin to rotate to the armed position. Upon impact, the force of impact inertia overcomes the firing pin spring and the firing pin impinges the detonator, thereby initiating the explosive train.

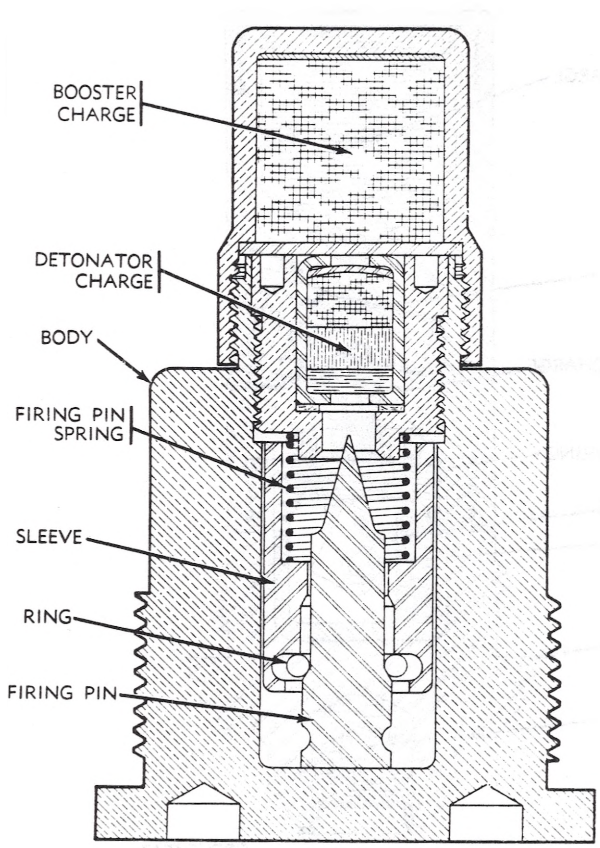

Figure 4–38 Fuze M58, Cutaway View Showing Unarmed Condition

4–2.3.3 FUZES M66, M66A1, M66A2, M68, M68A1, AND M72 (figure 4–41). The propellant ignites the tracer. Impact causes the firing pin to shear the washer, initiating the fuze.

4–2.3.4 FUZES M62, M62A1, M62A2, M91, AND M91A1 (figure 4–42). The M91 and M91A1 have tracers which are ignited by the propellant. Centrifugal force causes the slider and safety pins to move outward. The firing pin rotates to the armed position and the fuze functions by impact inertia.

4–2.3.5 FUZES M534A1 and M578 (figure 4–42.1). Centrifugal force causes the locking segment and the delay shutter to move into the armed position. Upon either direct or graze impact, inertia forces cause the impact ball to

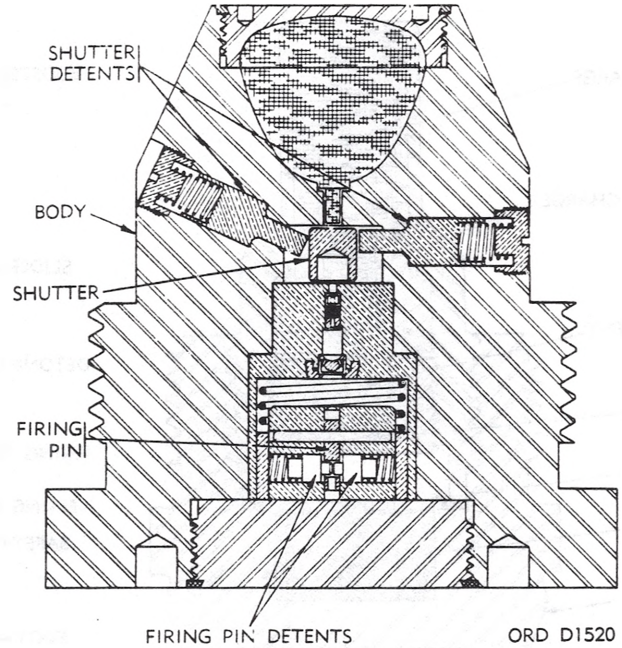

Figure 4–39 Fuze M60, Cutaway View Showing Unarmed Condition

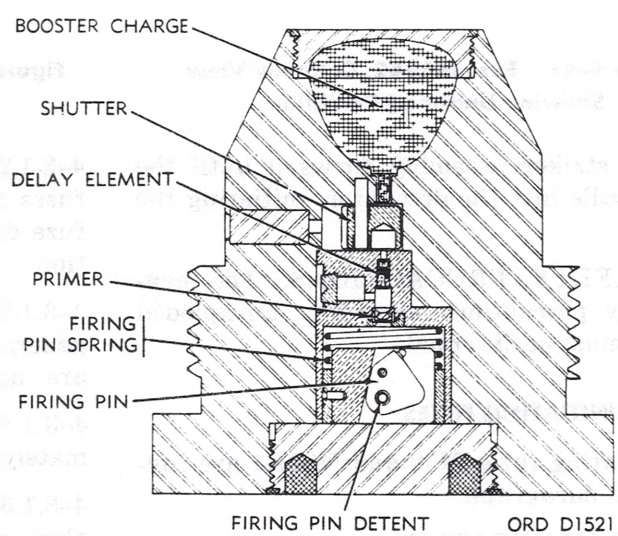

Figure 4–40 Fuze M60, Cutaway View, Rotated 90 Degrees, Showing Unarmed Condition

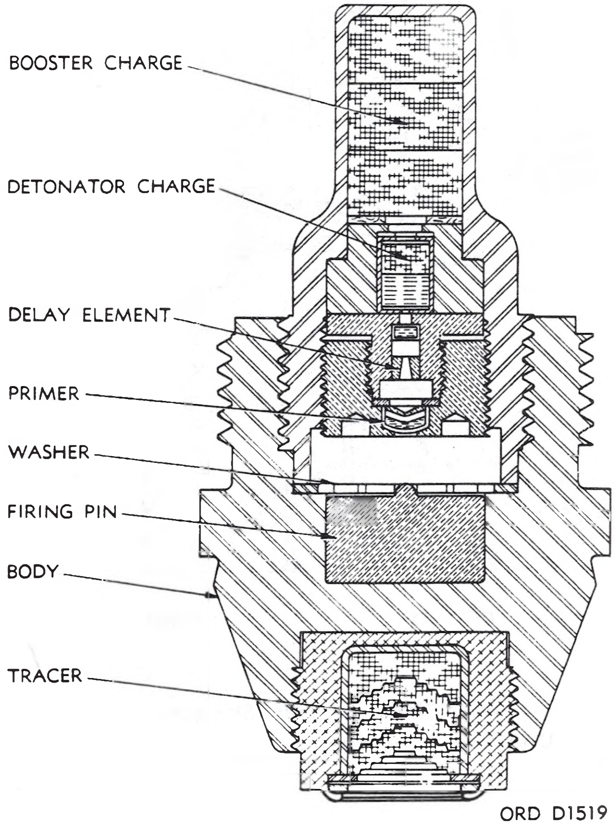

Figure 4–41 Fuze M66A2, Cutaway View Showing Unarmed Condition

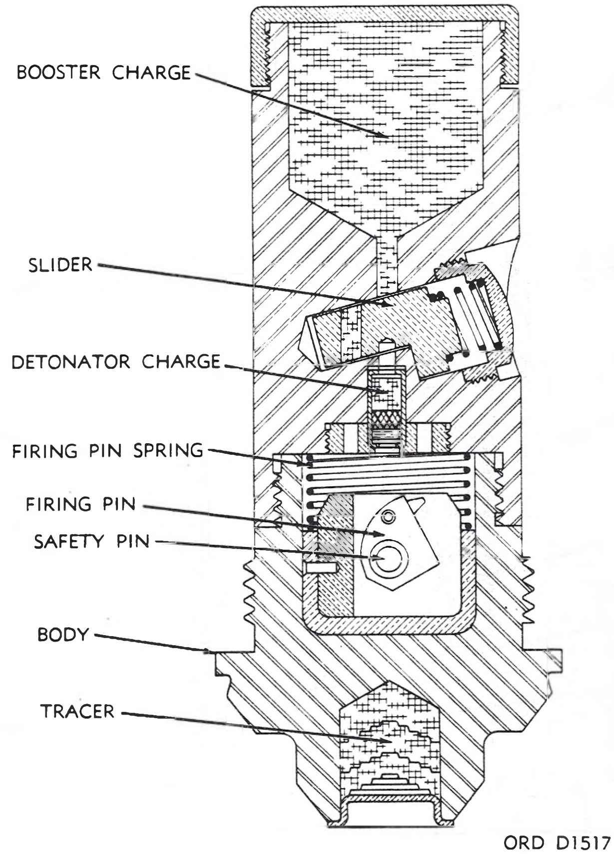

Figure 4–42 Fuze M91, Cutaway View Showing Unarmed Condition

move the striker assembly forward until the striker needle hits the detonator, initiating the fuze.

4–2.4 SAFETY PRECAUTIONS. The general safety precautions regarding unexploded ordnance must be observed.

4–3 POINT INITIATING FUZES.

Point initiating fuzes M90 and M90A1 are covered in this paragraph.

4–3.1 IDENTIFICATION.

4–3.1.1 TYPE. These fuzes require centrifugal force for arming and are instantaneous firing.

4–3.1.2 PAINTING AND MARKING. The fuzes are unpainted and are stamped with the fuze designation and various loading information.

4–3.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figure 4–43.

4–3.1.4 WEIGHTS. The fuzes weigh approximately four ounces.

4–3.1.5 MATERIALS. The fuzes are made of aluminum alloy.

4–3.2 HAZARDOUS COMPONENTS.

4–3.2.1 PRIMERS. Both fuzes contain primers composed of primer mixture.

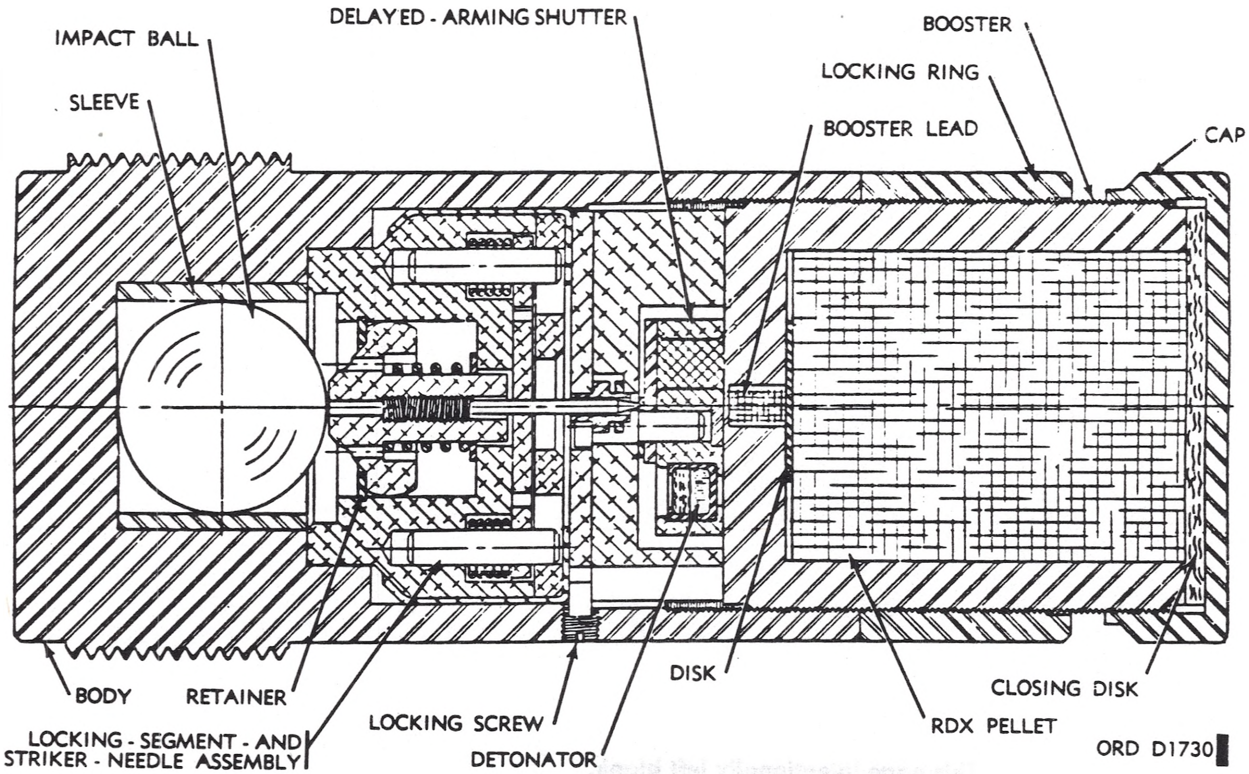

Figure 4–42.1 Fuze, base detonating: M578

4–3.2.2 DETONATORS. The M90 contains lead azide and tetryl. The M90A1 contains lead azide and RDX.

4–3.2.3 BOOSTERS. The M90 contains 50–50 pentolite. The M90A1 contains RDX. Both are shaped charges.

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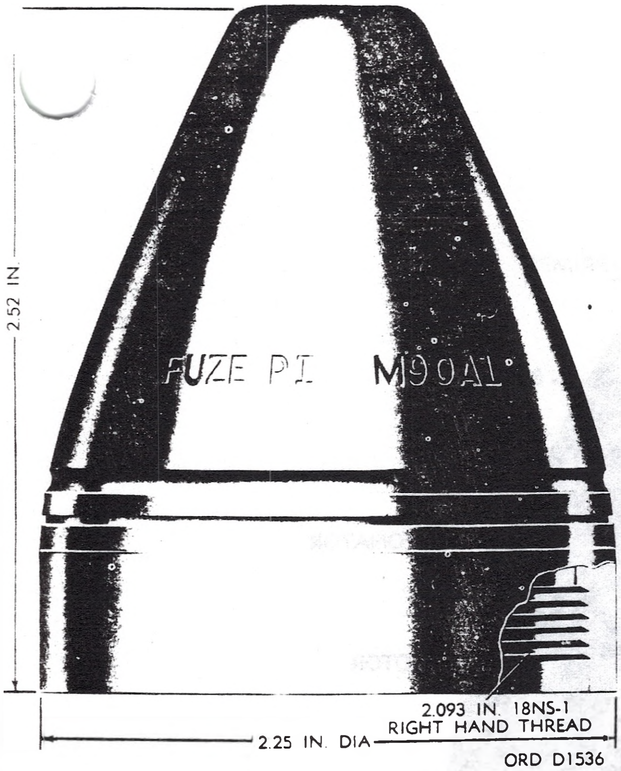


Figure 4-43 External Characteristics of Fuze M90A1.

4-3.3 FUNCTIONING.

4-3.3.1 The M90A1 fuze is basically similar in construction and operation to the M90 fuze. The major difference between the two fuzes is the explosives used in the detonator and booster.

4-3.3.2 When the projectile is fired, the fuze parts remain in the unarmed position until sufficient centrifugal force is developed to cause the rotor lock (fig. 4-44) to move outward. As the rotor lock moves outward against the lock spring, it disengages itself from the rotor. The rotor is now free to rotate. After the forces due to setback are over, the imbalanced rotor rotates until the detonator is aligned with the primer flash hole. The fuze is now armed. Upon impact, the ogive is crushed and the primer is initiated. The flash from the primer initiates the detonator.

4-3.4 SAFETY PRECAUTIONS. The general safety precautions regarding unexploded ordnance must be observed.

4-4 POINT INITIATING BASE DETONATING FUZES.

Point initiating base detonating fuzes M509A1, and M530 Series are covered in this paragraph. M530 Series and XM539E4 are covered in this paragraph.

4-4.1 IDENTIFICATION.

4-4.1.1 TYPE. These fuzes are setback armed and instantaneous firing.

4-4.1.2 PAINTING AND MARKING. The fuzes are wholly contained within the projectiles they are associated with and cannot be distinguished by painting or marking.

4-4.1.3 FITTINGS AND FEATURES.

4-4.1.3.1 GENERAL. Since the fuzes are housed in the projectile, identification can only be made by using the features of the cartridge and projectiles. The external and internal configurations are shown in figures 4-45 through 4-48.

4-4.1.3.2 CARTRIDGE AND PROJECTILES. The XM409E5 (152-mm) projectile contains the XM539E4 fuze. The M431 (90-mm) and M456 (105-mm) projectiles contain the M509A1 fuze only. The other projectiles can contain either M509A1 or M530 Series fuzes.

4-4.1.3.3 FUZES. The point initiating element mounted on an insulated shield in the nose or spike of the projectile contains a piezoelectric or "LUCKY" crystal. It is connected to the base detonating fuze by a conduit shield wire. The base detonating fuze contains arming devices and detonating elements.

4-4.1.4 WEIGHTS. The M371 projectile weighs approximately 7 pounds. The XM409E5 projectile weighs 42.8 pounds. The others weigh from 18 to 31 pounds.

4-4.1.5 MATERIALS. The M344, M431, M456, M469, and XM409E5 bodies are made of steel. The M371 body is aluminum.

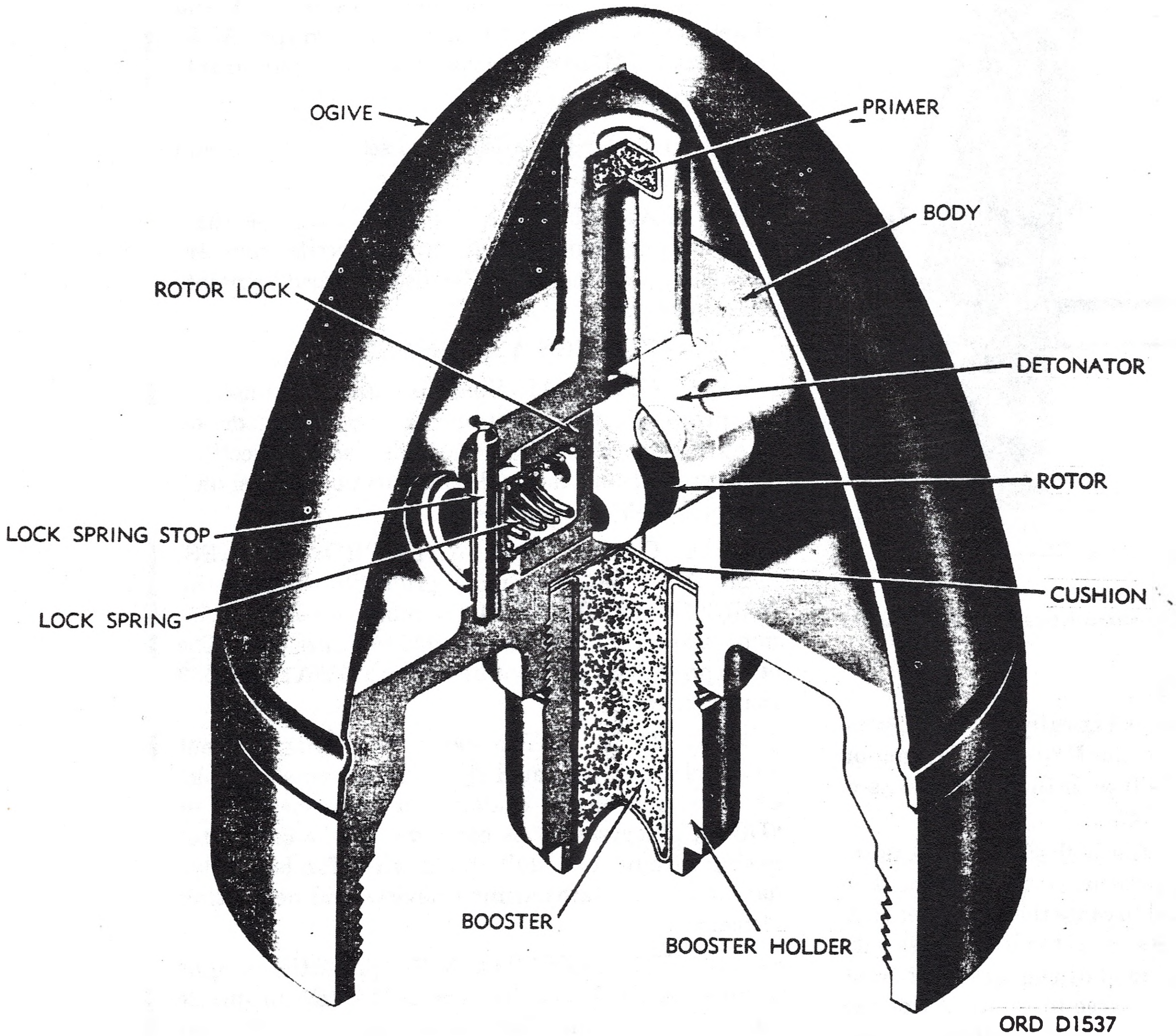


Figure 4-44 Fuze M90 or M90A1, Cutaway View Showing Unarmed Condition

GPO 804-578-4

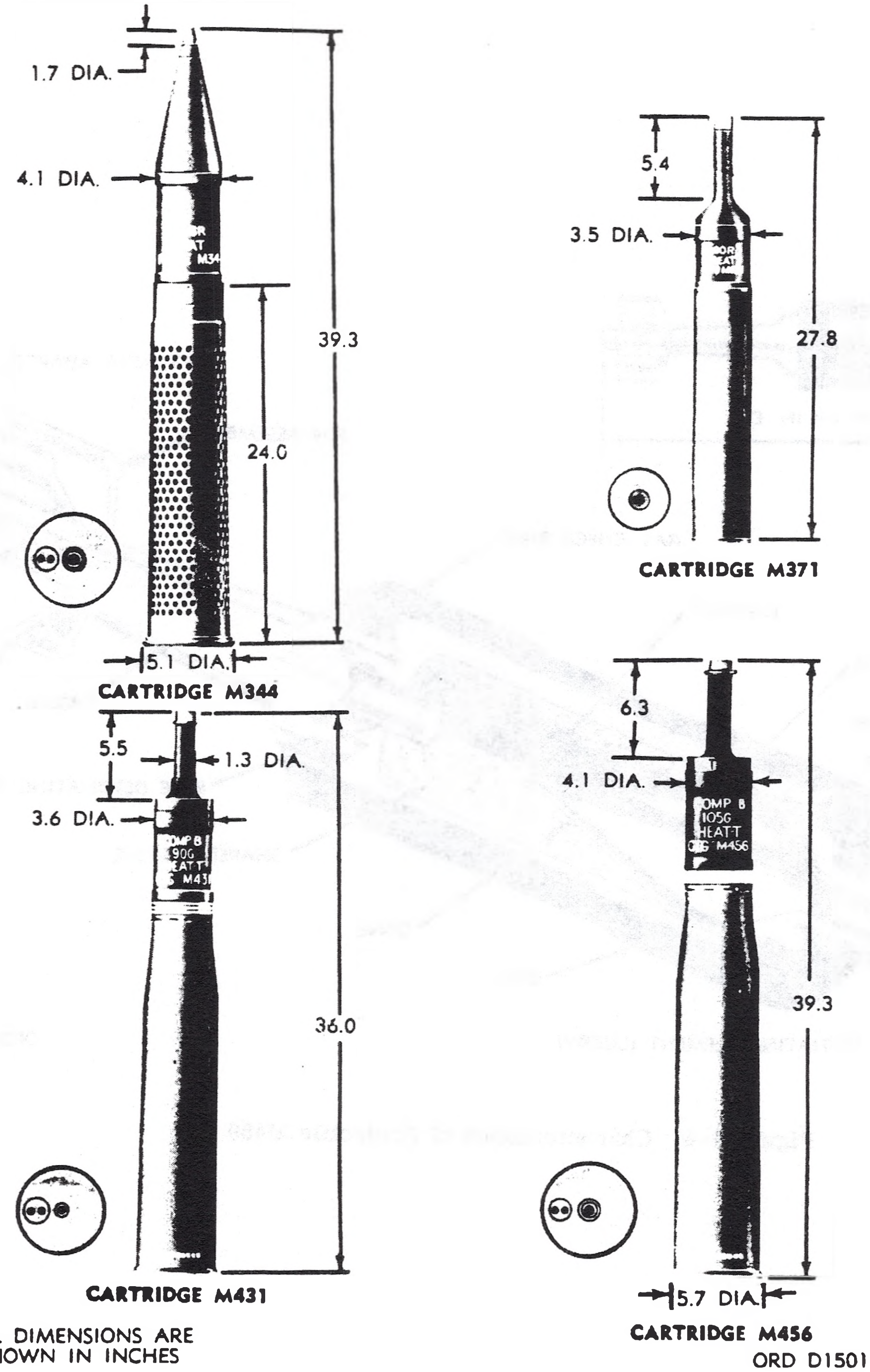


Figure 4-45 External Characteristics of Cartridges M344, M371, M431 and M456

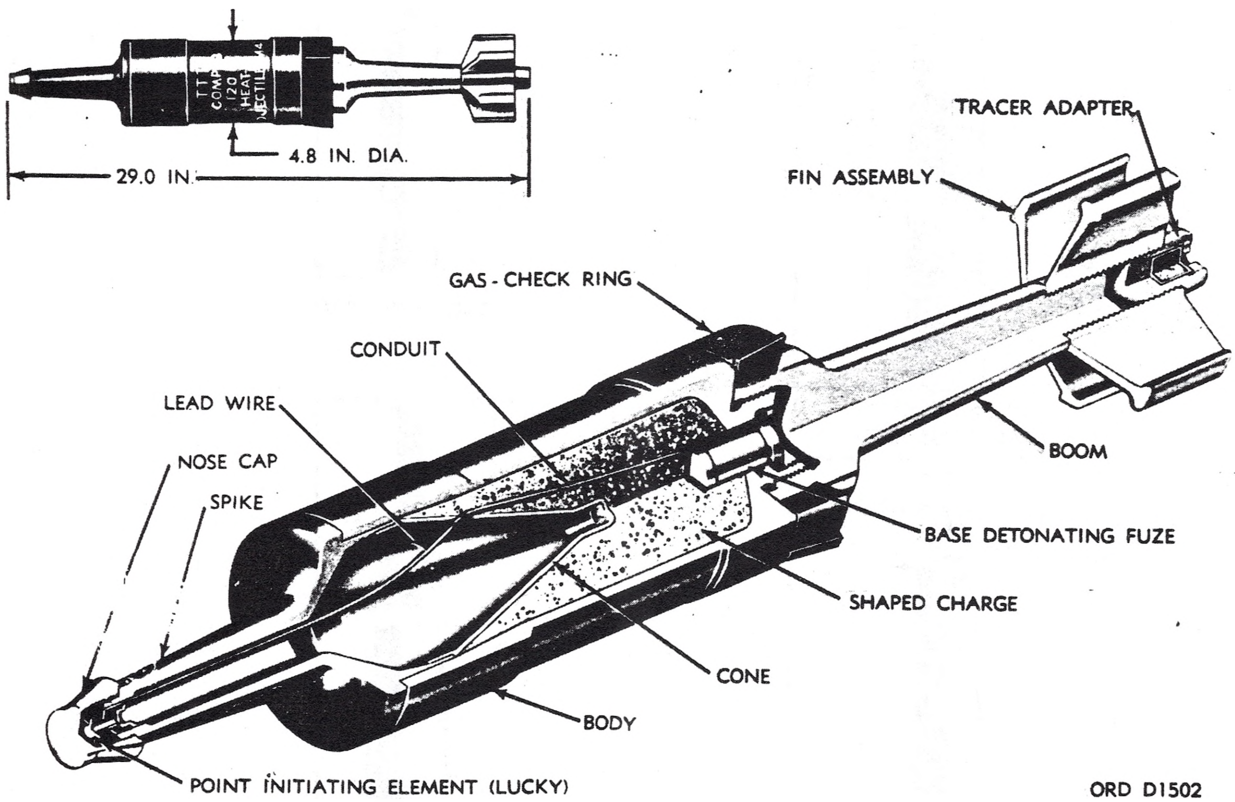
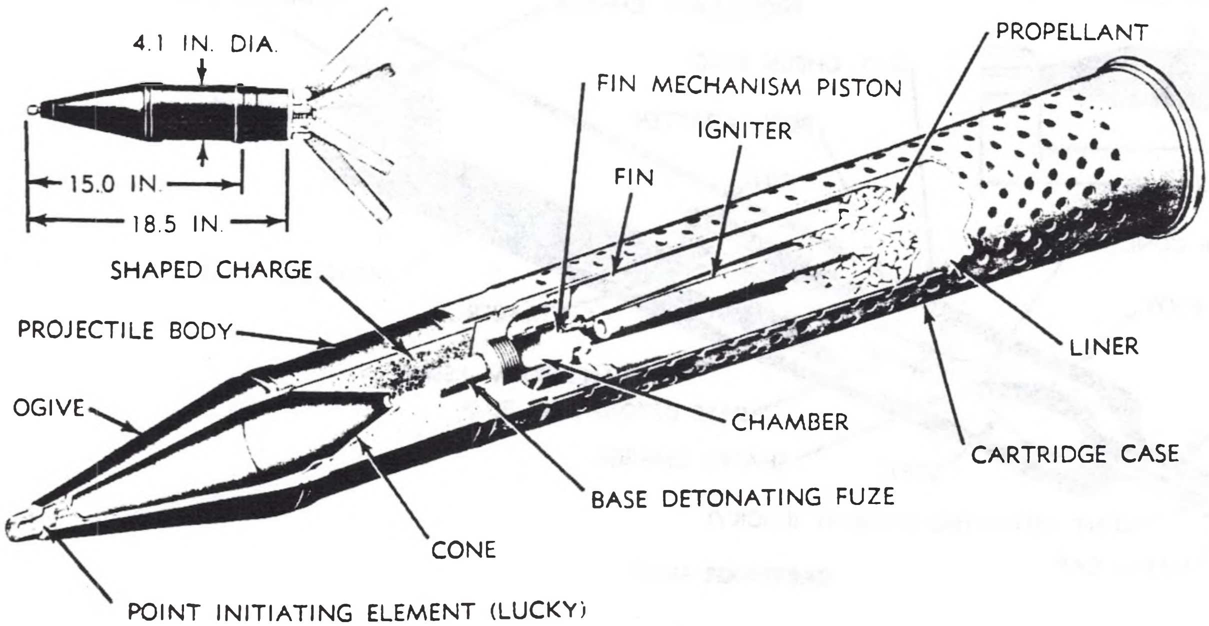
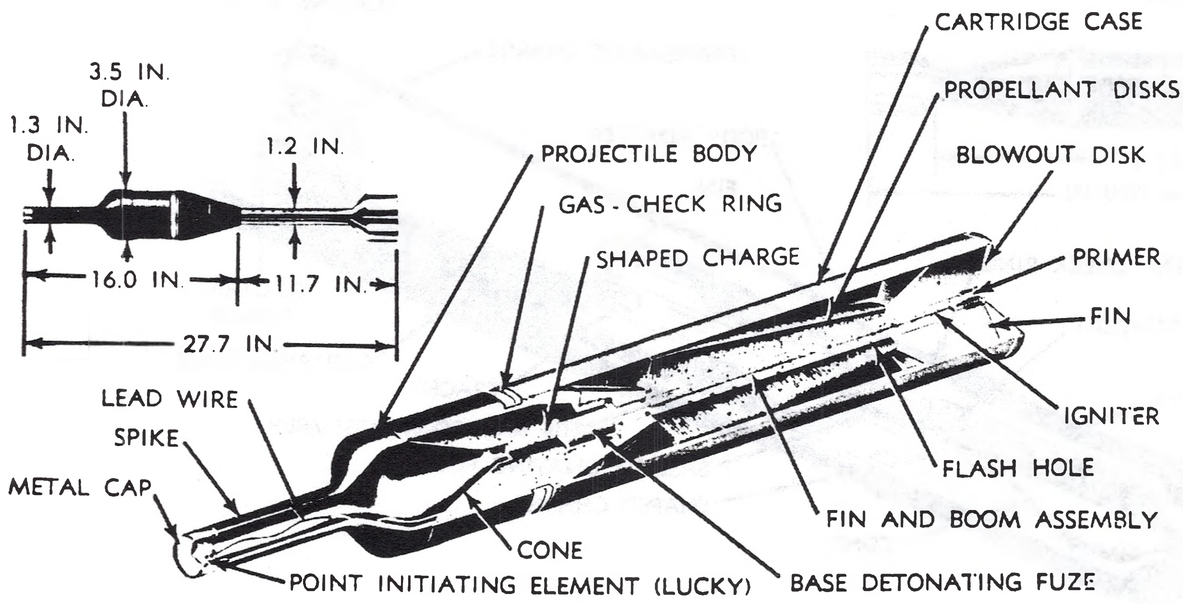


Figure 4-46 Characteristics of Projectile M469



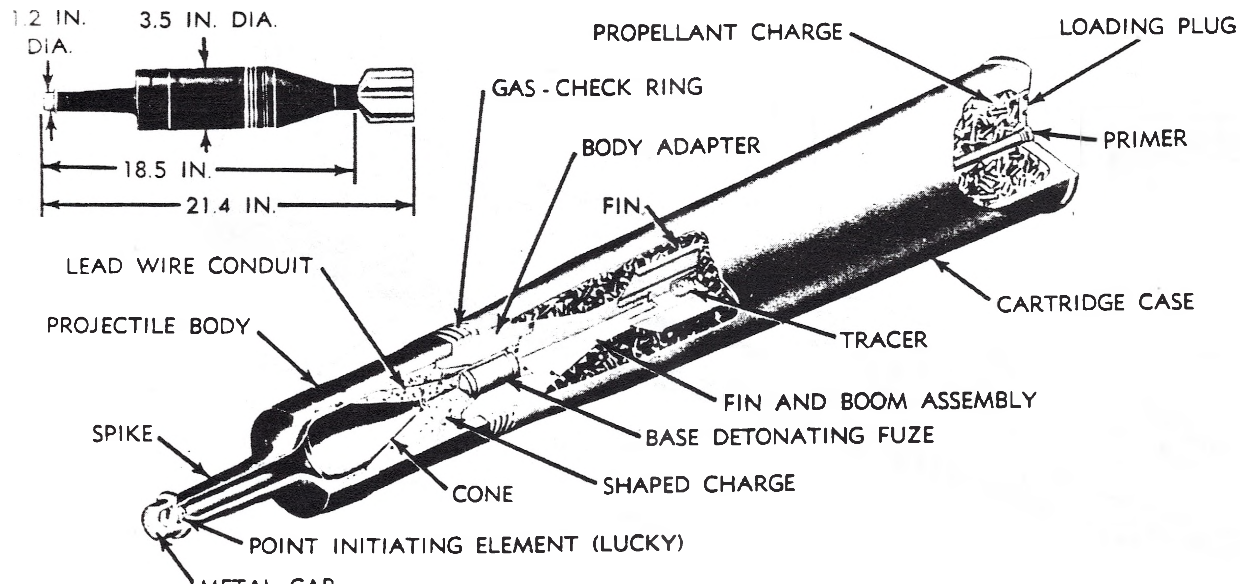
CARTRIDGE M344



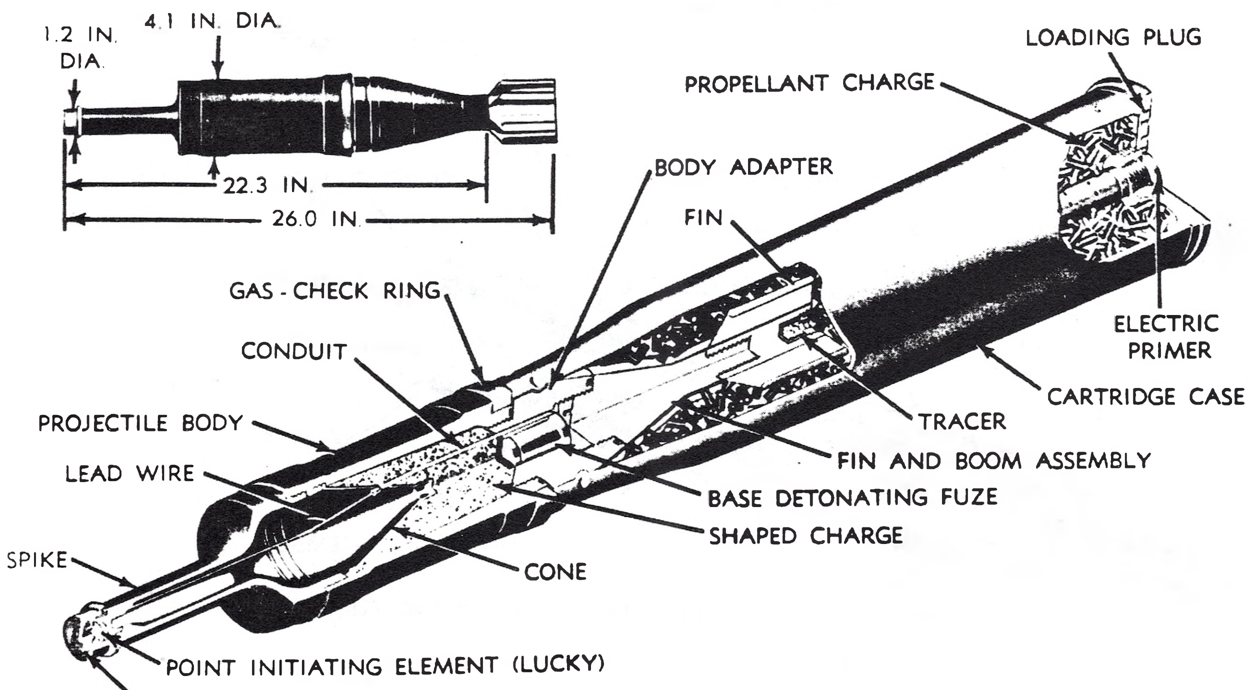
CARTRIDGE M371

ORD D1503

Figure 4-47 Characteristics of Cartridges M344 and M371



CARTRIDGE M431



CARTRIDGE M456

ORD D1504

Figure 4-48 Characteristics of Cartridges M431 and M456

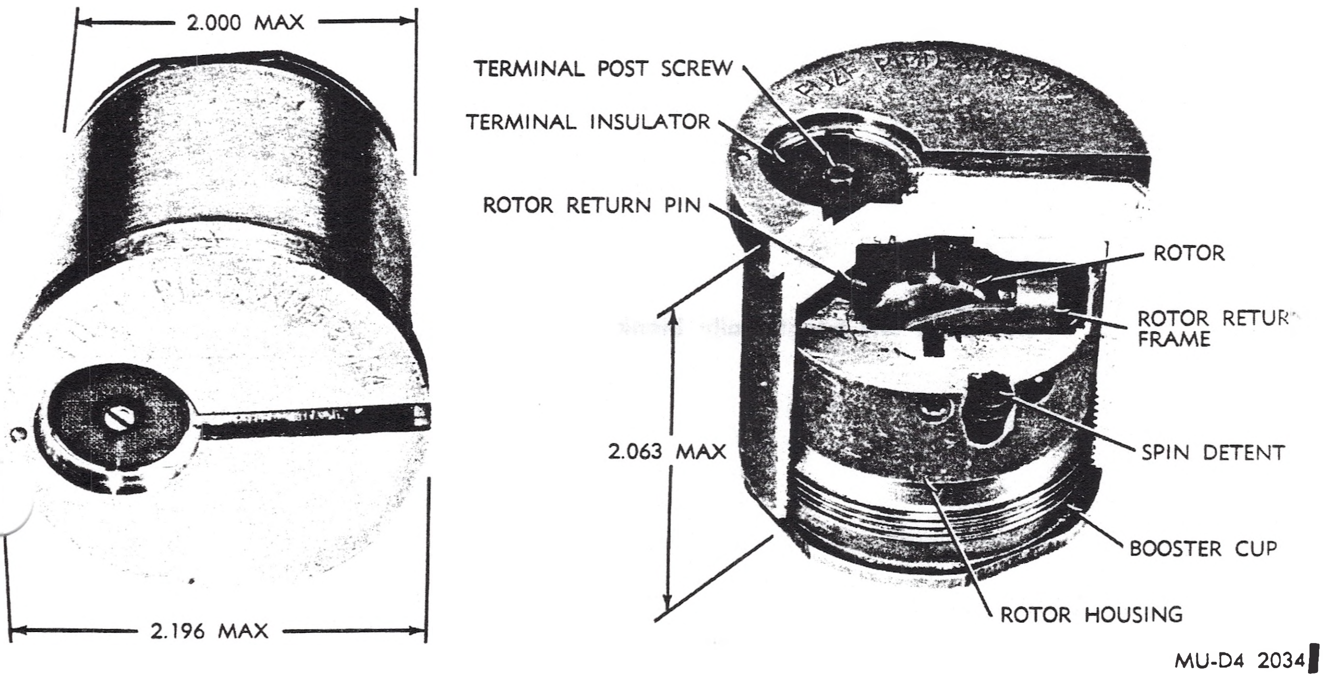


Figure 4–48.1 Characteristics of Fuze XM539E4.

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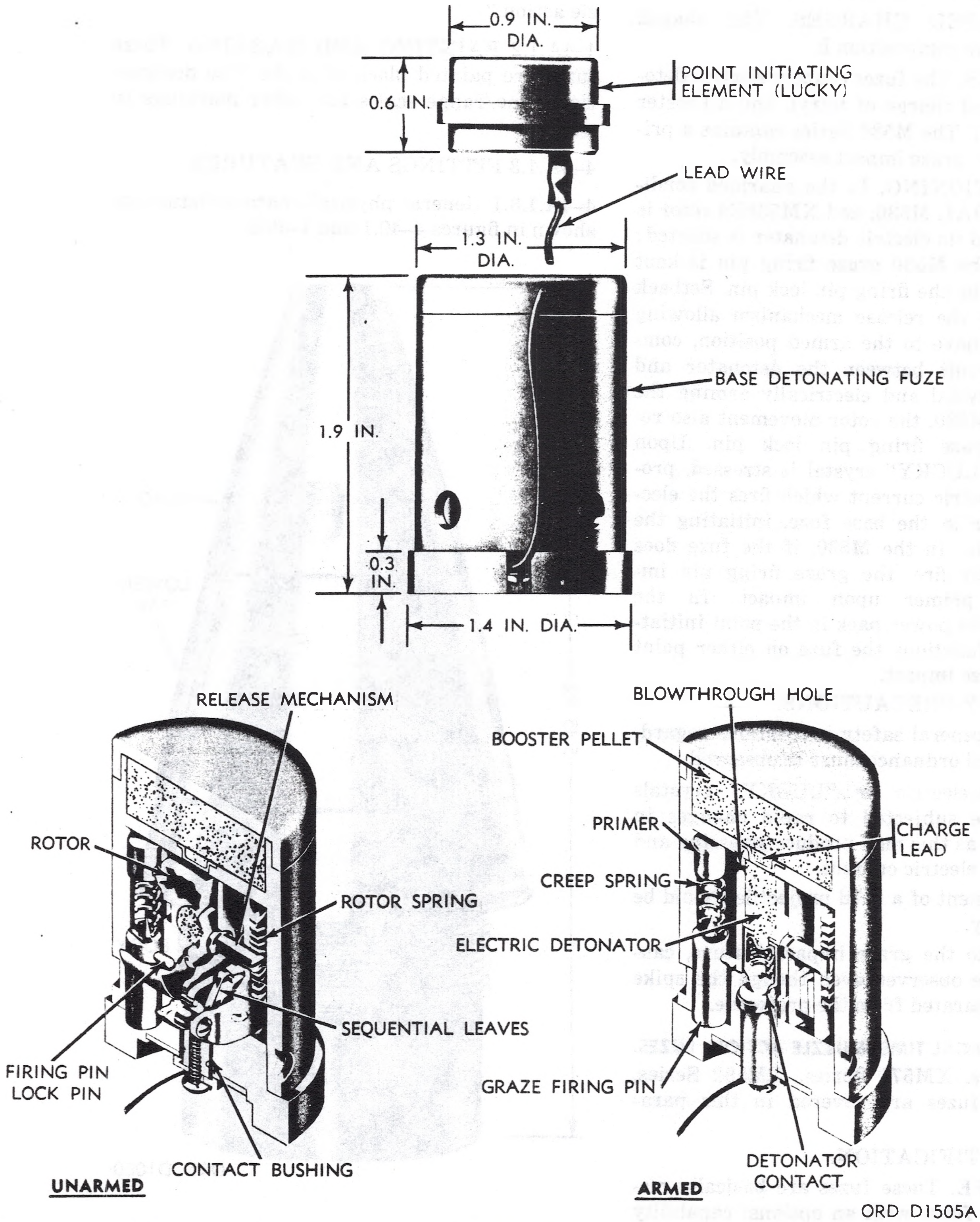

Figure 4-49. Characteristics of Fuze M530

4–4.2 HAZARDOUS COMPONENTS.

4–4.2.1 SHAPED CHARGES. The shaped charges contain composition B.

4–4.2.2 FUZES. The fuzes contain electric detonator T74, lead charge of tetryl, and a booster pellet of tetryl. The M530 Series contains a primer T92 in the graze impact assembly.

4–4.3 FUNCTIONING. In the unarmed condition, the M509A1, M530, and XM539E4 rotor is out-of-line and its electric detonator is shorted; in addition, the M530 graze firing pin is kept from moving by the firing pin lock pin. Setback forces unlock the release mechanism allowing the rotor to move to the armed position, completing a circuit between the detonator and "LUCKY" crystal and electrically arming the fuze. In the M530, the rotor movement also releases the graze firing pin lock pin. Upon impact, the "LUCKY" crystal is stressed, producing an electric current which fires the electric detonator in the base fuze, initiating the explosive train. In the M530, if the fuze does not electrically fire, the graze firing pin impinges the primer upon impact. In the XM–539E4, the power pack in the point initiating element functions the fuze on either point impact or graze impact.

4–4.4 SAFETY PRECAUTIONS.

4–4.4.1. The general safety precautions regarding unexploded ordnance must be observed.

4–4.4.2. Piezoelectric or "LUCKY" crystals should not be subjected to rapid changes in temperatures as this may produce stressing and consequently, electric current.

4–4.4.3 Movement of a fired projectile should be made remotely.

4–4.4.4 Due to the graze impact feature, caution should be observed even though the spike or ogive is separated from the projectile.

4–4A MECHANICAL TIME (MUZZLE ACTION) FUZES. XM536 Series, XM571 Series, XM592 Series, and XM711 fuzes are covered in this paragraph.

4–4A.1 IDENTIFICATION.

4–4A.1.1 TYPE. These fuzes are basically mechanical time fuzes with an optional capability of functioning immediately after leaving the gun tube. The latter functioning is called "muzzle action."

4–4A.1.2 PAINTING AND MARKING. These fuzes are painted black with the fuze designation, time/range scales and other markings in white.

4–4A.1.3 FITTINGS AND FEATURES.

4–4A.1.3.1 General physical characteristics are shown in figures 4–49.1 and 4–49.2.

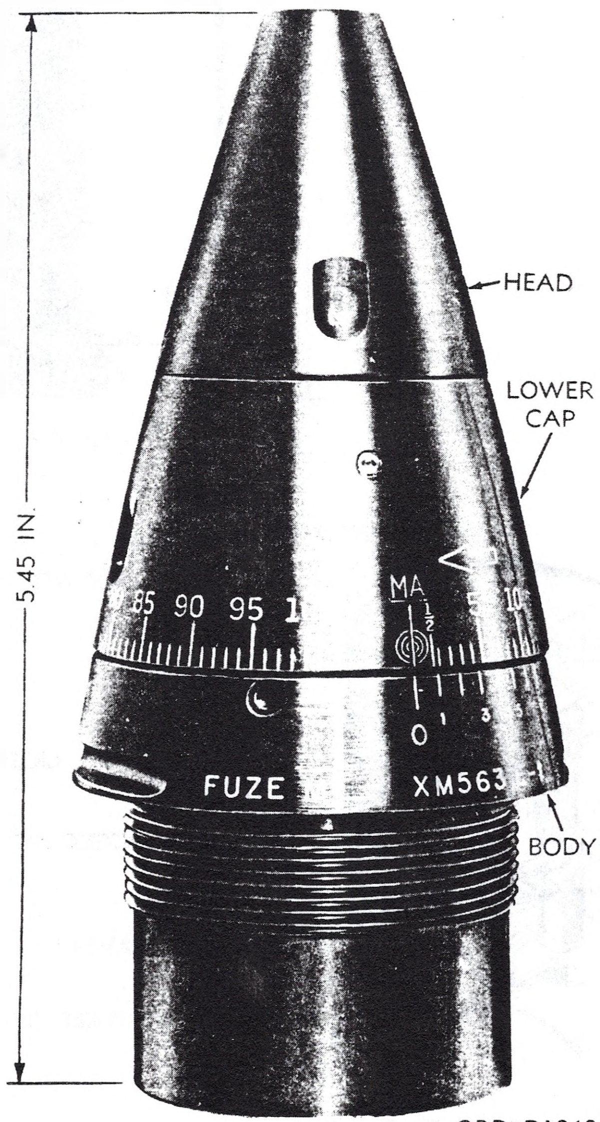

Figure 4–49.1 Mechanical Time Fuze XM563E1

4-4A.1.3.2 Fuzes consist of a head, a movement assembly, a lower cap assembly, a body, and a detonator-holder plug assembly. The movement assembly consists of time mechanism and a muzzle action feature which use a common firing pin. The range/time scale and the muzzle action setting are inscribed on the lower cap assembly.

4-4A.1.3.3 XM563 series fuzes have a time functioning capability of 0.5 to 100 seconds. XM592 series fuzes have a range capability of 200 to 3,300 meters. XM571 Series and XM711 fuzes can be set to function 200 to 4,000 meters from the weapon. All four series of fuzes are issued set to function immediately after leaving the gun tube.

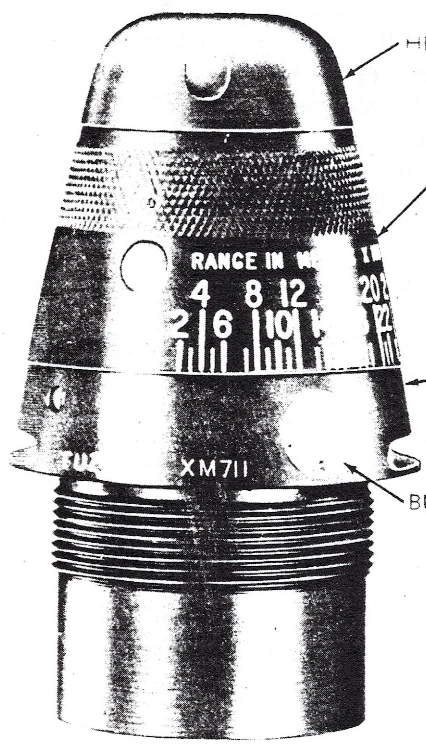

Figure 4–49.2 Mechanical Time Fuze XM711

4–4A.1.4 WEIGHTS, XM563, XM571 Series and XM592 Series fuzes weigh 1.41 pounds each. XM711 fuzes weigh 1.32 pounds each.

4–4A.1.5 MATERIALS. Fuze bodies are made of aluminum.

4–4A.2 HAZARDOUS COMPONENTS. XM571 Series and XM711 fuzes are assembled with an XM87 detonator, an M47 detonator, and an M7 relay. The XM563 and XM592 Series fuzes contain an M47 detonator an M49 detonator and an M7 relay.

4–4A.2.1 XM87 and M49 detonators are composed of 1.47 grains of lead azide and 2.79 grains of black powder.

4–4A.2.2 The M47 detonator is composed of 1.70 grains of lead azide, 0.525 grain of RDX and 0.23 grain of primer mix.

4–4A.2.3 The M7 relay consists of 1.54 grains of lead azide.

4–4A.3 FUNCTIONING. The fuze starts to arm immediately on firing, and functions as follows: if set for muzzle action, fuze will function as soon as projectile leaves the weapon; if set for time/range, fuze will function in accordance with the time/range setting.

4–4A.3.1 MUZZLE ACTION. Angular acceleration in combination with setback force causes the alpha weights (or setback pins) to release the centrifugal weights in the movement assembly. The centrifugal weights move outward uncovering a notch in the timing disk. The upright of the firing arm (directly in line with the notch) slides inward, turning the firing arm. This permits a safety plate to swing out, releasing the firing pin. The firing pin strikes the M47 detonator, initiating the explosive train (the XM87 or M49 detonator, depending on the fuze, and the M7 relay).

4–4A.3.2 RANGE/TIME ACTION. Upon firing, setback causes the upraised lug of the timing (range) disk to flatten and release the disk from the setting pin. At the same time the muzzle action mechanism partially functions up to point of releasing the firing arm upright, which is blocked by the timing disk orientation created by the fuze setting. When sufficient centrifugal force has developed, detents, holding the escapement lever in the movement assembly move outward, permitting the escapement to function. As the mainspring drives the movement, the rate of rotation of the arbor, and therefore of the timing disk, is governed by escapement through the gear train. When the notch in the rotating timing disk reaches the upright of the firing arm, it allows the upright to slide inward, turning the firing arm. This permits the safety plate to swing out, releasing the firing pin. The firing pin strikes the M47 detonator which initiates the explosive train (the XM87 or M49 detonator, depending on the fuze) and the M7 relay.

4–4A.4 SAFETY PRECAUTIONS.

4–4A.4.1. General safety precautions regarding unexploded ordnance will be observed.

4–4A.4.2 These fuzes contain "cocked" firing pins; appropriate precautions should be observed.

4-4A.4.3 If munition is found embedded, initial movement should be made remotely.

4-4B. MECHANICAL TIME FUZES.

Fuzes M43 series, M61 series, M67 series, and M565E1 are covered in this paragraph.

4-4B.1 IDENTIFICATION.

4-4B.1.1 TYPE. These fuzes are mechanical time fuzes and are without an impact element.

4-4B.1.2 PAINTING AND MARKING. Fuze designation, time scale, safe setting (S), and other markings are inscribed on the body of the fuze. The M565E1 fuze has a black finish with all markings in white.

4-4B.1.3 FITTINGS AND FEATURES.

4-4B.1.3.1 General physical characteristics are shown in figures 4-49.3 through 4-49.7

4-4B.1.3.2 Fuzes consist of an upper cap, lower cap, body, and movement assembly. The movement assembly contains a time setting disk, and a safety disk or leaf, which provides a safe setting and prevents functioning should the fuze be set for dangerously short periods. The time scale and safe (S) settings are inscribed on the body. Setting is accomplished by rotating the lower cap, and the fuze will not function if set below the minimum setting specified for the type of fuze.

4-4B.1.3.3 All modifications of fuze M43 series provide for time setting up to 30 seconds. M43 through M43A3 have a minimum functioning time of 1.67 seconds, and the M43A4 minimum setting is 0.6 seconds.

4-4B.1.3.4 Fuze M61A2 is essentially the same as the M43A4 but has an extended conical nose (upper cap). Fuze M61A2 is used with high-explosive 120-mm antiaircraft projectile M73, and unlike the M43 series, does not have a magazine charge, but has a flash hole which permits the primer to flash through and initiate relay M7. Relay M7 initiates the booster which, in turn, initiates the projectile supplementary charge. Fuze M61A1 is essentially fuze M43A4 with an extended conical nose, and is alike in construction and functioning. Fuze M61 is the same as fuze M43A3 except for the difference in shape and weight.

4-4B.1.3.5 Fuze M67 series is used with high-explosive projectiles in calibers from 105-mm to 280-mm (field weapons only) and with 90-mm high-explosive cartridge M71. Fuze M67A3 has the same size, shape, and weight as the M43A4. Time setting is provided with 0.5-second graduations up to 75 seconds and a safe (S) line and will not function if set for less than 1.5 seconds. A safety wire extends through the fuze body, providing positive safety during handling, and must be removed when preparing for firing.

4-4B.1.3.6 Fuze M565E1 main components are the lower cap, fuze body, head, movement assembly, and a safety adapter assembly. The fuze has a mechanical-time mechanism that can be set from 2 to 100 seconds. The rotatable lower cap has a scale from 0 to 100 in 1-second increments and numbered every 5 seconds, and contains the movement assembly and hammerspring assembly. The fuze body containing detonator M47 and relay M7 is inscribed with a vernier scale and a zero line to indicate the time settings. The vernier scale permits obtaining a setting accuracy of 0.1 seconds. The safety adapter assembly, which contains a detonator M49 is positioned at the base of the fuze body. The fuze arms by the centrifugal force of the projectile spin.

4-4B.1.3.6.1 The fuze M565E1 incorporates the following safety features:

a. The timing disk is locked by the setting pin and cannot be turned except with the appropriate fuze setter. The disk is released from the pin on setback when the hammerspring flattens the setting lug on the timing disk.

b. A post, projecting from the movement, prevents the hammerspring from moving when the fuze is set on "S" (Safe). Until the fuze is set for a specific time, the hammerspring is kept from disengaging the timing disk from the setting pin.

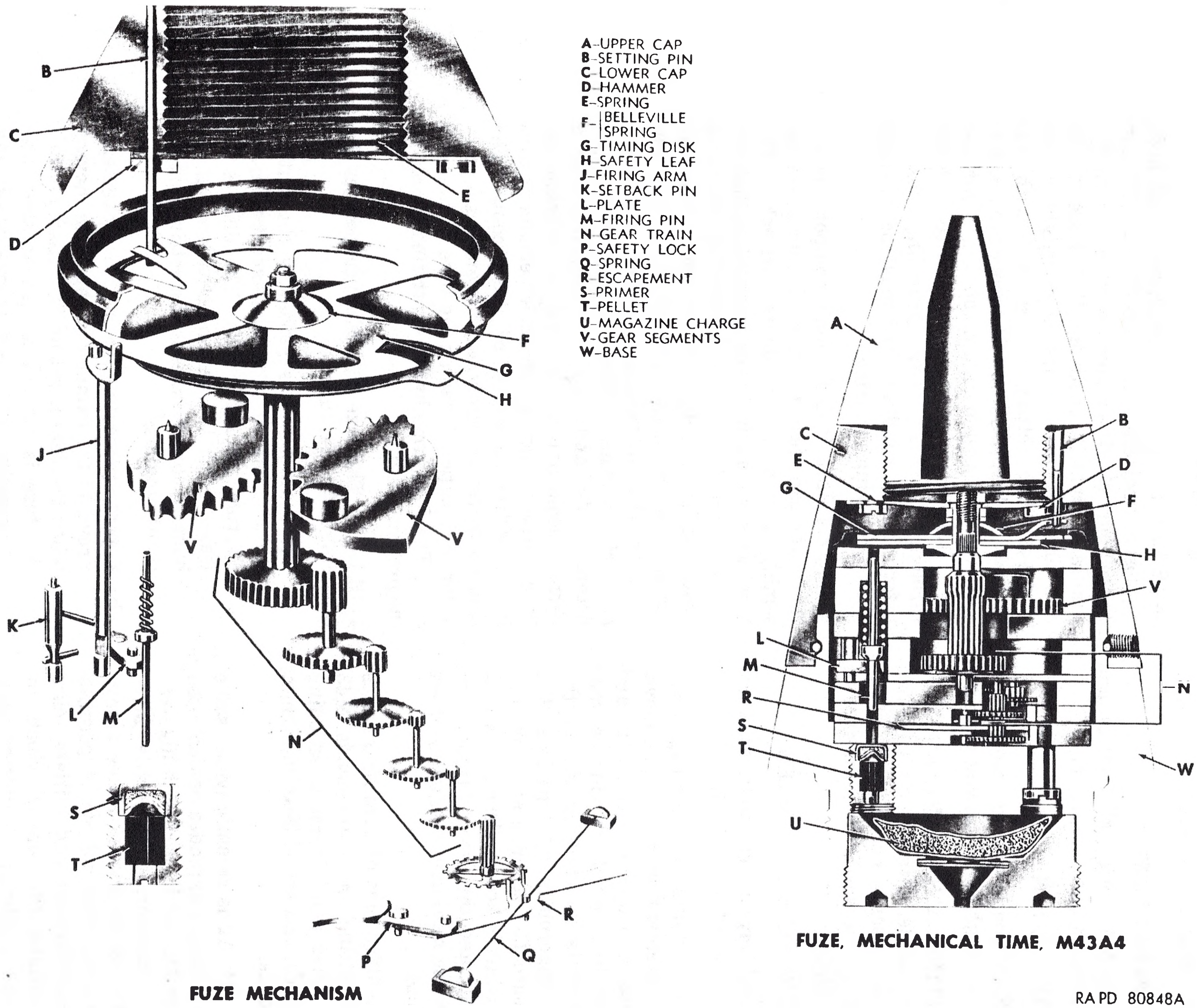

Figure 4–49.3 Mechanical Time Fuze M43A4 and Fuze Mechanism

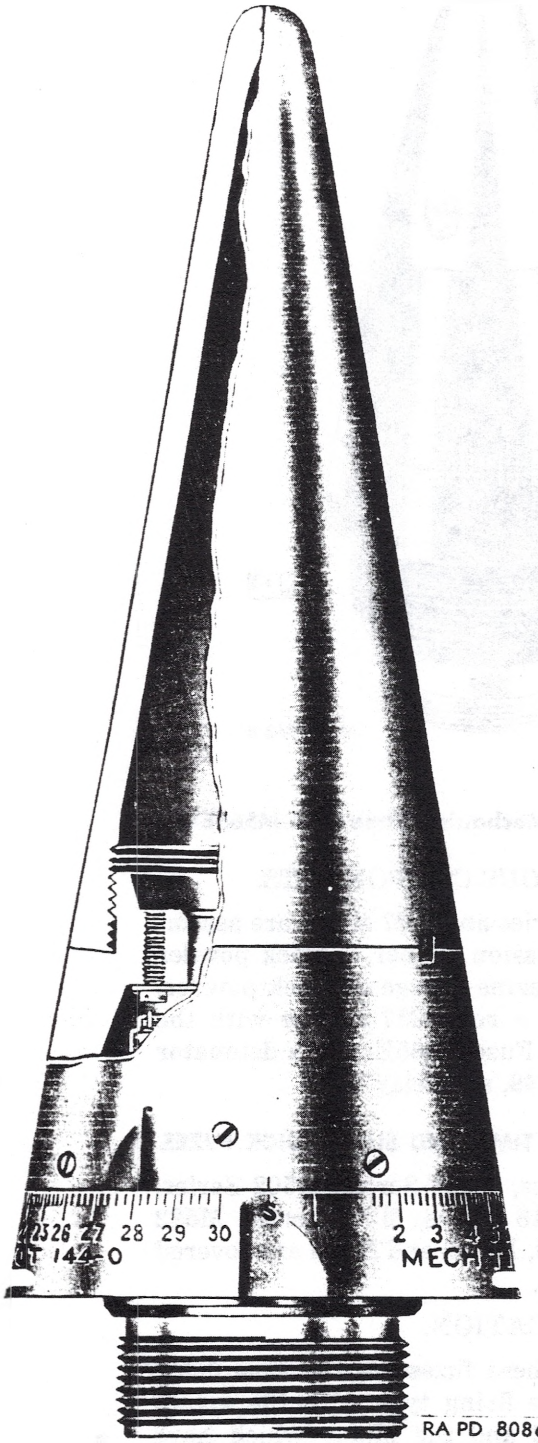

Figure 4-49.4 Mechanical Time Fuze M61A2

c. The escapement lever in the movement assembly is locked by two spring-loaded detents that prevent oscillation of the lever until they slide out of engagement by the application of the required centrifugal force.

d. The arbor stop-lock on the main arbor keeps the mainspring from unwinding until it slides out of engagement by the application of the required centrifugal force.

e. The safety disk covers the firing notch on the timing disk when the fuze is set "S" or for any time less than the prescribed two-second minimum setting. Under these conditions, the safety disk prevents the release of the firing arm and the tripping of the time firing pin.

f. The M49 detonator (located in the safety adapter assembly) is in an out-of-line position until a fixed time after the fuze safety adapter mechanism is actuated by centrifugal force when the projectile is fired.

4-4B.1.4 TABULATED DATA.

Fuze M43 Series:

Length:	
Overall (in.)	4.51
Visible (in.)	3.70
Weight (lb)	1.41
Thread size	1.7-14NS-1

Fuze M61 Series:

Length:	
Overall (in.)	7.667
Visible (in.)	6.867
Weight (lb)	1.62
Thread size	1.7-14NS-1

Fuze M67 Series:

Length:	
Overall (incl. booster) (in.)	5.93
Visible (in.)	3.74
Weight (incl. booster) (lb)	2.14
Thread size	2-12NS-1

Fuze M565E1:

Length:	
Overall (in.)	5.27
Visible (in.)	3.76
Weight (lb)	2.05
Thread size	2–12UNS–1A

NOTE

M67 series without the booster has the same size, weight, and shape as the M43 series.

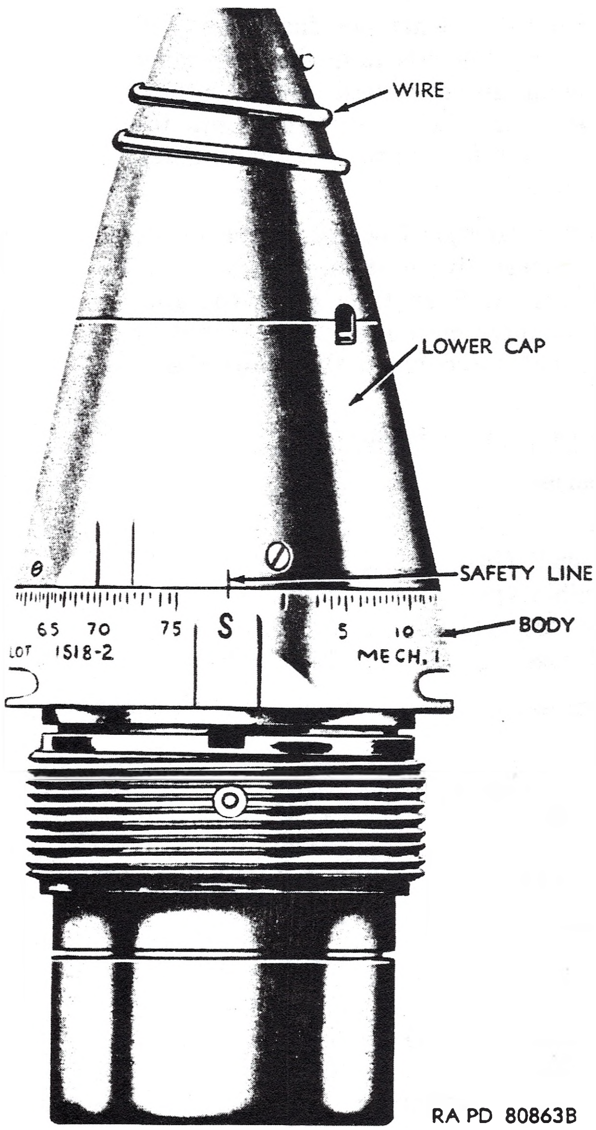

Figure 4–49.5 Mechanical Time Fuze M67A3

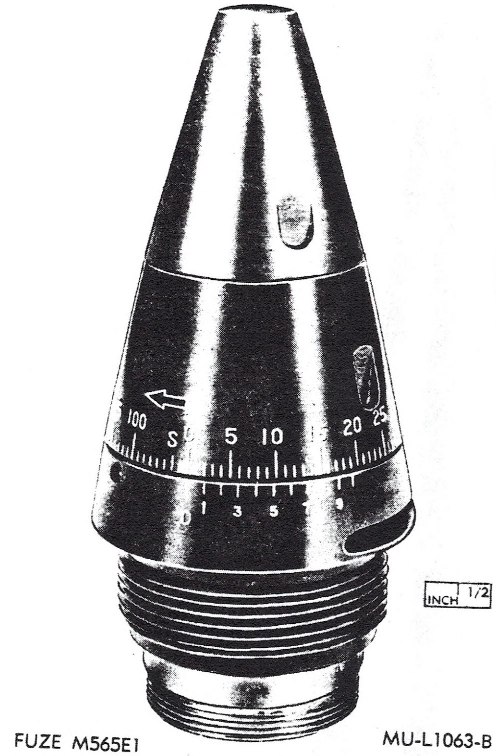

Figure 4–49.6 Mechanical Time Fuze M565E1

4–4B.2 HAZARDOUS COMPONENTS.

The fuzes M43 series and M67 series are assembled with a percussion primer, a black powder pellet, and a magazine charge of black powder. Fuze M61A2 has a relay M7 in line with the magazine charge. Fuze M565E1 has a detonator M27, detonator M49, and relay M7.

4–5 MECHANICAL TIME AND SUPERQUICK FUZES.

Fuzes M500 Series, M501 Series, M502 Series, M506 Series, M518 Series, M520 Series, M522 (T309–E2), M548, M562, and M564 are covered in this paragraph.

4–5.1 IDENTIFICATION.

4–5.1.1 TYPE. These fuzes are the time delay and instantaneous firing type with the exception of the M522 and the M562, which have only the time delay feature.

4–5.1.2 PAINTING AND MARKING. The M548, M562 and M564 are painted black; the

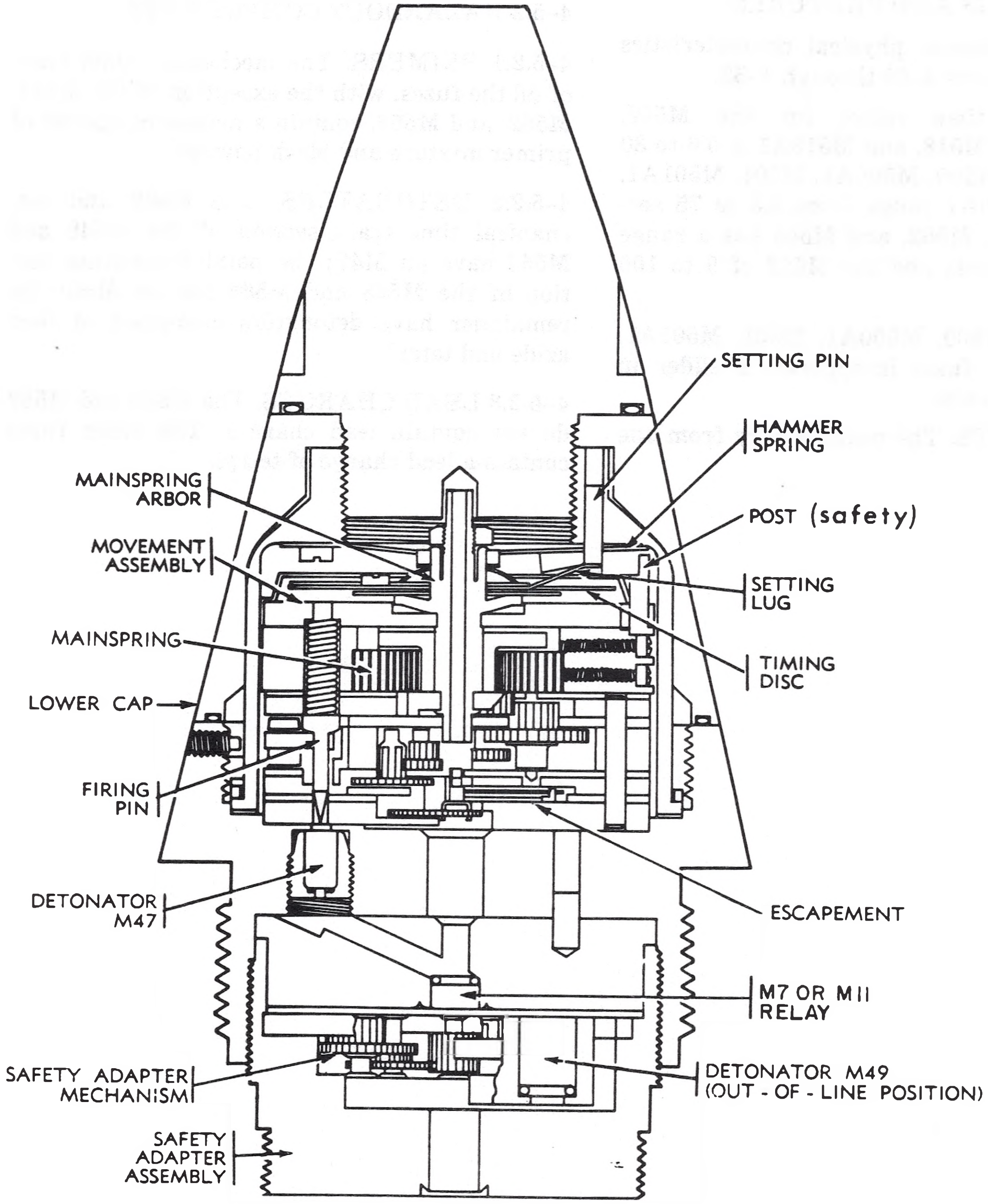

Figure 4–49.7 Fuze M565E1—Cutaway

others are unpainted. All are stamped with the fuze designation and various loading information.

4–5.1.3 FITTINGS AND FEATURES.

4–5.1.3.1 The general physical characteristics are shown in figures 4–50 through 4–52.

4–5.1.3.2 The time range for the M502, M502A1, M506, M518, and M518A1 is 0.6 to 30 seconds. Fuzes M500, M500A1, M501, M501A1, M520, and M520A1 range from 1.5 to 75 seconds. The M548, M562, and M564 has a range of 2 to 100 seconds and the M522 of 9 to 100 seconds.

4–5.1.3.3 The M500, M500A1, M501, M501A1, M520, M520A1, fuzes incorporate a slider in the superquick train.

4–5.1.4 WEIGHTS. The weights vary from one to three pounds.

4–5.1.5 MATERIALS. The M548, M562, and M564 bodies are made of brass; the other fuze bodies are made of aluminum.

4–5.2 HAZARDOUS COMPONENTS.

4–5.2.1 PRIMERS. The mechanical time train of all the fuzes, with the exception of the M548, M562, and M564, contain a primer composed of primer mixture and black powder.

4–5.2.2 DETONATORS. The M562 and mechanical time train section of the M548 and M564 have an M47; the point detonating section of the M548 and M564 has an M50; the remainder have detonators composed of lead azide and tetryl.

4–5.2.3 LEAD CHARGES. The M548 and M562 do not contain lead charges. The other fuzes contain a lead charge of tetryl.

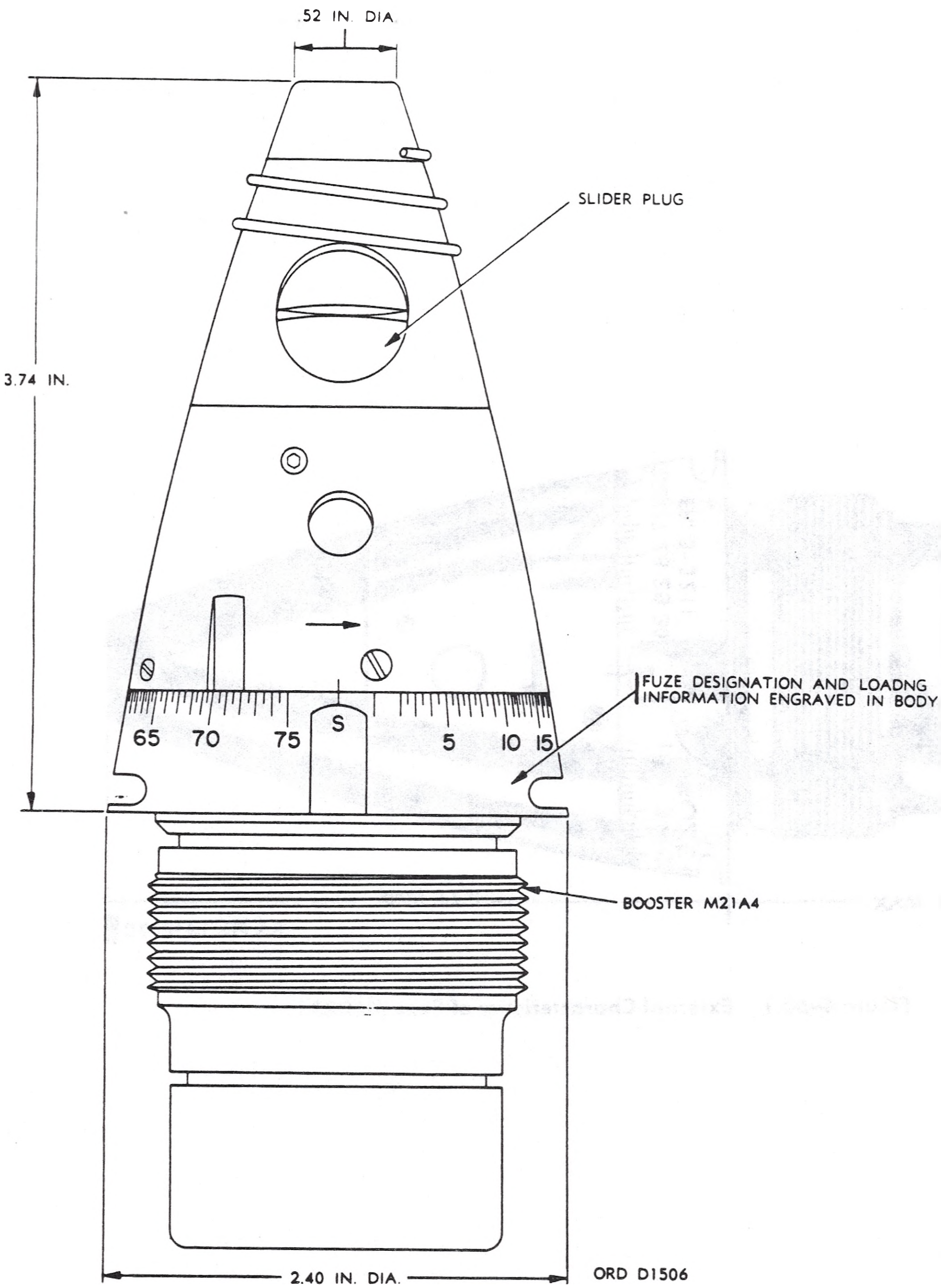

Figure 4-50 External Characteristics of Fuze M500A1

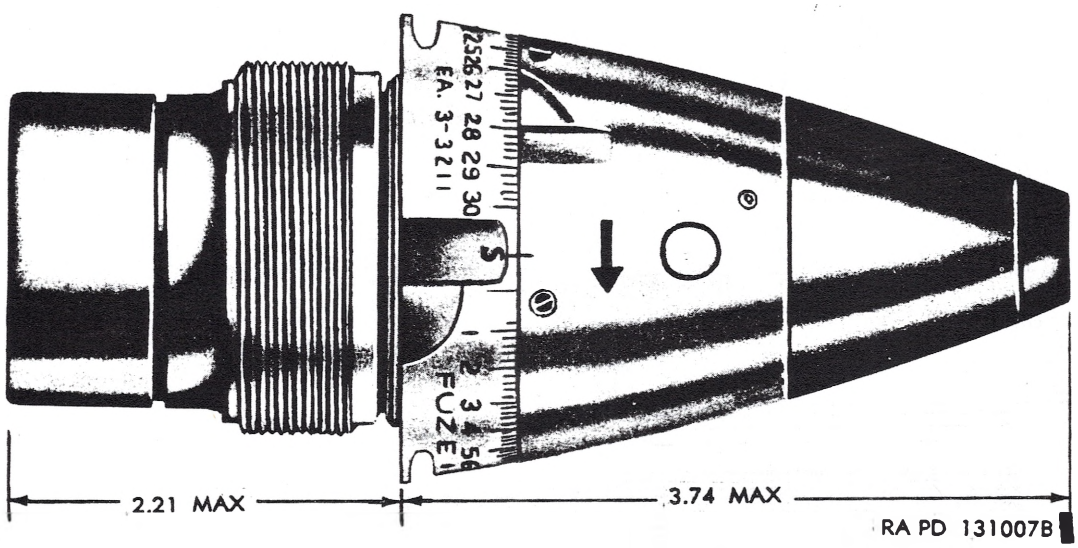

Figure 4—50.1 External Characteristics of Fuze M502A1

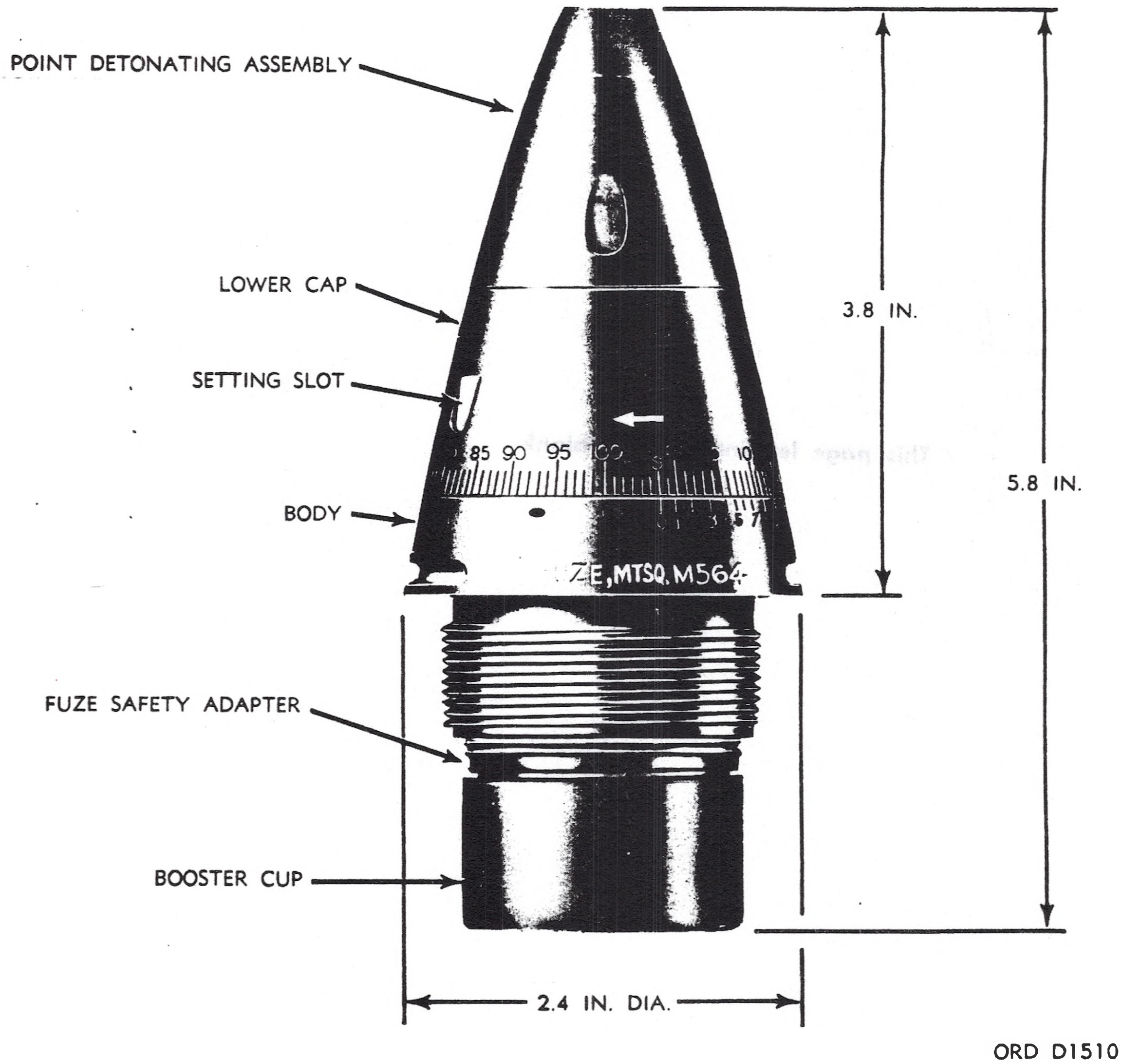

Figure 4-51 External Characteristics of Fuze M564.

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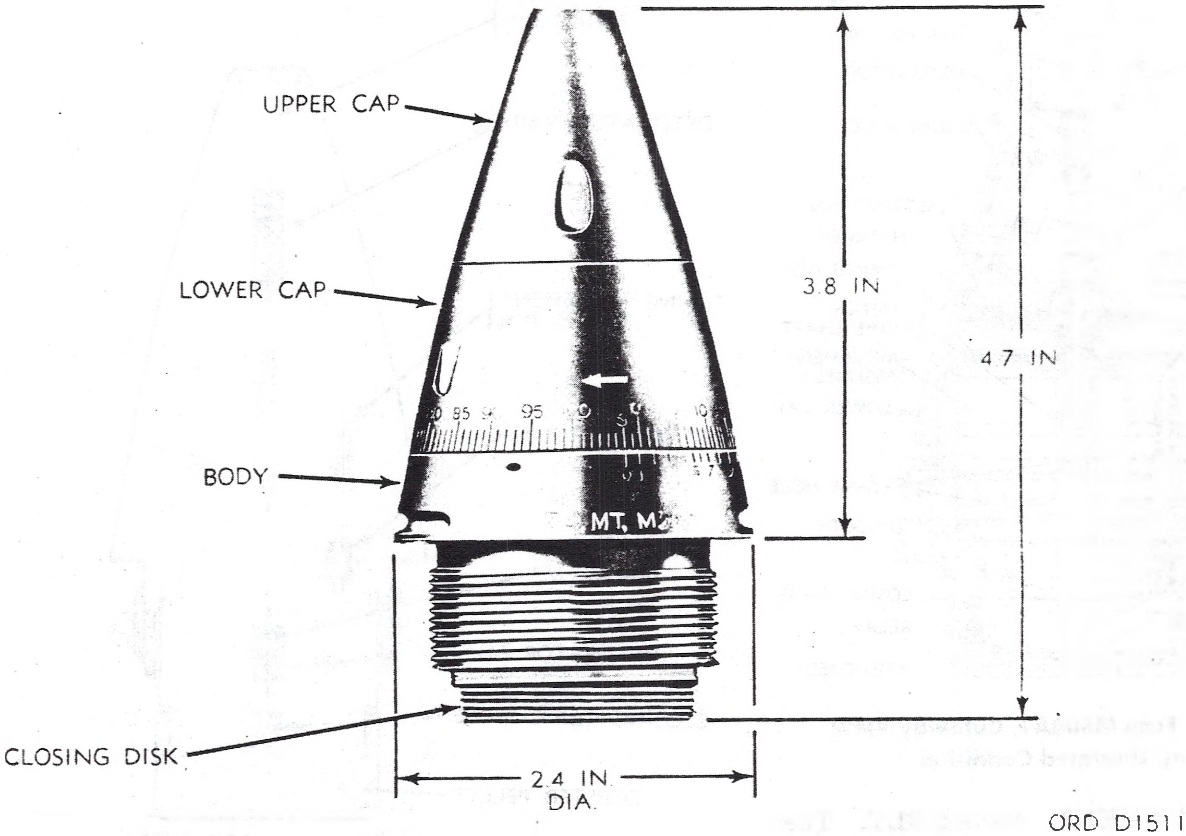

Figure 4-52 External Characteristics of Fuze M562

4-5.2.4 RELAYS. The M548 M554, M562, and M564 contain an M7; the remaining fuzes have tetryl relays.

4-5.2.5 BOOSTERS. The M501, M501A1, M548, M554, and M562 do not contain boosters; the others have boosters containing a charge of tetryl.

4-5.3 FUNCTIONING.

4-5.3.1 GENERAL (figures 4-53 and 4-54). All of the fuzes covered are basically similar in operation. The major operational differences between the various fuzes are time setting range, clock mechanism operation (direction of rotation), point detonator assembly operation (arming), and type of booster.

4-5.3.2 SUPERQUICK ACTION (figures 4-53 through 4-55.1).

4-5.3.2.1 CENTRIFUGAL FORCE. Centrifugal force causes the slider or detents to move outward arming the fuze. Impact functions the fuze. The M562 does not contain a superquick action train.

4-5.3.2.2 DESCRIPTION OF COMPONENTS. The mechanical time superquick fuze consists of four main subassemblies: the movement assembly, body, lower cap and point detonator assembly. Figure 4-53 shows the general arrangement of the M500A1 fuze (without booster) in the unarmed condition as well as the names of various parts. This figure and the following description applies to all the fuzes unless otherwise stated.

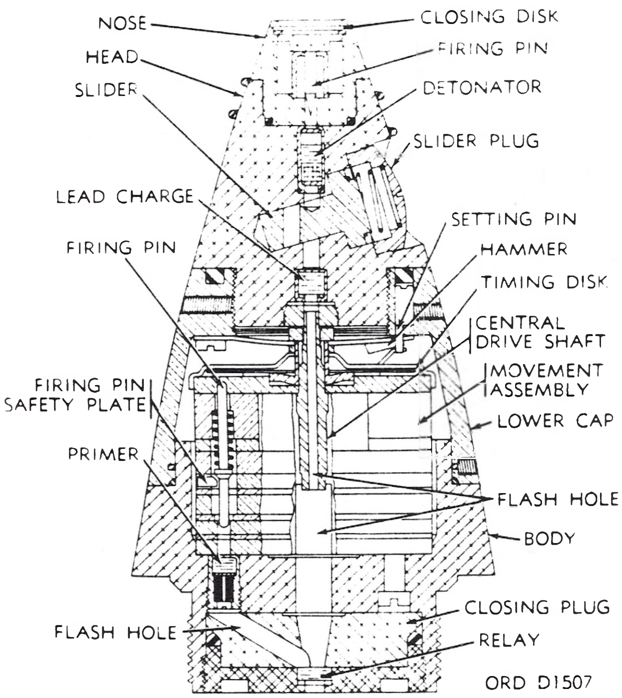

Figure 4–53 Fuze M500A1, Cutaway View Showing Unarmed Condition

4–5.3.2.2.1 MOVEMENT ASSEMBLY. The movement assembly is divided into three main parts: the timing disk mechanism, the clock mechanism, and the firing mechanism.

a. Timing disk mechanism. The timing disk mechanism consists of the timing disk, setting pin, spring-hammer assembly, safety disk, and central drive shaft.

b. Clock mechanism. The clock mechanism of all the fuzes consists of two centrifugal gear arcs, a series of reduction gears, and the escapement mechanism.

c. Firing mechanism. The firing mechanism consists of the firing arm, firing arm shaft, setback pin and its spring, firing pin safety plate, and firing pin and its spring. The firing pin safety plate is pivoted and fits under a shoulder of the cocked firing pin, thus holding it away from the primer.

4–5.3.2.2.2 BODY. The body provides a housing for the movement assembly, percussion primer M29A1, and relay M7. It is threaded to fit an adapter or a booster which may be assembled to it.

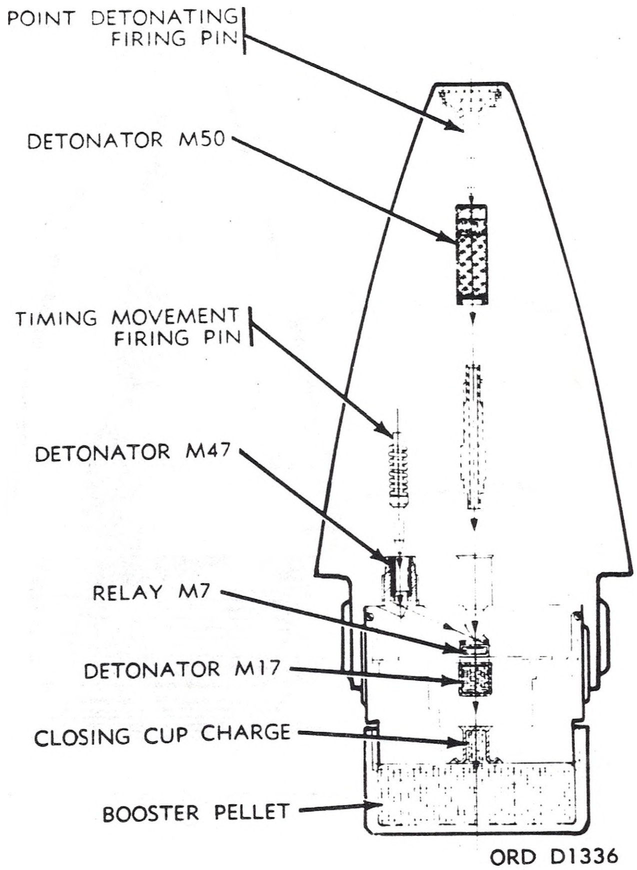

Figure 4–54 Fuze M564—Explosive Train

4–5.3.2.2.3 LOWER CAP. The lower cap is attached to the body by a joint consisting of a steel wire leading through grooves in the lower cap and body

4–5.3.2.2.4 POINT DETONATOR ASSEMBLY. The point detonator assembly contains the superquick impact element of the fuze. The main components of the point detonator assembly are the nose, head, explosive elements, firing pin, and arming device.

4–5.3.3 OPERATION

4–5.3.3.1 MECHANICAL TIME ACTION.

a. When the projectile is fired, the force of setback causes the hammer to strike the setting lug, thus depressing it and freeing the timing disk from the setting pin. The hammer is returned to its original posi-

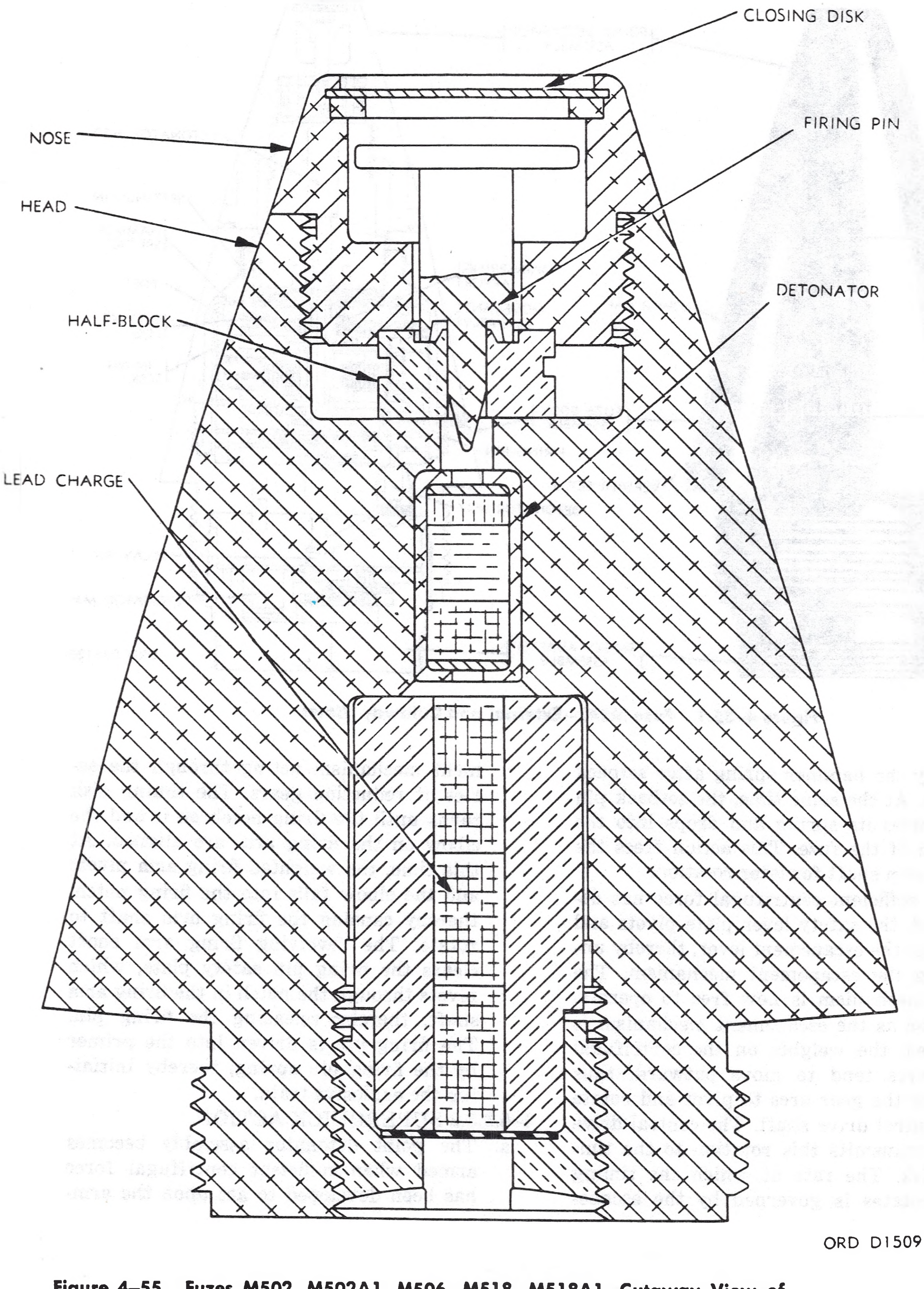

Figure 4–55 Fuzes M502, M502A1, M506, M518, M518A1, Cutaway View of Point Detonator Assembly Showing Unarmed Condition

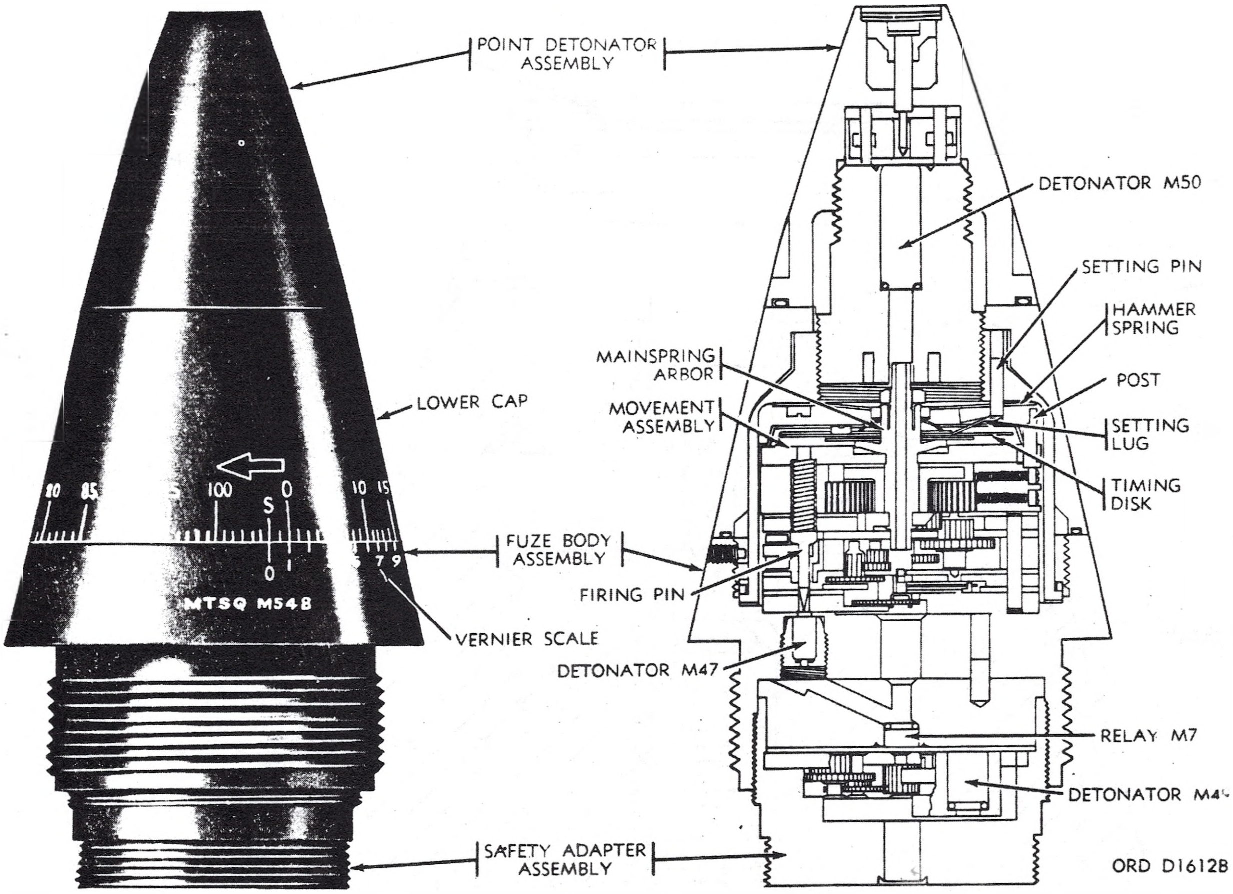

Figure 4–55.1 Fuze M548—External and Cutaway Views

tion by the hammer spring after setback ceases. At the same time, the setback pin overcomes its spring and drops into the bottom of the fuze. This action frees the firing arm shaft for later rotation.

b. When sufficient centrifugal force has developed, the safety lever plate pivots and releases the escapement lever, thereby unlocking the escapement mechanism. The clock mechanism is now free to operate. As soon as the escapement mechanism is released, the weights on the centrifugal gear arcs tend to move outward, thus causing the gear arcs to pivot and rotate the central drive shaft. The central drive shaft transmits this rotation to the timing disk. The rate at which the timing disk rotates is governed by the escapement mechanism acting through the series of reduction gears. The timing disk turns until the firing notch on it and the elbow on the firing arm are aligned. At this time, the weighted firing arm pivots and the elbow falls into the firing notch, thereby causing the firing arm shaft to rotate. The revolving firing arm shaft clears the firing pin safety plate, which pivots through the notch in the firing arm shaft, thereby releasing the firing pin. The firing pin is driven into the primer by the firing pin spring, thereby initiating the explosive train.

4–5.3.3.2 SUPERQUICK ACTION.

a. The point detonator assembly becomes armed when sufficient centrifugal force has been developed to act upon the arming device. Centrifugal force moves the slider or half-blocks outward, thereby aligning the explosive train or leaving the firing pin with unobstructed passage to the detonator. The point detonator assembly is now armed. Upon impact, the firing pin is driven into the detonator, which sets off the lead charge. The action of the lead charge is transmitted through the flash tube to the relay and thence to the booster.

b. The superquick impact element of the fuze will function if impact occurs before completion of the time interval for which the fuze was set or if the fuze was set at safe (S).

4-5.3.3.3 The M548, M554 and M564 fuzes incorporate a delay in the safety adapter mechanism which prevents alignment of the detonator, regardless of time setting, until the projectile has travelled from 200 to 480 feet. For all but the M522 and M562 fuzes, superquick action will function the fuze should impact occur prior to the time setting on the fuze.

4-5.4 SAFETY PRECAUTIONS.

4-5.4.1 The general safety precautions regarding unexploded ordnance must be observed.

4-5.4.2 These fuzes contain "cocked" strikers; appropriate precautions should be observed.

4-5A (TIME (POWDER TRAIN TYPE) FUZES.

Fuzes M65 Series and M84 Series are covered in this paragraph.

4-5A.1 IDENTIFICATION.

4-5A.1.1 TYPE. The fuzes contain a powder time train which is setback armed.

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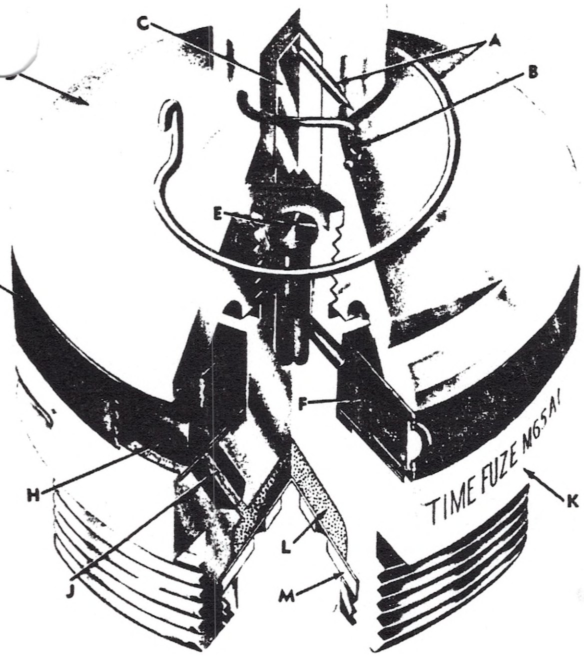


A—SAFETY (COTTER) PIN
B—SHEAR WIRE
C—STRIKER
D—HEAD
E—PRIMER
F—BLACK POWDER PELLET
G—TIME RING
H—TIME-RING CHARGE
J—BODY PELLET
K—BODY
L—EXPELLING CHARGE
M—RETAINER DISK

ORD D1741

Figure 4-55.2. Fuze M65A1.

4-5A.1.2 PAINTING AND MARKING. The fuzes are unpainted and are stamped with the fuze designation and various loading information.

4-5A.1.3 FITTINGS AND FEATURES. The general physical characteristics are shown in figures 4-55.2 and 4-55.3. The time range for fuze M65 Series is fixed at 15 seconds. The time range for fuze M84A1 is 0 to 50 seconds. The time range for fuze M84 is 0 to 25 seconds.

1-5A.1.4 WEIGHTS. Fuze M65 Series weighs approximately one pound. Fuze M84 Series weighs ıpproximately two pounds.

1-5A.1.5 MATERIALS. Fuze M65 Series has a :inc die cast body and head. Fuze M84 Series has ın aluminum body and a brass head.

-5A.2 HAZARDOUS COMPONENTS. The 'uzes contain a black powder expelling charge.

-5A.3 FUNCTIONING. (figures 4-55.2 and -55.3) when the projectile is prepared for firing, the afety wire is removed. A time is set on fuze M84A1 nd M84.

/hen projectile is fired, inertia forces due to acele (setback forces) cause plunger or striker to strike primer, thereby initiating the time train, which subsequently initiates the expelling charge.

4-5A.4 SAFETY PRECAUTIONS. The general safety precautions regarding unexploded ordnance must be observed.

4-6 TIME SUPERQUICK (POWDER TRAIN TYPE) FUZES.

Fuzes M5, M54, M55 Series and M77 are covered in this paragraph.

NOTE

Fuze M5 consists of Fuze M54 with an adapter for use in 4.2-inch mortar.

4-6.1 IDENTIFICATION.

4-6.1.1 TYPE. The fuzes contain a powder time train which is setback armed. The point detonation or superquick action portion provides for instantaneous firing upon impact. For Fuses M54 and M55 Series this superquick action portion is centrifugally armed; for Fuze M77 this portion is setback armed.

4-6.1.2 PAINTING AND MARKING. The fuzes are unpainted and are stamped with the fuze designation and various loading information.

4-6.1.3 FITTINGS AND FEATURES. The general physical characteristics are shown in figures 4-56 through 4-56.2. The time range is 0 to 25 seconds.

4-6.1.4 WEIGHTS. The fuzes weigh approximately two pounds each.

4-6.1.5 MATERIALS. The bodies are made of aluminum.

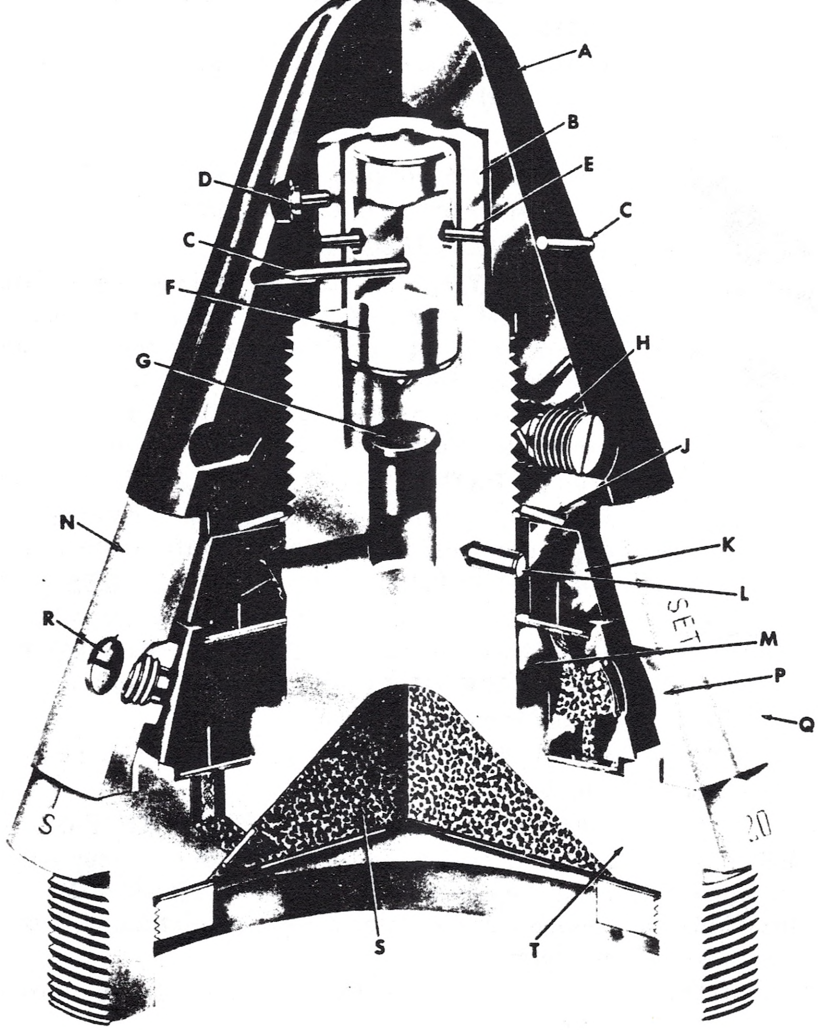
4-6.2 HAZARDOUS COMPONENTS. For Fuzes M54 and M55 Series, the detonator is composed of primer mixture and lead azide; for Fuze M77 the detonator is composed of primer mixture, lead azide, and tetryl.

4-6.3 FUNCTIONING. (figures 4-56.2 through 4-58).

4-6.3.1 FUZES M54 AND M55 SERIES.

4-6.3.1.1 When the projectile is prepared for firing, the safety wire is removed and a time is set on the fuze if time action is desired. When the projectile is fired, inertia forces due to acceleration (setback forces) push the time action plunger downward against the primer striker. The primer striker impinges the primer, thereby initiating the time train. The time train burns until it initiates the magazne charge. The magazine charge initiates the booster. The fuze will be initiated on impact regardless of the time setting.

4-6.3.1.2 If the fuze is set for impact functioning, the time train is blocked and the fuze will be initiated on impact. As centrifugal force builds up, it pushes



A—HEAD
B—PLUNGER GUIDE
C—SAFETY WIRE
D—POSITIONING PIN
E—SHEAR PIN
F—PLUNGER
G—PERCUSSION PRIMER
H—SETSCREW
J—WASHER
K—UPPER TIME-TRAIN RING
L—LOCK PIN
M—LOWER TIME-TRAIN RING
N—ADJUSTMENT RING
P—VENT HOLE
Q—RIB
R—LOCK SCREW
S—EXPELLING CHARGE
T—BODY ASSEMBLY

RA PD 108180A

Figure 4–55.3 Fuze M84.

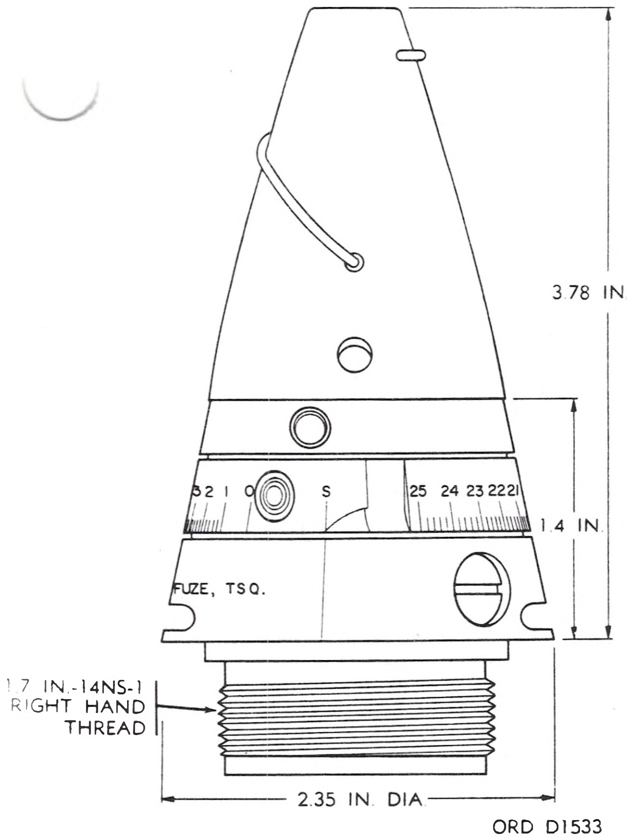


Fig. 4-56 External Characteristics of Fuze M54.

the interrupter outward. Upon impact, the firing pin is driven into the detonator. The flash from the detonator passes through the flash hole and initiates the booster (Fuze M55 Series) or the projectile filler (Fuze M54).

4-6.3.2 FUZE M77.

4-6.3.2.1 When the projectile is prepared for firing, the two cotter pins are removed and a time is set on the fuze if time action is desired. When the projectile is fired, inertia forces due to acceleration (setback forces) push the time action plunger downward, causing it to strike the primer, thereby initiating the time train. Setback forces also allow the detonator to move into alinement with the firing pin. When the time train has burned the designated time, it initiates the detonator, via the relay pellets. The detonator initiates the booster, via the booster lead. The fuze will be initiated on impact regardless of the time setting.

4-6.3.2.2 If the fuze is set for impact functioning, the time train is blocked and the fuze will be initiated on impact. Setback forces allow the detonator to move into alinement with the firing pin. Upon impact, the firing pin is driven into the detonator. The detonator initiates the booster, via the booster lead.

4-6.4 SAFETY PRECAUTIONS. The general safety precautions regarding unexploded ordnance must be observed.

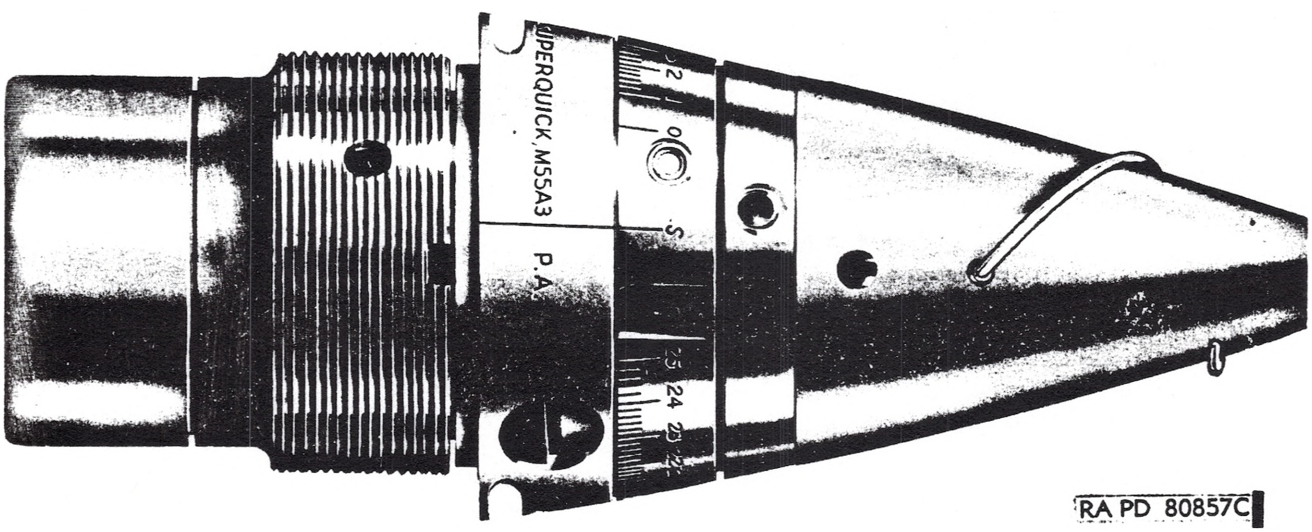


Figure 4-56.1 External Characteristics of Fuze M55 Series.

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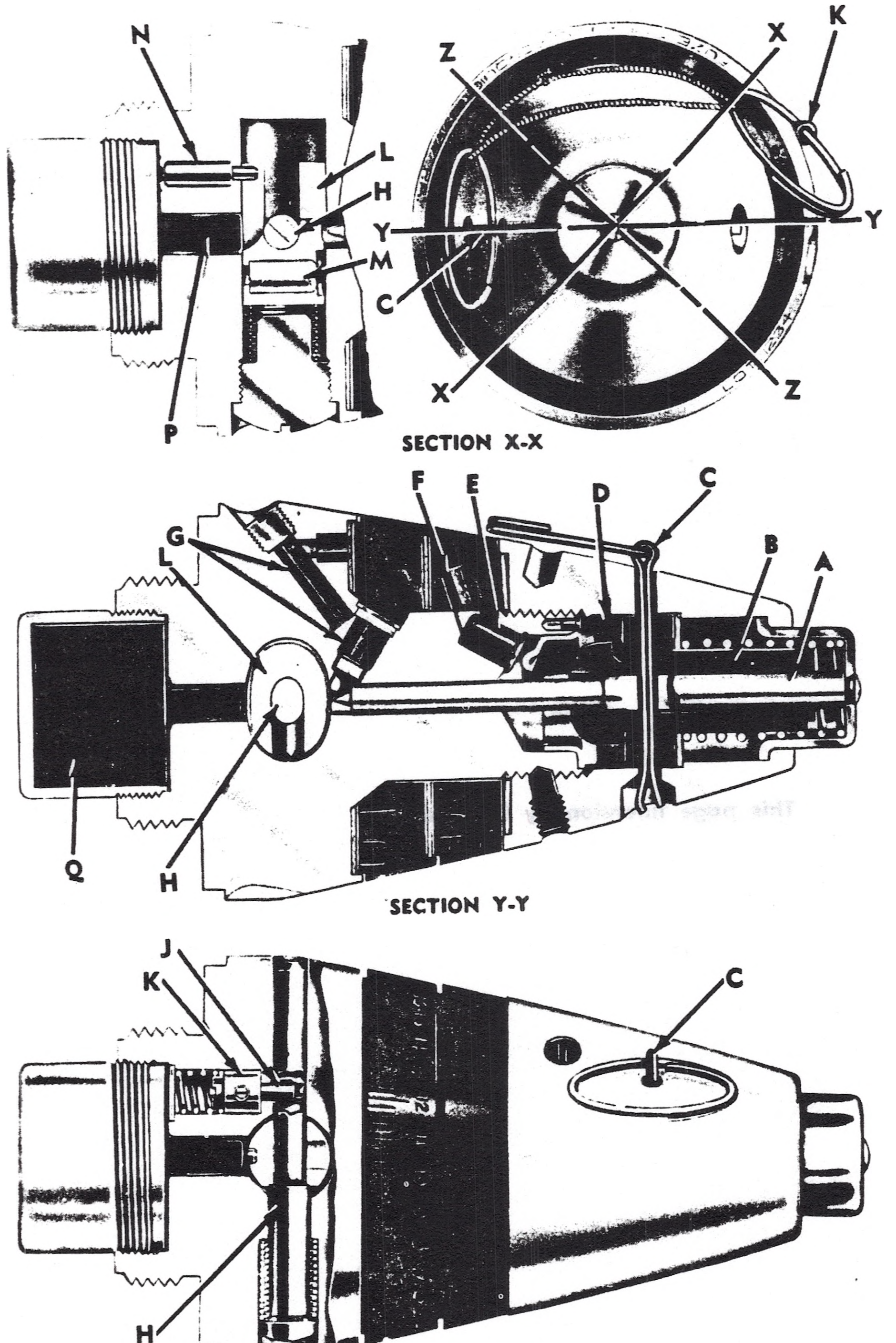

A—FIRING PIN
B—PLUNGER ASSEMBLY
C—COTTER PIN
D—SHEAR PIN
E—PRIMER
F—PELLET
G—RELAY PELLETS
H—SAFETY PIN
J—SETBACK PIN
K—COTTER PIN
L—SLIDER ASSEMBLY
M—DETONATOR
N—GUIDE PIN
P—BOOSTER LEAD
Q—BOOSTER

RA PD 65178A

Figure 4-56.2 Fuze M77—External and Cutaway Views.

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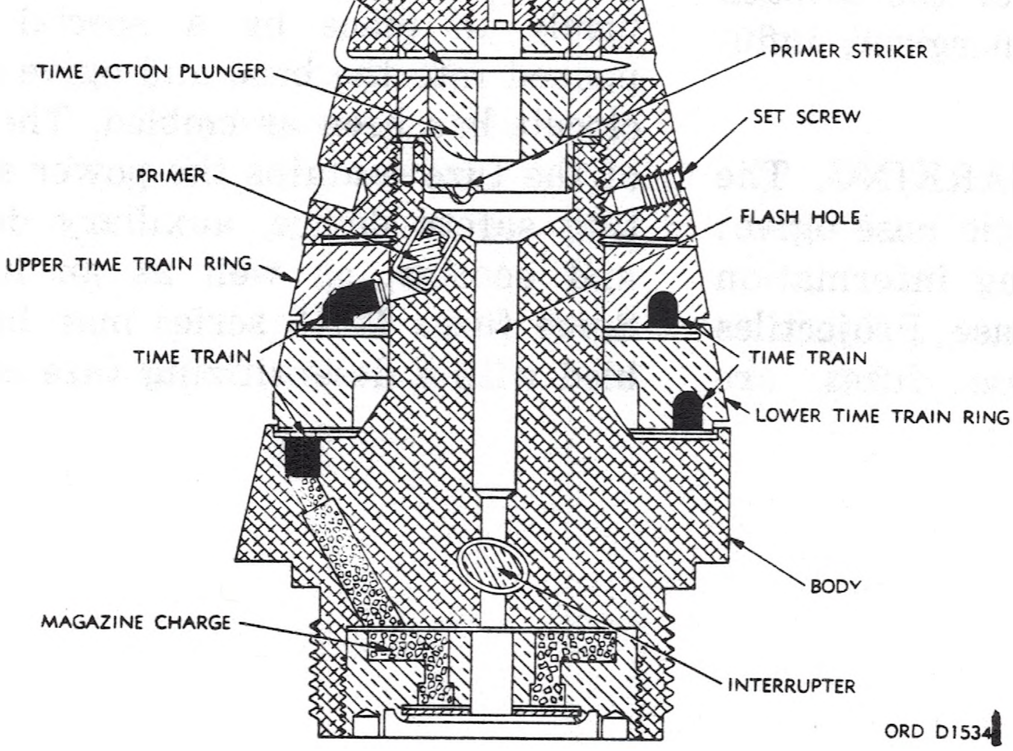

Figure 4–57 Fuze M54, Cutaway View Showing Unarmed Condition

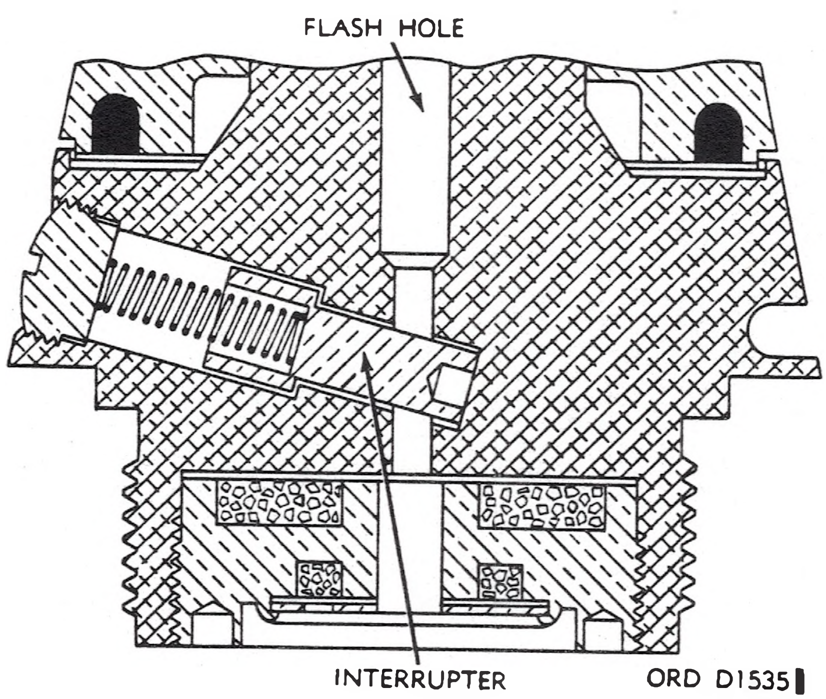

Figure 4–58 Fuze M54, Cutaway View Showing Interrupter

4–6A PROXIMITY FUZES (WITH WET ENERGIZERS)

Proximity fuzes M93, M96, M97, M402, M504 Series, M513 Series, M514 Series, M515, M516, and M92 are covered in this paragraph.

4–6A.1 IDENTIFICATION.

4–6A.1.1 TYPE. These fuzes of the setback and centrifugally armed, wet energizer, influence (proximity) fired type.

4–6A.1.2 PAINTING AND MARKING. The fuzes are unpainted with a plastic nose ogive; the fuze designation and loading information are stamped on the metal fuze base. Projectiles which can accommodate these fuzes are marked "W/SUPPL CHG" or "FOR VT FUZE —".

4–6A.1.3 FITTINGS AND FEATURES. The fuze (figures 4–58.1 and 4–58.2) consists of a plastic nose ogive, a metal base, a metal shank (body), and a booster cup. The fuze base and ogive contain the radio circuits which are held firmly in place by a special casting resin, poured into the base and ogive after the radio circuit has been assembled. The shank (body) of the fuze contains the power supply, rear fitting safety device, auxiliary detonating fuze, and booster, as well as an impact element. Some fuzes M513 series may be found assembled with a desensitizing fuze cap XM5.

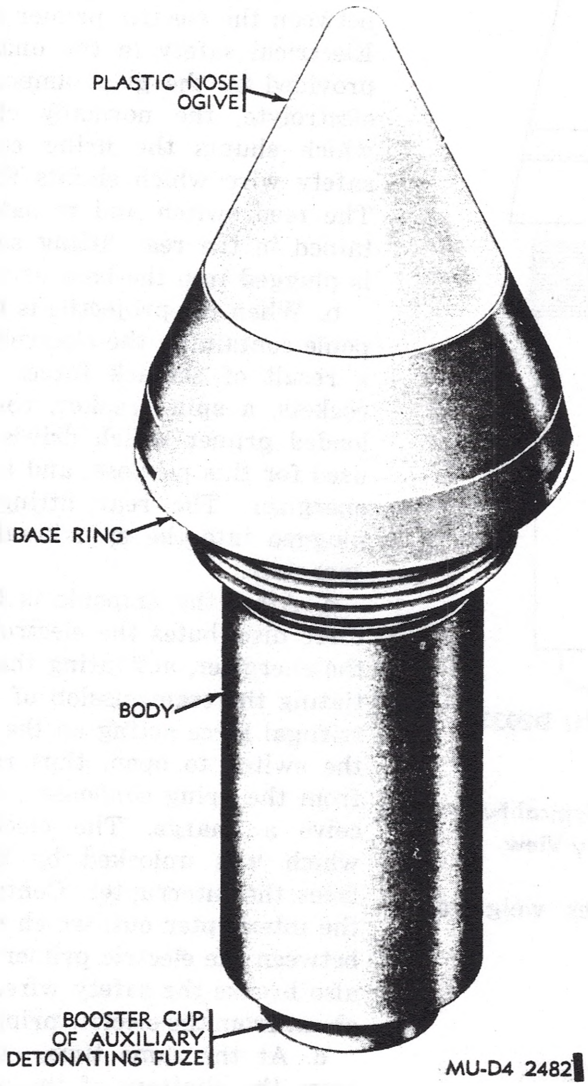

Figure 4–58.1 General Appearance of Proximity Fuze

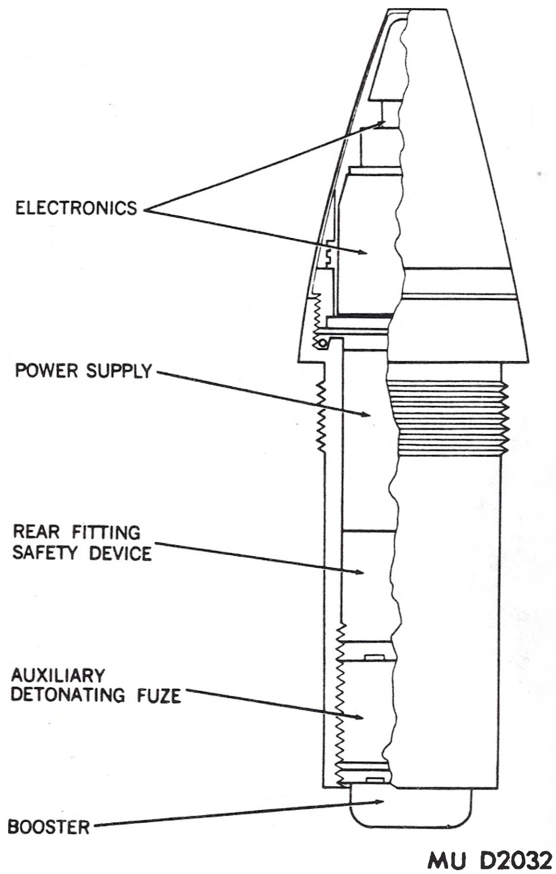

Figure 4–58.2 Components of Typical Fuze (Wet Energizer Type) Cutaway View

4–6A.1.4 WEIGHT. These fuzes weigh approximately 3 pounds.

4–6A.1.5 MATERIALS.

a. Nose—plastic.

b. Base—metal (aluminum or steel).

c. Shank (body)—metal (aluminum or steel).

d. Booster cup—metal (aluminum or steel).

4–6A.2 HAZARDOUS COMPONENTS.

a. Electric primer.

b. Impact detonating element.

c. The spin breaker, used in proximity fuzes for spin-stabilized rockets, contains a spring-loaded primer carrier.

4–6A.3 FUNCTIONING.

a. When a proximity fuze is in the unarmed condition, mechanical safety is provided by the auxiliary detonating fuze (boresafe element) and an interrupter which covers the flash hole between the electric primer and the detonator. Electrical safety in the unarmed condition is provided by the glass ampoule containing the electrolyte, the normally closed reed switch which shunts the firing condenser, and the safety wire which shunts the electric primer. The reed switch and te safety wire are contained in the rear fitting safety device which is plugged into the base of the energizer.

b. When the projectile is fired, the glass ampoule containing the electrolyte is shattered as a result of setback forces. In spin-stabilized rockets, a spin breaker, containing a spring-loaded primer which drives a breaker pin, is used for this purpose, and is located below the energizer. The rear fitting safety device is plugged into the spin breaker instead of the energizer.

c. After the ampoule is broken, centrifugal force distributes the electrolyte to the ceils of the energizer, activating the energizer and initiating the transmission of radio signals. Centrifugal force acting on the reed switch causes the switch to open, thus removing the shunt from the firing condenser, which begins to receive a charge. The clockwork mechanism, which was unlocked by the setback forces, frees the interrupter. Centrifugal force moves the interrupter out, which opens the flash hole between the electric primer and detonator, and also breaks the safety wire, thus removing the shunt from the electric primer.

d. At the same time, centrifugal force rotates the shutters of the auxiliary detonating fuze so that the explosive train is alined with the electric primer. The fuze is then fully armed.

e. In flight, the armed fuze receives and transmits radio signals. As the fuze approaches a target, the reflected signals from the target interact with the transmitted signals from the fuze. When this interaction of transmitted and reflected signals, resulting in ripples or beats, reaches a predetermined intensity, an electronic switch (thyratron) in the fuze is tripped, discharging the firing condenser through the electric primer. The flash from the electric primer initiates the explosive train of the auxiliary detonating fuze (or boresafe element and booster) which, in turn initiates the detonation of the projectile.

f. Some proximity fuzes, particularly those used in antiaircraft projectiles, such as the M515, and M516 have a self-destroying feature.

g. An impact-detonating element is an integral part of certain proximity fuzes. If the proximity element of the fuze does not function upon approach to the target, the impact-detonating element will cause instantaneous operation upon impact.

4–6A.4 SAFETY PRECAUTIONS.

WARNING

Do not operate radios or radars in the vicinity of proximity fuzes.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

b. Wait one hour for condenser voltage bleed-off.

c. Identify the type of projectile (or rocket) and fuze present and determine the condition of the fuze.

d. Be extremely careful when recovering or disposing of a proximity fuze which contains an impact-detonating element. If fully armed, the impact-detonating element may be functioned by a slight jar or jolt.

e. When a proximity fuze is removed from a projectile or rocket head, the fuze well should be covered with tape so as to exclude dirt and other foreign matter.

4–6B PROXIMITY FUZES (SHORT INTRUSION) Proximity fuzes M517 and M532 are covered in this paragraph.

4–6B.1 IDENTIFICATION.

4–6B.1.1 TYPE. These fuzes are of the short intrusion type, and are radio proximity fuzes incorporating an impact element (the fuze M532 also has a point-detonating feature for "PD" function only). The fuzes contain arming mechanisms (safety and arming devices) which are released by setback force. Delay arming is provided by the mechanism, since its operation is not completed until the projectile has traveled approximately 120 meters (M517) or 550 meters (M532) along the trajectory.

4–6B.1.2 PAINTING AND MARKING. The fuzes are unpainted with a green plastic fluted nose cone (M532) or a black plastic nose cone (M517). The fuze designation and loading information are stamped on the retainer rign (M517) or locking ring (M532) of the fuze.

4–6B.1.3 FITTINGS AND FEATURES. The visible parts of the fuzes (figs. 4–58.3 and 4–58.4) are the nose cone, a locking ring (M532) or a retainer ring (M517), a fuze body (M532) or a fuze base (M517), and a rear housing (M532) or a sleeve (M517) that is closed at the bottom by a booster cup. The nose cone protects the electronic head, the fuze body (M532) or fuze base (M517) contains a thermal battery, and the rear housing (M532) or the sleeve (M517) contains the arming mechanism and the booster. There are two wrench slots (180° apart) in the fuze body (M532) or the fuze base (M517).

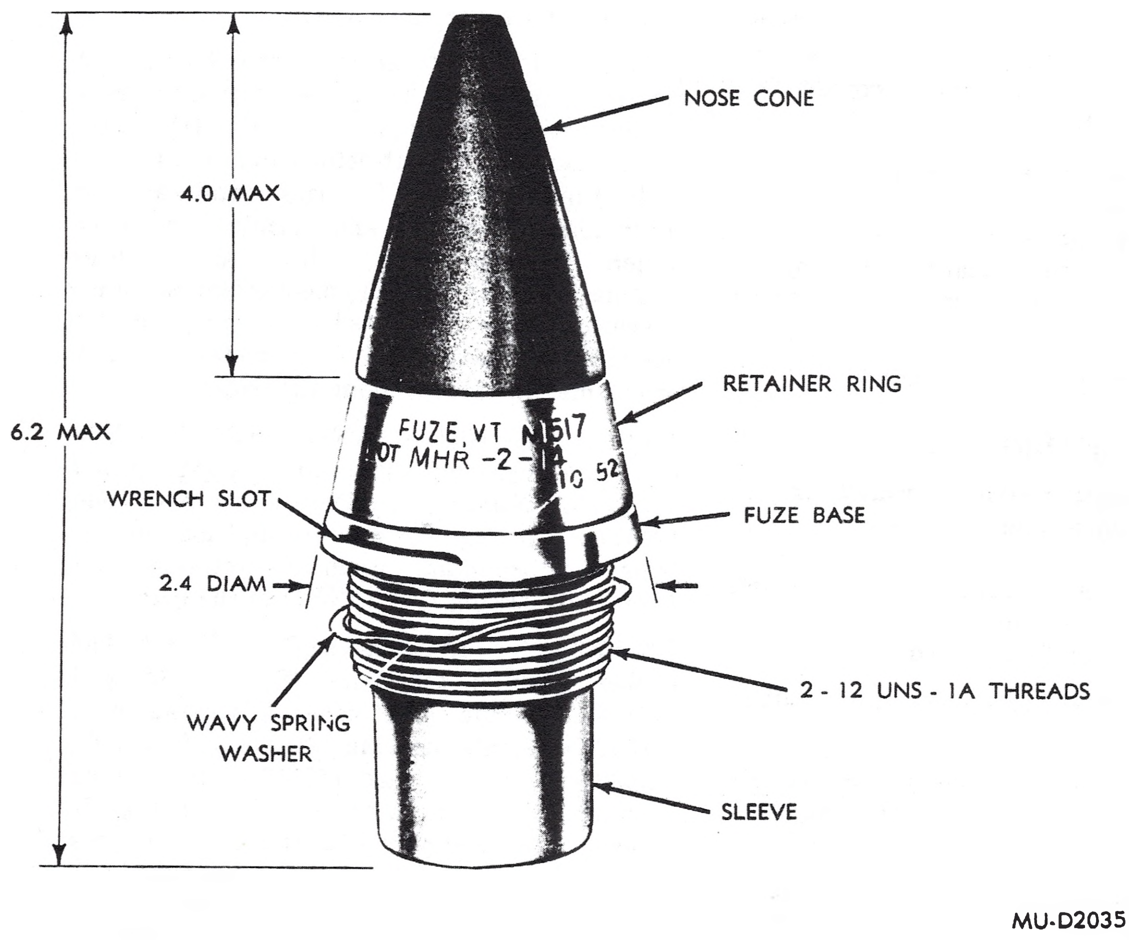

Figure 4–58.3. General Appearance and Dimensional Characteristics of Fuze M517

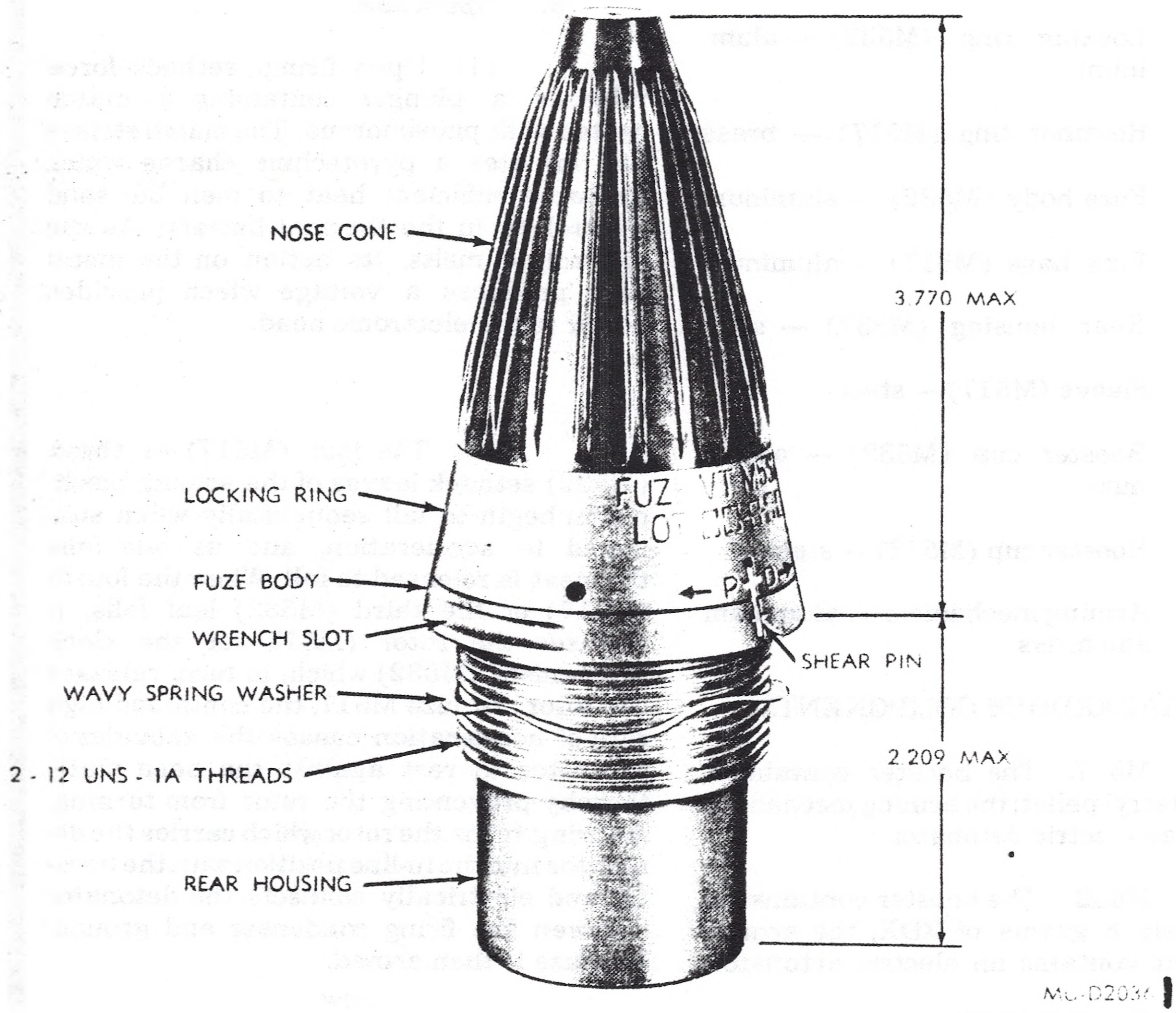

Figure 4—58.4 General Appearance and Dimensional Characteristics of Fuze M532

4-6B.1.4 WEIGHTS. The fuzes weigh approximately 1 pound.

4-6B.1.5 MATERIALS.

a. Nose cone — plastic

b. Locking ring (M532) — aluminum

c. Retainer ring (M517) — brass

d. Fuze body (M532) — aluminum

e. Fuze base (M517) — aluminum

f. Rear housing (M532) — steel

g. Sleeve (M517) — steel

h. Booster cup (M532) — aluminum

i. Booster cup (M517) — steel

j. Arming mechanism — aluminum and brass

4-6B.2 HAZARDOUS COMPONENTS.

a. M517. The booster contains a 15-grain tetryl pellet; the arming mechanism contains an electric detonator.

b. M532. The booster contains approximately 8 grams of RDX; the arming mechanism contains an electric detonator.

4-6B.3 FUNCTIONING.

a. *General.* The major functional components of the fuze are the electronic head, the thermal battery, and the arming mechanism. The electronic head contains the oscillator, a combined transmitter and receiver unit, and the amplifier assembly with its thyratron that acts as the electronic switch to trigger the discharge of the condenser through the detonator and a trembler switch that serves as the impact element. The thermal battery is the power source for all electronic components. The arming mechanism, consisting of a spring-driven rotor containing an electric detonator, a clock-delay mechanism (M532 only), and a falling-leaf setback device, maintains the detonator out of alinement with the booster until the round is fired.

b. *Operation.*

(1) Upon firing, setback force releases a plunger containing a match coated with phosphorous. The match strikes and initiates a pyrotechnic charge which produces sufficient heat to melt the solid electrolyte in the thermal battery. As the electrolyte melts, its action on the metal cells produces a voltage which provides power to the electronic head.

(2) The four (M517) or three (M532) setback leaves of the arming mechanism begin to fall sequentially when subjected to acceleration, and as one falls the next is released to fall. When the fourth (M517) or the third (M532) leaf falls, it releases the rotor (M517) or the clock mechanism (M532) which, in turn, releases the rotor. In fuze M517, the continued high rate of acceleration causes the shoulder of the rotor to rest against the base plate, thereby preventing the rotor from turning. A spring turns the rotor which carries the detonator into the in-line position with the booster and electrically connects the detonator between the firing condenser and ground. The fuze is then armed.

NOTE

If deceleration begins before all the setback leaves have fallen, the setback leaves reset themselves, leaving the detonator in the out-of-line position.

(3) Activation of the battery charges the firing condenser. It normally requires 4 to 6 seconds (M517) or 7 to 9 seconds (M532) to reach operating voltage. At the same time, the oscillator in the electronic head of the fuze transmits signals, some of which are reflected by the target. The reflected signals received by the oscillator vary with the changing distance between the projectile and the target and

cause a change in the oscillator output signal which is fed to the amplifier. This output signal is intensified by the amplifier, and when the amplifier output reaches the required level, the thyratron is triggered, discharging the firing condenser through the detonator. If proximity action fails to produce an air burst, the fuze functions on impact when the trembler switch closes to discharge the firing condenser.

(4) For fuze M532, if the firing mission requires that the fuze be used as a point-detonating (impact) fuze, the nose cone is turned in excess of 120 degrees in either direction, deactivating the proximity device, and the trembler switch causes the fuze to function at impact.

4-6B.4 SAFETY PRECAUTIONS.

a. Observe the general safety precautions regarding the approach, attack, and disposal of unexploded ordnance.

b. Positively identify the fuze and round.

c. If the round is embedded in the ground, make initial withdrawal by remote means.

d. Wait one hour to allow the charge on the firing condenser to bleed off before undertaking any EOD procedures involving the fuze.

4-7. IDENTIFICATION OF PROJECTLES.

4-7.1 152MM PROJECTILES.

4-7.1.1 IDENTIFICATION.

4-7.1.1.1 NOMENCLATURE. The following 152-mm projectiles are identified in this paragraph:

TP-T projectile XM411E3, XM411E4, and XM411E5 Canister projectile XM626 (Antipersonnel)
HE-T projectile XM 657E2
HEAT-T-MP projectile XM409E5

4-7.1.1.2 TYPE.

4-7.1.1.2.1 The TP-T projectile XM411E3 is a fuzed practice round used for training in marksmanship. It contains a TNT supplementary charge as well as explosive components in the fuze. (See paragraph 4-1, PD fuze M557.) TP-T projectile XM411E4 is similar to the XM411E3 except that it is unfuzed and has no explosive components.

4-7.1.1.2.2 Projectiles XM411E3, XM411E4 and XM411E5 are practice rounds with tracer. Projectile XM411E3 contains a TNT supplementary charge and an M557 PD fuze. Projectiles XM411E4 and XM411E5 do not contain any explosive components.

4-7.1.1.2.3 The canister projectile is a flechette loaded (beehive) type designed for antipersonnel use. It carries a payload of approximately 10,000 steel flechettes, and has no explosive components or fuze.

4-7.1.1.2.4 The high explosive (HE-T) projectile is employed against light materiel and personnel. It is fitted with a PD fuze and contains a filler of TNT.

4-7.1.1.2.5 The high-explosive antitank multipurpose (HEAT-T-MP) projectile is a chemical energy, armor-defeating (shaped-charge) type with antipersonnel capability. It contains a comp B filler and is fitted with a PIBD fuze.

4-7.1.1.2.6 All 152-mm projectiles are issued as fixed rounds, assembled to XM157 combustible cartridge cases. XM157 cases are made of felted nitrocellulose and contain a bagged propelling charge and an electrically-initiated consumable primer.

4-7.1.1.3 PAINTING AND MARKING.

4-7.1.1.3.1 Target practice projectiles are painted blue with the caliber, type of weapon, type or round and model designation are stenciled in white. The lot number and date of manufacture are stenciled in black. The XM411E3 has a yellow band circling the projectile body to indicate the presence of explosive.

4–7.1.1.3.2 The canister (antipersonnel) projectile is painted olive drab with markings in white. The caliber, type of weapon, type of round, and model designation of the complete round (XM625) are stenciled on the projectile body. The model designation of the projectile (XM626), the lot number, and the date of manufacture are based on the base of the projectile body. A staggered row of white, diamond-shaped figures circles the projectile near the base, indicating that the round is flechette-loaded for antipersonnel use.

4–7.1.2 FITTINGS AND FEATURES.

4–7.1.2.1 PROJECTILE CHARACTERISTICS.

4–7.1.2.1.1 Figure 4–59 shows the external and internal arrangement of the TP–T projectile XM411E3 assembled with the M557 point-detonating fuze. A steel windshield is threaded to the projectile spike. The spike houses the supplementary charge and the fuze, and is threaded to the projectile body. A tracer is located in an aluminum base adapter. TP–T projectile XM411E4 is similar in construction except that an inert filler in the form of a metal plug is used in lieu of the supplementary charge and fuze. TP–T projectile XM411E5 may be found in two configurations. In the first configuration the projectile is a one piece construction with a solid base into which the tracer element is threaded. In the second configuration the HEAT XM 409 projectile is inert loaded. The XM411E5 may be identified from the XM409 by the base plug. The base plug of the XM411E5 has two "X" stamped 180° apart on the raised portion of the plug.

4–7.1.2.1.2 Figure 4–59.1 shows the arrangement of the canister projectile. The flechette-loaded canister has four axial grooves, located 90° apart, which extend from the forward end of the projectile for ¾ its length. A bleedhole in the base of the projectile allows propellant gases to build up inside the canister.

4–7.1.2.2 WEIGHTS.

TP–T projectile	41.8 lb.
Canister projectile	41.8 lb.
HE–T projectile	41.8 lb.
HEAT–T–MP projectile	42.8 lb.

4–7.1.2.3 MATERIALS.

4–7.1.2.3.1 The body and windshield of the TP–T projectile are made of steel. The spike and base adapter are aluminum. The rotating band is iron.

4–7.1.2.3.2 The body of the canister projectile is aluminum. The rotating band is iron, and the flechettes are fin-stabilized fragments of 8-grain steel wire.

4–7.1.2.3.3 The HE–T projectile is made of forged steel with a rotating band of gilding metal. The tracer adapter is aluminum.

4–7.1.2.3.4 The HEAT–T–MP projectile has a forged steel body containing a copper liner. The ring which locks the liner in place, the base plug and the windshield are steel. The windshield nose cap is aluminum. The rotating band is sintered iron.

4–7.1.3 HAZARDOUS COMPONENTS.

4–7.1.3.1 The TP–T projectile XM411E3 contains a supplementary charge of TNT which weighs approximately 0.30 pound.

4–7.1.3.2 The flechette-loaded canister projectile does not contain explosive components.

4–7.1.3.3 The HE–T projectile contains approximately six pounds of TNT, an M13 tracer containing 1.8 grams of igniter composition and 5.7 grams of tracer composition and a PD fuze.

4–7.1.3.4 The HEAT–T–MP projectile contains 6.3 pounds of Comp B, an M13 tracer and a PIBD fuze.

4–7.1.4 FUNCTIONING.

4–7.1.4.1 Refer to paragraph 4–1.3.3 for information on functioning of the M557 PD fuze with which the TP–T projectile is assembled.

4–7.1.4.2 Functioning of the unfuzed canister round is dependent on the propellant gases, air pressure, and centrifugal force created when the round is fired. On firing, these forces combine to cause the canister to break at the

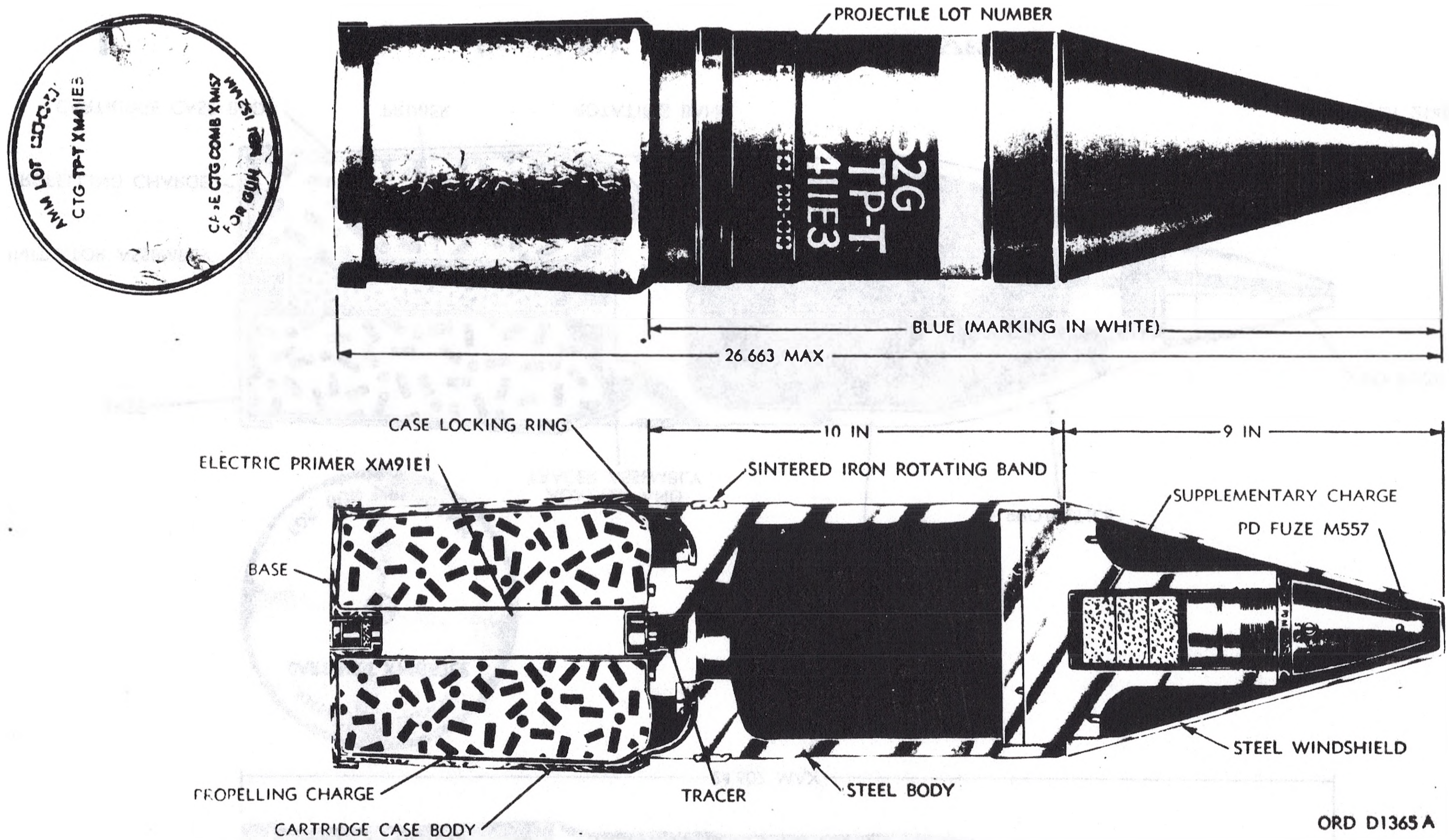

Figure 4–59 152-mm TP–T Round, XM411E3.

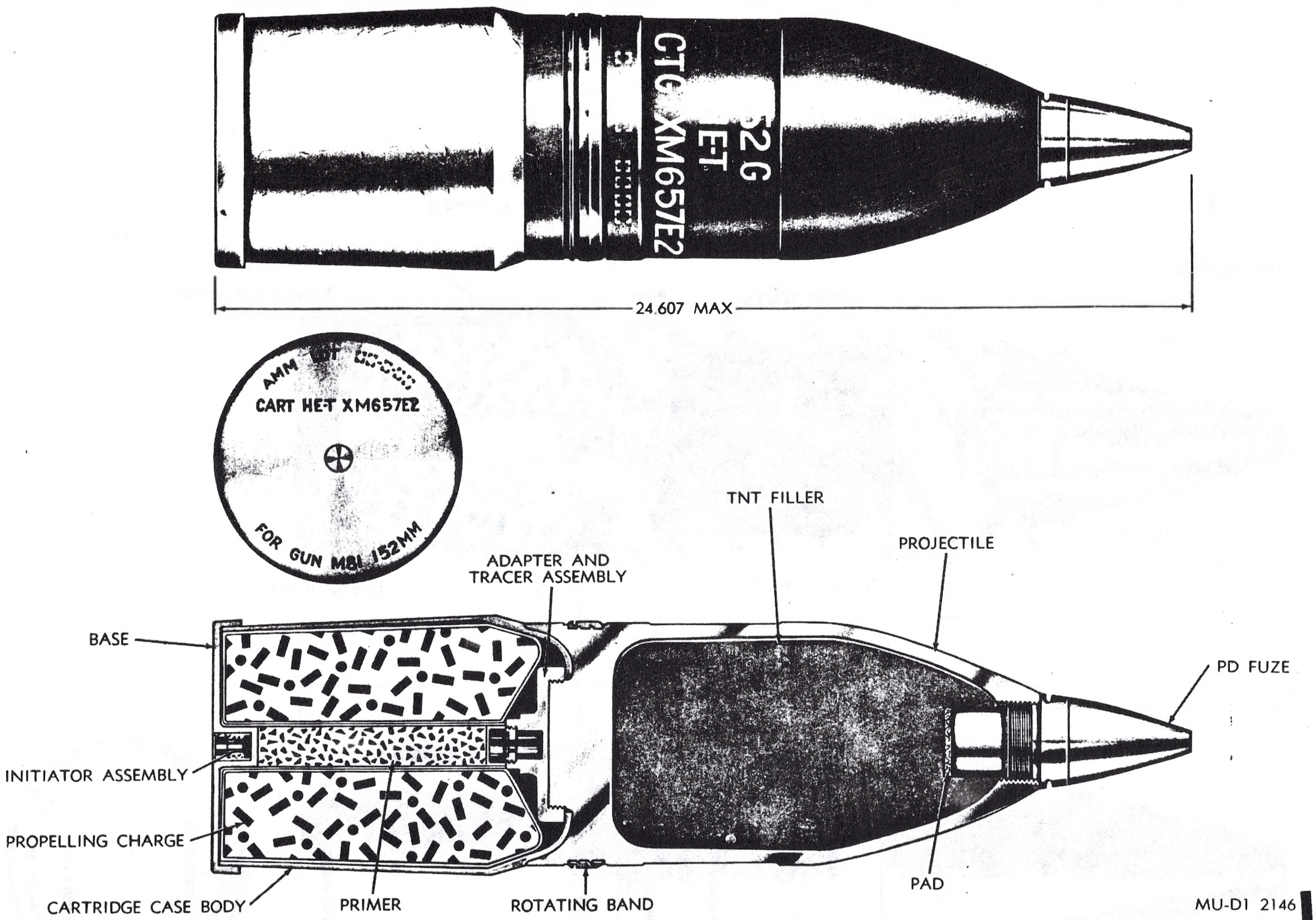

Figure 4–59.1 152-mm HE–T Round, XM657E2.

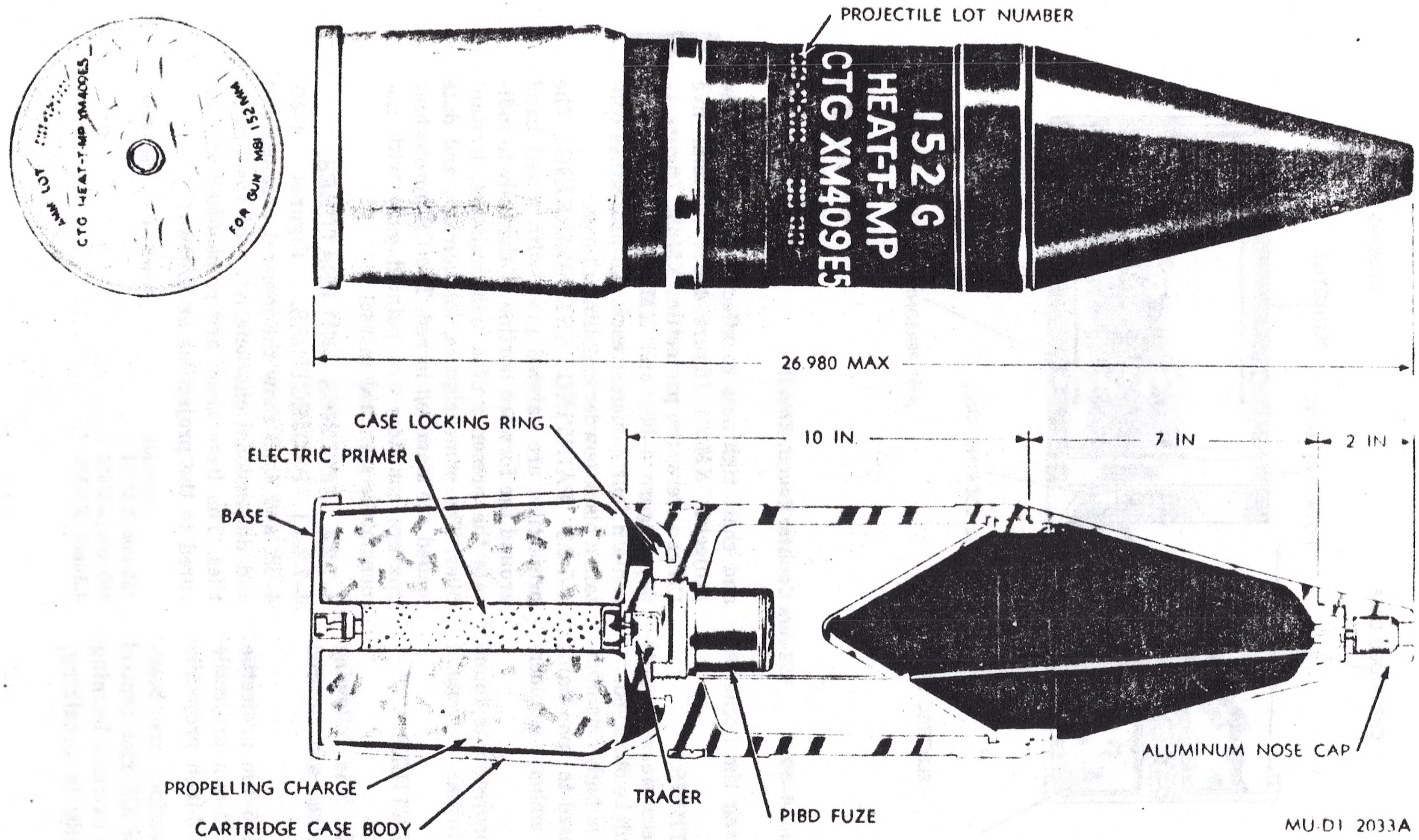

Figure 4–59.2 152-mm HEAT–T–MP Round, XM409E5

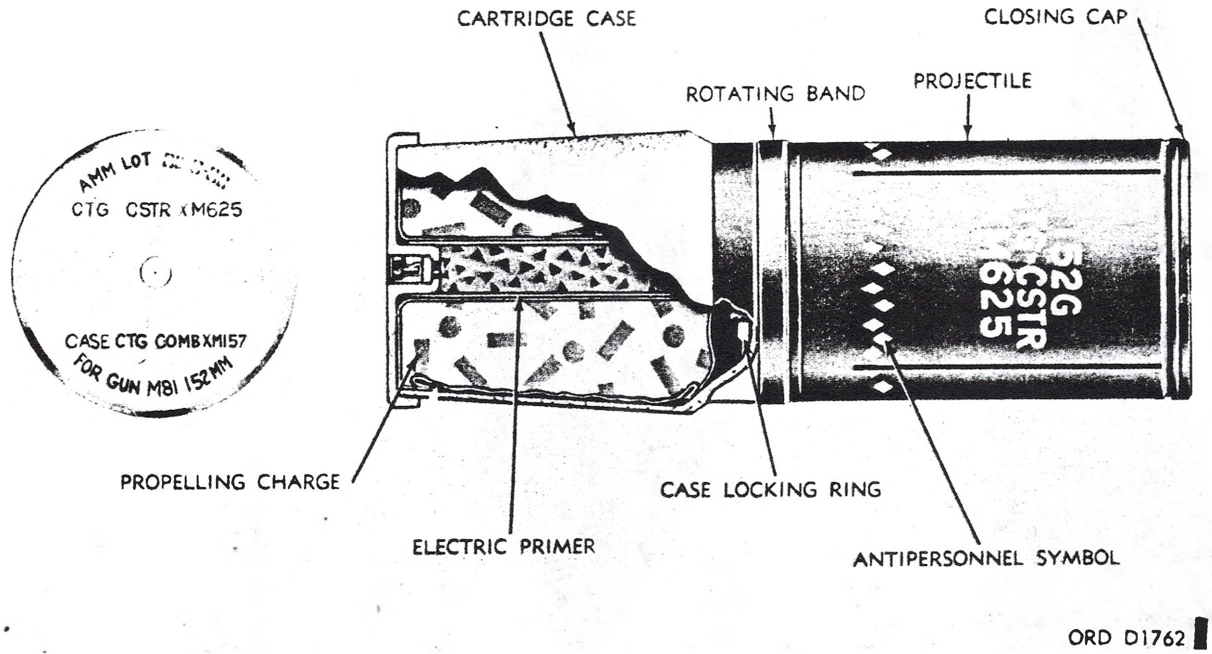

Figure 4–59.3 152-mm Canister Round, XM625

grooves on the body, dispersing the flechettes in a conical pattern.

4–7.1.5 SAFETY PRECAUTIONS.

4–7.1.5.1 General safety precautions regarding unexploded ammunition will be observed.

4–7.1.5.2 The cartridge case is highly flammable and will ignite when exposed to open flame or embers, such as cigarette embers, smoldering residue, etc.

4–7.1.5.3 If the XM411E3 projectile is found imbedded in the ground, initial movement should be made remotely.

4–7.2 TACTICAL CS PROJECTILES.

4–7.2.1 IDENTIFICATION.

4–7.2.1.1 NOMENCLATURE. The following family of tactical CS projectiles are covered herein:

XM631	155-mm projectile
XM632	105-mm projectile
XM633	4.2-inch projectile

4–7.2.2 TYPE. These projectiles are base-ejection type used to disperse CS riot control agent, an agent which causes extreme burning of the eyes, coughing, difficulty in breathing, and chest tightness to affected personnel. The projectile XM631 (figure 4–63) contains five CS canisters, the projectiles XM632 (figure 4–60) (figure 4–60) and XM633 (figure 4–62) contain four canisters each. All projectiles contain a black powder expelling charge.

4–7.2.3 PAINTING AND MARKING. The projectiles are painted gray with a red band around the forward portion of the body to indicate the presence of a nonpersistent, irritant filler. The nomenclature, lot number, and date loaded are stenciled in red. The CS pyrotechnic mixture canisters are painted gray with nomenclature stenciled in red.

4–7.2.4 FITTINGS AND FEATURES.

4–7.2.4.1 PROJECTILES. Figures 4–60, 4–62, and 4–63 show the general arrangement and dimensional characteristics of the projectiles. The base plugs are press fitted and secured to the projectiles as follows:

Projectile	*Shear Pins*	*Twist Pins*
155-mm XM631	3	
105-mm XM632	3	3
4.2-inch XM633	4	4

Figure 4-16 shows the general arrangement and characteristics of the CS canister.

4-7.2.4.2 MTSQ FUZE M548. Refer to paragraph 4-5.

4-7.2.5 WEIGHTS AND DIMENSIONS.

4-7.2.5.1 PROJECTILE WEIGHTS.

Item	*Weight (lb)*
155-mm projectile XM631	97.0
105-mm projectile XM632	32.0
4.2-inch projectile XM633	21.5

4-7.2.5.2 CS CANISTER WEIGHTS AND DIMENSIONS.

Item	*Weight (lb.)*	*Length (in.)*	*Width (in.)*
Canister XM7	5.5	3.0	5.5
Canister XM8	1.2	2.75	3.0
Canister XM9	2.0	2.0	3.75

4-7.2.6 MATERIALS. The projectile bodies are made of steel with aluminum baffle plates. The canister side, bottom, and center flash tube are made of steel. The top closure plate is aluminum.

4-7.2.7 HAZARDOUS COMPONENTS.

Component	*105-mm XM632*	*155-mm XM631*	*4.2-in. XM633*
Expelling charge—black powder (grains)	780	1,470	1,100
Canister:			
Sleeve (impregnated cloth-mixture of potassium nitrate, charcoal, and gum arabic) (grains)	2.5	3.0	2.0
Starter mixture (potassium nitrate and charcoal) (grains)	18.0	21.0	16.0
CS pyrotechnic mixture (CS, sugar, potassium chlorate and magnesium carbonate w/nitrocellulose-acetone binder)	1.0	2.0	1.0
Fuse Refer to paragraph 4 5.			

4-7.2.8 FUNCTIONING. When the projectile is fired, the fuze is armed by setback and rotational forces. The fuze functions either at a predetermined time setting or upon impact and ignites the expelling charge. The expelling charge simultaneously ignites the CS canister starter mixture and exerts a force that shears the base plate and ejects the canisters. The burning starter mixture ignites the CS pyrotechnic mixture. The CS pyrotechnic mixture burns from 35 seconds to 2 minutes for the projectiles XM632 and XM633 and from 50 seconds to 2 minutes for the projectile XM631.

4-7.2.9 SAFETY PRECAUTIONS.

4-7.2.9.1 Wear protective mask or remain upwind when performing EOD operations.

4-7.2.9.2 Wait 30 minutes before approaching an armed projectile.

4-7.2.9.3 Always remain to the side of projectile or canister when performing EOD operations.

4-7.2.9.4 Never place any portion of the hand over nose or base end of projectile.

4-7.2.9.5 Projectiles can eject canisters up to 1,000 feet.

4-7.2.9.6 The canisters constitute a fire hazard and an explosive hazard.

4-7.3 FLECHETTE-LOADED (BEEHIVE) AMMUNITION

4-7.3.1 IDENTIFICATION.

4-7.3.1.1 To facilitate identification in the field, both the complete round nomenclature and projectile model numbers are listed below:

Projectile model number (stamped on projectile)	*Complete round nomenclature (Stenciled on projectile)*
M377	90G CANISTER M377
XM594E1	90G APERS-T CTG XM580E1
XM593	90R CTG CSTR XM590
XM593E1	90R CTG CSTR XM590E1
XM380E5	105H APERS-T CTG XM546
XM595	106R APERS-T CTG XM581
XM603E1	105G APERS-T CTG XM494E3

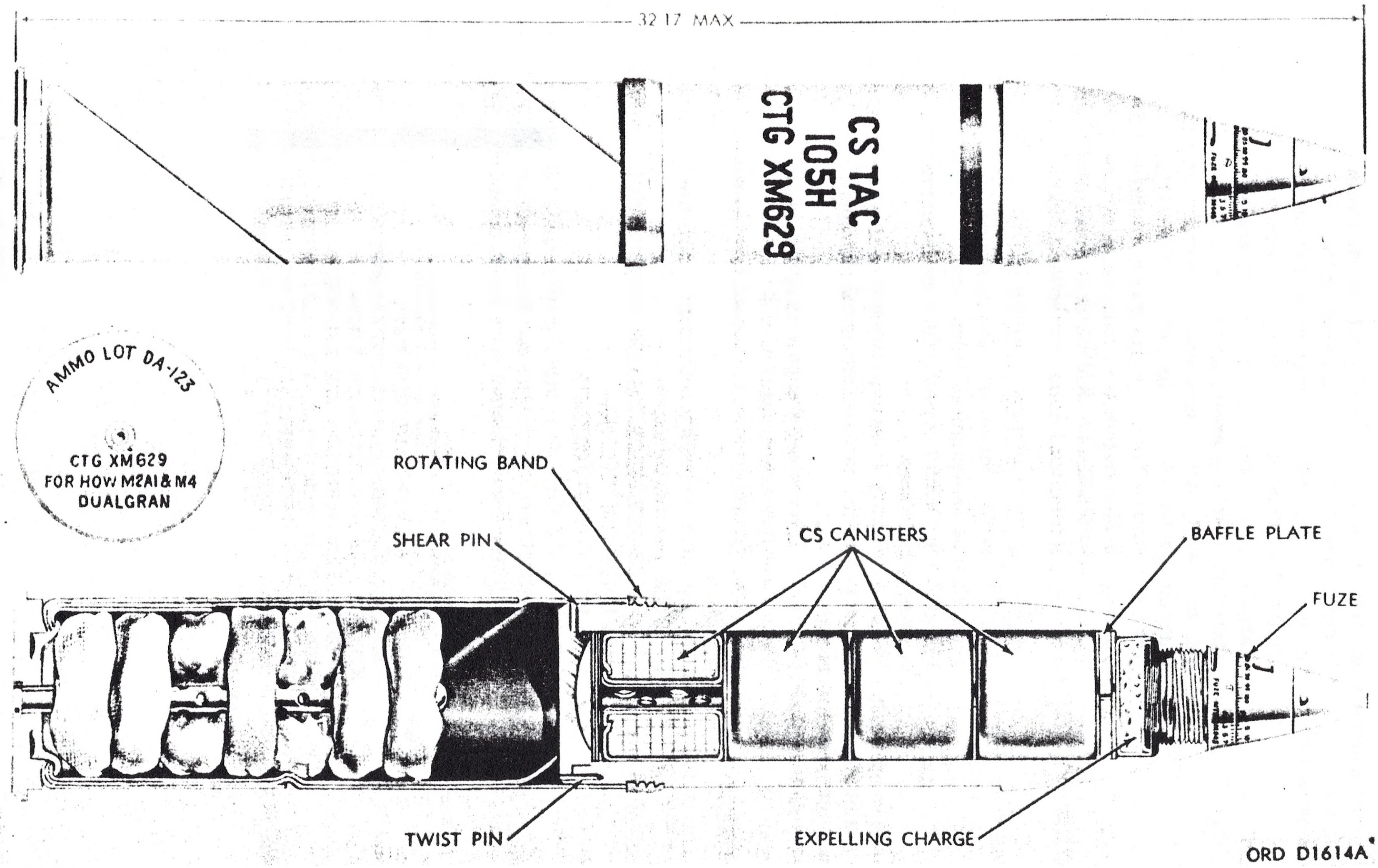

Figure 4–60 Characteristics of Cartridge XM629 with MTSQ Fuze M548 (Projectile XM632)

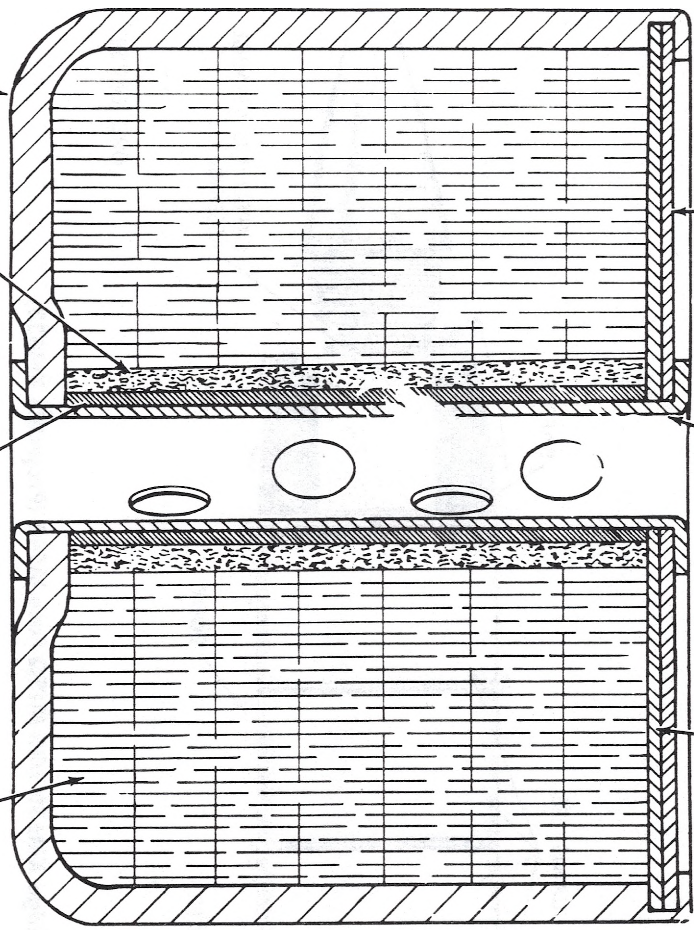

Figure 4-61 Canister XM8

4-7.3.1.2 The term "antipersonnel" is used in the nomenclature of fuzed projectiles only. Unfuzed projectiles are identified by the term "canister."

4-7.3.1.3 In the description which follows, projectiles will be referred to by projectile model number only.

4-7.3.2 TYPE. All flechette-loaded projectiles, both fuzed and unfuzed, are designed for antipersonnel use.

4-7.3.3 PAINTING AND MARKING. These projectiles are painted olive drab with marking in white. A yellow band, denoting the presence of explosive, circles fuzed projectiles forward of the nomenclature. Below the nomenclature, a staggered row of white diamond-shaped figures indicates that the projectile is flechette-loaded and intended for antipersonnel use.

4-7.3.4 FITTINGS AND FEATURES.

4-7.3.4.1 GENERAL. The payload of these projectiles consists of small, fin-stabilized fragments of steel called "flechettes."

4-7.3.4.2 XM594E1, XM380E5, XM603E1, and XM595 PROJECTILES (figure 4-64). The fuzes used with these projectiles are described in paragraph 4-5. The flechettes are loaded in bay assemblies held in place in the projectile by a fuze adapter at the forward end and a hollow steel base at the rear. A steel flash tube extends through the center of the projectile from the base to the fuze adapter.

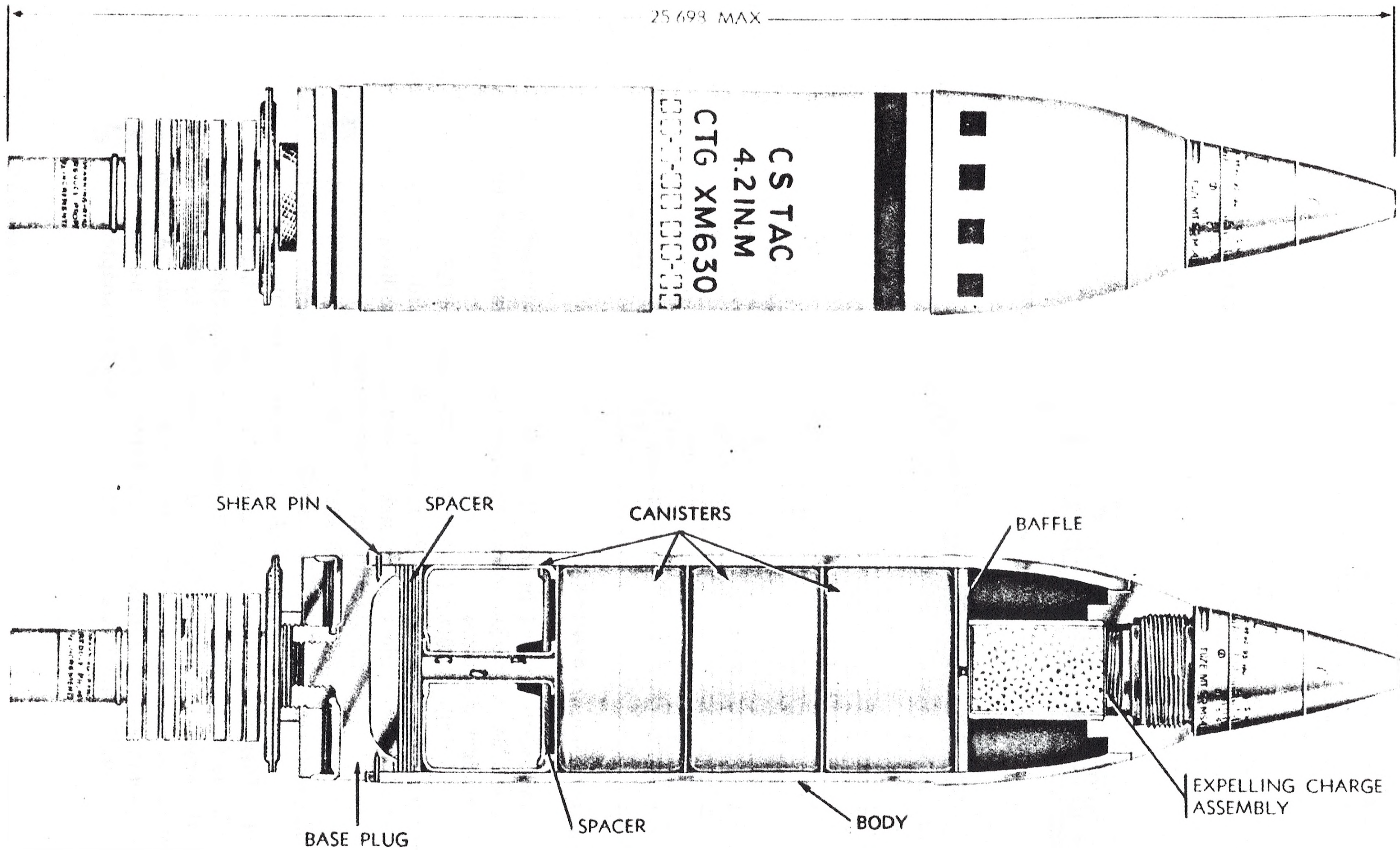

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Figure 4–62 Characteristics of Cartridge XM630 with MTSQ Fuze M548 (Projectile XM633)

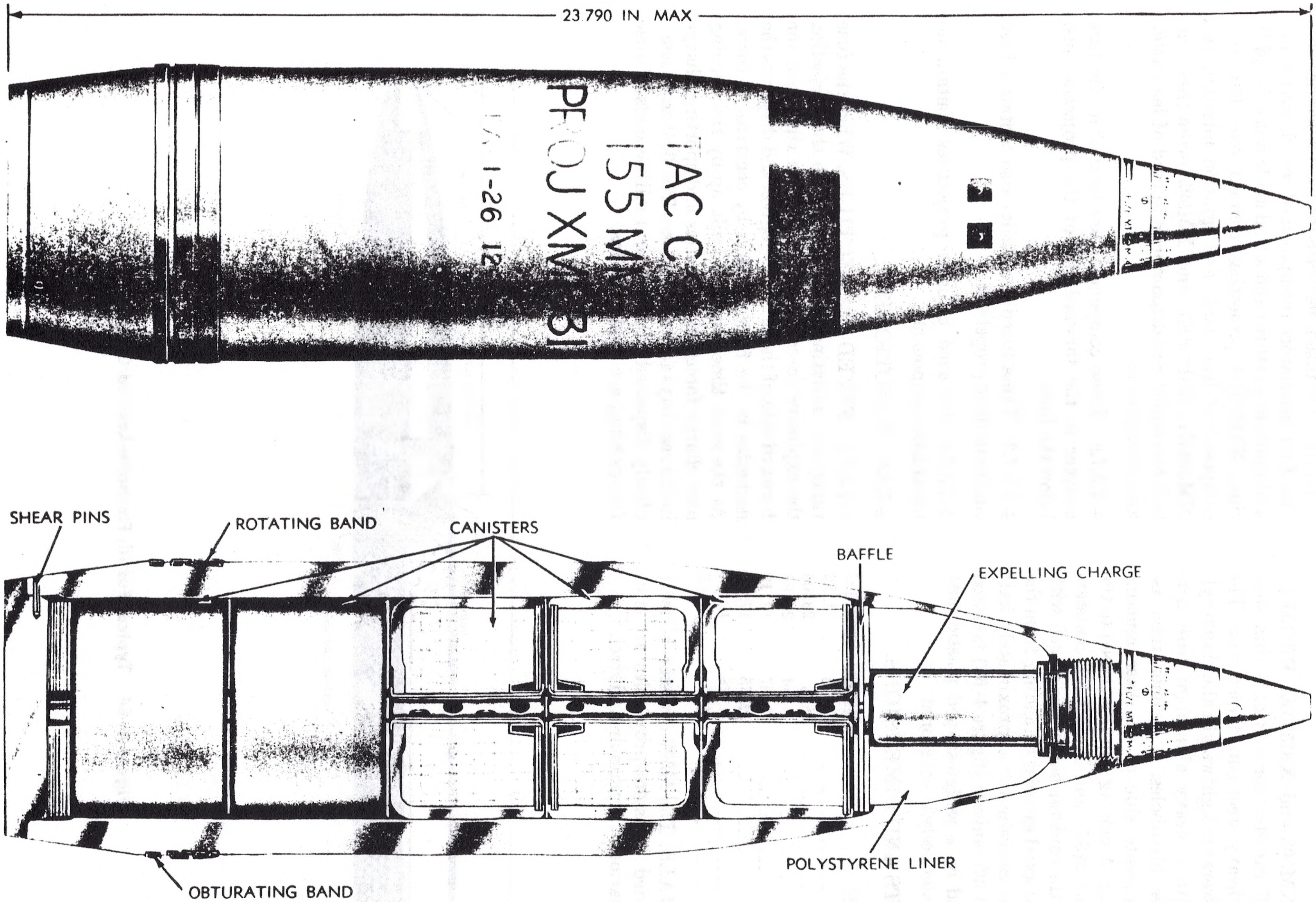

Figure 4–63 Characteristics of Projectile XM631.

The projectile also contains a dye marker, tracer, and base charge.

4–7.3.4.3 M377, XM593 and XM593E1 PROJECTILES. The M377 canister consists of a thin steel body welded to a heavy steel cup-shaped base. The XM593 series canisters are lightweight aluminum cylinders assembled to a heavy aluminum base perforated with three bleedholes. A primer tube assembled to the opposite side of the base remains attached after firing. A closing cup is crimped to the forward end of the M377 and XM593E1 canisters (figure 4–65) and the canister bodies are scored with four equally spaced axial grooves extending from the forward end of the canister for approximately half its length. The XM593 canister (figure 4–66) is closed at the forward end by a wedge-shaped plastic nose block, and the canister body is not scored.

4–7.3.5 WEIGHTS AND DIMENSIONS.

Projectile	Weight (lb.)	Length (in.)
M377	23. 75	11. 32
XM380E5	28. 3	23. 06
XM593	4. 41	20. 83
XM593E1	3. 97	19. 12
XM594E1	22. 75	17. 73
XM595	21. 78	19. 81
XM603E1	31. 0	14. 65

4–7.3.6 MATERIALS. The M377 canister is steel; other flechette-loaded canisters/projectiles are aluminum or a combination of aluminum and steel.

4–7.3.7 HAZARDOUS COMPONENTS.

4–7.3.7.1 All fuzed, flechette-loaded projectiles contain four detonators (composed of tetryl, lead azide and ignition mixture) and a lead azide relay. In addition, XM380E5 projectiles contain one detonator composed of lead azide and ignition mixture, and XM594E1, XM603E1, and XM595 projectiles contain one additional detonator composed of lead azide and black powder.

4–7.3.7.2 These components are located in the fuze adapter in the forward end of the projectile, just below the fuze.

4–7.3.7.3 These fuzed projectiles also contain a base charge of flake propellant.

4–7.3.7.4 Unfuzed canister projectiles contain no hazardous components.

4–7.3.8 FUNCTIONING.

4–7.3.8.1 FUZED PROJECTILES. When the fuze functions, initiating the detonators in the projectile, the explosive force of the detonators rips open the forward skin of the projectile ogive, and disperses the flechettes in the forward bays by centrifugal force. At the same time, pressure built up by the burning base charge forces the flechettes and sporting charge in the rear bays forward and out. The flechettes, completely dispersed within several milliseconds of fuze functioning, are projected for

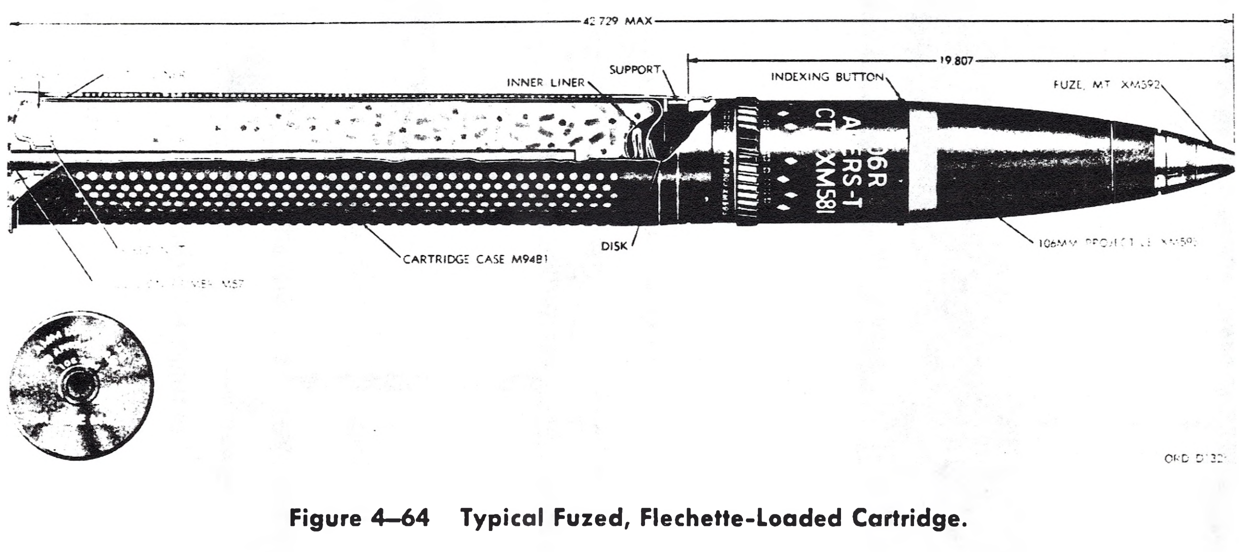

Figure 4–64 Typical Fuzed, Flechette-Loaded Cartridge.

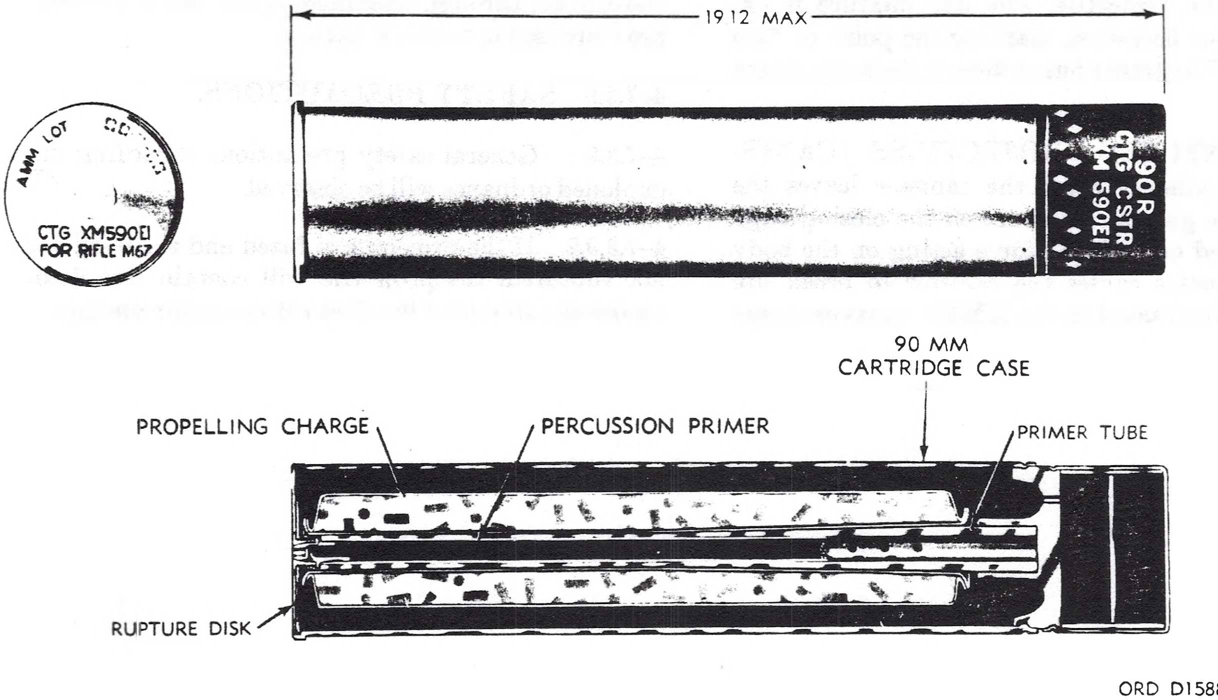

Figure 4–65 90-mm Canister Cartridge XM590E1 (Projectile XM593E1).

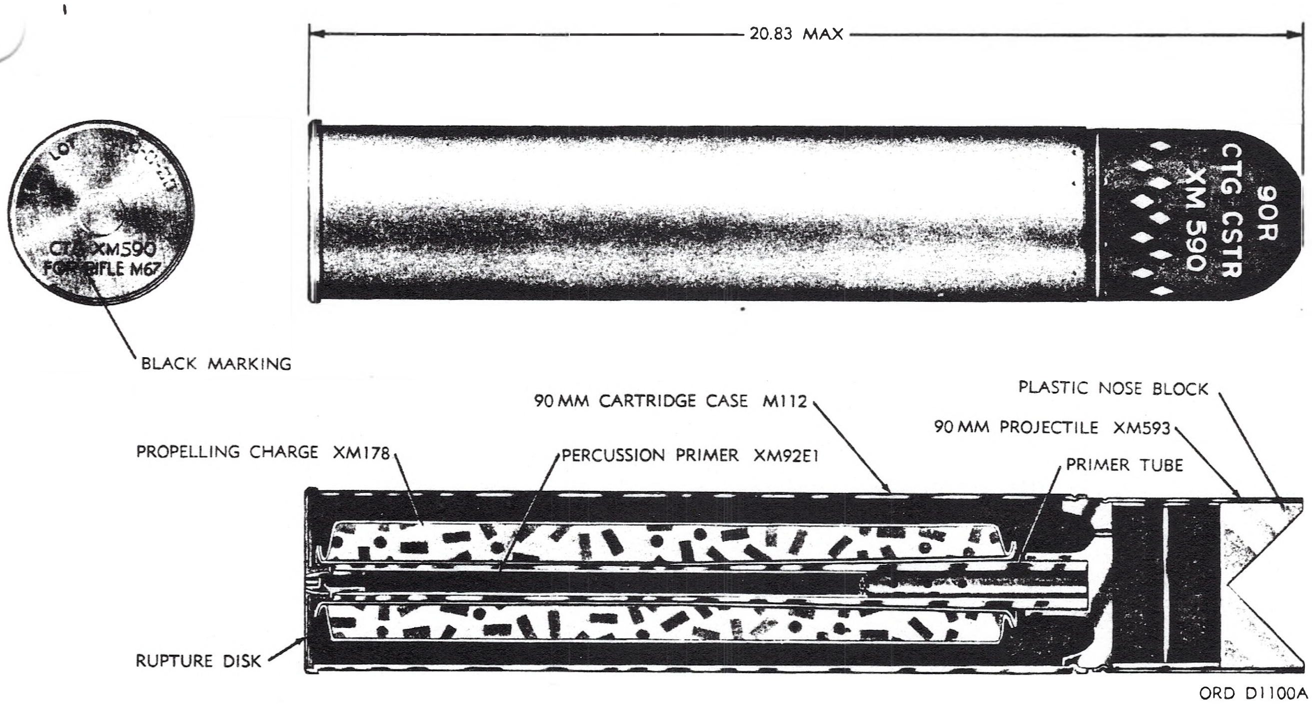

Figure 4–66 90-mm Canister Cartridge XM590 (Projectile XM593.

ward in a conical pattern by the rotational force and velocity of the projectile. The dye mixture is expelled with the flechettes, marking the point of fuze functioning. The tracer burns during the early stages of flight.

4–7.3.8.2 UNFUZED PROJECTILES (CANISTER). Immediately after the canister leaves the muzzle of the gun, air pressure on the closing cup/ nose block and centrifugal force acting on the body and the flechettes causes the canister to break up. Break-up is facilitated in the XM593 series canisters by pressure from the propellant gases which feed into the canister through bleedholes in the base. Flechettes are dispersed in a conical pattern.

4–7.3.9 SAFETY PRECAUTIONS.

4–7.3.9.1 General safety precautions regarding unexploded ordnance will be observed.

4–7.3.9.2 If the projectile is fuzed and the body has not ruptured, the projectile will contain live detonators and should be handled with appropriate care.

4–7.4 16-INCH PROJECTILE.

4–7.4.1 NOMENCLATURE. Projectile, 16-inch: high-explosive, MK 19 MOD 0.

4–7.4.1.2 TYPE. The MK 19 MOD 0 projectile is a submissile (grenades M43A1), airburst, antipersonnel munition, fuzed with the mechanical time fuze M565E1.

4–7.4.2 PAINTING AND MARKING.

4–7.4.2.1 The projectiles are painted olive drab with markings stenciled in yellow (fig. 4–67). The forward portion (18.56-inches) is painted yellow, with a row of thirteen yellow diamonds (3 x 2 inches) equally spaced around the projectile. In addition, the rotating band and base plug are stamped with MK and MOD numbers.

4–7.4.3 FITTING AND FEATURES.

4–7.4.3.1 PROJECTILE CHARACTERISTICS.

4–7.4.3.2 Figure 4–68 shows the external and internal arrangement of the high-explosive projectile MK 19 MOD 0 assembled with the mechanical time fuze M565E1. The MK 19 MOD 0 projectile is comprised of a steel shell body (approximately 3 inches thick), a nose section, an expulsion charge, fuze adapter, and mechanical time fuze. The inner body of shell houses a pusher plate and 400 grenades M43A1. The grenades are arranged in 20 layers with 20 grenades in each layer. The grenades are wedged-shaped and are held in place by a plastic spacer, and each layer is separated by a metal disc. The payload is retained by a base plug, which is retained by 6 shear pins.

4–7.4.3.3 Distinguishing features of the MK 19 MOD 0 projectile are six 3/16-inch diameter holes, equally spaced around the circumference 0.80 inch from the base end. The base end is fitted with a base plug which is expelled during functioning.

4–7.4.4 WEIGHTS AND DIMENSIONS.

Projectile with fuze:

Weight (approx)	1,900 lb
Length (approx)	64.0 in.
Diameter (max)	16.0 in.

4–7.4.5 MATERIALS.

4–7.4.5.1 The body of the MK 19 MOD 0 projectile is made of steel. The rotating band is copper.

4–7.4.6 HAZARDOUS COMPONENTS.

4–7.4.6.1 The MK 19 MOD 0 projectile consists of 400 grenades M43A1 containing 21 pounds of RDX total explosive weight, an M9 propellant of 400 grams, and an MT fuze container approximately 8.32 grains of primer mix, lead azide, RDX, tetryl, and black powder.

4–7.4.7 FUNCTIONING.

4–7.4.7.1 After the projectile is fired, the fuze M565E1 (having been set to function at a predetermined time) initiates the expulsion charge while the projectile is in flight. The pressure created by the expulsion charge acts upon the pusher plate forcing it aft. This action shears the shear pins in the base plug expelling the grenades from the base of the projectile. The spin of the projectile disperses the grenades.

4–7.4.8 SAFETY PRECAUTIONS.

4–7.4.8.1 General safety precautions regarding unexploded ordnance must be observed.

4–7.4.8.2 Do not jar, strike, or move an armed projectile.

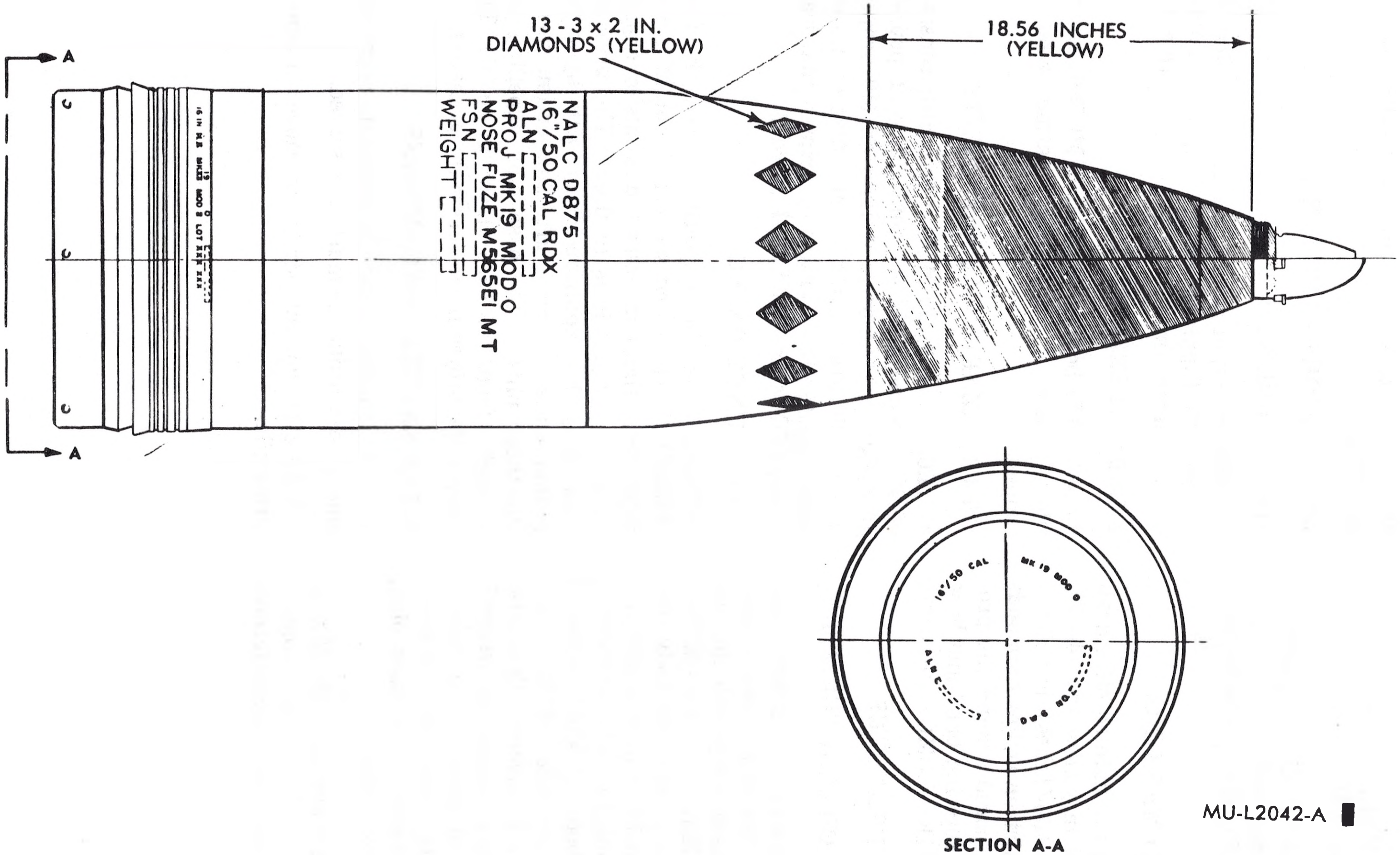

Figure 4–67 High-Explosive 16-Inch Projectile MK 19 MOD 0

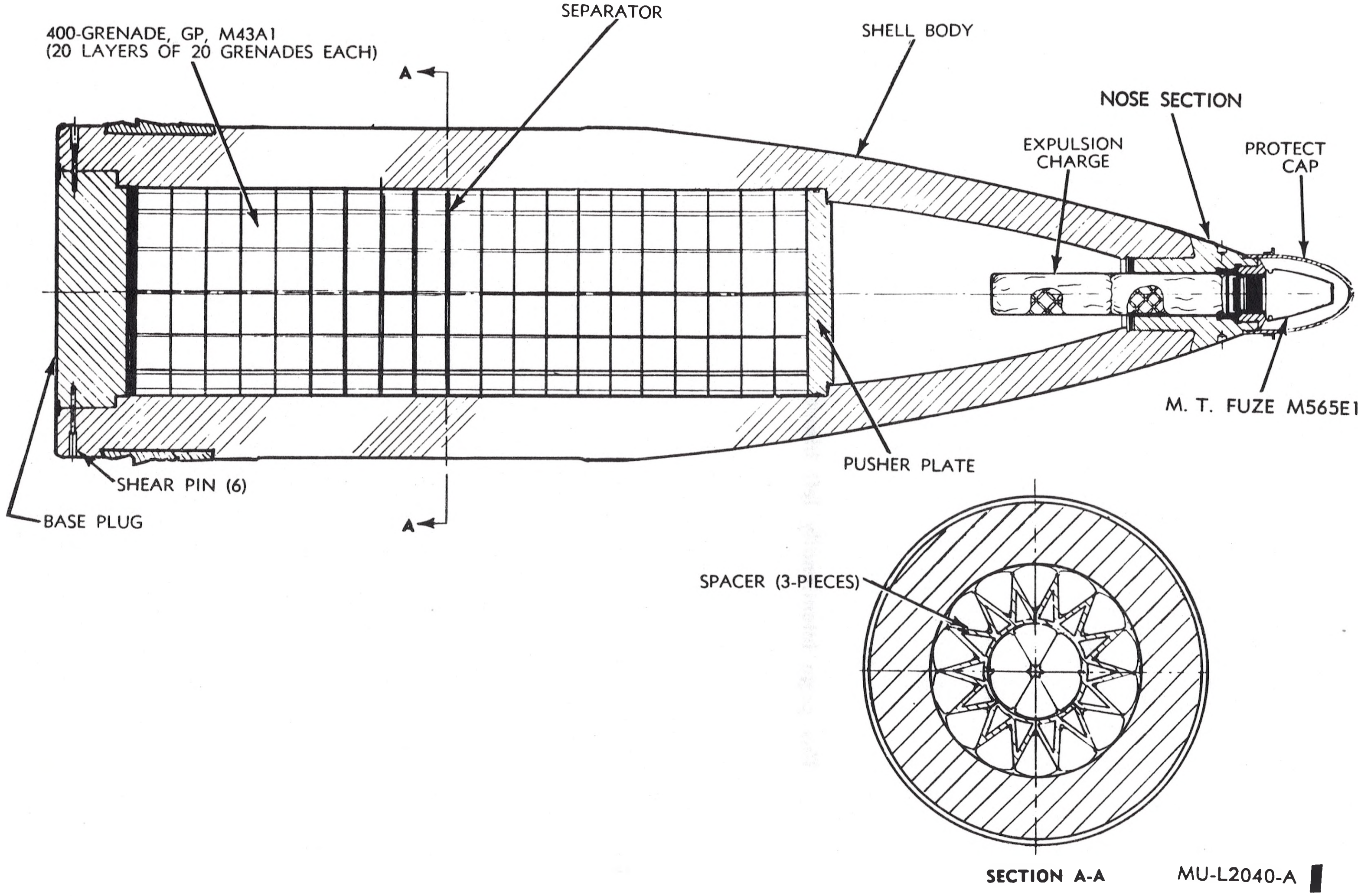

Figure 4–68 High-Explosive 16-Inch Projectile MK 19 MOD 0—Cross Section

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SECTION 5

BOMBS

5–1 NOSE FUZES (IMPACT AND INERTIAL)

Nose fuzes M3, M142, M142A1, M197, M103, AN–M103, AN–M103A1, M139, AN–M139A1, M140, AN–M140A1, M148, M163, M164, M165, M186, M187, AN–M104, M104, M109, M120, AN–M120, M120A1, AN–M120A1, M170, M105, M108, M110, AN–M110A1, M126, AN–M126, AN–M126A1, M158, AN–M158, M159, AN–M159, M193 (T778), M149, M904 (T709E4), M904E1, and M904E2 are covered in this paragraph.

5–1.1 IDENTIFICATION.

5–1.1.1 TYPE. Fuzes of this type are arming pin or arming vane operated and delay armed. They function on contact with the target. Their action can be instantaneous or delayed.

5–1.1.2 PAINTING AND MARKING. The fuzes are unpainted and are marked either by stenciling or stamping the type, model, lot number, and delay time on the fuze body. Fuzes are marked to indicate differences in delay or arming time and some fuzes have the vane cups painted for this purpose.

5–1.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5–1 through 5–9. The fuzes M104, AN–M104, M109, M120, M120A1, AN–M120A1, and M170 contain an arming pin which is off center and protrudes from both sides of these fuzes. The fuzes M3, M142, M142A1, M197 M4, and M150 contain wrench holes in the top surface of the head.

5–1.1.4 MATERIALS. These fuzes are made of aluminum, steel, or cadmium, or zinc-plated steel, as indicated below.

5–1.1.4.1 ALUMINUM. M904 (T709E4), M904E1, M904E2, M104, AN–M104, M109, M120, AN–M120, M120A1, AN–M120A1, M170.

5–1.1.4.2 STEEL. M103, AN–M103, AN–M103A1, M139, AN–M139A1, M140, AN–M140A1, M148, M163, M164, M165, M186, M187, M3, M142, M142A1, and M197.

5–1.1.4.3 ZINC OR CADMIUM PLATED STEEL. M110, AN–M110A1, M126, AN–M126, AN–M126A1, M158, AN–M158, M159, AN–M159, M193, M149, M108, and M105.

5–1.2 HAZARDOUS COMPONENTS.

5–1.2.1 DETONATORS.

5–1.2.1.1 PRIMER MIXTURE, LEAD AZIDE, AND TETRYL: Fuzes M110, AN–M110A1, M126, AN–M126, AN–M126A1, M158, AN–M158, M159, AN–M159, M193, M904, M904E1, M904E2, M103, AN–M103, AN–M103A1, M139, AN–M139A1, M140, AN–M140A1, M148, M163, M164, M165, M186, M187, M105, M108, M149, AN–M104, M109, M120, AN–M120, M120A1, AN–M120A1, and M170.

5–1.2.1.2 FULMINATE OF MERCURY: Fuze M104.

5–1.2.2 BOOSTERS.

5–1.2.2.1 TETRYL: Fuzes AN–M158, M158, M110, AN–M110A1, M159, AN–M159, M193, M904, M904E1, M904E2, M149, M103, AN–M103, AN–M103A1, M139, AN–M139A1, M140, AN–M140A1, M148, M163, M164, M165, M186, M187, M120, AN–M120, M120A1, AN–M120A1, M170, M109, AN–M104, and M104.

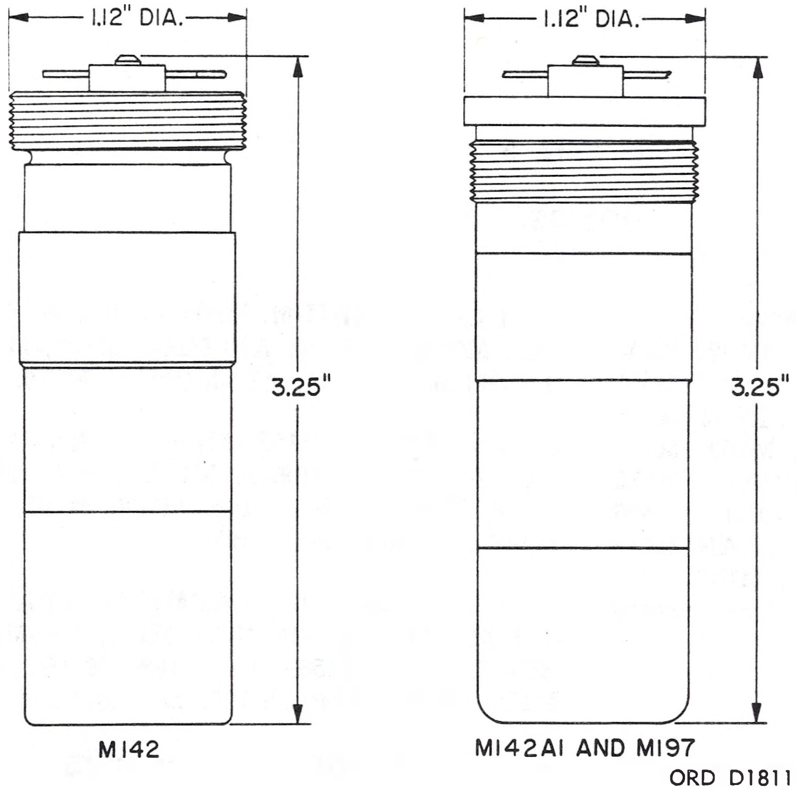


Figure 5-1 Dimensional Characteristics of Fuzes M142, M142A1, and M197

5-1.2.2.2 NO BOOSTER: Fuzes M126, AN-M126, AN-M126A1, M105, and M108.

5-1.2.3 LEAD CHARGE.

5-1.2.3.1 TETRYL: Fuzes M158, AN-M158, M193, M904, M904E1 and M904E2.

5-1.2.4 DELAY.

5-1.2.4.1 BLACK POWDER, LEAD AZIDE RELAY: M904, M904E1, M904E2, M103, AN-M103, AN-M103A1, M139, AN-M139A1, M140, AN-M140A1, M148, M163, M164, M165, M186, M187 and M105.

5-1.3 FUNCTIONING.

5-1.3.1 FUZES M3, M142, M142A1, and M197 (figures 5-10 and 5-11).

a. When a bomb using one of these fuzes is assembled in the cluster, the retaining wire is removed. A spring-loaded release clip, which is assembled to the bomb, holds the release pin and arming pin in place in the fuze head. While the bombs are in the cluster, their proximity holds the release clip to the body of the bomb and fuze.

b. When the cluster is dropped from an aircraft, the cluster adapter arming wire is withdrawn. The cluster adapter disintegrates either immediately (quick-opening) or upon completion of the functioning time of a mechanical time fuze. As the cluster adapter disintegrates, the clustered bombs are released.

c. As the clustered bombs are released from the cluster adapter to drop freely, the release clip falls away from the bomb.

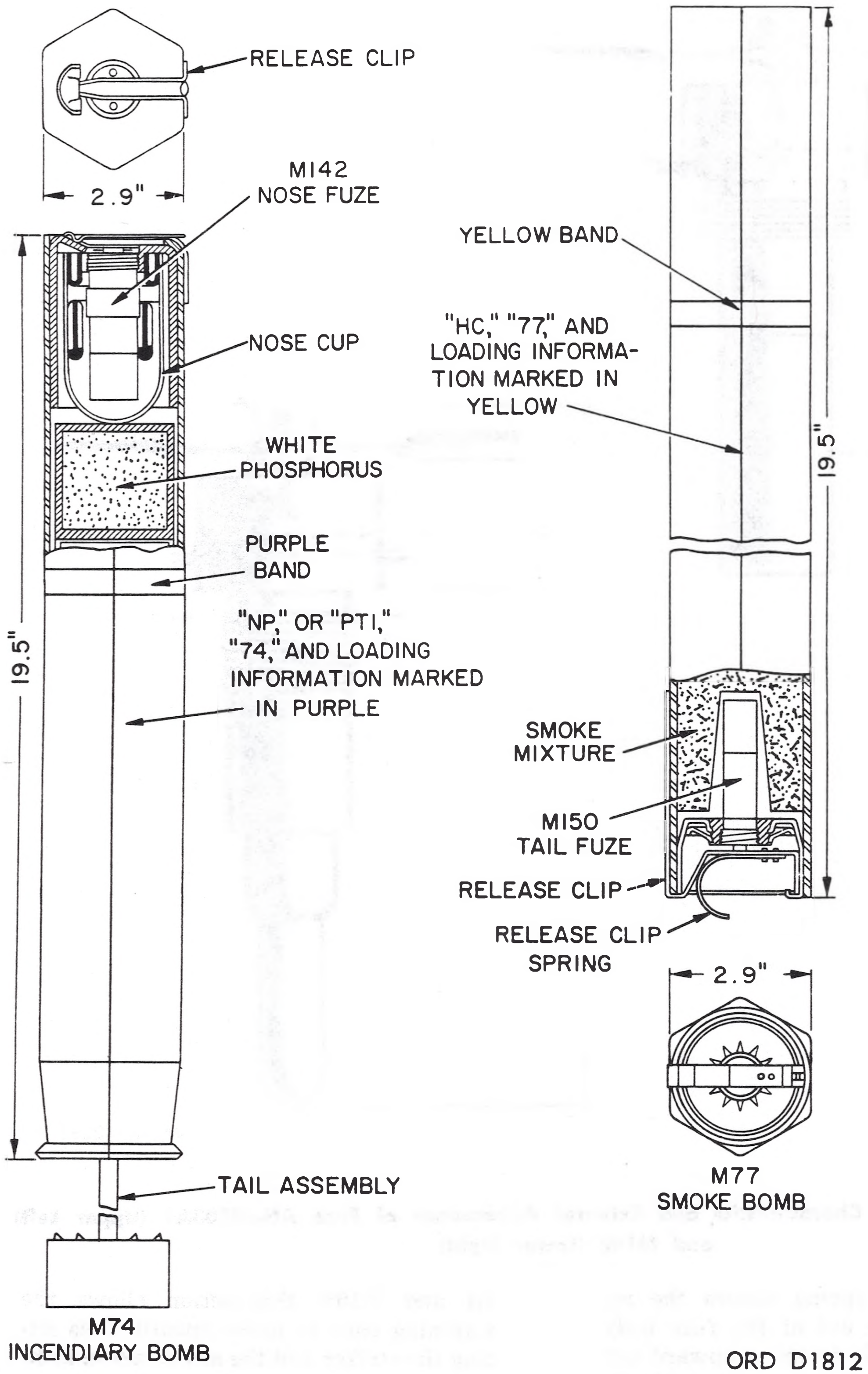


Figure 5–2 Views Showing Fuzes M142 and M150 Assembled in Bombs M74 and M77 Respectively

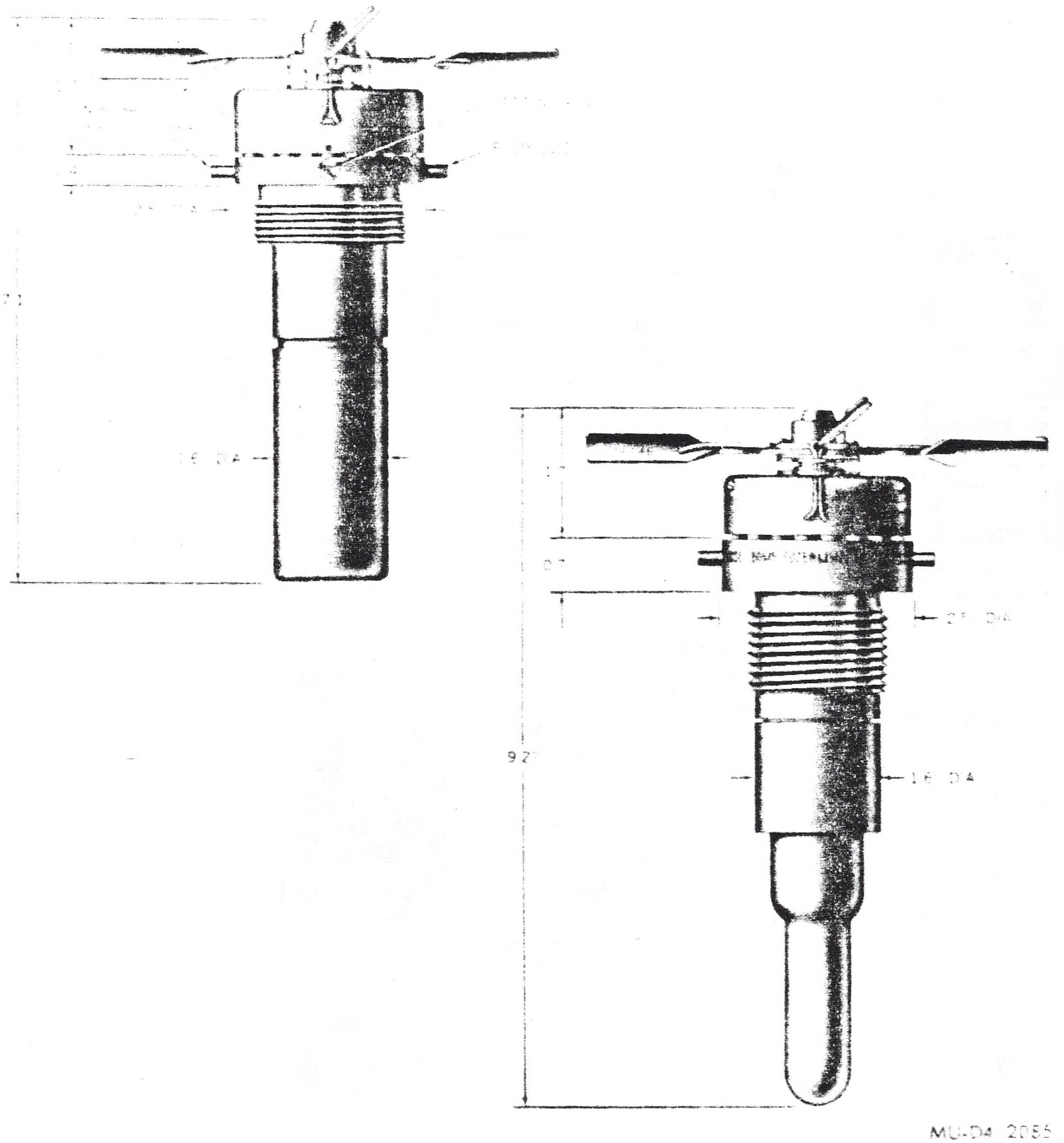


Figure 5-3 Dimensional Characteristics and External Appearance of Fuze AN-M103A1 (Upper Left) and M148 (Lower Right)

The arming pin spring causes the release pin to move out of the fuze body and the arming pin to move upward out of the striker cavity. In the fuzes M142-E1 and M197, this action allows the retaining balls to move inward, thus letting the striker and the sleeve move, arming the fuze. In all of the other fuzes,

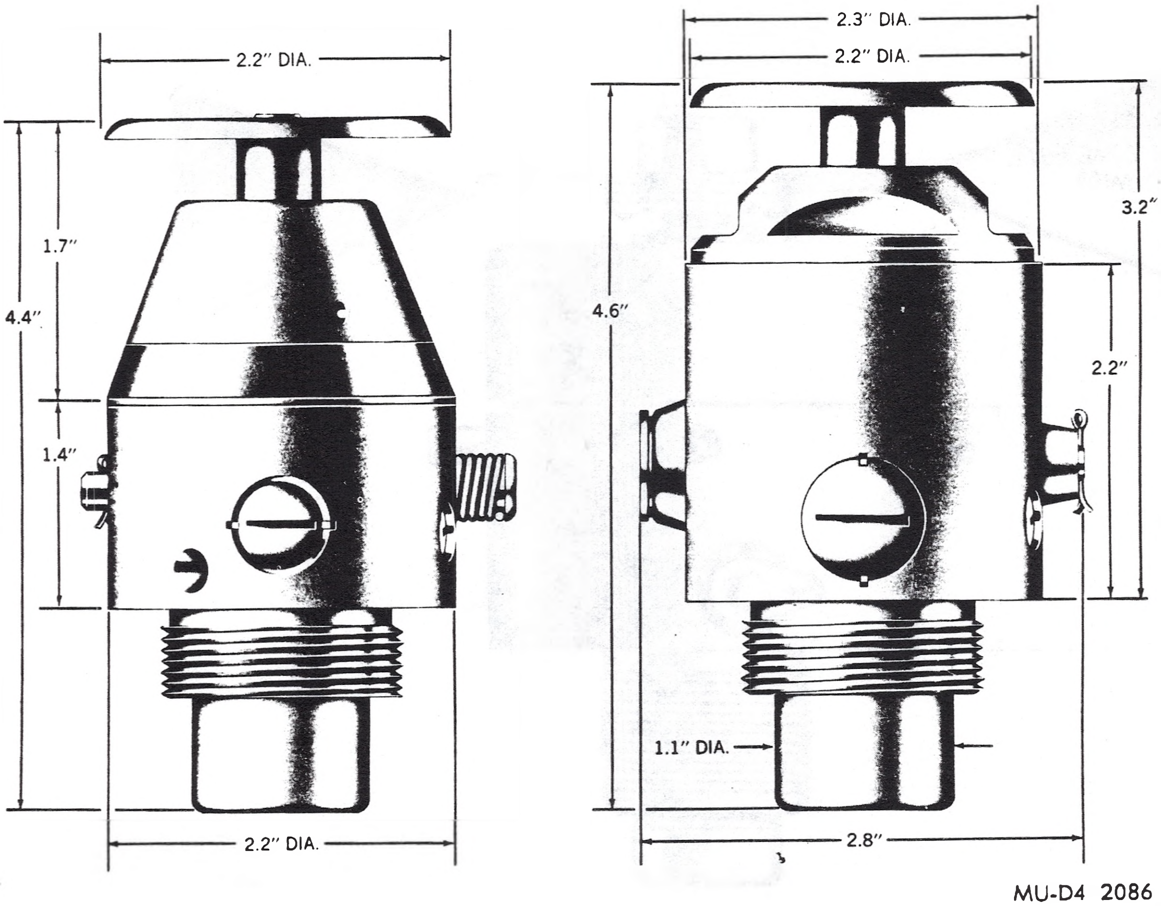


Figure 5-4 Dimensional Characteristics: Pyrotechnic Delay Arming Type Fuze M104 (Left); Mechanical Delay Arming Type Fuze M120 (Right)

this action allows the safety pin spring to push the safety pin inward, thus letting the striker and the sleeve move, arming the fuze.

d. Upon any angle impact, the striker and sleeve are forced together, thus causing the firing pin to impinge on and initiate the primer. The primer initiates the remainder of the explosive train.

5-1.3.2 FUZES M103, AN-M103, AN-M103-A1, M139, AN-M139A1, M140, AN-M140A1, M148, M163, M164, M165, M186 and M187.

a. The main illustration in figure 5-12 shows the general arrangement of the fuze AN-M103A1 in the unarmed condition. In this condition the arming stem holds the slider so that the detonator is not aligned in the explosive train. The striker is held in position by the shear pin and setting pin, and the safety discs place a positive block between the striker and the fuze body.

b. Fuzes AN-M139A1 and AN-M140A1 are identical in construction to the fuze AN-M103A1, and the M148 has the same internal components as the fuze AN-M103A1.

c. Fuzes M163, M164, M165, M186 and M187 are the same as the fuze AN-

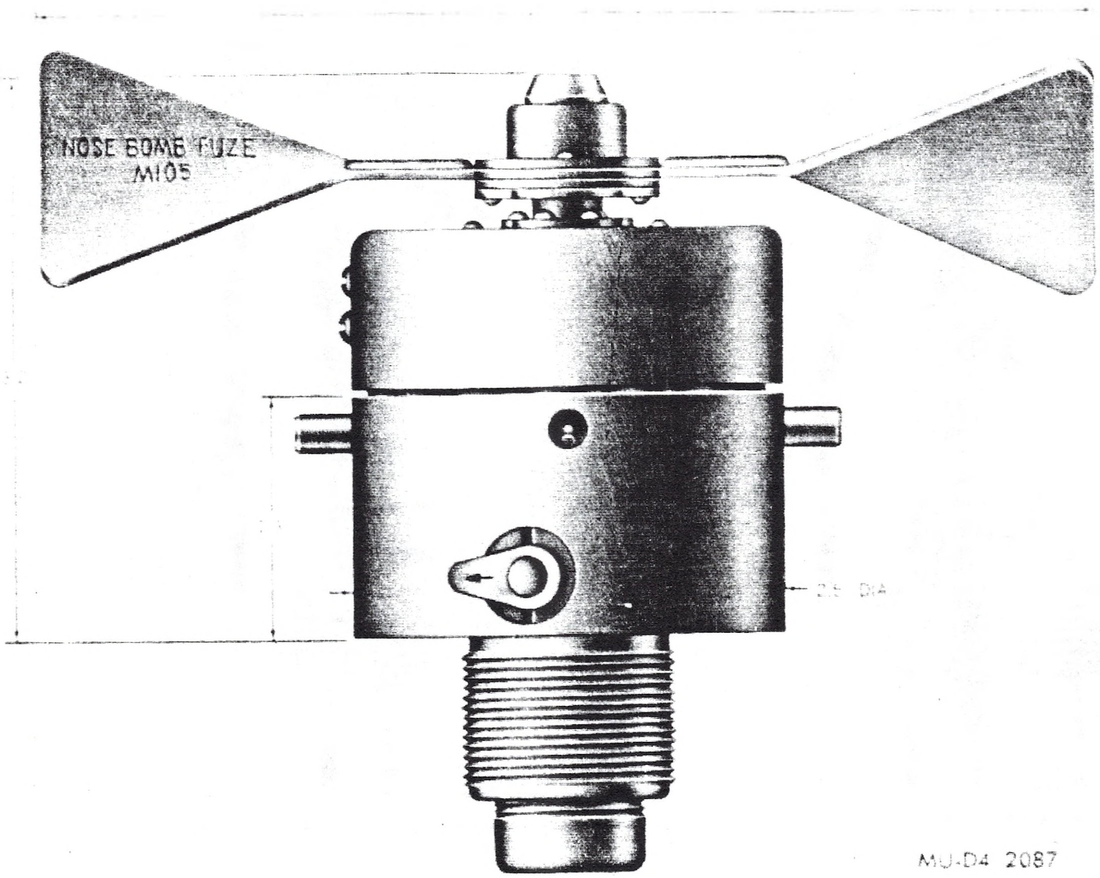


Figure 5–5 Characteristics and Dimensions of Fuze M105

M103A1 except for the arming screw-striker-shear safe arming stem arrangement shown in the upper left inset of figure 5–12. Fuzes AN–M103, M139, and M140 are the same as fuze AN–M103A1 except for the arming screw-striker-non-shear safe arming stem arrangement shown in the upper right inset of figure 5–12. Fuze M103 is identical to fuze AN–M103 except for the number of threads per inch on the arming screw.

d. When the bomb is released, the arming wire is withdrawn from the fuze and the airstream rotates the arming vane. This rotation is transferred through the reduction gears to the arming screw which unthreads from the striker. As the arming screw unthreads, it lifts the entire vane assembly, including the vane cup, clear of the safety discs, which are ejected from the fuze by the discharge spring. This leaves the striker secured only by the shear pin and setting pin. Also, as the arming screw unthreads, the arming stem rises. The action that follows depends on the fuze setting.

(1) If the fuze is set for delay action, the setting pin is in the deep slot and protrudes into the arming stem channel. When the arming stem moves enough to clear the step in the slider, the slider, under pressure of its two springs, moves to align the detonator between the delay column and one of

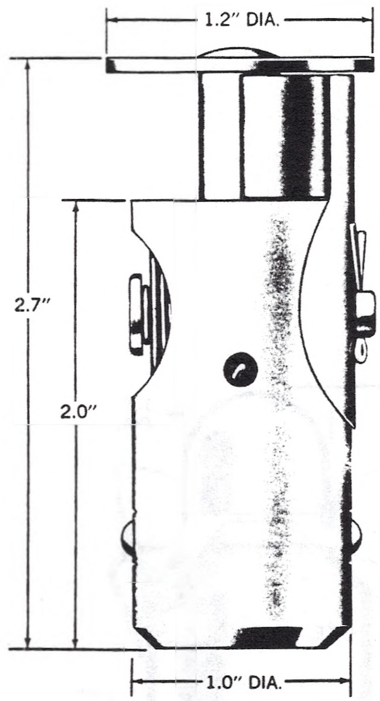


Figure 5–6 General Arrangement and Dimensional Characteristics of Fuze M108

the leads. A spring-loaded detent prevents return of the slider to its unarmed position, and the setting pin prevents any further movement of the arming stem. Upon impact, the striker shears the shear pin and the setting pin, and the delay firing pin strikes the primer, initiating the delay explosive train.

(2) <u>If the fuze is set for instantaneous action</u>, the setting pin is in the shallow slot and does not protrude into the arming stem channel. When the arming stem moves out of the slider cavity, the slider moves to align the detonator between the instantaneous firing pin and the other lead. Upon impact, the instantaneous firing pin impinges the detonator, initiating the instantaneous explosive train. The delay firing pin always strikes the primer, igniting the delay column, which may fire the fuze if the detonator fails to function.

e. The arming screw continues to unthread until it clears the striker entirely, or until impact, whichever occurs first. If the arming screw clears the striker before impact, the vane cup falls away from the fuze, leaving the striker exposed as shown in figure 5–13.

5–1.3.3 FUZES M104, AN–M104, M109, M120, AN–M120, M120A1, AN–M120A1, and M170 (figures 5–14 through 5–16).

a. When a bomb using one of these fuzes is dropped from a single suspension position in an aircraft, the parachute pullout wire is withdrawn. This releases the parachute cover assembly. If the bomb (see figure 5–14) is dropped as part of a cluster, the parachute cover assembly is released when the cluster opens.

b. As the airstream carries away the parachute cover assembly, the parachute is pulled out of the parachute housing. When the main suspension cord of the parachute extends, it withdraws the fuze arming wire from the arming pin. Subsequent action depends on the fuze, pyrotechnic or mechanical delay arming type.

5–1.3.3.1 PYROTECHNIC DELAY ARMING TYPE FUZE. As the fuze arming wire is withdrawn, the arming pin spring ejects the arming pin. See figure 5–15. Ejection of the arming pin frees the delay firing pin which strikes the primer igniting the pyrotechnic delay arming train. The delay arming train burns for a short time and then ignites the body pellet of black powder which detonates the arming charge. The arming charge blows out the disc and plug, allowing the spring-loaded slider to force the plunger out of the fuze and move the detonator directly below the firing pin. The slider is locked in the in-line position by a spring-loaded detent. Upon impact, the striker plate is forced in, driving the firing pin into the detonator to initiate the fuze explosive train.

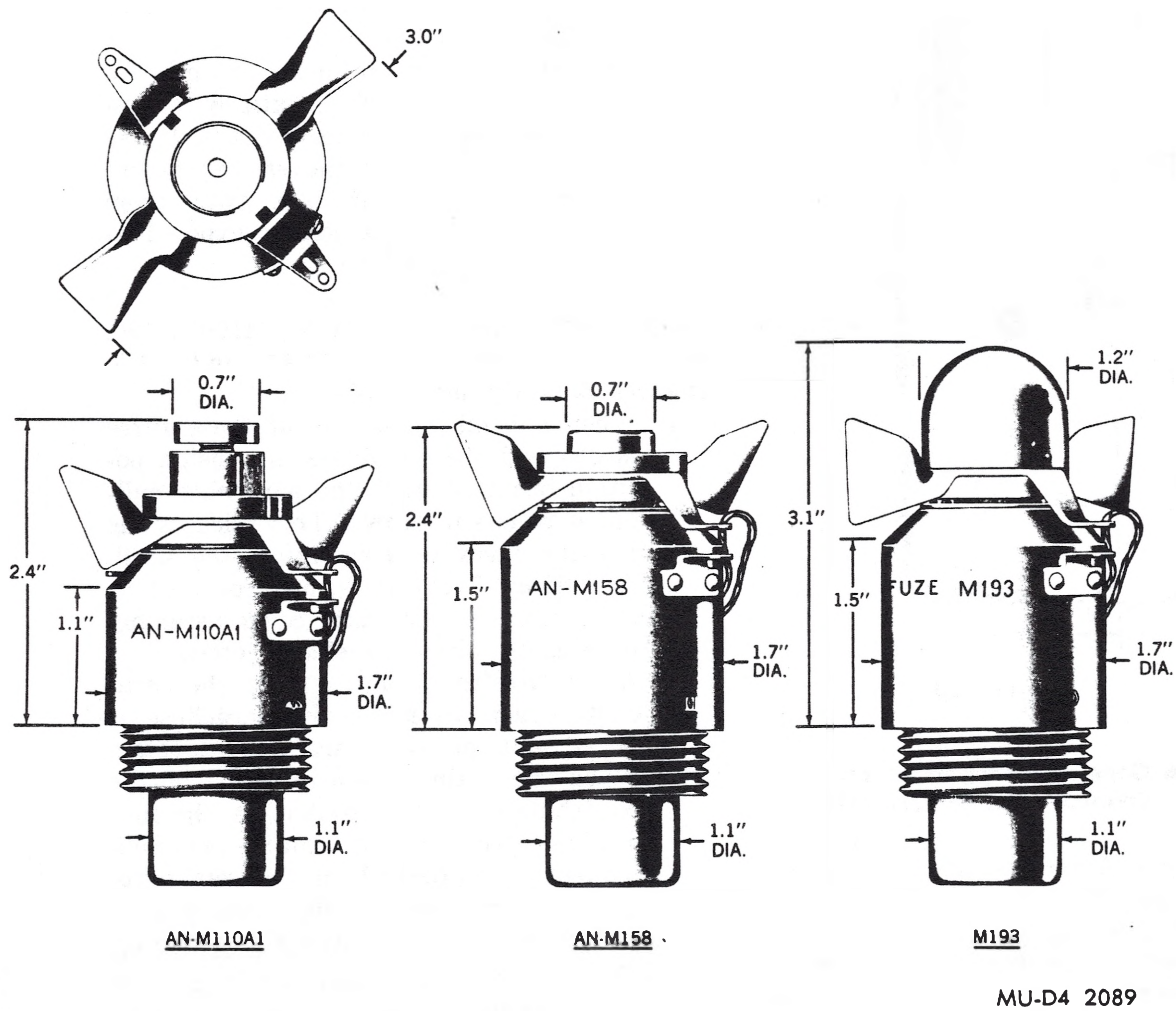


Figure 5–7 External Appearance and Dimensional Characteristics of Fuzes AN–M110A1, AN–M158, and M193

5–1.3.3.2 MECHANICAL DELAY ARMING TYPE FUZE. As the fuze arming wire is withdrawn, the arming pin spring ejects the arming pin, freeing the arbor. See figure 5–16. The timing mechanism, actuated by the main spring, starts to turn the arbor. After a time interval (1.9 seconds) for the fuzes M120A1 and AN–M120A1, 2.5 seconds for the fuze M120; and 1.5 seconds for the fuze M170, the arbor clears the slider pin and the slider spring moves the slider so that the detonator is located directly below the firing pin. A spring-loaded detent locks the slider in the in-line position. Upon impact, the striker plate is forced in, driving the firing pin into the detonator to initiate the fuze explosive train.

5–1.3.4 FUZE M105 (figure 5–17).

a. The selective characteristics of the fuze is set by positioning the setting pin for either instantaneous or delayed action. Prior to this an arming wire is inserted

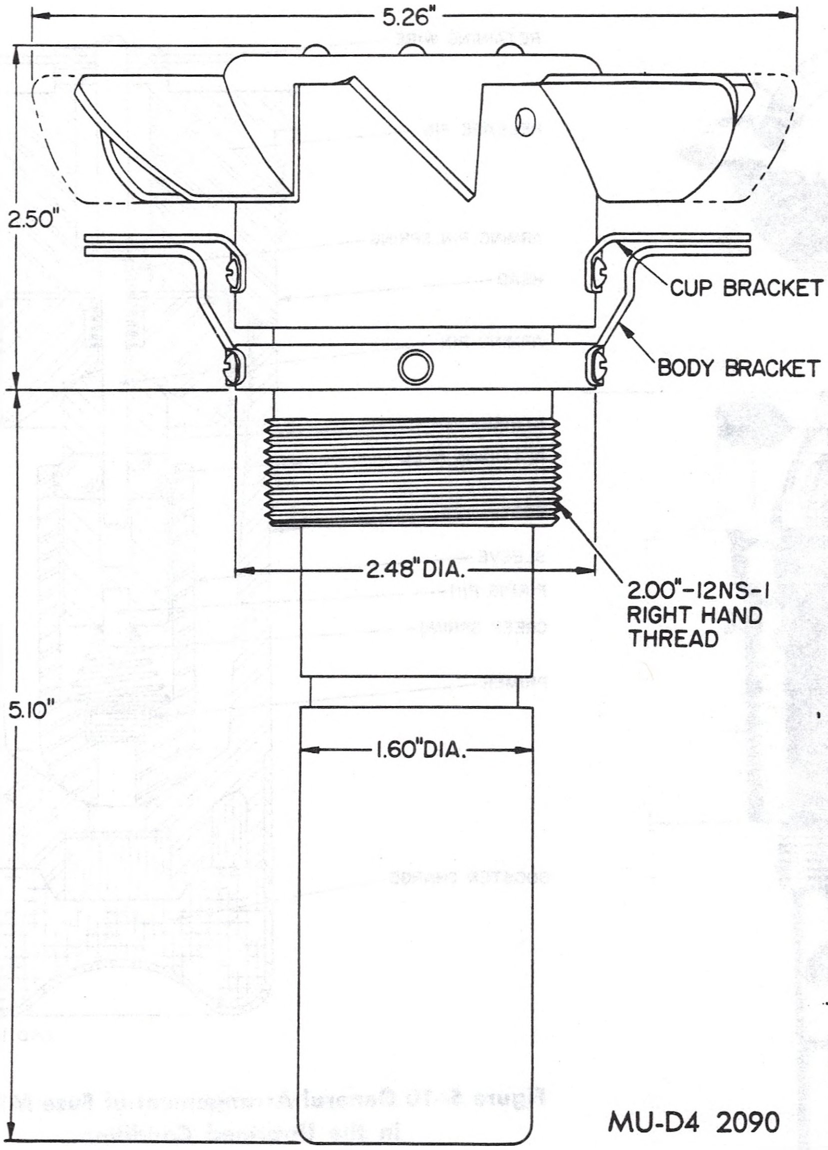


Figure 5–8 Dimensional Characteristics of Fuze M149

in the fuze by threading it through the vane strap and the eyelet strap.

b. Fuze arming begins the instant the arming wire is withdrawn from the fuze and the rotation of the arming vane is initiated by the airstream. This rotation is transferred through a gear reduction system which unthreads the arming screw. After the arming screw unthreads sufficiently, the vane cup clears the safety discs and the discs are expelled by the safety disc spring. The fuze is now armed. The rotation of the arming vane continues until the arming screw unthreads from the striker entirely. The arming vane and the vane cup, with the gear reduction system and arming screw, then separate from the fuze.

c. The action on impact depends upon the fuze setting: if set for instantaneous

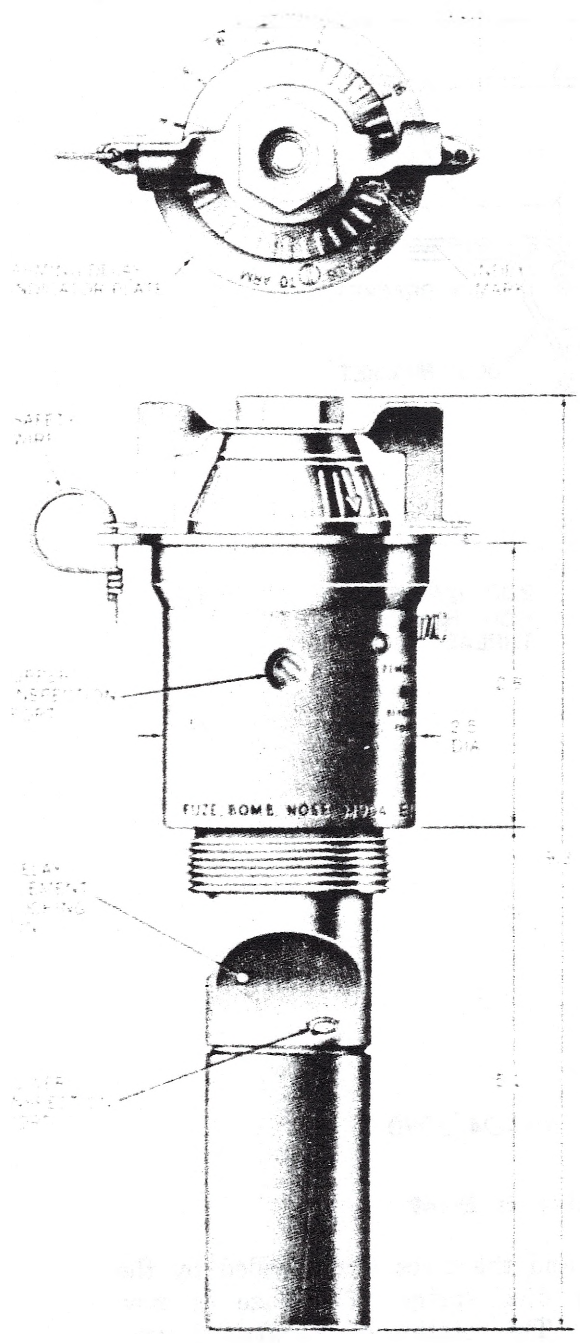


Figure 5-9 Appearance and Dimensional Characteristics of Fuze M904E1

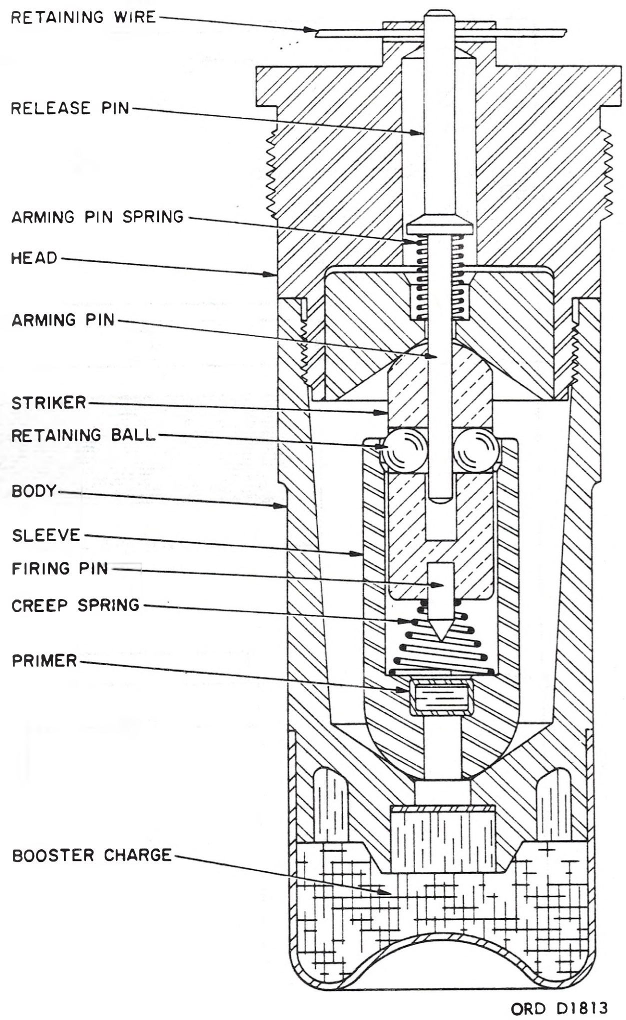


Figure 5-10 General Arrangement of Fuze M142A1 in the Unarmed Condition

functioning, the instantaneous firing pin initiates the instantaneous explosive train and the delay firing pin initiates the delay explosive train; if set for delay functioning (0.1 second), the delay firing pin initiates the delay explosive train and the instantaneous firing pin drops into a recess in the setting pin.

5-1.3.5 FUZE M108 (figure 5-18).

a. After the fuze is installed in a bomb, the head of the arming pin is depressed into the fuze so that the arming wire hole in the arming pin emerges from the fuze body. The arming wire is then inserted in the arming pin and the cotter pin is removed.

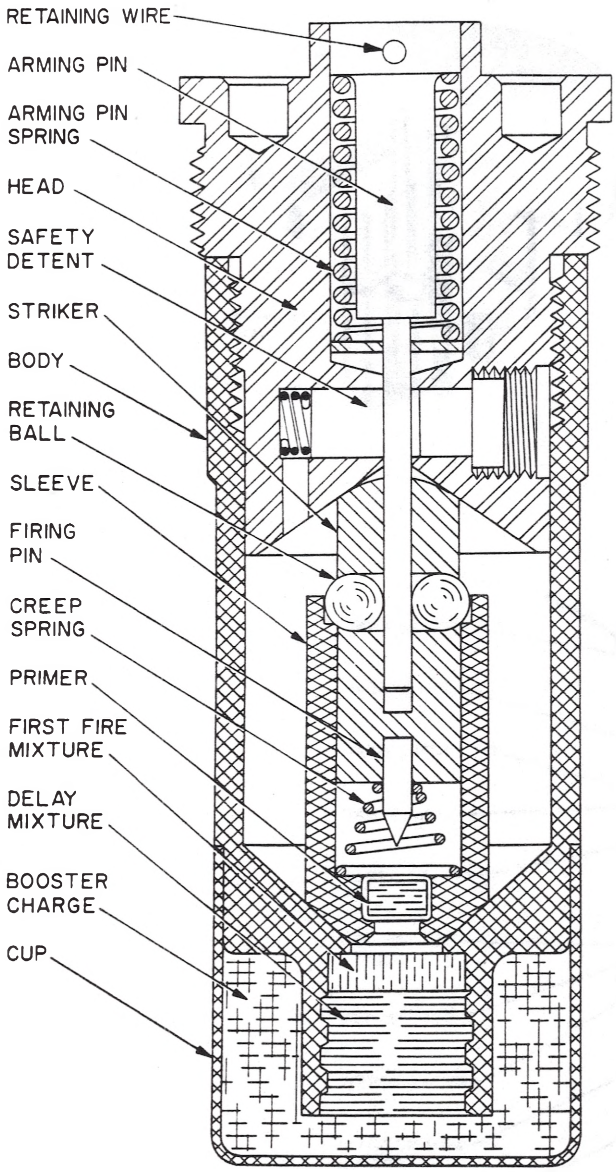


Figure 5-11 General Arrangement of Fuze M197 in the Unarmed Condition

b. When the bomb is dropped, the arming wire is withdrawn from the fuze. The spindle-shaped arming pin spring then ejects the arming pin. Simultaneously, the safety holder and safety block are forced away from under the striker plate by the safety block spring. The fuze is now armed and the firing pin is held only by the shear wire.

c. Upon impact the striker plate drives the firing pin into the fuze body. The firing pin severs the shear wire and pierces the detonator to initiate the explosive train.

5-1.3.6 FUZES M110, AN-M110A1, M126, AN-M126, AN-M126A1, M158, AN-M158, M159, AN-M159, and M193 (figure 5-19).

a. When the bomb is released, the arming wire is withdrawn from the fuze, freeing the vanes to rotate in the airstream. The vanes drive the arming hub (see figure 5-19) and the stationary gear which in turn drives the pinion. The pinion drives the movable gear.

b. In the fuzes with in-line detonators, the movable gear and arming sleeve move downward as the arming sleeve unthreads from the arming hub. After a specific number of vane revolutions, the arming sleeve clears the safety block. Centrifugal force throws the safety block clear of the striker and the fuze is armed.

c. In the fuzes with out-of-line detonators, the movable gear, arming sleeve, firing pin and striker move upward as the arming sleeve threads into the arming hub. After a specific number of vane revolutions, the firing pin clears the hole in the rotor, releasing the rotor. The rotor spring pivots the rotor, aligning the detonator with the firing pin and the lead. A spring-loaded detent locks the rotor in the in-line position and the fuze is armed.

d. Upon impact, the striker is forced downward, driving the firing pin into the detonator, thus initiating the explosive train.

5-1.3.7 FUZE M149 (figure 5-20).

a. While the bomb is carried in the aircraft, the arming wire prevents the vane cup assembly from rotating. When the bomb is released from the aircraft, the arming

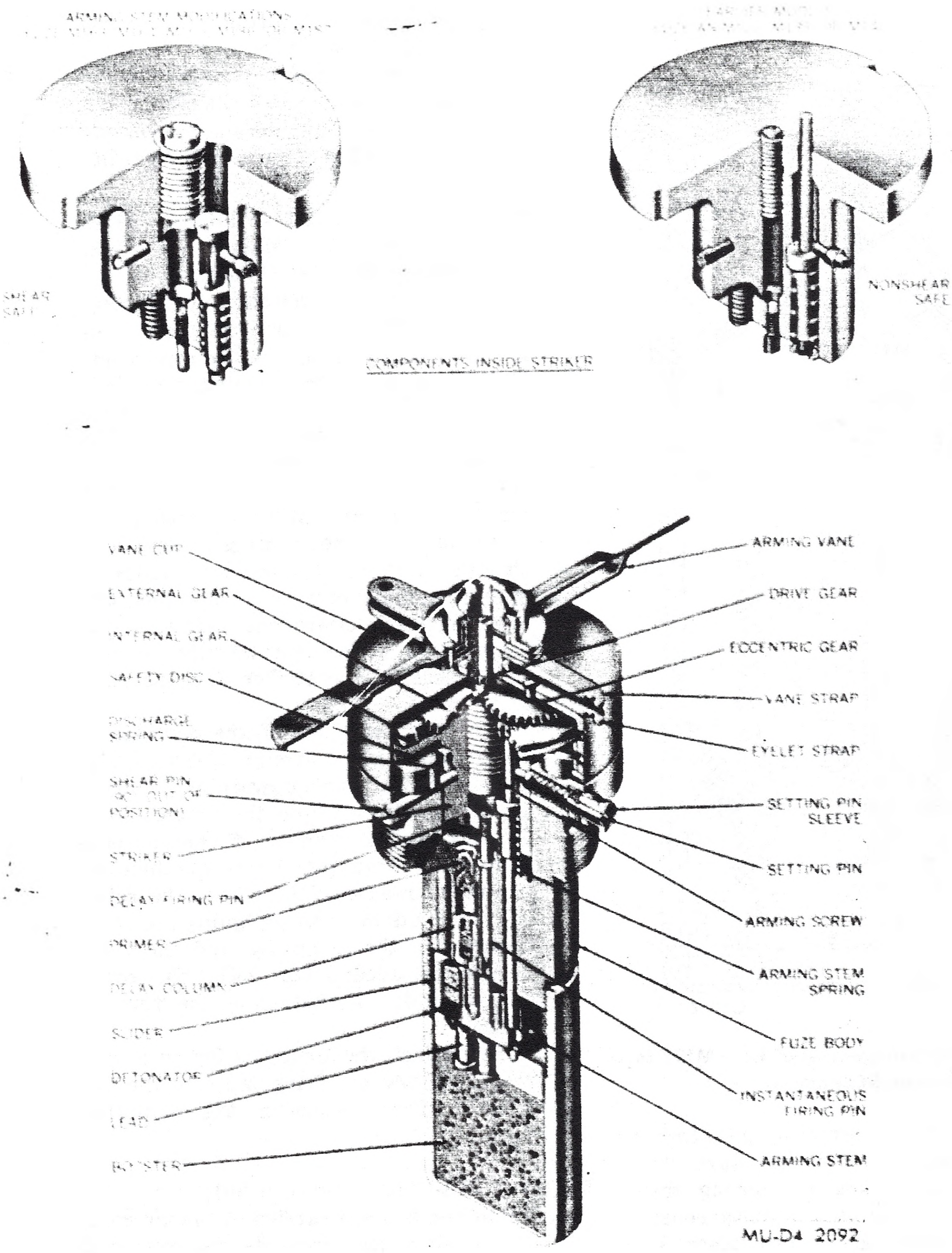


Figure 5-12 General Arrangement of Fuze AN-M103A1 in the Unarmed Condition (Bottom). Insets Show Component Arrangement of Other Fuzes After the Arming Screw Has Been Sheared

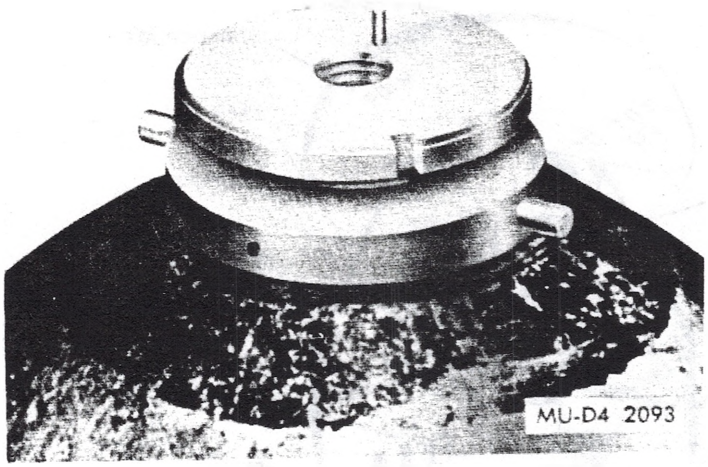


Figure 5–13 Appearance of a Fuze With The Arming Screw and Vane Cup Missing

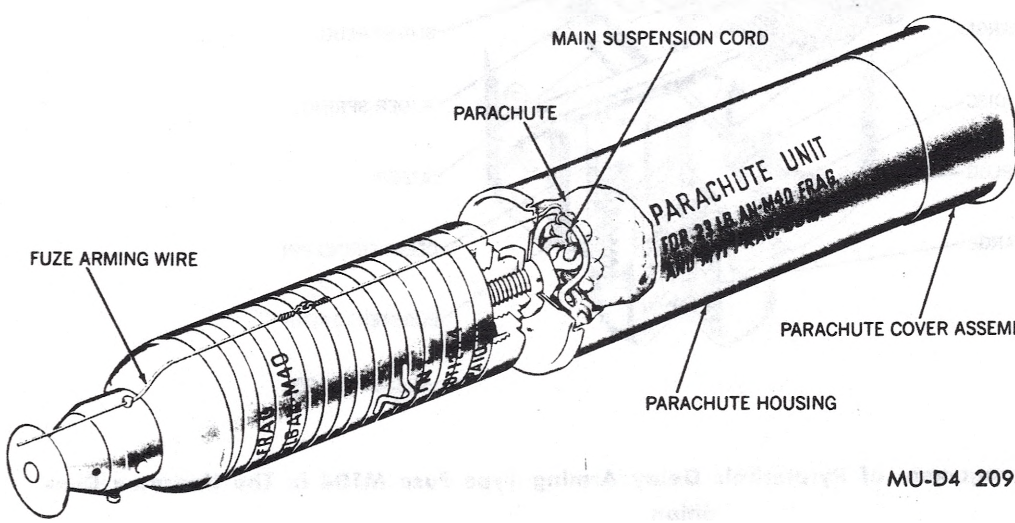


Figure 5–14 Parachute Unit Attached to a Typical Fragmentation Bomb for Use in a Cluster

wire is withdrawn from the cup bracket and body bracket. (The cup bracket and body bracket are shown in figure 5–20.) The vane cup assembly is now free to rotate, and action of the airstream on the vane causes the vane cup assembly to rotate clockwise. After approximately 8 or 9 turns of the vane cup assembly, this assembly has sufficiently unthreaded from the body to allow ejection of the releasing pin by its spring. As the releasing pin is ejected, the spring-loaded arming stem rises out of the slider cavity, allowing the slider to align the detonator beneath the flash tube. The slider is motivated by two springs and is locked in the armed position by a spring-loaded detent. After an additional 4 or 5 (12

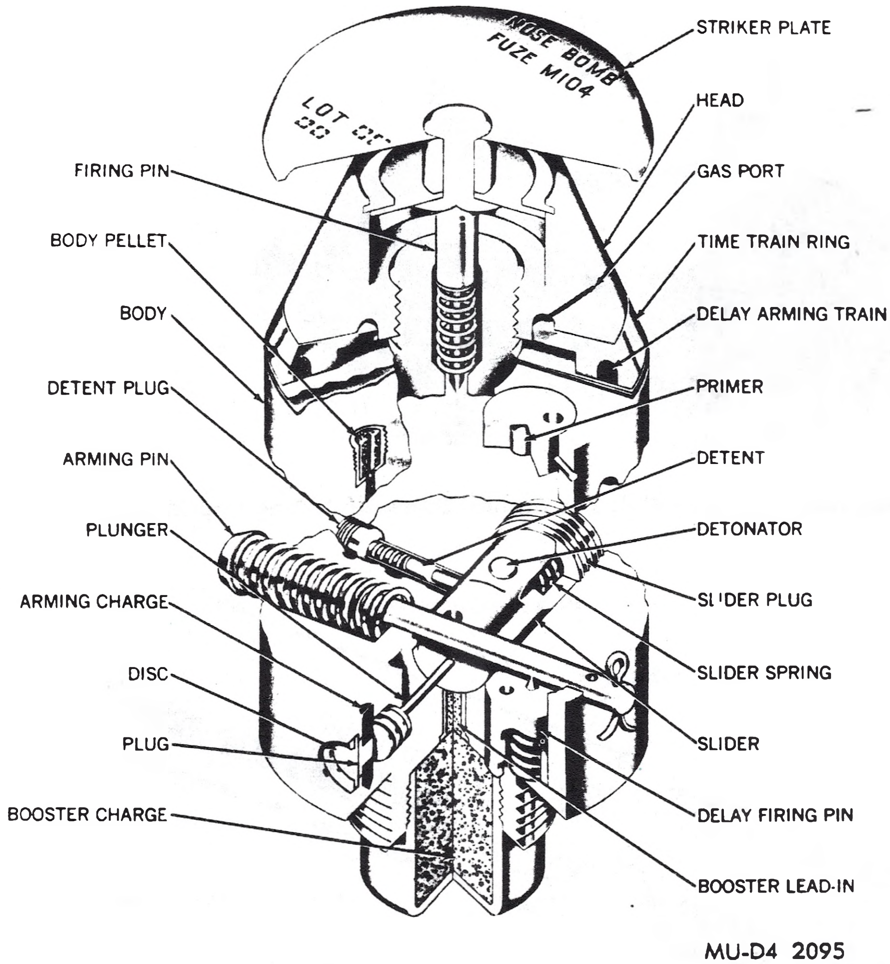


Figure 5–15 General Arrangement of Pyrotechnic Delay Arming Type Fuze M104 in The Unarmed Condition

to 14 total) turns of the vane cup assembly, this assembly unthreads from the body and falls free of the fuze.

b. Bombs using this fuze are usually released in close train, to take advantage of the airburst feature of the fuze. The first bomb detonates upon impact with the ground. Upon impact, the diaphragm of the fuze is snapped into its reversed position, causing the firing pin to strike and initiate the primer. Flame from the the primer passes through the flash tube and ignites the detonator, booster lead-in, booster, and main charge, respectively.

c. The pressure blast of the first bomb causes the diaphragm of the fuze in the second bomb to snap into its reversed position while the bomb is still in the air. This drives the firing pin into the primer, thereby setting off the explosive train. Should the diaphragm of the fuze in the second bomb fail to function upon the pressure blast from the first bomb; the fuze can still function upon impact

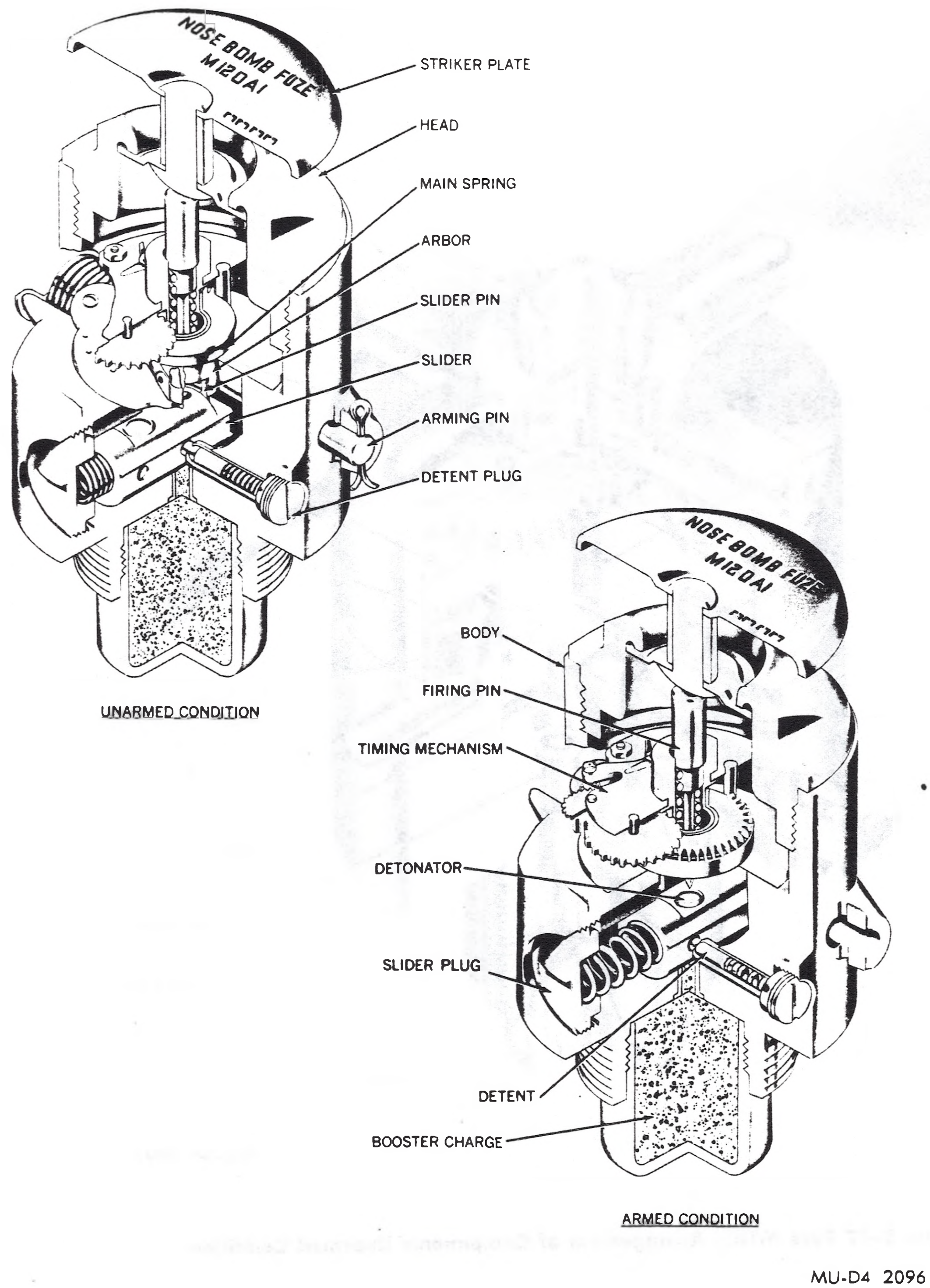


Figure 5–16 General Arrangement of Mechanical Delay Arming Type Fuze M120A1 in the Unarmed Condition (Upper View) and in the Armed Condition (Lower View)

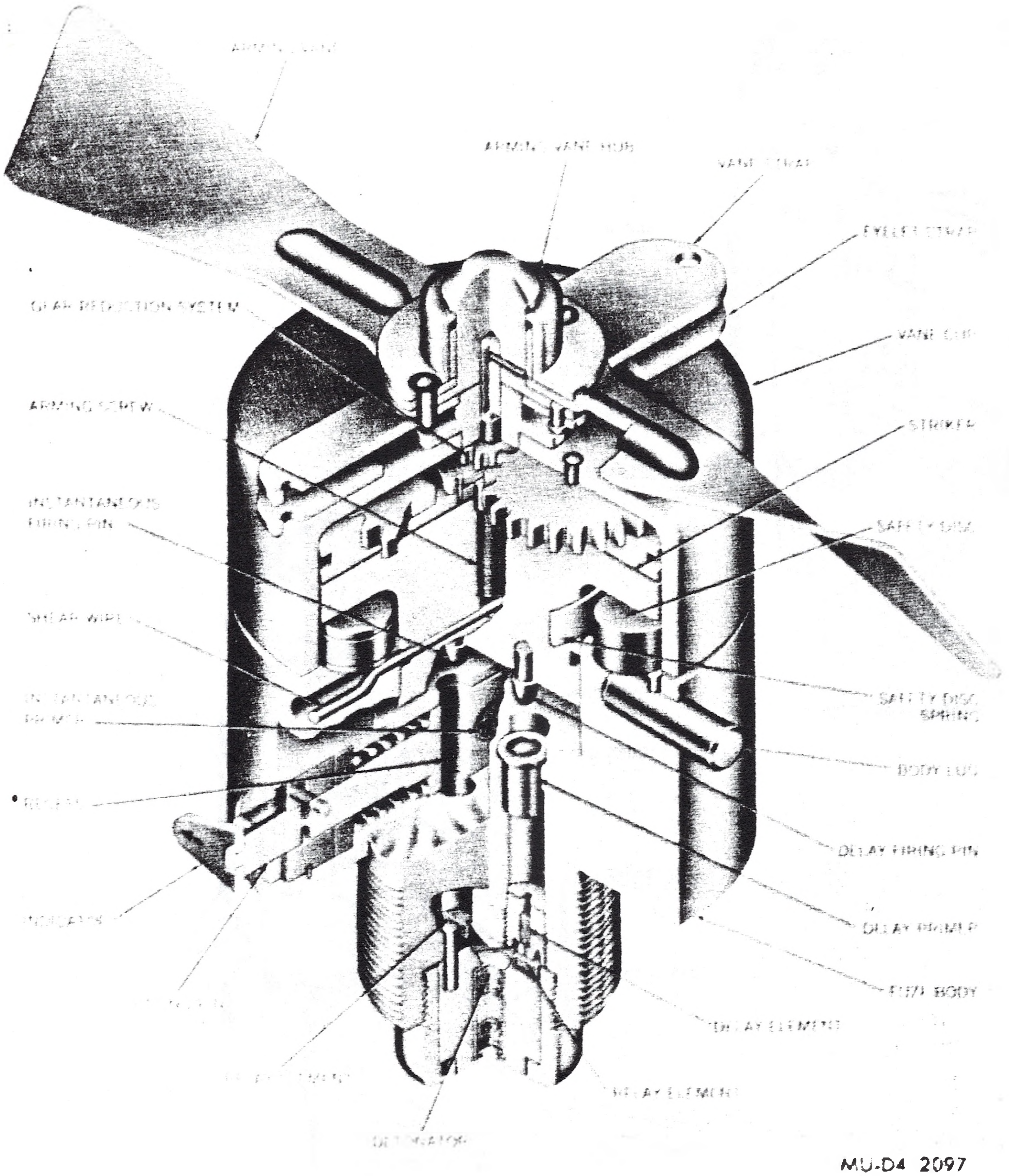


Figure 5–17 Fuze M105; Arrangement of Components Unarmed Condition

with the ground. The third bomb functions as the second, and so on.

5–1.3.8 FUZES M904, M904E1, and M904E2 (figure 5–21).

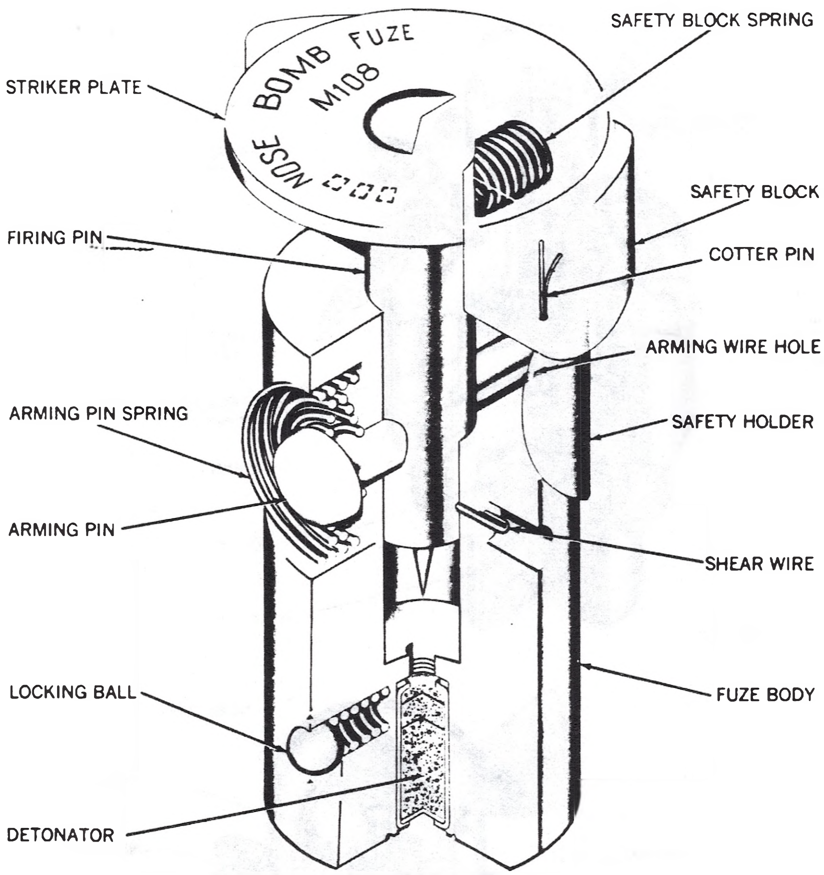


Figure 5–18 Cutaway View of Fuze M108 in The Unarmed Condition

a. The delay element with the desired delay time is selected and inserted before the fuze is installed in the bomb. The arming delay time is then set by depressing the index pin and rotating the nose assembly until the index mark is aligned with the desired time setting on the arming delay indicator plate. Rotation of the nose assembly sets the distance the striker will have to turn before aligning the notch with the index stop. (See figure 5–21). The fuze has a minimum setting of four seconds. When the fuze is in the unarmed condition, the top edge of the striker is visible in the lower half of the upper inspection port.

b. When the bomb is dropped, the arming wire is withdrawn and the arming vane begins to rotate. The rotation of the arming vane turns the governor drum at a constant speed. Rotation of the governor drum is transmitted, through a gear reduction mechanism, to the arming stop assembly. Two driving pins extend from the arming stop assembly through the striker and cause the striker to turn with the arming stop assembly. The firing pin is keyed to the striker and is secured to

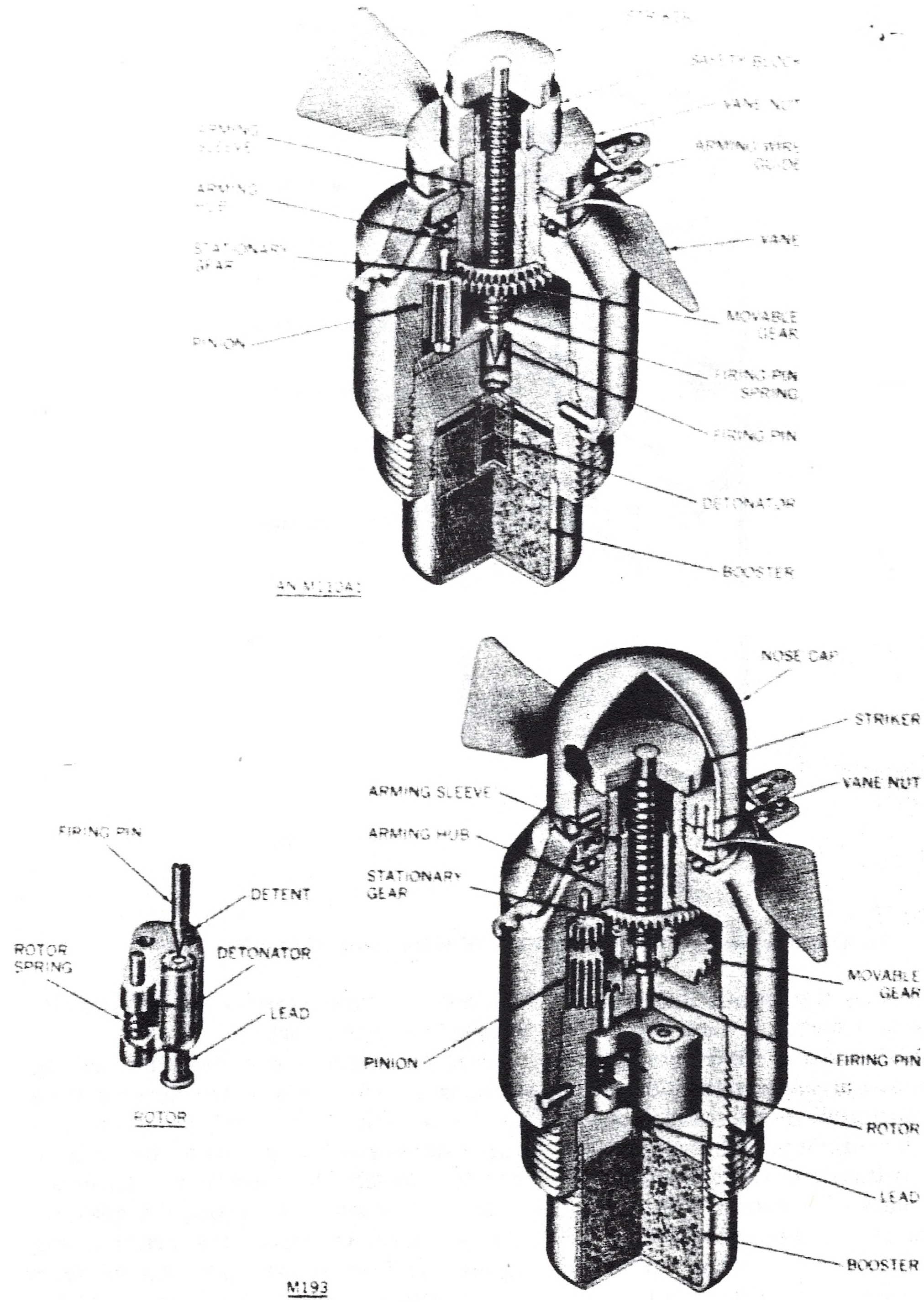


Figure 5-19 General Arrangement of Fuzes AN-M110A1 and M193. Inset Shows Rotor of Fuze M193 in the Armed Condition

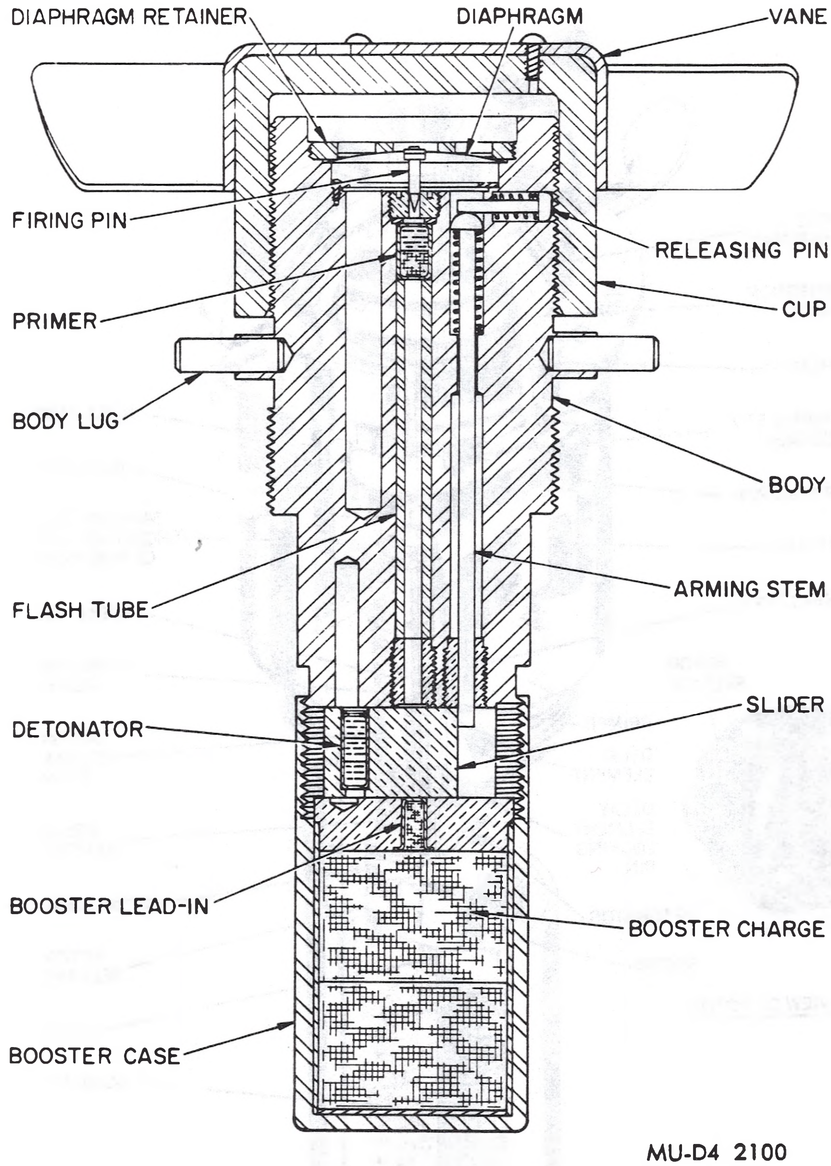


Figure 5–20 Cross Section View Showing Fuze M149 in the Unarmed Condition

the firing pin guide by a shear pin, so that the entire assembly turns as a unit with the arming stop assembly.

c. When the preselected arming time has elapsed and the notch in the striker is aligned with the index stop, the striker spring forces the striker against the bottom of the arming stop assembly. The firing pin does not move upward with the striker, and the space above the firing pin is filled by the spring-loaded strike ball. A longitudinal cut in the striker i now visible in the upper inspection point

d. Simultaneously with the striker-inde stop alignment, a longitudinal slot in th firing pin guide aligns with the stem o the rotor release. A spring lifts the sten upward through the pin-held stem guid into the slot. This raises the rotor releas clear of the rotor and the rotor pivot

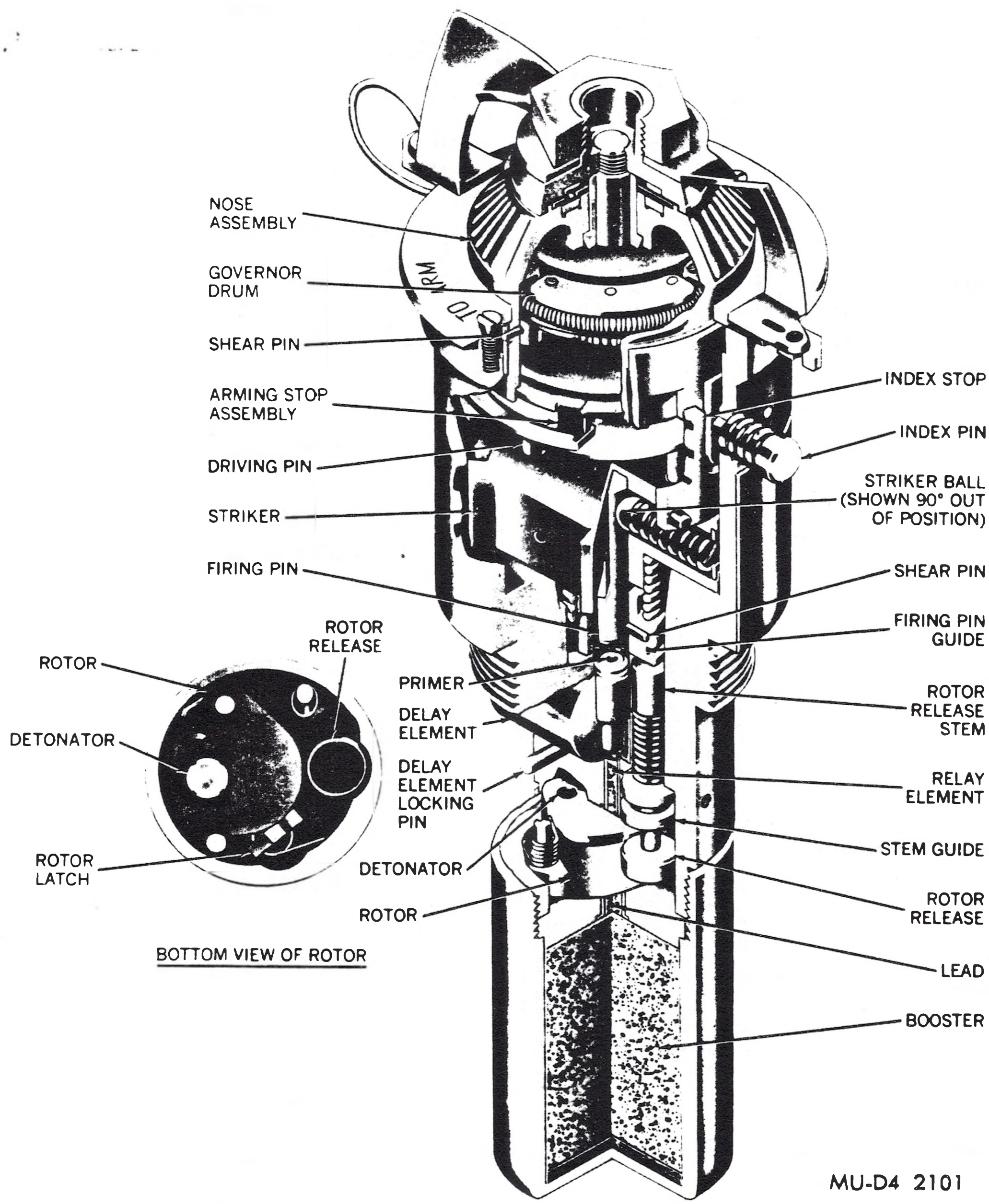


Figure 5-21 Cutaway View of Fuze M904, M904E1, or M904E2 in the Unarmed Condition. Inset Shows Arrangement of Rotor and Rotor Latch

to align the detonator in the explosive train. The rotor is then locked in position by the rotor latch and the fuze is armed.

e. Upon impact, the nose assembly is driven into the fuze body against the arming stop assembly. This forces the striker and the striker ball against the firing pin which, in turn, impinges the primer of the delay element. The primer initiates the remainder of the explosive train.

f. If the fuze should fail to fire, the edge of one or both of the arming stop assembly rings would be visible through the upper inspection port.

5-2 TAIL FUZES (IMPACT AND INERTIAL)

TAIL FUZES M4, AN-M100A1, AN-M100A2, AN-M100A2C, AN-M101A1, AN-M101A2, AN-M101A2C, AN-M102A1, AN-M102A2, AN-M102A2C, M106 SERIES, M160, M161, M162, M169, M172, M175, M176, M184, AN-M177, AN-M177, AN-M185, AN-M194, AN-M195, M190 and M191 are covered in this paragraph.

5-2.1 IDENTIFICATION.

5-2.1.1 TYPE. The M106 Series fuzes and the M169 fuze are armed by withdrawal of the arming wire. The remainder of the fuzes are armed by arming vane or drive and cable assembly.

5-2.1.2 PAINTING AND MARKING. The fuzes are unpainted and are marked either by stenciling or stamping the type, model, lot number, and delay time on the fuze body. Fuzes are marked to indicate differences in delay arming time and some fuzes have colored bands painted around the arming-stem case to indicate arming delays.

5-2.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5-23 through 5-33 and table II.1.

5-2.1.4 MATERIALS. The fuzes are made of aluminum, steel, cadmium or zinc-plated steel, or zinc alloy.

5-2.2 HAZARDOUS COMPONENTS.

5-2.2.1 PRIMER: Fuze M4 contains percussion primers.

5-2.2.2 DETONATOR: Fuze M106 series.

5-2.2.3 PRIMER-DETONATOR M14: Fuzes, M169, M172, M175, M176, M184, M190, M191, AN-M177, AN-M185, AN-M194, AN-M-195, AN-M100A1, AN-M100A2, AN-M100A-2C, AN-M101A1, AN-M101A2, AN-M101-A2C, AN-M102A1, AN-M102A2, AN-M102-A2C, M160, M161, and M162.

TABLE II.1
TAIL FUZES

	AN-M100A2	AN-M101A2	AN-M102A2	M160	M161	M162	M172
Firing Action	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial
Firing Delay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay
Arming:							
Type	Delayed	Delayed	Delayed	Delayed	Delayed	Delayed	Delayed
Revolutions to Arm	150 to 170	150 to 170	150 to 170				
Air Travel to Arm (ft):							
Vane M4	445—650	445—650	445—650	1780—2680	1780—2680	1780—2680	445—550
Vane M5	1225—1420	1225—1420	1225—1420	4900—5850	4900—5850	4900—5850	1225—1510
Overall Length (in.)	9.26	12.26	16.26	9.26	12.26	16.26	25.29
Protrusion from Bomb (in.)	6.26	9.26	13.26	6.31	9.31	13.31	22.29
Body Diameter (in.)	1.5	1.5	1.5	1.44	1.44	1.44	1.5
Vane Span (in.)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Weight (lb)	2.7	2.9	3.2	2.7	2.9	3.2	3.65
No. of Blades on Vane	4	4	4	4	4	4	4
Vane Types							

	M175	M176	AN-M177	M184	M185	M194	M195
Firing Action	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial	Impact-Inertial
Firing Delay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay	Delay or Nondelay
Arming:							
Type	Delayed	Delayed	Delayed	Delayed	Delayed	Delayed	Delayed
Revolutions to Arm	150 to 170	150 to 170	150 to 170				
Air Travel to Arm (ft):							
Vane M4	1150—1935	1150—1935	1150—1935	550	450—460	500	500
Vane M5	3200—5225	3200—5225	3200—5225				
Overall Length (in.)	25.29	37.05	45.12	37.05	45.12	31.035	28.972
Protrusion from Bomb (in.)	22.29	34.05	42.12	34.05	42.12	28.035	25.972
Body Diameter (in.)	1.5	1.5	1.5	1.5	1.5	1.5	1.5

	M175	M176	AN-M177	M184	M185	M194	M195
Vane Span (in.)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Weight (lb)	3.65	4.4	5.0	4.4	5.0	4.1	3.9
No. of Blades on Vane	4	4	4	4	4	4	4
Vane Types							

5-2.2.4 BOOSTER CHARGE: Fuze M4.
Figure 22. Deleted.

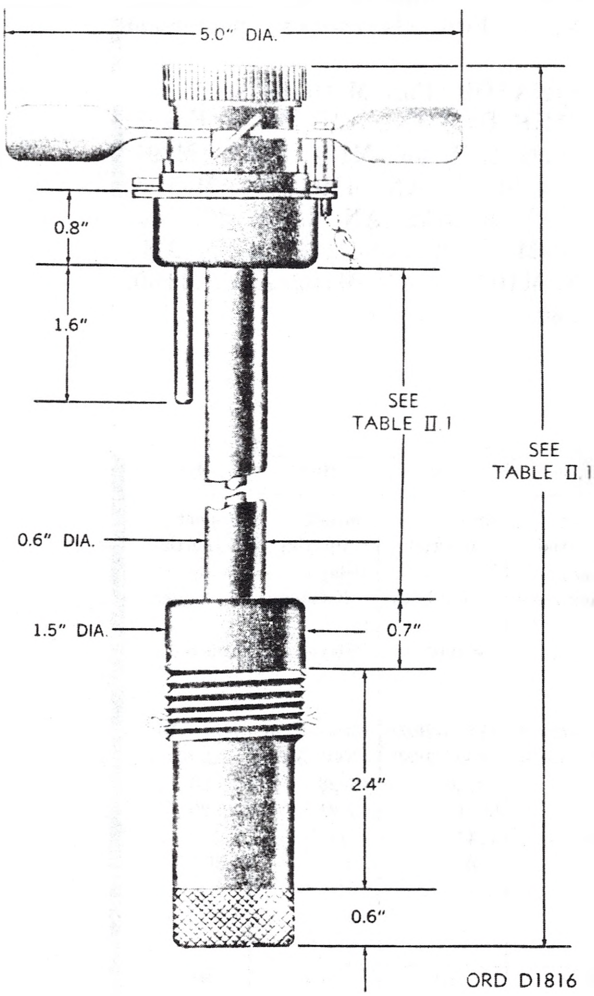


Figure 5-23. Dimensional Characteristics of Fuzes AN-M100 Series, AN-M101 Series, AN-M102 Series, M160, M161, and M162

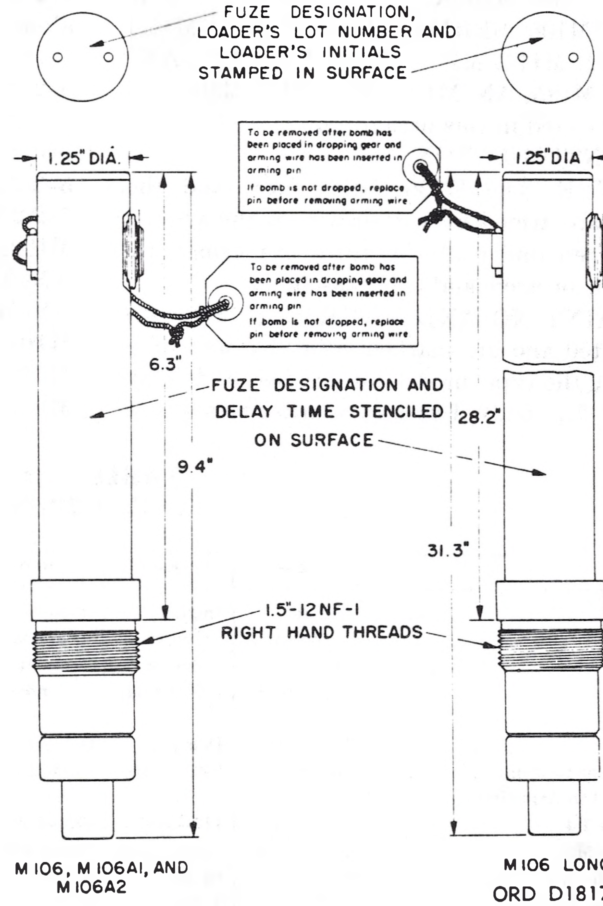


Figure 5-24. Dimensional Characteristics of Fuze M106 Series

5-2.3 FUNCTIONING.

5-2.3.1 Fuze M4. Refer to paragraph 5-1.3.1 and figure 5-27 for functioning information.

5-2.3.2 Fuzes AN-M100A1, AN-M100A2 (figure 5-29), AN-M100A2C, AN-M101A1, AN-M101A2, AN-M101A2C, AN-M102A1, AN-M102A2, AN-M102A2C, M160, M161, M162 and M172. When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze, and the arming vane is rotated by the airstream. After a sufficient number of arming vane revolutions, the arming stem unthreads from the plunger and the fuze is armed. Now, only the anticreep spring prevents the plunger from striking the primer. Further air travel unthreads the arming stem from the fuze body cap, and the arming vane, arming head assembly, and arming stem are carried clear of the fuze by the airstream. Upon impact, the inertia of the plunger causes it to overcome the resistance of the anticreep spring and the firing pin strikes the primer, thereby initiating the explosive train.

5-2.3.3 Fuzes M106A2, M106A1, M106, and M106 Long (fig. 5-30). When a bomb using one of these fuzes is dropped from an aircraft,

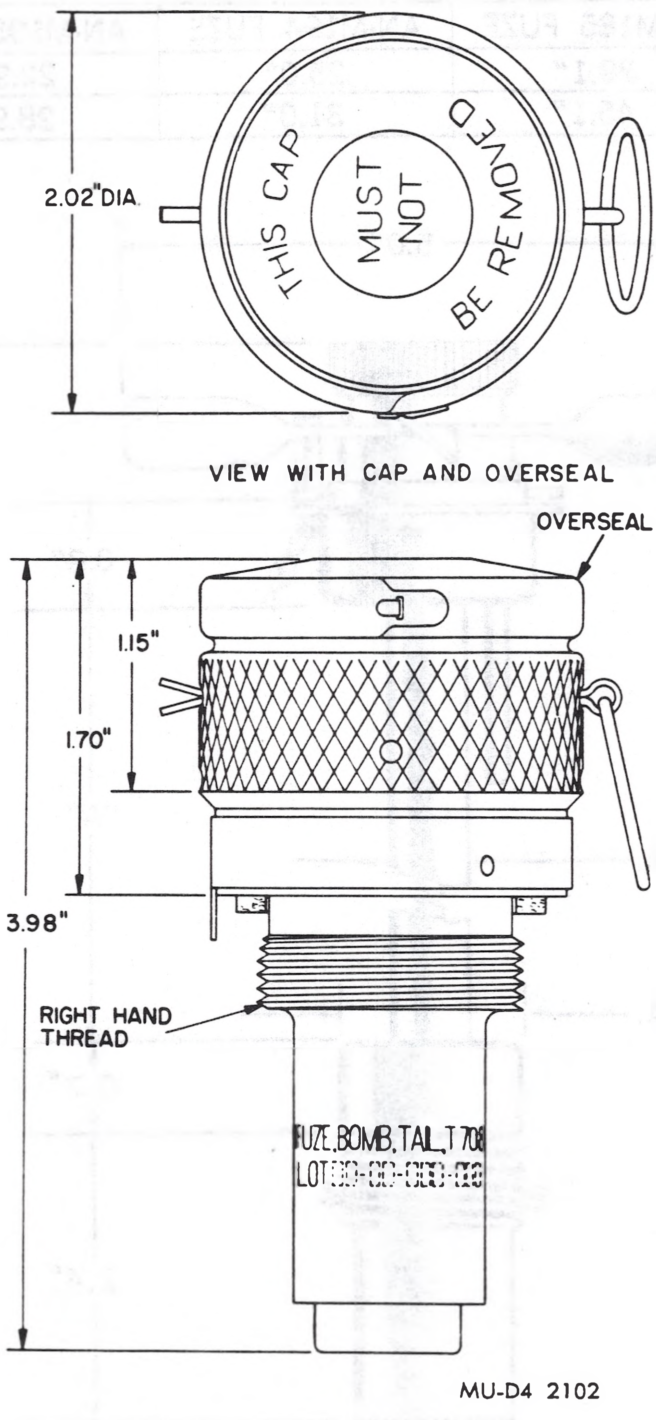


Figure 5-25 Dimensional Characteristics of Fuze M169 (T708)

DIMENSION	AN-M185 FUZE	AN-M194 FUZE	AN-M195 FUZE
"A"	39.1"	25.0"	22.9"
"B"	45.1"	31.0"	28.9"

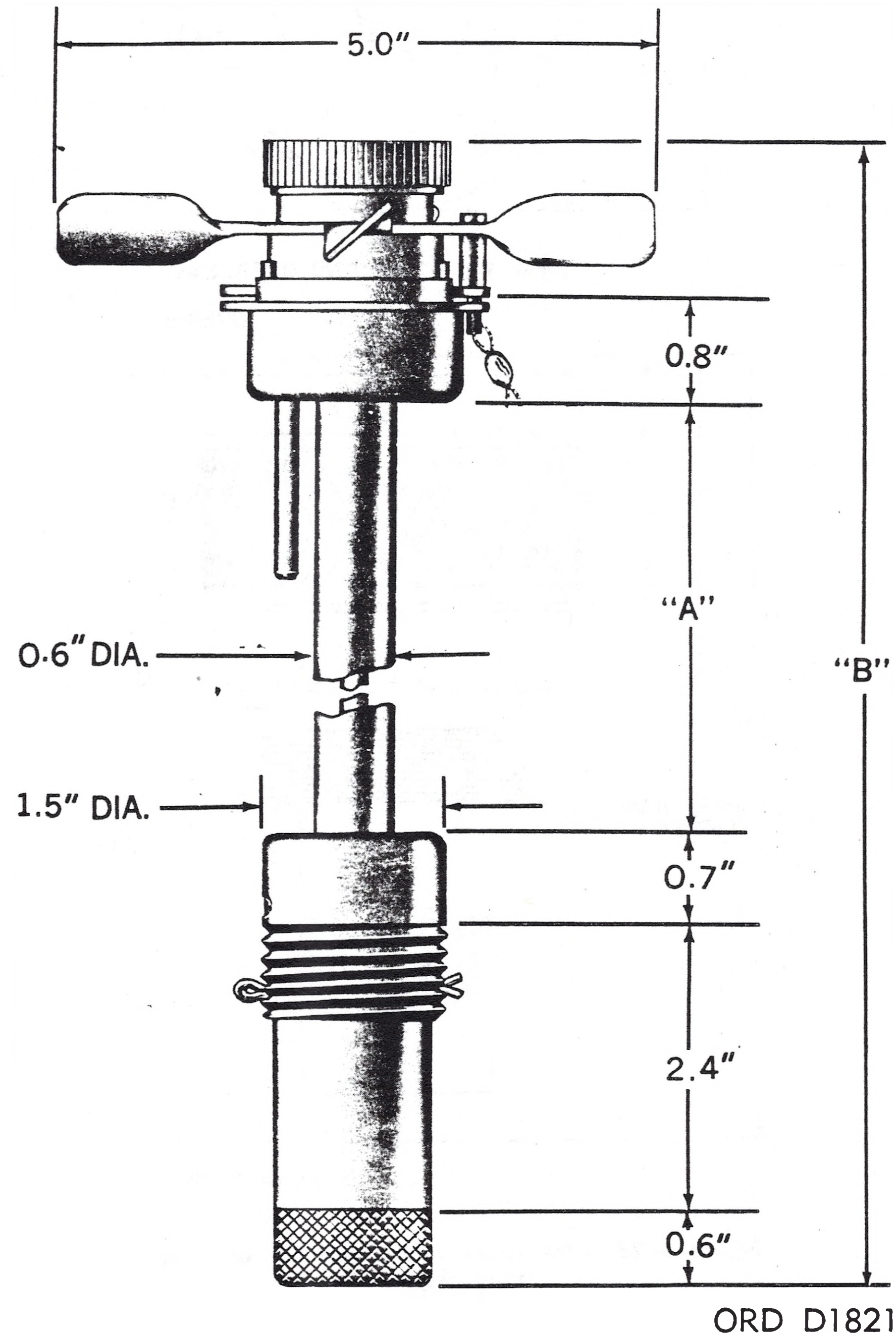


Figure 5-26 Dimensional Characteristics of Fuzes AN-M185, AN-M194, and AN-M195

the arming wire is withdrawn and remains in the aircraft. The withdrawal of the arming wire releases the arming pin. The arming pin spring ejects the arming pin. The fuze is now fully armed. Upon impact, inertia forces overcome the firing pin spring and drive the firing pin into the primer, thus initiating the firing train. The firing train consists of the primer, ignition fuse, and detonator. Different ignition fuse lengths produce different delays. The fuzes M106 and M106 Long function in 45 to 60 seconds, the M106A1 functions in 8 to 11 seconds, and the M106A2 functions in 3 to 5 seconds after impact.

5-2.3.4 Fuze (fig. 5-31).

a. When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze and remains in the aircraft.

b. When the arming wire is removed from the fuze, only the striker support prevents the striker from moving forward toward the primer detonator. The striker support is pinned to the upper end of the striker and has four tabs which extend outward over an inner shoulder of the fuze body so as to prevent the movement of the striker until impact.

c. On impact, the inertia of the heavy striker bends the tabs of the striker support, allowing the striker to move forward and pierce the primer detonator thereby initiating the explosive train.

5-2.3.5 Fuzes AN-M177, AN-M185, AN-M194, AN-M195, M175, M176, and M184 (fig. 5-32).

a. When a bomb is released from the aircraft, the arming wire is withdrawn from the fuze, and the arming vane is rotated clockwise by the airstream. The arming vane turns the bearing cup assembly as it rotates. The pinion gear mounted on the bearing cup, is in mesh

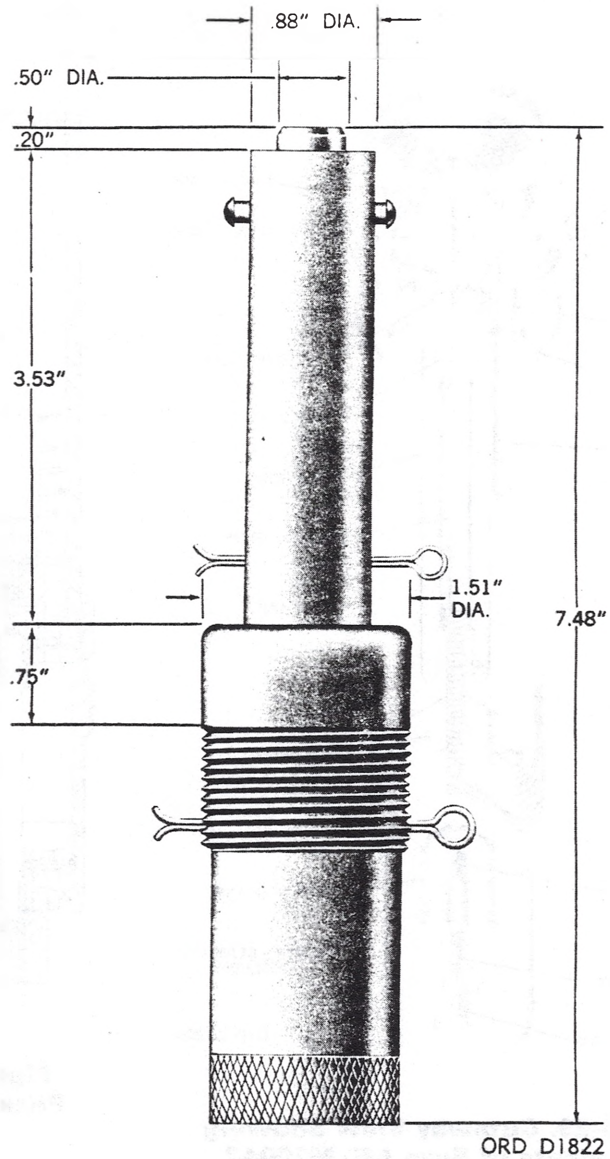


Figure 5-27. Dimensional Characteristics of Fuzes M190 and M191

Figure 5–28. Deleted

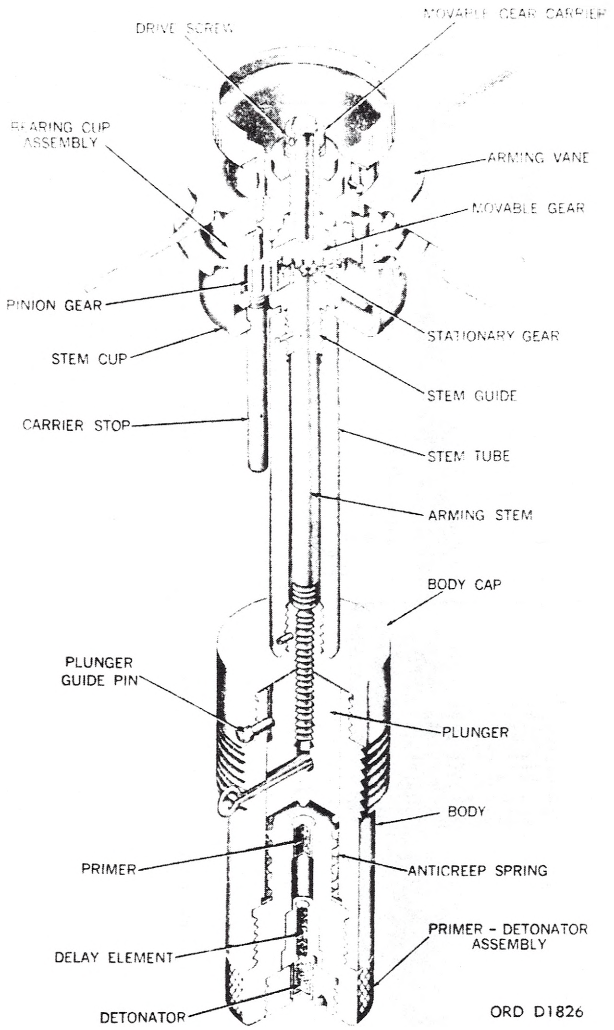


Figure 5-29. Cutaway View Showing Components of Fuze AN-M100A2 in the Unarmed Position

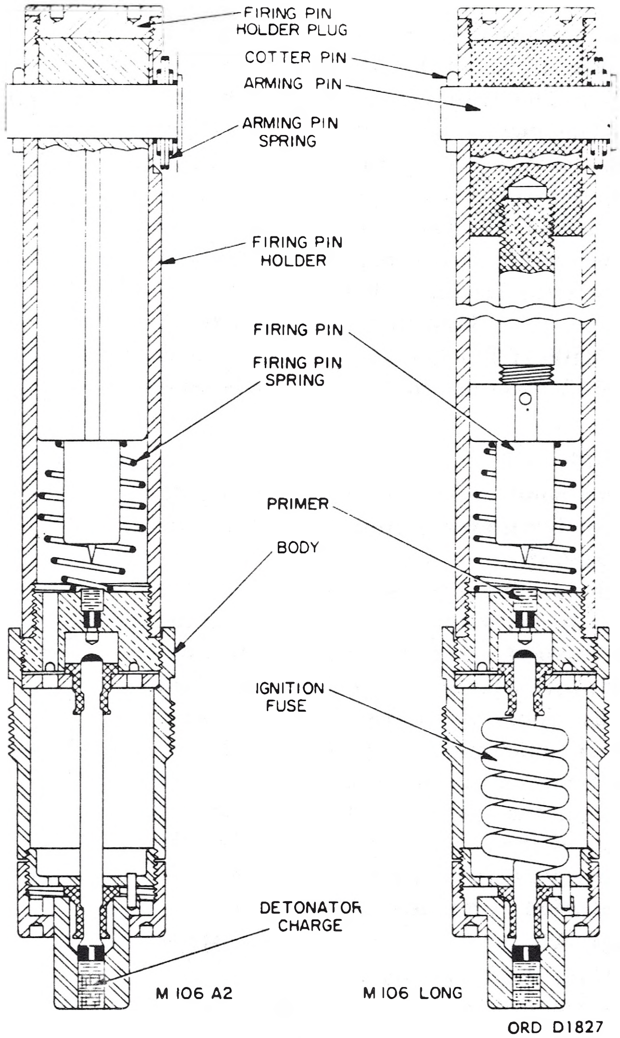


Figure 5-30. General Arrangement of Fuze M106 Series, Unarmed Condition

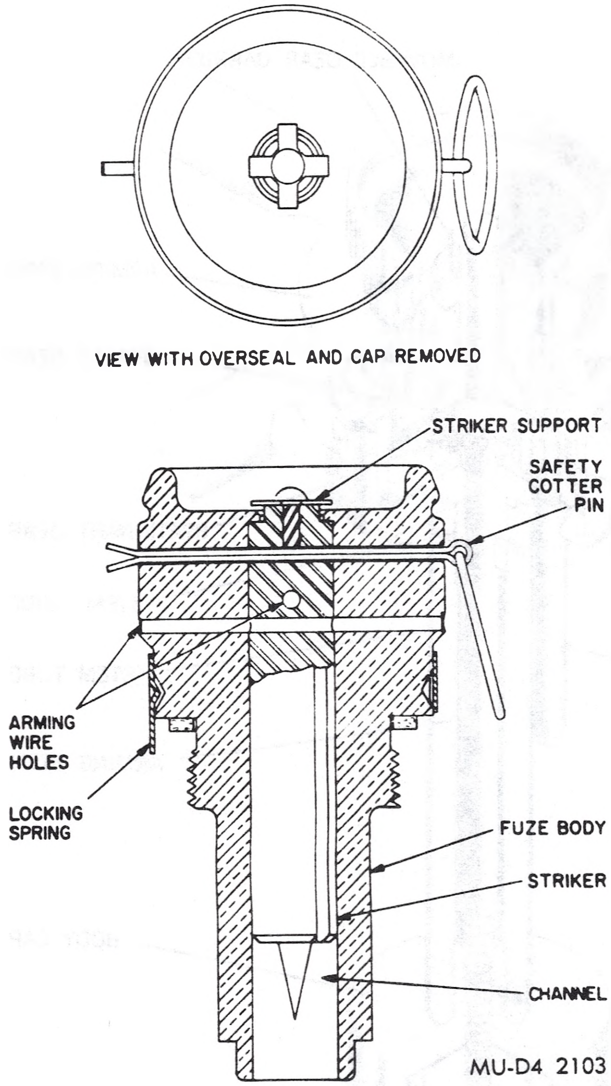


Figure 5-31. General Arrangement of Fuze M169 in the Unarmed Condition

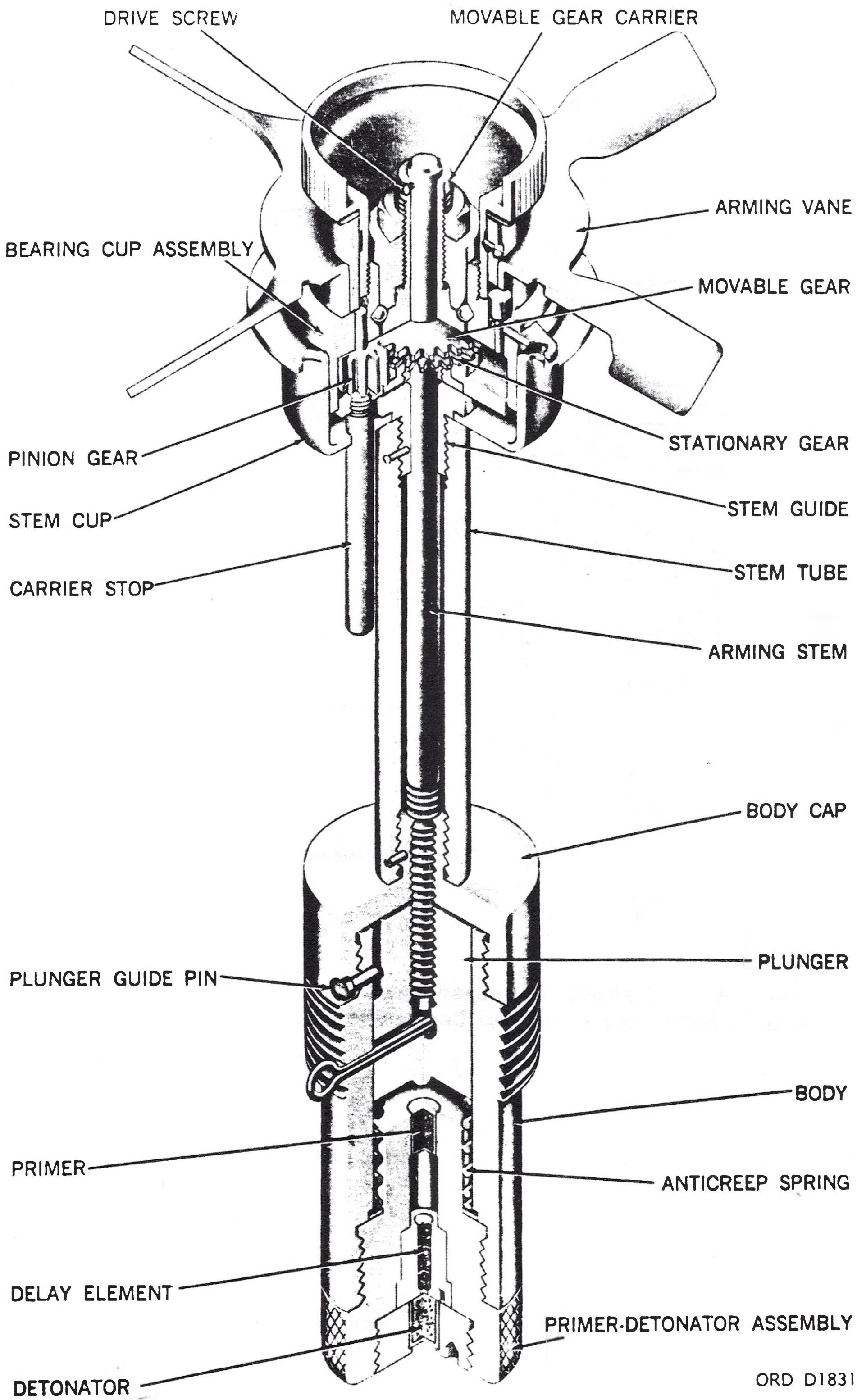


Figure 5-32. Cutaway View of Fuzes AN-M177, AN-M185, AN-M194, AN-M195, M175, M176, and M184. The Fuze Components are Shown in the Unarmed Position

with a 29-tooth stationary gear and a 30-tooth movable gear. The stationary gear is prevented from rotating by the carrier stop passing through a hole in the stem cup. Each revolution of the pinion gear around the movable and stationary gears forces the movable gear to advance one tooth ahead of the stationary gear. The arming stem is secured by either a drive screw or cotter pin to the movable gear carrier and unthreads from the plunger as the movable gear rotates. As it unthreads, the arming stem lifts the movable gear, bearing cup assembly, and the stationary gear which is secured to the lower extension of the movable gear carrier.

b. After 150 to 170 revolutions of the arming vane, the arming stem completely unthreads from the plunger and the fuze is armed. Further air travel unthreads the arming stem from the fuze body cap and the arming vane. The bearing cup assembly and arming stem are carried clear of the fuze by the airstream. Now, only the anticreep spring prevents the plunger from striking the primer. Upon impact, the inertia of the plunger causes it to overcome the resistance of the anticreep spring and strike the primer, thereby initiating the explosive train.

5–2.3.6 Fuzes M190 and M191 (figure 5–33).

a. When a bomb using one of these fuzes is released from an aircraft, the arming wire is withdrawn from the arming assembly and remains in the aircraft. Withdrawal of the arming wire frees the arming assembly, and the action of the airstream rotates the anemometer vanes of the arming assembly. The flexible shaft which is attached to the arming assembly through a gear reduction system rotates with the anemometer vanes. As the flelxible shaft rotates, it turns the coupling through a key and pin arrangement. The key is rigidly attached to the flexible shaft and fits over the pin which passes through the coupling. Rotation of the coupling is transmitted directly to the arming stem which is also free to move longitudinally in a slotted recess in the coupling. As the arming stem rotates, it unthreads upward and out of the plunger, arming the fuze.

b. In the armed condition, the plunger is restrained from striking the primer by the anticreep spring until impact. Upon impact, inertial force causes the plunger to overcome the resistance of the anticreep spring and strike the primer, thereby initiating the fuze explosive train.

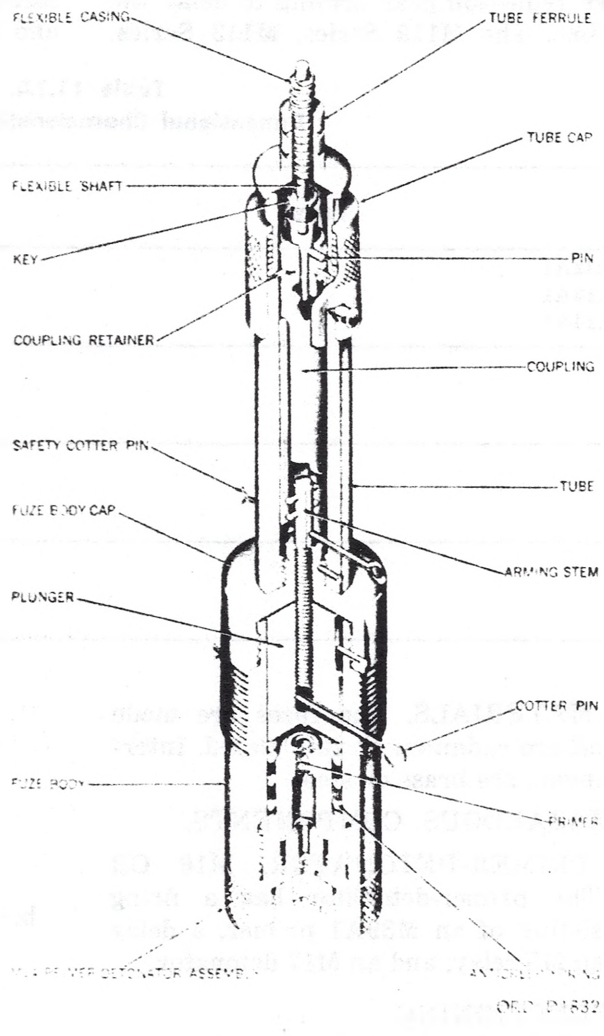


Figure 5–33 Cutaway View of Fuzes M190 and M191 in the Unarmed Condition

5-2A. TAIL FUZES (IMPACT (INTERTIAL) INITIATED, DELAY FIRED)

Tail fuzes M112, M112A1, M113, M113A1, M114, M114A1, M115, M116, M117, M178, M179, M180, M181, M182 and M183 are covered in this paragraph.

5-2A.1 IDENTIFICATION.

5-2A.1.1. TYPE. These fuzes are vane armed, impact initiated and delay fired. The fuzes contain cocked, spring-loaded firing pins. The M112 Series, M113 Series, M114 Series, M178, M179 and M180 fuzes are direct arming. The M115, M116, M117, M181, M182 and M183 fuzes have reduction gear arming to delay the arming time. The M112 Series, M113 Series, M114 Series, M115, M116 and M117 fuzes are used with box-type fin assemblies. The M178, M179, M180, M181, M182 and M183 fuze are used with conical-type fin assemblies.

5-2A.1.2 PAINTING AND MARKING. The fuzes are unpainted. The fuze designation and loading information may be printed or stamped on the cylindrical surface of the fuze body cap. The base of the primer-detonator is painted yellow and printed with the time delay.

5-2A.1.3 FITTINGS AND FEATURES. The external appearance and dimensional characteristics are shown in figures 5-33.1 and 5-33.2 and given in Table 11.1A.

Table 11.1A.
Dimensional Characteristics of Fuzes

FUZE	Length (in.)	
	Protrusion from bomb	Overall
M112, M112A1	6.6	9.6
M113, M113A1	9.6	12.6
M114, M114A1	13.6	16.6
M115	6.54	9.54
M116	9.54	12.54
M117	13.54	16.54
M178	21.85	24.85
M179	33.65	36.65
M180	41.71	44.71
M181	21.60	24.60
M182	33.97	36.97
M183	42.03	45.03

5-2A.1.4 MATERIALS. The fuzes are made of steel and are cadmium or zinc plated. Internal components are brass or steel.

5-2A.2 HAZARDOUS COMPONENTS.

5-2A.2.1 PRIMER-DETONATOR, M16 OR M16A1. The primer-detonator has a firing train consisting of an M39A1 primer, a delay mixture, an M5 relay, and an M17 detonator.

5-2A.3 FUNCTIONING.

a. Prior to bomb release, the arming vane is kept from rotating by an arming wire. In this condition, the lower portion of the arming stem is threaded through the fuze body cap and into the inertia plunger, securing the plunger from movement. The lockballs retain the cocked firing pin inside the plunger and are held in place by the fuze bore.

b. Upon bomb release, the arming wire is withdrawn, freeing the vane to rotate in the airstream. Vane rotation, operating through the arming drive assembly, unthreads the arming stem from the inertia plunger, arming the fuze. After unthreading from the plunger, the arming stem continues to turn until it unthreads from the fuze body cap. The arming stem, arming drive assembly, and arming vane are then withdrawn from the fuze as a unit by the airstream. Upon bomb impact, the inertia plunger overcomes the resistance of the anticreep spring and moves forward. When the plunger advances sufficiently, the lockballs are moved outward into a counterbore area by the spring-load firing pin. This releases the firing pin to be driven by its spring into the primer, initiating the firing train.

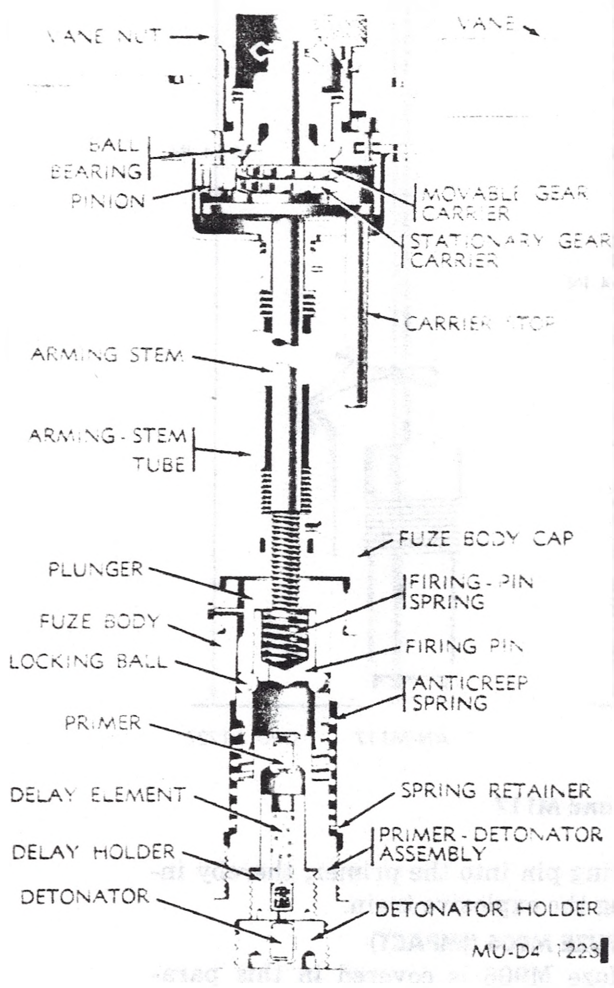


Figure 5–33.1 Tail Fuze M115–Cross Section

5–2B. TAIL FUZES (IMPACT, SIDE-ARMING)

Tail fuzes M151 and M151E2 are covered in this paragraph.

5–2B.1 IDENTIFICATION.

5–2B.1.1 TYPE. These fuzes are anemometer vane operated and function on contact with the target. A delay action of 4–5 seconds of 8–15 seconds is provided by a primer-detonator.

5–2B.1.2 USAGE. Fuze M151 is used only in the 100-pound, (AN–M30) and 250-pound, (AN–M57) General Purpose bombs equipped with Anti-Ricochet Device, M16, or with the 500-pound, GP bomb equipped with Anti-Ricochet Device, M17. Fuze M151E2 is only used with a modified M17 anti-ricochet device.

5–2B.1.3 MARKING. The fuzes are unpainted and are marked by stamping the type, model, lot number, and delay time on the fuze body.

5–2B.1.4 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5–33.3 and 5–33.4.

5–2B.1.5 MATERIALS. The fuze body cap, coupling, and body are cadmium plated steel.

5–2B.2 HAZARDOUS COMPONENTS.

5–2B.2.1 PRIMER-DETONATOR: These Fuzes are equipped with Primer-Detonator, M16A1 (earlier models with M16), 4–5 Seconds Delay or 8–15 Seconds Delay.

5–2B.3 FUNCTIONING.

5–2B.3.1 Fuzes M151 and M151E2 differ in external appearance, but house the same basic internal components.

a. Upon release of the bomb, the arming wire is withdrawn from the anemometer vane shaft, allowing the anemometer to rotate in the airstream. This rotation unthreads the arming stem until it is completely withdrawn from the plunger stem and the fuze is armed.

b. In this armed condition the fuze is prevented from firing prematurely only by the plunger balls, which block the passage of the spring-loaded firing pin, and by the anticreep spring, which restricts the forward movement of the plunger.

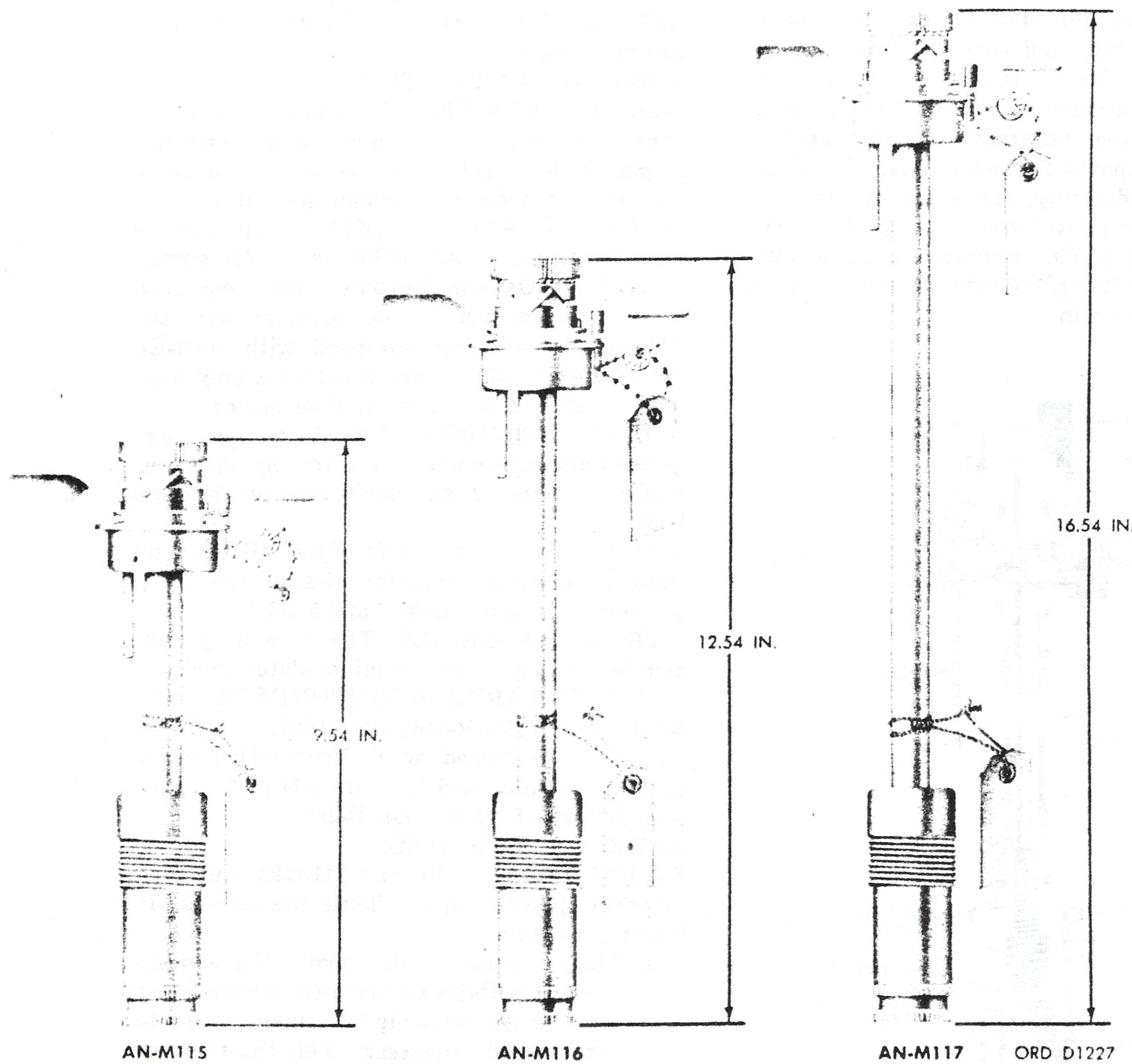


Figure 5-33.2 Tail Fuzes, M115, M116 and M117

c. Upon impact, the plunger overcomes the resistance of the anticreep spring and moves forward. When the plunger advances so that the holes containing the plunger balls are brought opposite a counterbore machined in the body, the spring-loaded firing pin forces the plunger balls outward into the body counterbore. The cocked firing pin spring drives the firing pin into the primer, thereby initiating the explosive train.

5-2C TAIL FUZE M906 (IMPACT)

Bomb tail fuze M906 is covered in this paragraph.

5-2C.1 IDENTIFICATION.

5-2C.1.1 TYPE. The M906 is a cocked striker, medium delay tail fuze. An auxiliary drive assembly arms the fuze.

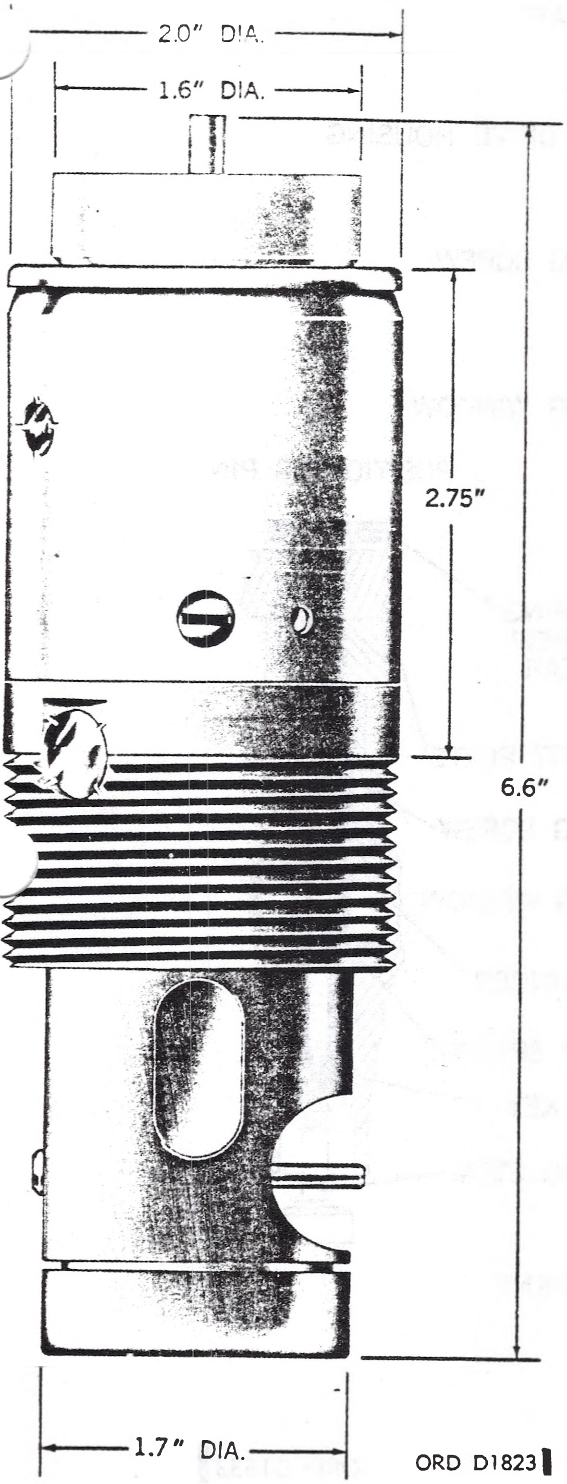


Figure 5-33.2A External Characteristics of the M906 Fuze

5-2C.1.2 PAINTING AND MARKINGS. Markings are stamped into the input drive housing and are filled in with white paint. The input drive housing is unpainted, the fuze body is black and the rotor cap is gold (figure 5-33.2A).

5-2C.1.3 FITTINGS AND FEATURES.

a. Three screws, spaced 120° apart, secure the input drive housing to the fuze body.
b. The fuze has two viewing windows, which may be used to determine the condition of the fuze. The window in the input drive housing shows the position of the arming screw gear; the window in the fuze body indicates the position of the plunger (figure 5-33.2B).
c. The delay element fits into an oval cavity in the fuze body and is held in place by a lockpin.
d. A detonator-rotor viewing window shows the position of the detonator; however, this window is inaccessible after the fuze is installed in the bomb.

5-2C.1.4 MATERIALS. Major components of the fuze are made of aluminum. The rotor cap and other minor components are of steel.

5-2C.2 HAZARDOUS COMPONENTS. The fuze contains a delay element, secondary relay and a detonator.

5-2C.3 FUNCTIONING. Before the fuze is installed in the bomb, the delay element (5 or 12.5 seconds) is selected and inserted in the fuze. When the bomb is released from the aircraft, the arming wire is withdrawn from the drive assembly. This permits the arming vane to rotate in the airstream. Rotation of the vanes is transmitted through the flexible drive shaft and drive assembly coupler to the fuze input shaft. As the input shaft turns, its pinion engages the arming screw gear to withdraw the arming screw from the plunger. A positioning pin prevents plunger rotation. As the arming screw unthreads from the plunger, the arming stem is withdrawn. This unblocks the detonator rotor. The plunger is restrained by an anticreep spring. The spring-loaded detonator rotor swings the detonator into alignment with the remainder of the explosive train. A

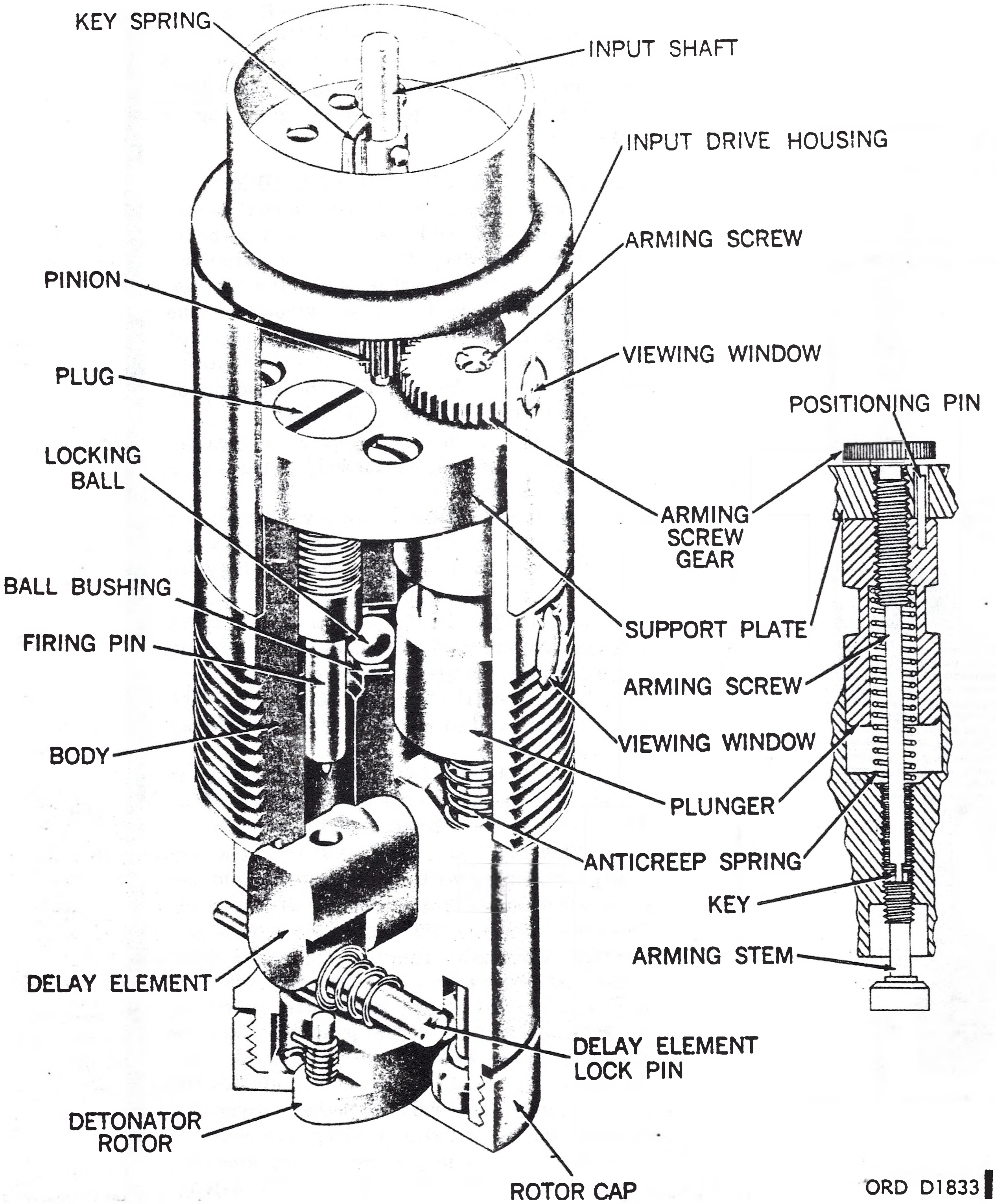


Figure 5–33.2B C[illegible]way View of the M906 Fuze in the Unarmed Condition

detent locks the rotor in the armed position. Upon impact, the plunger overcomes the anti-·eep spring. A circumferential slot aligns ·ith the locking ball, which is cammed into the slot by the spring-loaded firing pin. The firing pin is driven into the primer, initiating the explosive train.

5-2C.4 SAFETY PRECAUTION. Do not strike or jar an armed fuze, since the fuze has a cocked-striker type action.

5-2D TAIL FUZE M905 (IMPACT)

Bomb tail fuze M905 is covered in this paragraph.

5-2D.1 IDENTIFICATION.

5-2D.1.1 TYPE. The M905 (figure 5-33.2C) is a vane-armed (from 4 to 20 seconds) impact firing, inertial arming, selective action (instantaneous or delay up to 0.25 second) tail fuze.

5-2D.1.2 PAINTING AND MARKING. Fuze designation, lot number, variable delay times, REMOVE STOP SCREW BEFORE SETTING TO 4 SECONDS, SECONDS TO ARM, AND UNSAFE WHEN RED are stamped on the input drive housing.

5-2D.1.3 FITTINGS AND FEATURES.

a. An inspection port on the housing shows either red or white, depending on fuze condition.
b. The delay element fits into a recess perpendicular to the fuze axis below the mounting threads. An offset spring-loaded lock pin holds the delay element in place.

5-2D.1.4 MATERIALS. The fuze is composed mainly of steel, aluminum alloy, brass, and zinc alloy.

5-2D.2 HAZARDOUS COMPONENTS. The M905 fuze contains a delay element, lead azide relay and an M35 detonator composed of lead azide and tetryl.

5-2D.3 FUNCTIONING. Before the fuze is installed in the bomb, the delay element is selected and inserted in the fuze, and the fuze arming delay time is set. When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze drive assembly. The airstream rotates the arming vane, drive shaft, governor and input shaft. Input shaft rotation is transmitted through the gear train to the setting gear. The setting gear drives the firing pin and firing pin guide for the delay arming time. At the end of this time, the projection of the firing pin aligns with an axial groove in the fuze body. A groove on the side of the firing pin guide aligns with the spring-loaded shutter release pin. The anticreep spring prevents movement of the firing pin. The shutter release pin moves into the groove in the firing pin guide. This releases the spring-loaded shutter to align the detonator with the remainder of the explosive train. The shutter is held in place by a spring-loaded lock The fuze is now armed. Upon impact, the firing pin overcomes the anticreep spring, strikes the primer and initiates the explosive train.

5-2D.4 SAFETY PRECAUTIONS.

a. Do not jar an armed fuze while attempting to remove the delay element.
b. Do not allow any sudden movement of an armed fuze parallel to the longitudinal axis of the fuze body. This might allow the firing pin to overcome the anticreep spring and strike the primer.

5-3. MECHANICAL TIME FUZES

Mechanical time fuzes M107, M111, M111A1, M111A2, M127, M128, AN-M128, M135, M-35A1, M136, M136A1, M138, M144, M145, AN-

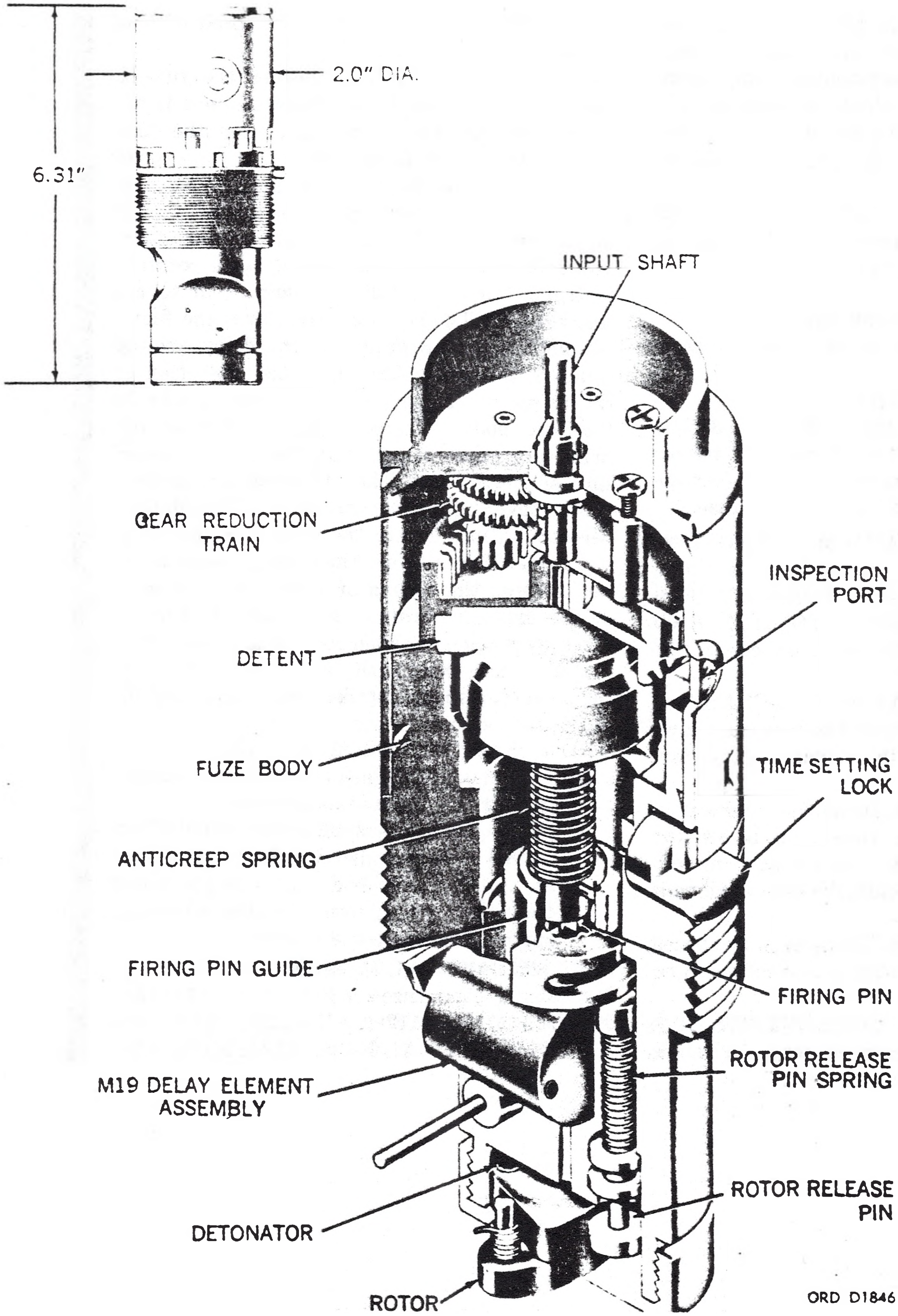


Figure 5-33.2C External Characteristics and Cutaway View of the M905 Fuze

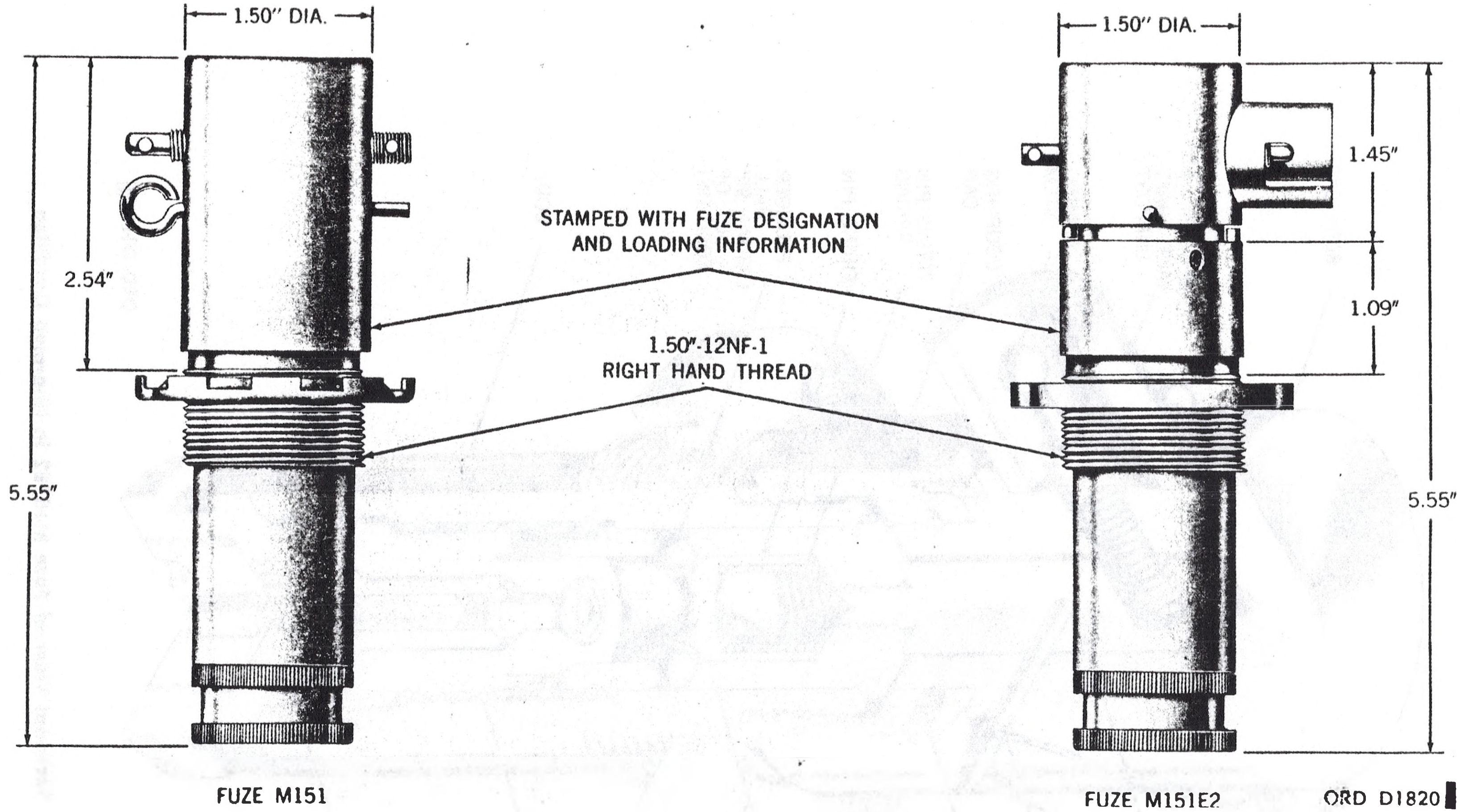


Figure 5–33.3 External Characteristics of Fuzes M151 and M151E2

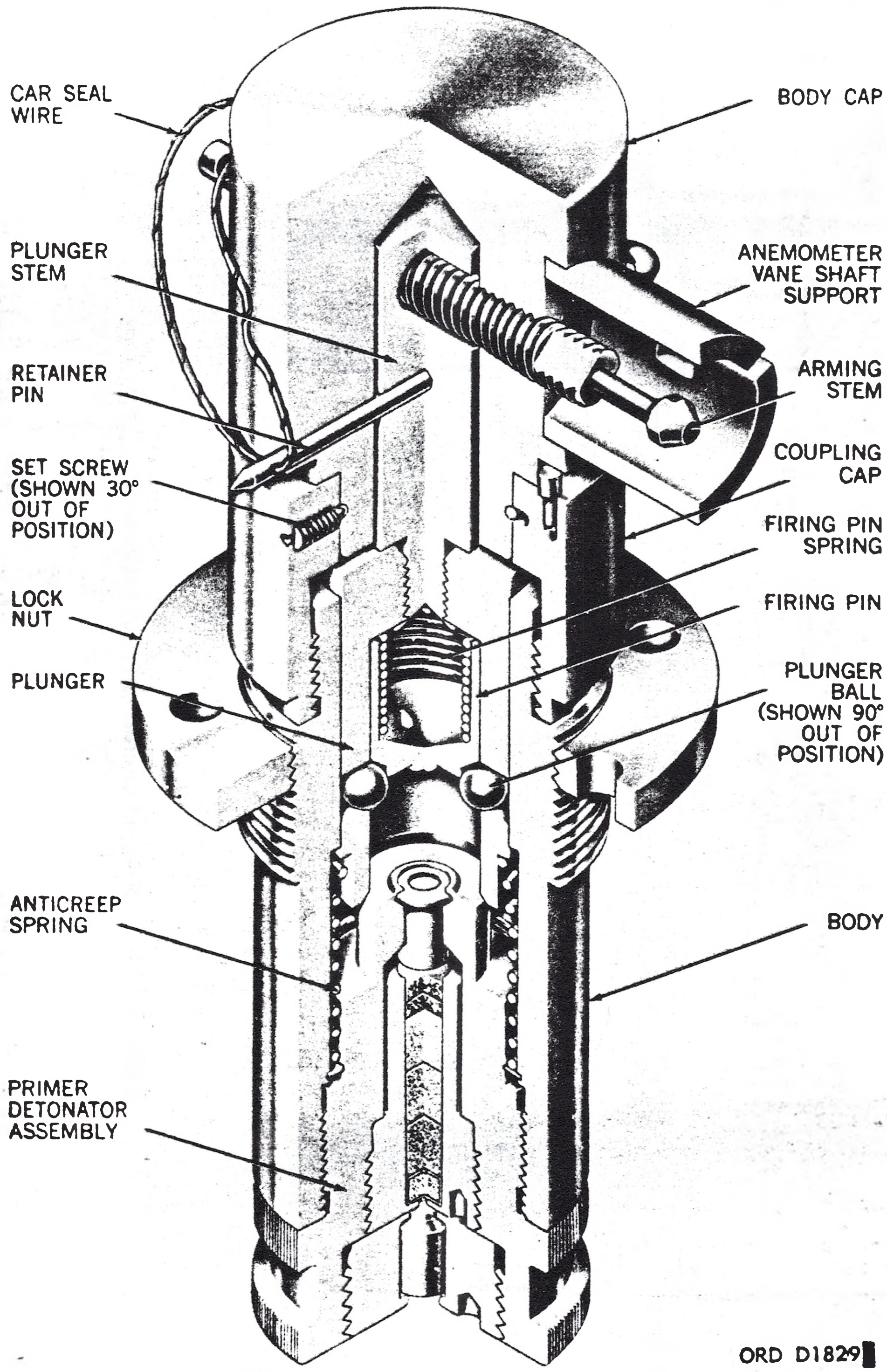


Figure 5-33.4 Sectional View of Fuze M151E2 in Unarmed Condition

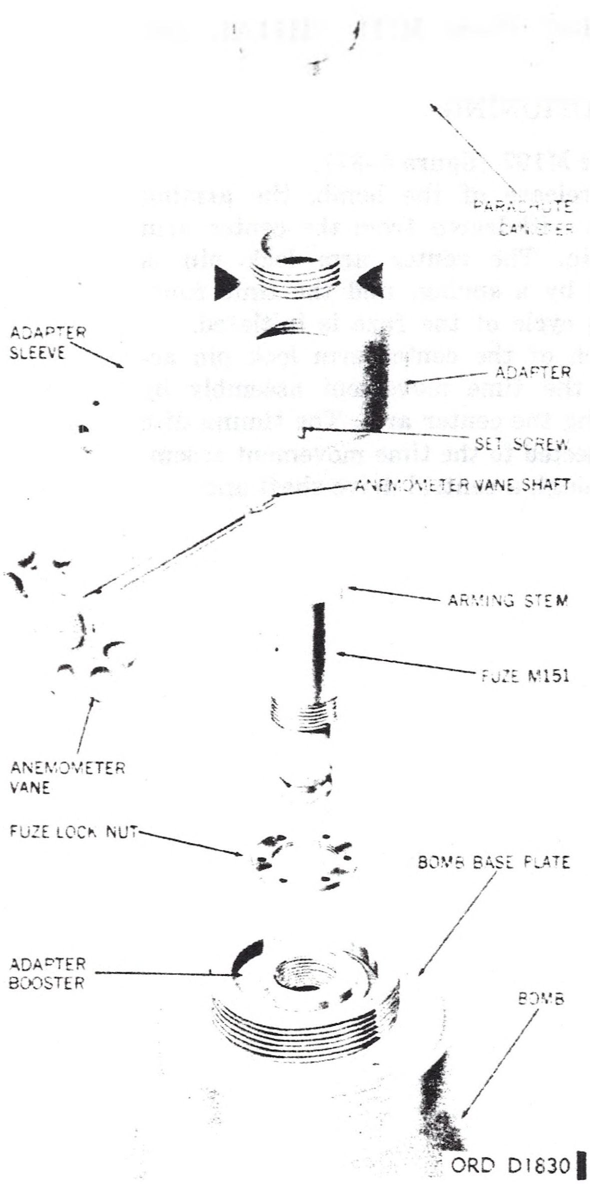


Figure 5-33.5 Exploded View Showing Components of Typical Anti-Ricochet Device

M145, AN-M145A1, M146, AN-M146, AN-M146A1, M147, AN-M147, AN-M147A1, M152, M152A1, M153, M155, M155A1, M155A2, M-155E3, M198, M901, M902, M907, M908, and M909 are covered in this paragraph.

5-3.1 IDENTIFICATION.

5-3.1.1 TYPE. Fuzes of this type are mechanical time, vane or direct armed, arming pin ini-

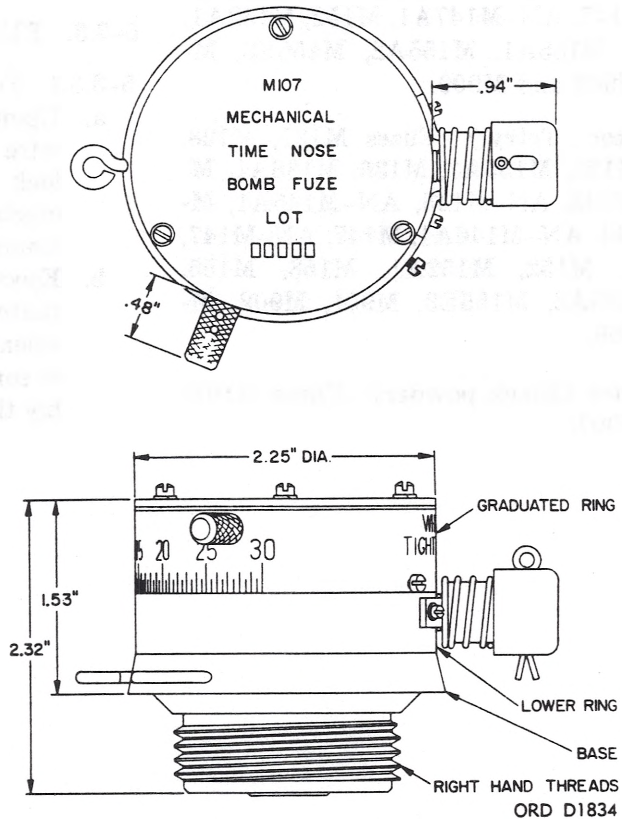


Figure 5-34 Dimensional Characteristics of Fuze M107

tiated. They function either on ground impact or on timed airbursts.

5-3.1.2 PAINTING AND MARKING. The fuzes are unpainted and are marked either by stenciling or stamping the type, model, lot number, and a time scale. The arming vanes of tail fuzes are painted red.

5-3.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5-34 through 5-36.

5-3.1.4 MATERIALS. The fuzes are made of aluminum, brass, or cadmium plated steel.

5-3.2 HAZARDOUS COMPONENTS.

5-3.2.1 Primer: Fuzes M107, M198, and M907.

5-3.2.2 Detonator: Fuzes M111, M111A1, M11-1A2, M127, M128, AN-M128, M135, M135A1,

M136, M136A1, M138, M144, M145, AN–M145, AN–M145A1, M146, AN–M146, AN–M146A1, M147, AN–M147, AN–M147A1, M152, M152A1, M153, M155, M155A1, M155A2, M155E3, M-901, M902, M908 and M909.

5–3.2.3 Booster (Tetryl): Fuzes M127, M128, AN–M128, M135, M135A1, M136, M136A1, M-138, M144, M145, AN–M145, AN–M145A1, M-146, AN–M146, AN–M146A1, M147, AN–M147, AN–M147A1, M152, M152A1, M153, M155, M155A1, M155A2, M155E3, M901, M902, M-908, and M909.

5–3.2.4 Booster (Black powder): Fuzes M107, M198, and M907.

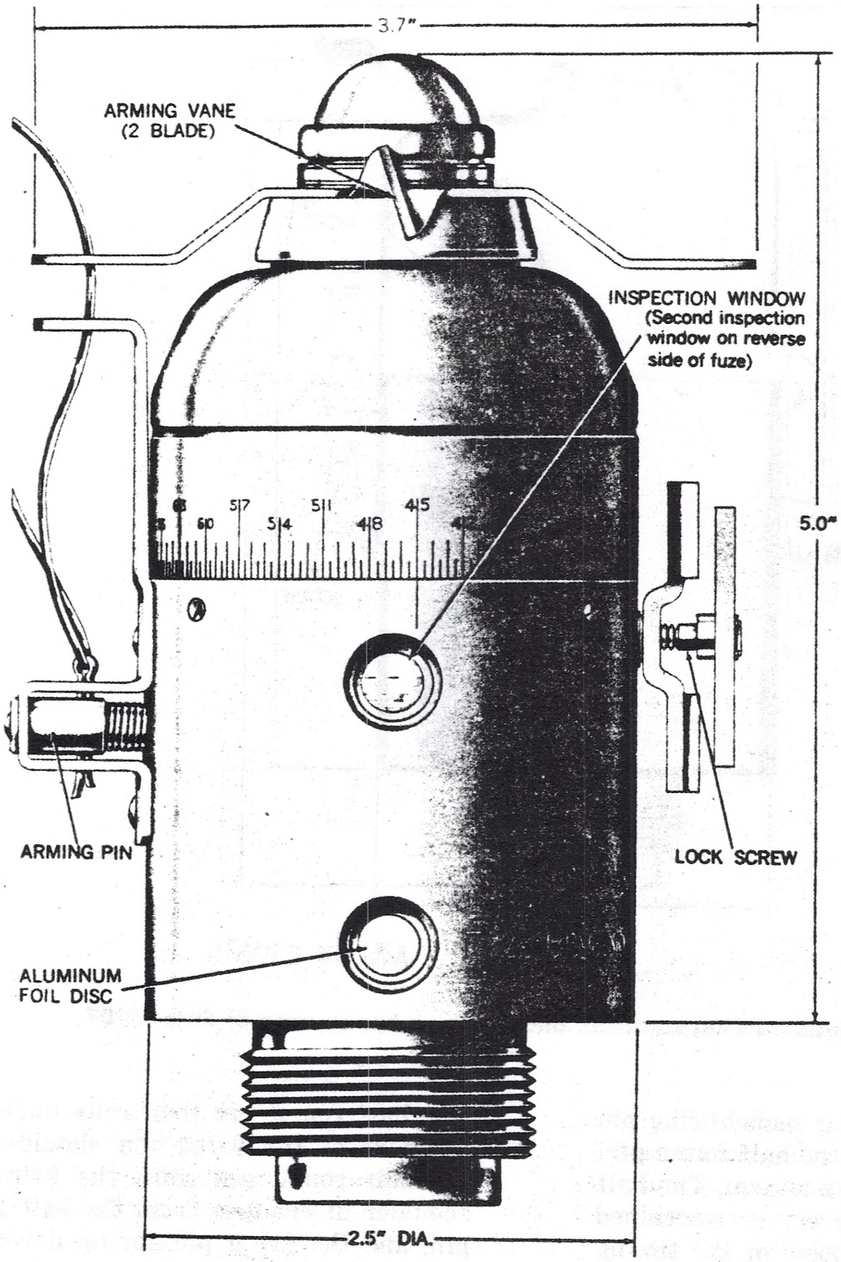
5–3.2.5 Igniter: Fuzes M111, M111A1, and M111A2.

5–3.3. FUNCTIONING.

5–3.3.1 Fuze M107 (figure 5–37).

a. Upon release of the bomb, the arming wire is withdrawn from the center arm lock pin. The center arm lock pin is ejected by a spring, and the time functioning cycle of the fuze is initiated.

b. Ejection of the center arm lock pin actuates the time movement assembly by releasing the center arm. The timing disc is connected to the time movement assembly through a central drive shaft and



MU-D4 2104

Figure 5–35 Dimensional Characteristics and External Appearance of Fuze M198

rotates at a uniform rate with the rotation of the drive shaft. The timing disc lever bears against the edge of the timing disc under pressure of the spring loaded firing pin. This pressure is transmitted to the timing disc lever through a linkage of parts consisting of the half round pin, half round pin arm, and firing

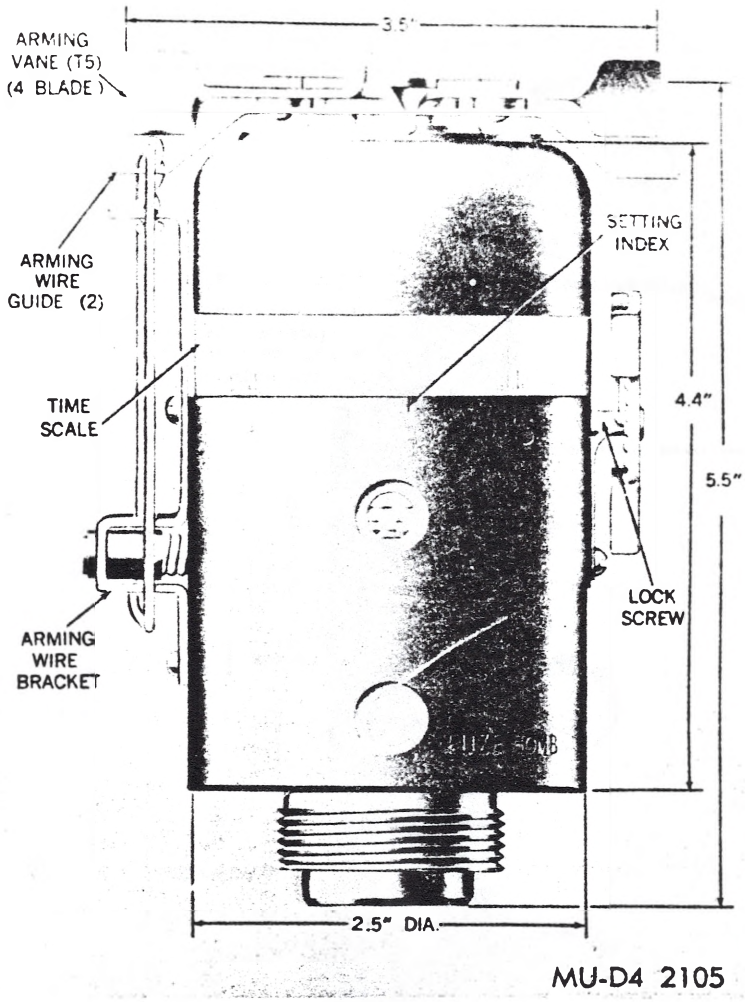


Figure 5-36 Dimensional Characteristics and External Appearance of Fuze M907

pin shoulder. The spring loaded firing pin shoulder bears against the half round pin, tending to roll the pin and arm. The half round pin arm, however, is restrained from moving by the elbow of the timing disc lever which so pivots as to bring the timing disc lever to bear against the timing disc. After the predetermined time for which the fuze was set has elapsed, the notch in the timing disc lines up with the timing disc lever, and the timing disc lever snaps into the notch. This change in position of the timing disc lever releases the half round pin arm. The half round pin then rolls under the pressure of the firing pin shoulder. As the half round pin rolls, the firing pin shoulder disengages from the half round pin, and the firing pin spring drives the firing pin into the primer, thereby initiating the explosive train.

5-3.3.2 Fuzes M111, M111A1, M111A2, M127, M128, AN-M128, M135, M135A1, M136, M136-A1, M138, M144, M145, AN-M145, AN-M145-A1, M146, AN-M146, AN-M146A1, M147, AN-M147, AN-M147A1, M152, M152A1, M153, M155, M155A1, M155A2, and M155E3.

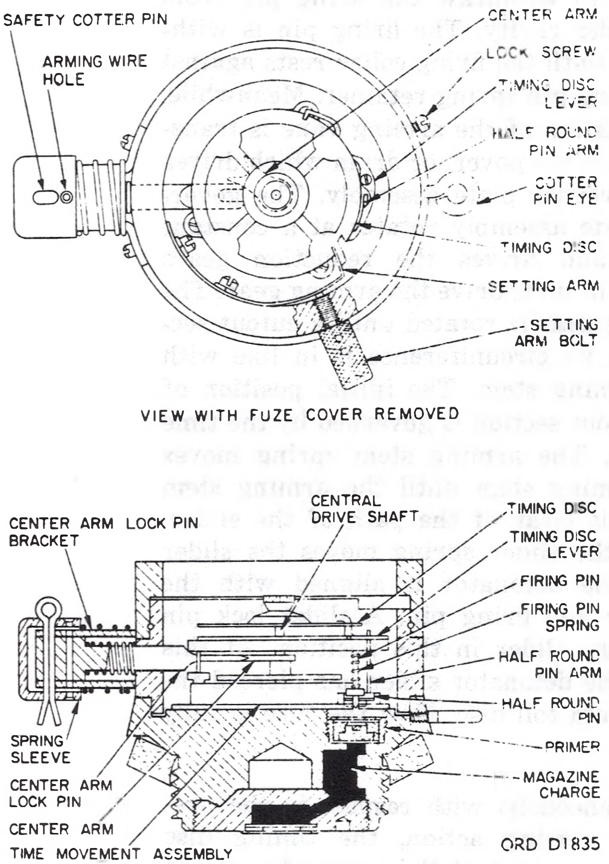


Figure 5–37 General Arrangement of Fuze M107

a. M111A2 Group. When the munition is released from the aircraft the arming wire is withdrawn from the fuze. The arming pin is ejected and the arming vane starts to rotate in the airstream.

(1) Delay Vane Arming Cycle. The arming vane, nut, hub, and stationary gear rotate as a unit. The stationary gear drives the pinion which turns the arming sleeve through the movable gear. Since the movable gear has one more tooth than the stationary gear, it lags behind the stationary gear one tooth every vane revolution. This causes the arming sleeve to unthread from the hub. As soon as the arming sleeve clears the safety block, centrifugal force throws the safety block clear of the fuze leaving the firing pin unobstructed.

(2) Direct Vane Arming Cycle. The fuzes M155 series are vane armed directly. The stationary gear and pinion have been removed and the movable gear has been replaced by a lever attached to the arming sleeve which bears against the exposed pinion shaft. This keeps the arming sleeve from rotating with the hub and causes the arming sleeve to unthread enough to clear the safety block after 6 to 9 revolutions of the hub.

(3) Firing Cycle. Ejection of the arming pin releases the timing disc, starting the timing mechanism. The timing mechanism rotates the timing disc until the notch in the timing disc is presented to the timing disc lever. When this occurs, the timing disc lever snaps into the notch and releases the firing lever. The firing lever pivots, releasing the cocking pin. The pressure exerted by the firing pin spring through the firing pin collar to the edge of the half round section of the cocking pin forces the cocking pin to rotate, clearing the firing pin path. The firing pin spring then drives the firing pin into the detonator, initiating the explosive train.

NOTE

The time required for completion of the timing cycle depends on the distance the timing disc must rotate before its notch is presented to the timing disc lever. This is determined by the time setting of the head to which the timing disc lever is attached. If impact occurs before the timing cycle is complete but after the vane arming cycle is complete, the shear pin that secures the firing pin collar to the firing pin is sheared as the firing pin is driven on impact into the detonator.

b. M135 Group. Fuzes of the M135 Group have upper bodies which are mechanically identical to the fuze M111A2. Thus, upon arming wire withdrawal the arming pin is ejected from the upper body to initiate the delay vane arming cycle. Simultaneously, the lower arming pin is ejected by its spring. As a result, the arming stem spring lifts the arming stem clear of the slider in the lower body of the fuze. Two springs move the slider to position the detonator beneath the firing pin, and the detent locks the slider in position. At the end of the delay vane arming cycle the fuze is armed and it detonates at the end of the firing cycle.

c. M146 Group.

(1) All fuzes in this group are delay vane arming types, with the exception of the fuze M144 which is a direct vane arming type. This group of fuzes combines the vane arming and firing cycles of the M111A2 Group with an out-of-line detonator which moves to the in-line position a few seconds after the timing mechanism has started.

(2) A cam below the timing disc holds the arming stem in a position so its half-round section obstructs the slider. After the arming pin is ejected, the timing disc and cam are turned together by the timing mechanism. After a few seconds, the cam clears the arming stem and the force of the spring-loaded slider against the edge of the half-round section of the arming stem turns the arming stem thus clearing the path of the slider. The slider then moves the detonator into the in-line position and is locked in this position by a spring-loaded detent.

5–3.3.3 Fuzes M198, M901, M902, M907, M908, and M909 (figures 5–38 and 5–39).

a. When the fuzed bomb is released from the aircraft, the arming wire is withdrawn. This frees the arming vane for rotation and permits the arming pin spring to eject the arming pin from the fuze. Ejection of the arming pin releases two components: the timing disc, which begins to rotate due to the spring-driven clock mechanism, and the firing pin collar, which permits the firing pin set spring to withdraw the firing pin from the slider cavity. The firing pin is withdrawn until the firing collar rests against the firing pin spring retainer. Meanwhile, the rotation of the arming vane is transmitted to the governor drum which drives the governor plate assembly. The governor plate assembly rotates at a constant speed and drives the reduction gears which, in turn, drive the arming gear. The arming gear is rotated until a cutout section in its circumference is in line with the arming stem. The initial position of the cutout section is governed by the time setting. The arming stem spring moves the arming stem until the arming stem shank is clear of the path of the slider. Next, the slider spring moves the slider until the detonator is aligned with the booster and firing pin. A slider lock pin locks the slider in this position. At this time, the detonator slider has pierced the aluminum foil disc. Now the fuze is fully armed.

b. Simultaneously, with respect to the preceding arming action, the timing disc lever bears against the outer edge of the rotating timing disc. The timing disc lever is linked to the cocking pin through the firing lever and cocking pin stud. The cocking pin tends to turn, due to the action of the compressed firing pin spring forcing the firing pin spring retainer against a flat section on the cocking pin. The tendency of the cocking pin to turn causes the timing disc lever to bear against the outer edge of the timing disc. When the fuze functioning time has elapsed, the timing disc lever moves into a cutout section in the timing disc. The turning movement of the timing disc lever frees the firing lever which in turn frees the cocking pin for rotation. The firing pin spring drives the firing pin spring retainer past the cocking pin and into the firing pin collar. The firing pin collar is driven rearward forcing the firing pin into the detonator, thus initiating the explosive train. If the fuze fails to

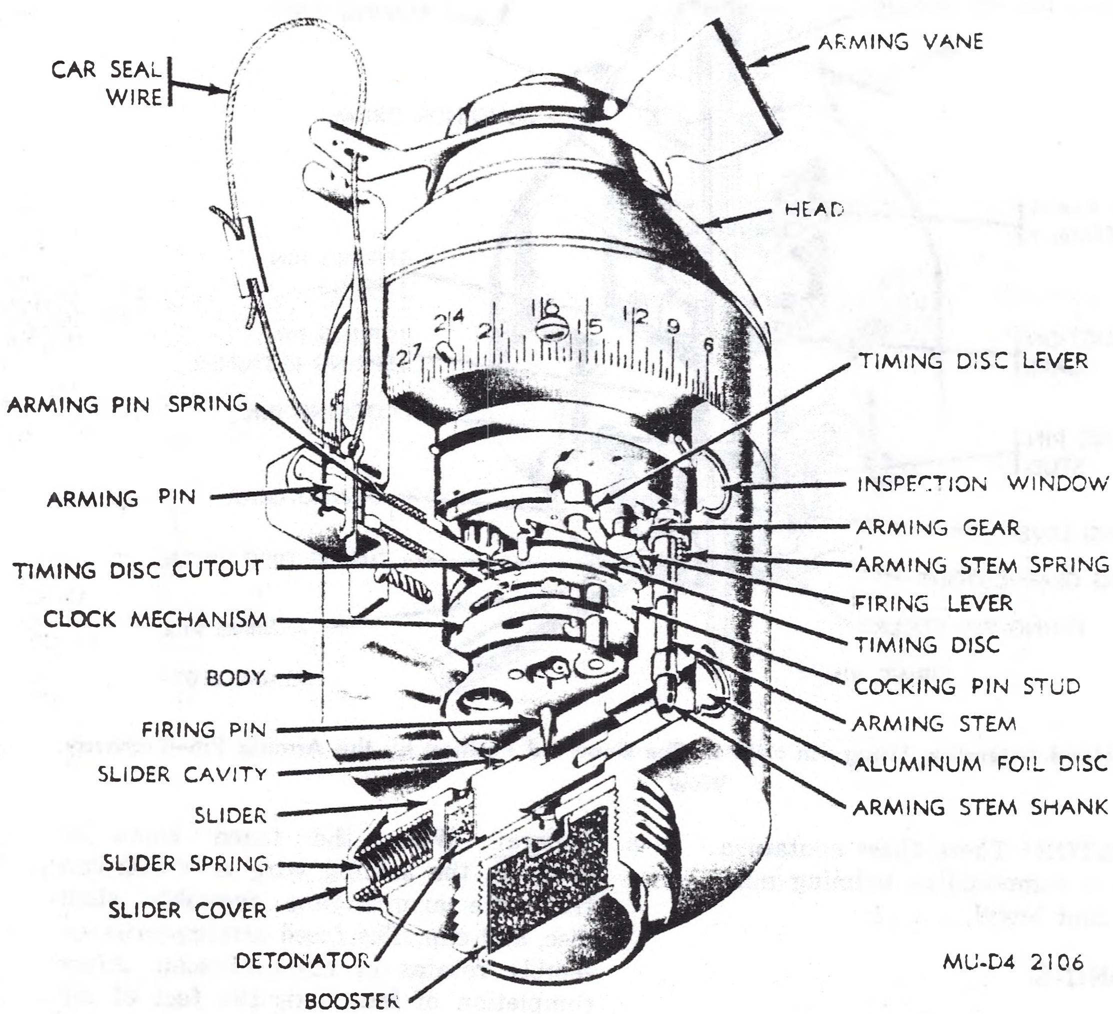


Figure 5-38 Fuze M198 in The Unarmed Condition—Cutaway View

function on timed air-burst, it will function upon ground impact.

5-4 CHEMICAL LONG DELAY ANTIWITHDRAWAL BOOBY TRAP TAIL FUZES

Chemical long delay antiwithdrawal booby trap tail fuzes M123, M123A1, M124, M124A1, M125, M125A1, M125A1 Modified, M132, M133, and M134 are covered in this paragraph.

5-4.1 IDENTIFICATION.

5-4.1.1 TYPE. Fuzes of this type are delayed arming (arming vane and impact) long delay action, antiwithdrawal.

5-4.1.2 PAINTING AND MARKING. The fuzes are unpainted and are marked either by stenciling or stamping the designation, lot number, and date loaded.

5-4.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5-40 and 5-41.

5-4.1.4 MATERIALS. The fuzes are made of case hardened, cadmium plated, or zinc-plated steel.

5-4.2 HAZARDOUS COMPONENTS.

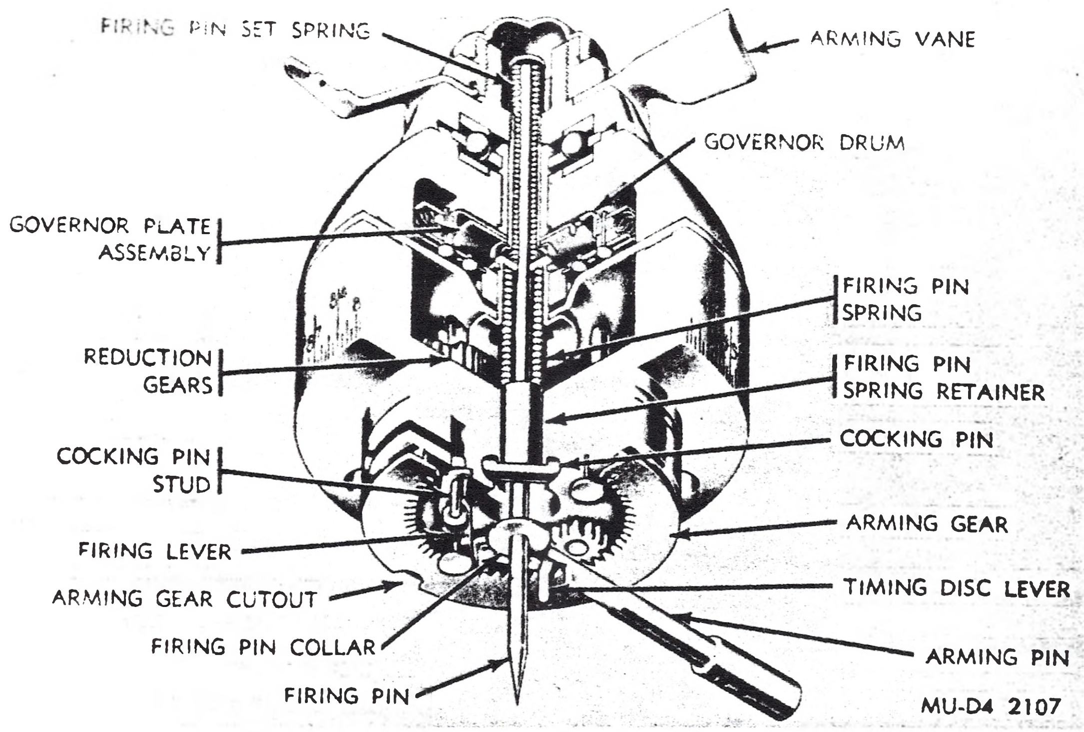


Figure 5–39 Fuze Head Assembly, Firing Pin Held in The Unarmed Position by the Arming Pin—Cutaway View

5–4.2.1 DETONATOR: These fuzes contain a detonator which is composed or priming mixture, lead azide, and tetryl.

5–4.3 FUNCTIONING.

5–4.3.1 FUZES M123, M123A1, (figure 5–42), M124, M124A1, M125, M125A1, and M125A1 MODIFIED

NOTE

These fuzes function alike except that the fuzes M123A1, M124A1, M125A1, and M125A1 Modified are direct-arming; that is, they do not have a gear-reduction mechanism. The fuzes M123, M124, and M125 have a gear-reduction mechanism and are consequently classed as delayed-arming type. However, either type can be armed without completing the normal arming cycle because of the frangible glass ampoule in the fuze body.

a. General. When the fuzed bomb is dropped, the arming wire is withdrawn from the arming-vane assembly, stem disc, and clip. The freed arming-vane assembly rotates in the airstream. After completion of less than 100 feet of air travel, the fuze is armed and sealed against the entrance of moisture and the escape of solvent. Impact produces no effect upon the armed fuze. The fuze does not act to explode the bomb until the delay time has expired or until someone attempts to defuze the bomb.

b. Arming. The arming-vane assembly (figure 5–43) is connected directly to the arming stem by means of the safety catch. At its lower end, the arming stem passes through the retainer locking nut and is threaded into the ampoule retainer. As the arming-vane assembly turns the arming stem, the stem is screwed into the ampoule retainer and ampoule-retainer nut. After a short air travel, the

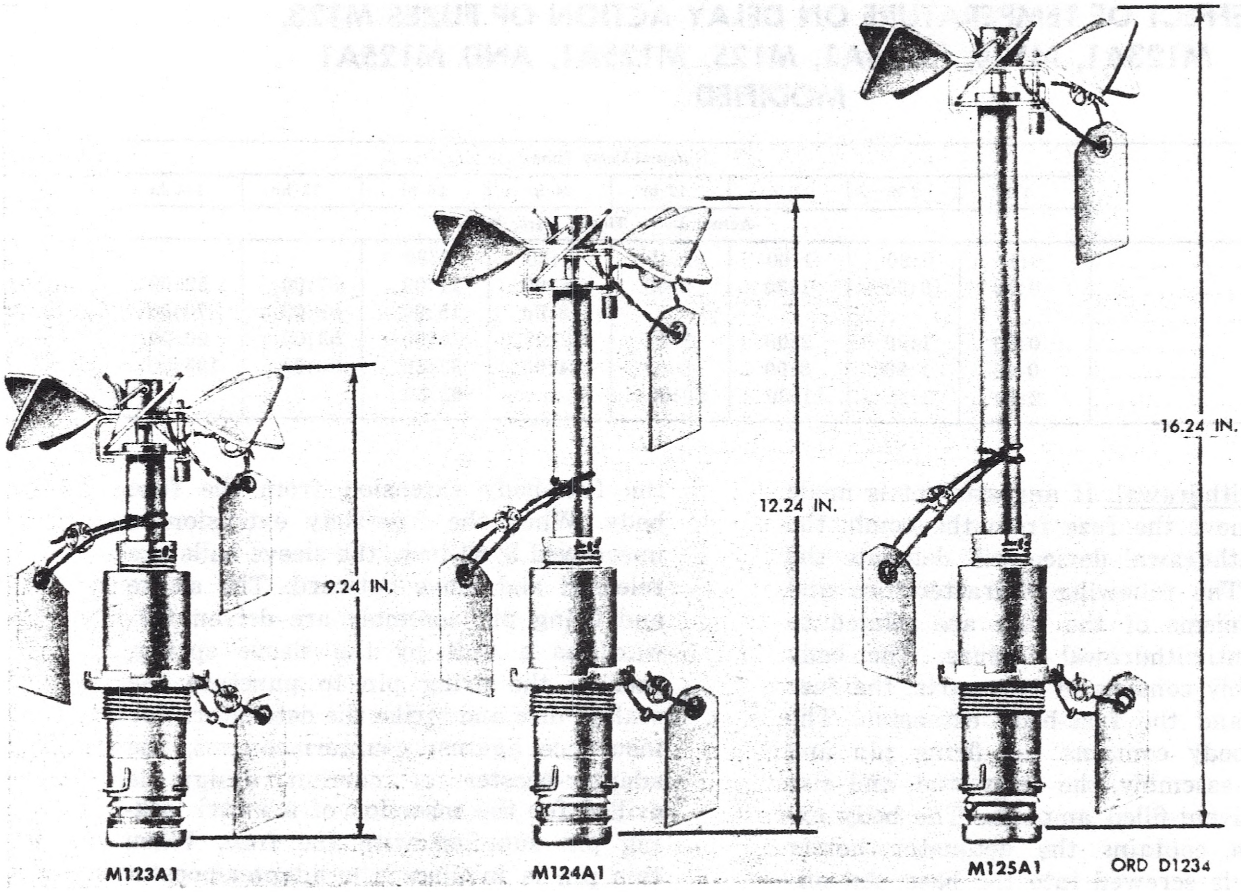


Figure 5-40 General Appearance and Dimensional Characteristics of Fuzes M123A1, M124A1, and M125A1

stem, moving into the fuze body, crushes the ampoule and frees the solvent. With additional air travel, the arming stem progresses far enough to force the stem collar against the retainer locking nut. This action seals the outer end of the fuze body to prevent the escape of solvent or the entrance of moisture.

c. Action. The solvent from the crushed ampoule filters through the delay wad to contact the celluloid delay collar. It is this celluloid delay collar that is the key to the locking arrangement of the spring-loaded firing pin. The firing-pin balls are wedged between the head of the firing pin in place against the action of the compressed firing-pin spring. The celluloid delay collar prevents the firing-pin balls from being forced outward until the celluloid delay collar is softened by the solvent. (see table II.2)

WARNING

If a fuze is suspected of having an acetone leak (odor or wetness at any joint or cavity), consider the fuze to be armed.

Table II.2

EFFECT OF TEMPERATURE ON DELAY ACTION OF FUZES M123, M123A1, M124, M124A1, M125, M125A1, AND M125A1 MODIFIED

Temp (° F.)	Nominal Delay Time:							
	1 hr	2 hr	6 hr	12 hr	24 hr	26 hr	72 hr	144 hr
	Actual Delay Time: (Hrs. Mins)							
115	0:15	0:20	1:00	1:15	1:30	2:30		
90	0:20	0:50	1:30	2:30	6:00	11:00	37:00	52:00
80	----	----	--	---	8:00	15:00	38:00	70:00
75	0:30	1:00	2:00	3:50	12:00	20:00	53:00	90:00
55	0:45	1:30	3:00	9:00	24:00	37:30	96:00	135:00
25	2:10	3:15	11:20	30:00	----	62:30		

d. Antiwithdrawal. If any attempt is made to remove the fuze from the bomb, the antiwithdrawal device will detonate the fuze. The following characteristics and mechanisms of the fuze are related to the antiwithdrawal feature. The body assembly consists of two parts, the fuze body and the fuze-body extension. The fuze body contains the firing pin and sleeve assembly, the delay wad, and also the solvent-filled ampoule. The body extension contains the detonator holder which is screwed into the base. An off-center circumferential groove is machined into the outer surface of the body extension. This groove contains the locking ball, used in conjunction with the antiwithdrawal mechanism. The sleeve within the fuze body is held in place against the action of the compressed sleeve spring by the sleeve balls. These balls are wedged between the sleeve shoulder and the body-extension shoulder and are held in place by the lips of the fuze body. Since the ball groove of the fuze-body extension is machined off-center, the locking ball is forced outward when the fuze is turned counterclockwise. This action wedges the ball between the adapter-booster wall and the fuze-body extension, thus locking the fuze-body extension in place. Any further counterclockwise rotation unscrews the fuze-body extension from the fuze body. When the fuze-body extension is unscrewed 3/64-inch, the sleeve balls are released and move outward. The sleeve and firing pin assembly are driven forward as a unit by the sleeve spring, causing the firing pin to puncture the sealing disc and strike the detonator. For insurance against countermeasures, the adapter-booster of current design is drilled for the insertion of a metal locking pin supplied with the fuze. When this pin is in place, the adapter-booster is locked to the base plug of the bomb, thus preventing removal of the fuze by the unscrewing of the adapter-booster.

e. Detonation. When the firing pin punctures the sealing disc and the detonator, the detonator explodes, setting off the adapter-booster and the bomb.

5–4.3.2 FUZES M132 (figure 5–44), M133, and M134.

a. General. When the fuzed bomb is dropped, the arming wire is retained in the bomb rack and withdrawn from the fuze. This frees the arming-vane assembly which rotates in the airstream. The revolving motion of the arming-vane assembly is transmitted through the reduction gears to initiate the time train, arming the fuze. Approximately 100 feet of air travel along the trajectory of

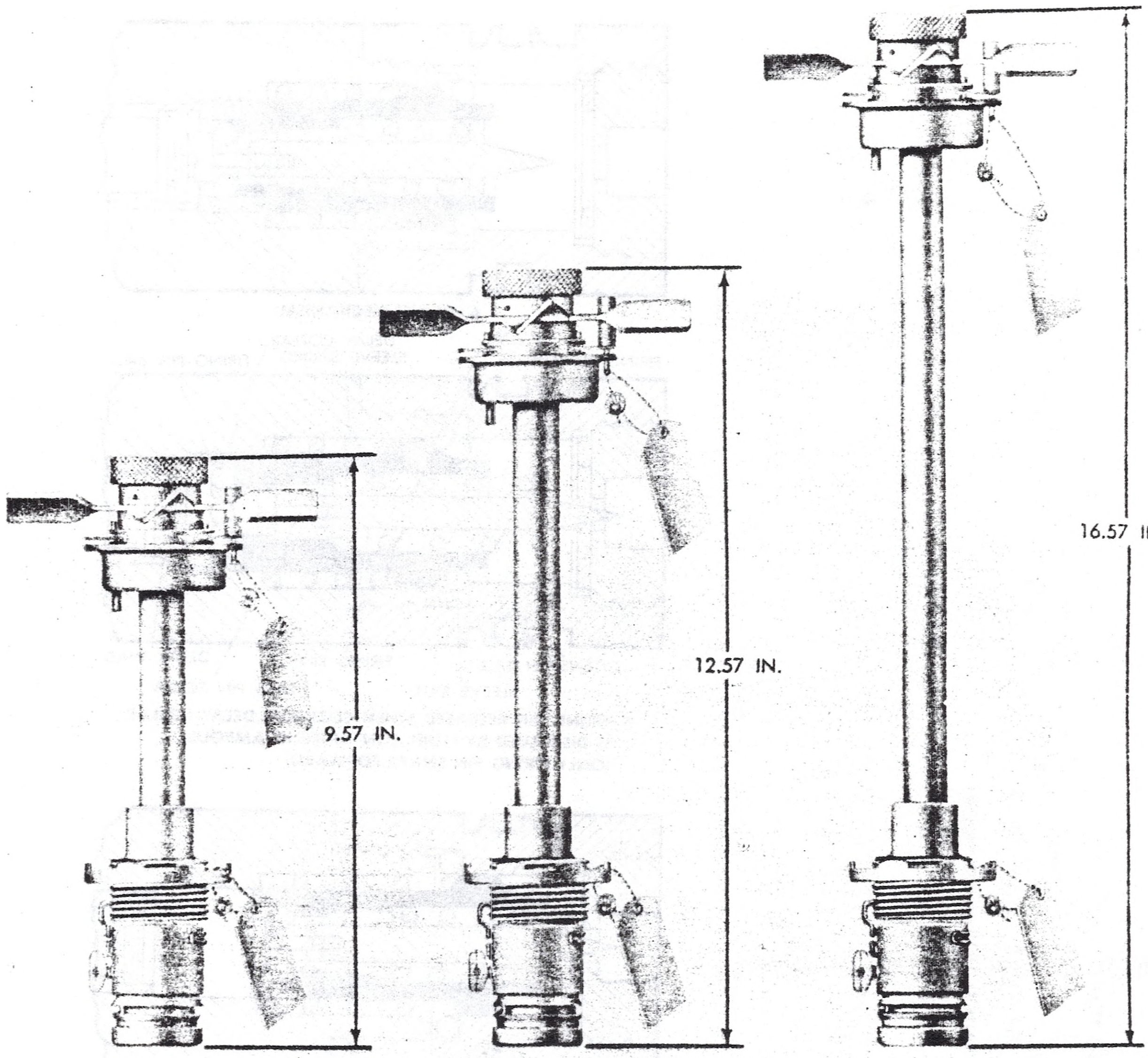


Figure 5–41 General Appearance and Dimensional Characteristics of Fuzes M132, M133 and M134

the bomb is necessary to complete this operation. Impact will not cause the fuze to detonate. Detonation will take place when the delay time has run out or when an attempt is made to remove the fuze from the bomb. Such an attempt will cause the antiwithdrawal device to detonate the fuze instantaneously.

b. Arming. The arming-vane assembly is assembled to the bearing cup by the vane nut. Eyelet pins, which fit into notches in the vane hub, insure positive rotatio of the bearing cup with the arming-var assembly. Delay arming is obtained by reduction-gear train between the armin; vane assembly and the arming stem. Tl ratio is one revolution of the armir stem to 30 revolutions of the armin; vane assembly. The reduction-gear trai is composed of a pinion, a movable gea and a stationary gear. The movable ge; has 30 teeth while the stationary ge;

Figure 5-42 Fuze M123A1—Cross Section

has 29 teeth. The idler gear (pinion) is driven around the stationary and movable gears by the bearing cup and the arming-vane assembly. Since the movable gear contains one more tooth than the stationary gear, the pinion pushes the movable gear one tooth forward each complete revolution. When the pinion has completed 30 revolutions, the movable gear has completed one. The movable gear is connected to the arming stem through the movable gear carrier. The stationary gear is secured to the

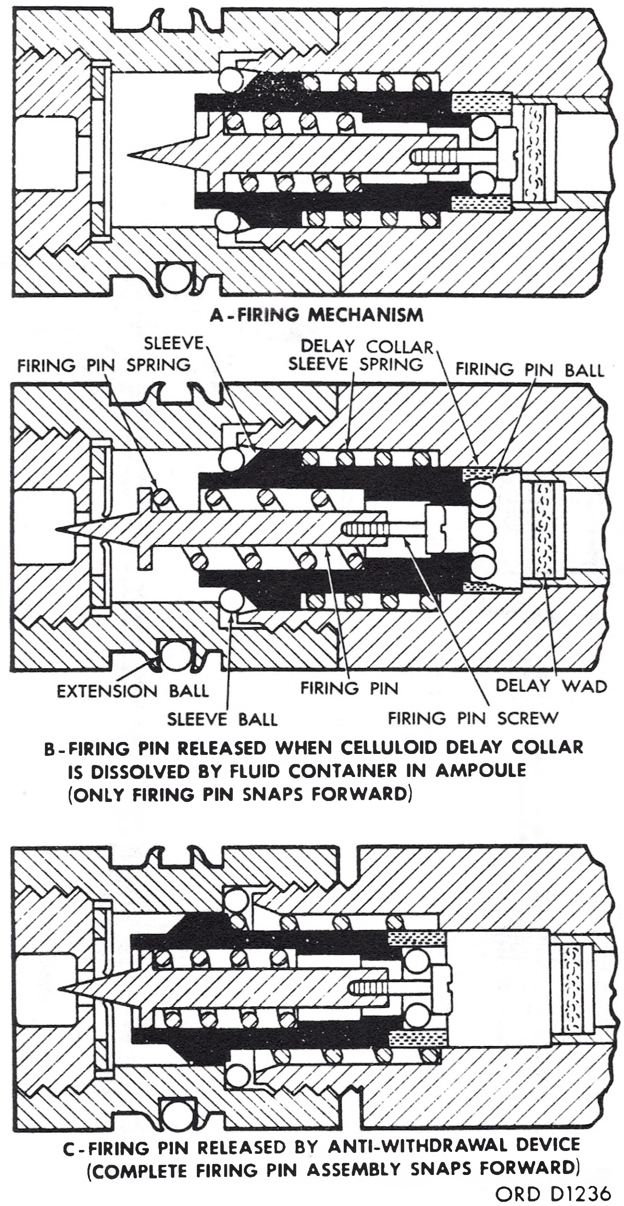


Figure 5-43 Fuze M123A1—Operation

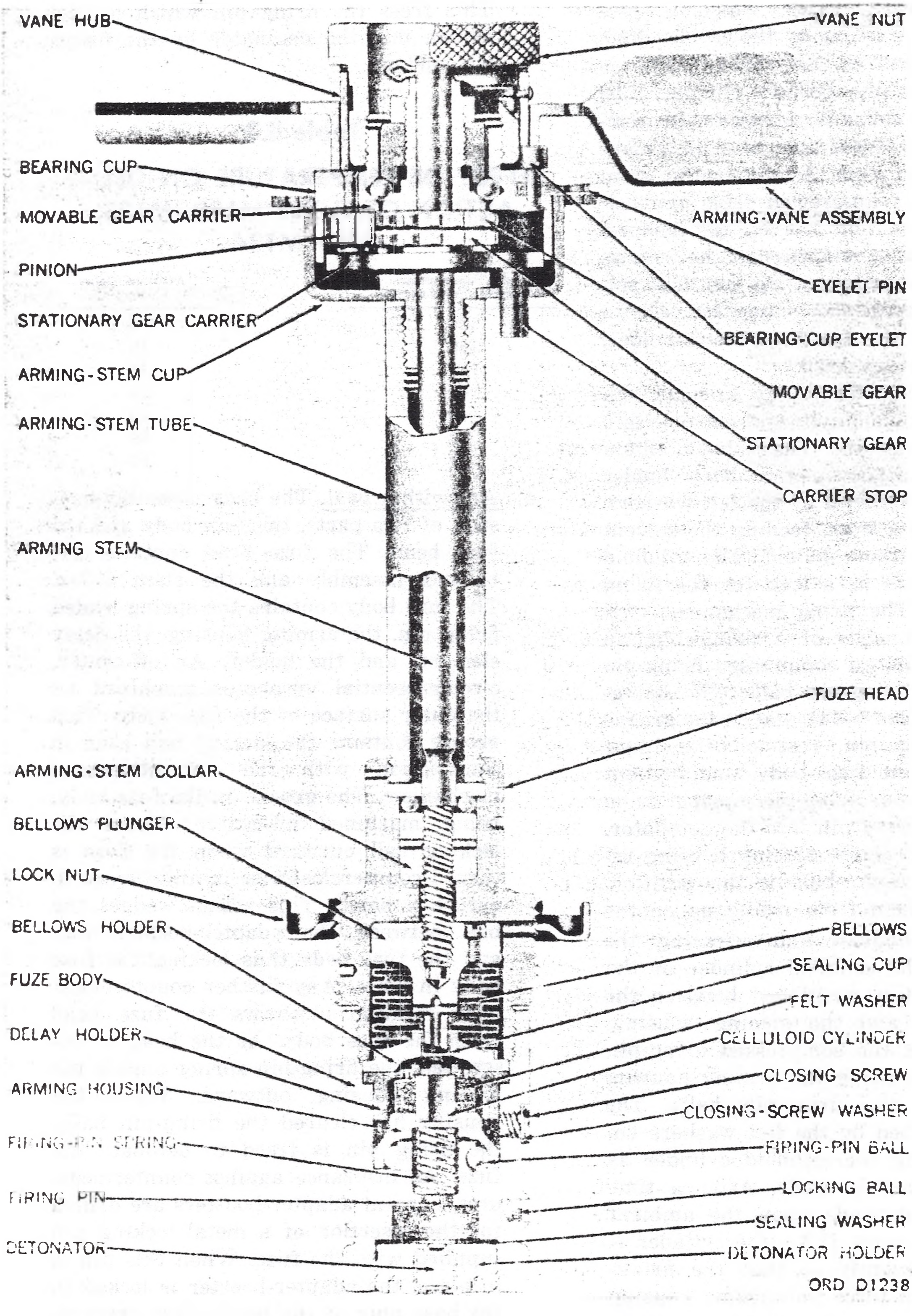


Figure 5–44 Fuze M132–Cross Section

stationary-gear carrier, which is prevented from rotating by the carrier stop. The lower end of the arming stem is threaded into the bellows plunger. The arming-stem collar is pinned to the arming stem to prevent any axial movement of the arming stem. As the arming stem revolves, it is unscrewed from the bellows plunger. This forces the bellows plunger inward, compressing the bellows and puncturing the sealing cup. The solvent contained in the compressed bellows is forced out through the bellows holder, and the fuze is armed.

c. Delayed Action. The delay element consists of a celluloid cylinder seated within three felt washers. The solvent filters through openings in the delay holder and is then absorbed by the felt washers, which act as a wick, feeding the solvent gradually to the celluloid. The celluloid cylinder serves as a lock for the firing mechanism. The firing mechanism (figure 5–45) consists of a firing pin, an arming housing, a compressed firing-pin spring, and firing-pin balls. The firing-pin balls (figure 5–44) seat in the groove of the firing pin, rest on the inner shoulder of the fuze body, and prevent the compressed firing-pin spring from driving the firing pin into the detonator. The lower lip of the arming housing retains the firing-pin balls in this position, preventing them from riding up on the fuze body shoulder and releasing the firing pin. The celluloid cylinder of the delay element is positioned between the delay holder and the arming housing. This prevents the compressed firing-pin spring from raising the arming housing and freeing the firing-pin balls. The solvent absorbed by the felt washers begins dissolving the celluloid cylinder as soon as contact is made. After a time lapse which depends upon the ambient temperature (table II.3), the cylinder is softened sufficiently so that the firing-pin spring can force the arming housing upward to release the firing-pin balls. This frees the firing pin which is then driven into the detonator by the firing-pin spring.

Table II.3

EFFECT OF TEMPERATURE ON DELAY ACTION OF FUZES M132, M133, AND M134

Fuze Temperature (Degrees Fahrenheit)	Average Delay (Minutes)
120	6
100	10
80	16
60	26
40	40
20	59
10	80

d. Antiwithdrawal. The body assembly consists of two parts, the fuze body and the fuze head. The fuze head contains the bellows assembly and the stem collar. The fuze body contains the spring-loaded firing pin, the arming housing, the delay element, and the holder. An off-center, circumferential groove is machined on the outer surface of the fuze body. This groove contains the locking ball used in conjunction with the antiwithdrawal mechanism. The groove on the fuze body, being machined off-center, forces the locking ball outward when the fuze is turned counterclockwise in an attempt to defuze a bomb. This action wedges the ball between the adapter-booster wall and the fuze body thus locking the fuze body in place. Any further counterclockwise rotation unscrews the fuze head from the fuze body. As the head is unscrewed, the firing-pin spring pushes the arming housing outward. When the housing has cleared the firing-pin balls, the firing pin is freed to detonate the fuze. As insurance against countermeasures, current adapter-boosters are drilled for the insertion of a metal locking pin supplied with the fuze. When this pin is in place, the adapter-booster is locked to the base plug of the bomb, thus prevent-

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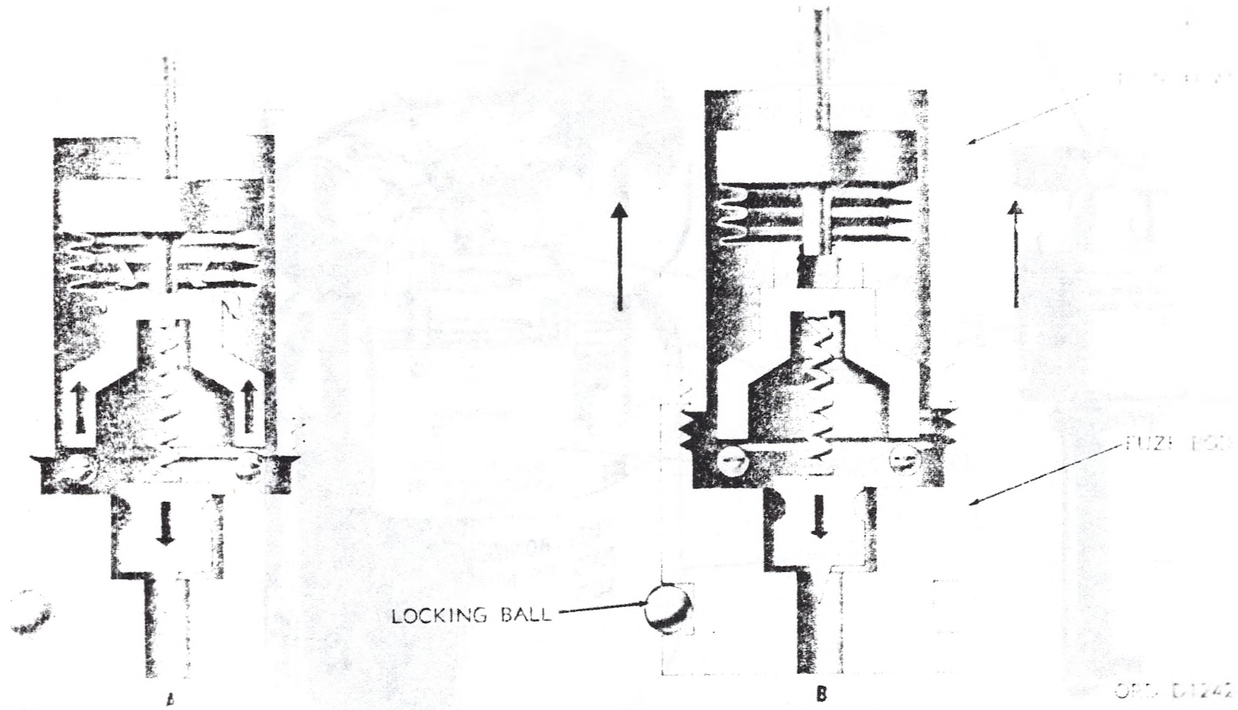


Figure 5-45. Fuze M132—Firing Mechanism Operation

ing removal of the fuze by the unscrewing of the adapter-booster.

e. Detonation. When the firing pin punctures the sealing disc and the detonator, the detonator explodes, setting off the booster and the bomb.

5-5 PROXIMITY (VT) FUZES

Proximity Fuzes AN-M166, M166, M166E1, M166E3, AN-M168, AN-M168E1, M168, M168E1, M188, M914, and M914E1 are covered in this paragraph.

5-5.1 IDENTIFICATION

5-5.1.1 TYPE. Fuzes of this type are vane arming, proximity (VT) fired. They are further classified as bar (M166, AN-M166, M166-E1, M166E3, M188, M914, and M914E1) type or ring (M168, AN-M168, AN-M168E1 and M168E1) type.

5-5.1.2 PAINTING AND MARKING.

5-5.1.2.1 RING TYPE. The fuzes are unpainted and designation and loading information are stenciled on the upper portion of the fuze body.

5-5.1.2.2 BAR TYPE. The fuzes are unpainted and designation and loading information are stenciled or appear on a label on the lower portion of the fuze body. In addition, assembly and use information may be stenciled on the bars of the fuzes.

5-5.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5-46 through 5-48.

5-5.1.4 MATERIALS.

5-5.1.4.1 The bar-type fuze has aluminum antenna bars, plastic head and arming vane, and a steel body.

5-5.1.4.2 The ring-type fuze has an aluminum ring antenna, plastic head, plastic or steel arming vane, and a steel body.

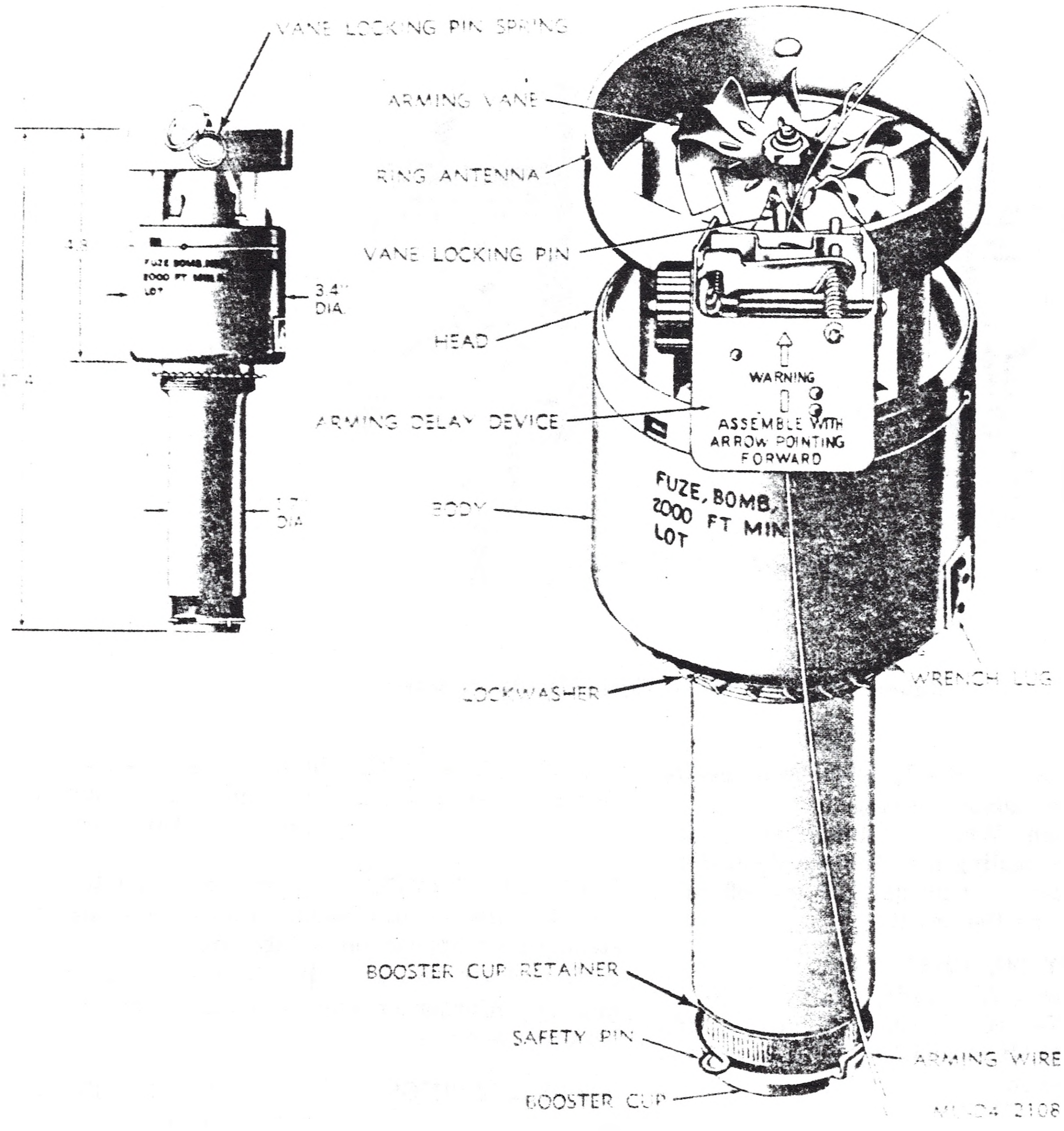


Figure 5–46 Appearance and Dimensions of Fuze M168 (a Typical Ring Type VT Bomb Nose Fuze)

5–5.2 HAZARDOUS COMPONENTS. The fuze contains a detonator, a booster lead-in, and a booster.

5–5.3 FUNCTIONING (figure 5–49).

a. When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze and the vane locking pin or locking arm is expelled by its spring. If an arming delay device is used, this action occurs when the arming delay separates itself from the fuze.

b. As the arming vane rotates in the airstream, rotation is transmitted to the

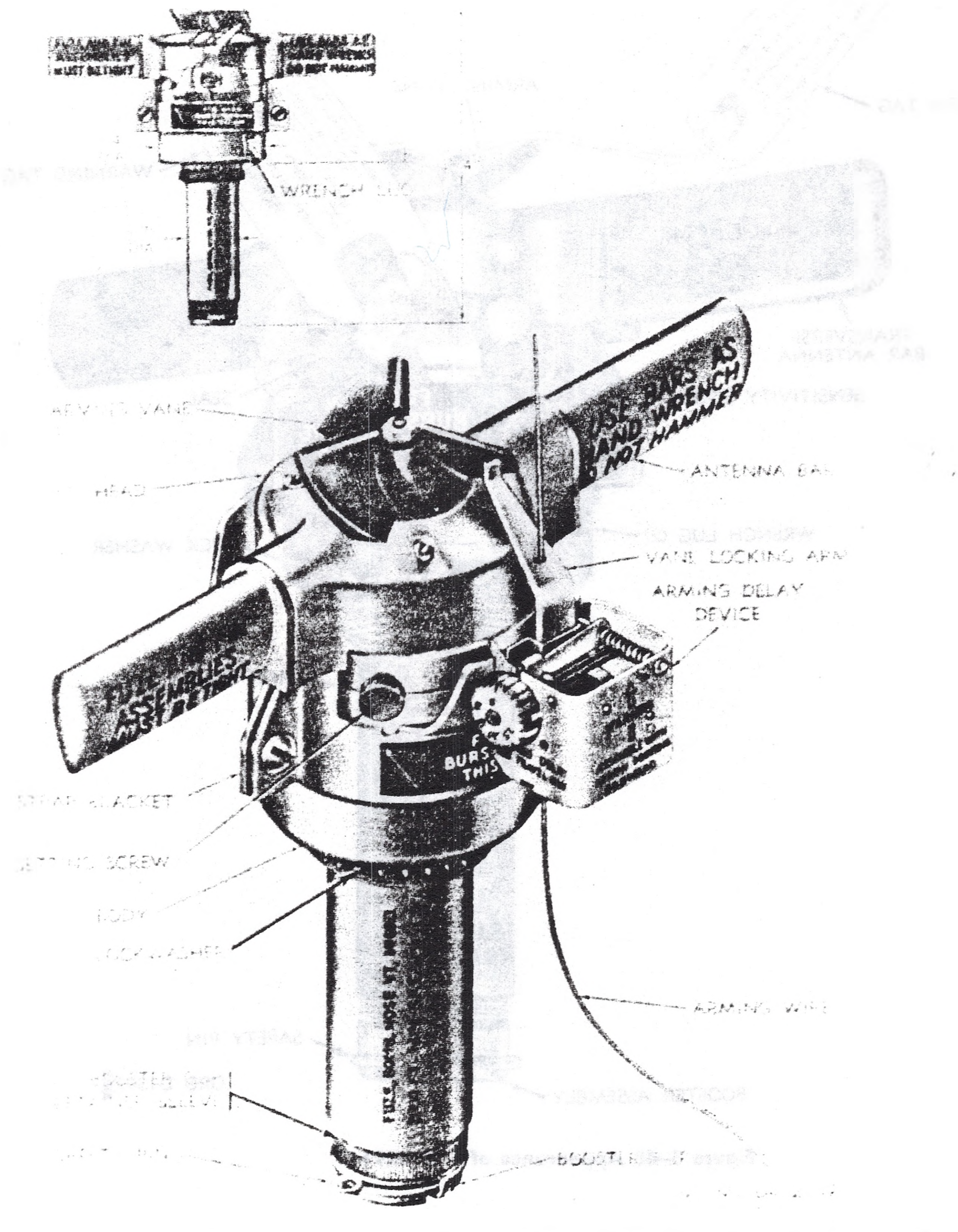


Figure 5–47 Appearance and Dimensions of Fuze M166E1 (a Typical Bar Type VT Bomb Nose Fuze)

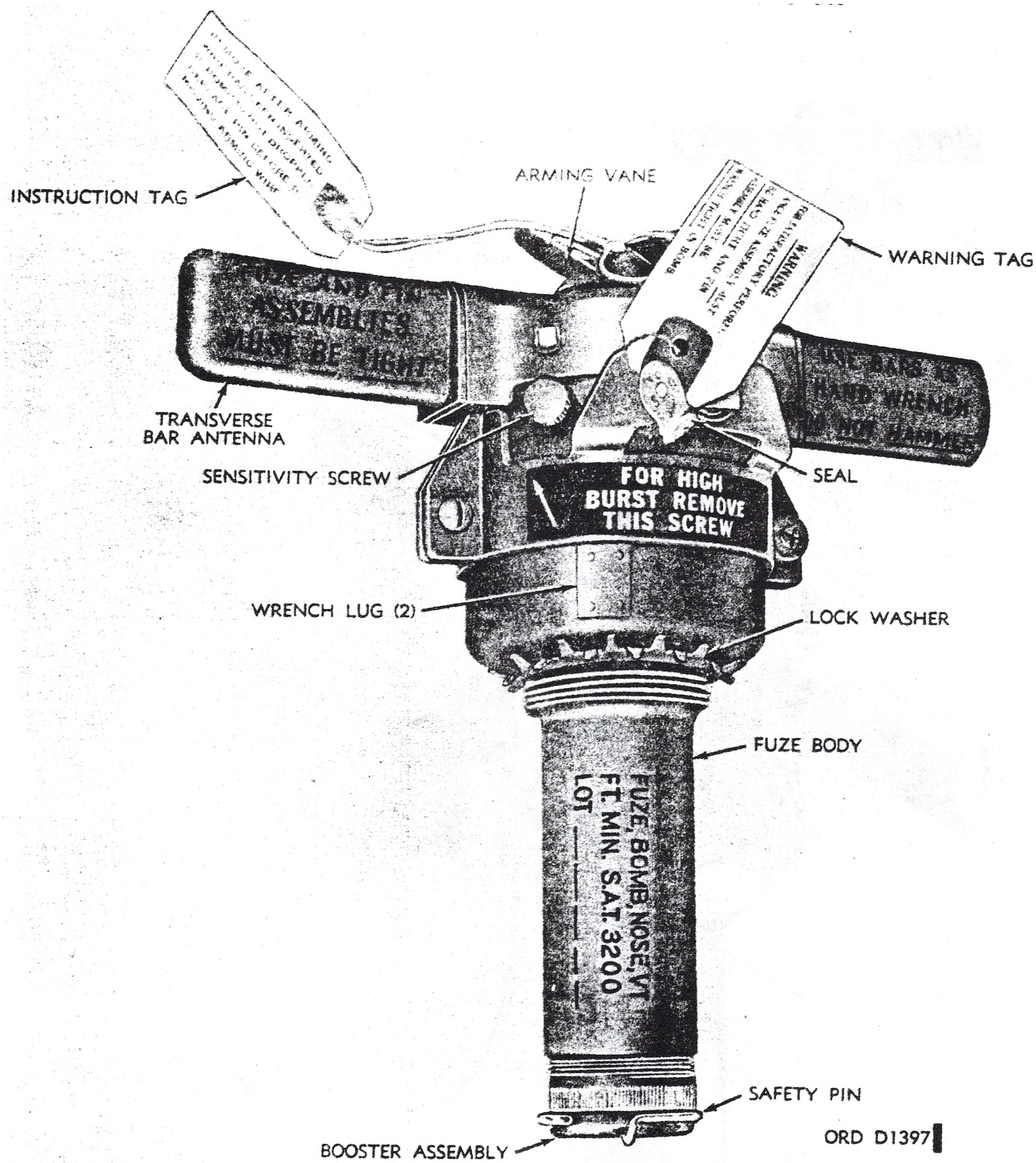


Figure 5–48 Appearance of Fuze M914

slow speed gear shaft via the coupling shaft, rotor shaft, and reduction gear train. The rotor shaft that drives the reduction gear train also drives a generator which supplies power to operate the electronic components and charge a firing condenser.

c. The slow-speed gear shaft which is coupled to the rotor lock pin slowly turns the rotor containing the detonator. When the detonator and booster lead-in are aligned, the rotor lock pin is also aligned with the locking hole in the rotor housing. Under the pressure of its spring, the rotor lock pin snaps into the locking hole, releasing the rotor from the slows-speed gear shaft and locking the detonator rotor in the *mechanically* armed position.

d. Although mechanically armed, the detonator cannot fire until it is electrically connected to the fuze electronic circuit. Movement of the detonator rotor to align the detonator and booster lead-in, simultaneously positions the firing-terminal screws of the detonator so that they touch firing contacts on the detonator rotor housing. After contact is made, the detonator is fired by the firing condenser when an electronic firing switch (thyratron) operates upon approach to the target.

5-5A SENSING DEVICE, M20 SERIES.

5-5A.1 IDENTIFICATION.

5-5A.1.1 TYPE. The M20 sensing device is a proximity, doppler frequency sensing element, designed for use with electrical or mechanical bomb fuzes to provide an airburst capability.

5-5A.1.2 PAINTING AND MARKING. The nose cone is white. The designation and loading data are stenciled in black on the encasing can.

5-5A.1.3 FITTINGS AND FEATURES. The general physical characteristics of the sensing element are shown in figure 5-49.1. A screw-headed "HI-LO" selection switch is located near the seating surface of the element. A striker rod protrudes through a metal insert on the forward end of the nose cone.

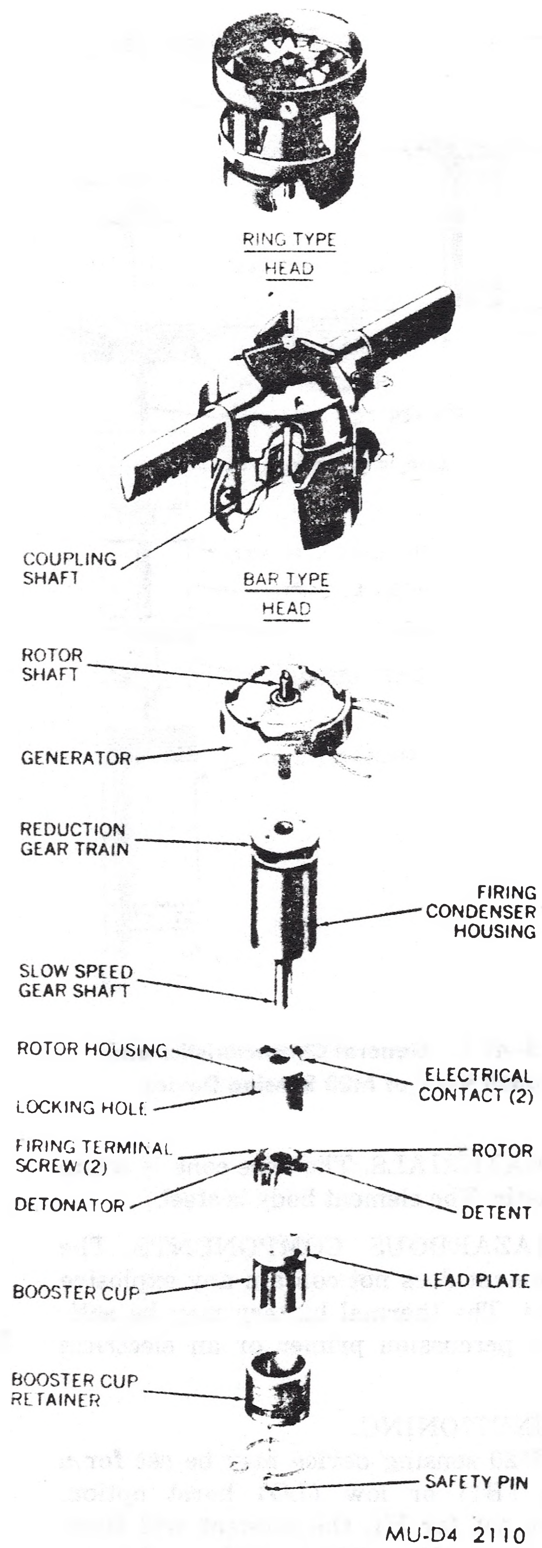


Figure 5-49 Exploded View of VT Bomb Nose Fuze (Bar and Ring Types)

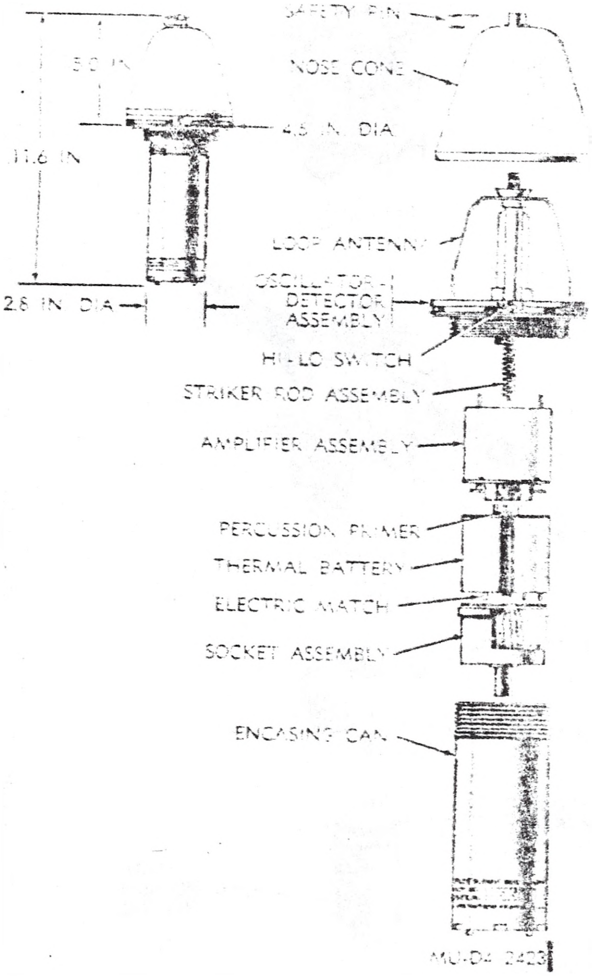


Figure 5–49.1 General Characteristics and Exploded View of M20 Sensing Device.

5–5A.1.4 MATERIALS. The nose cone is white opaque plastic. The element body is steel.

5–5A.2 HAZARDOUS COMPONENTS. The sensing element does not contain any explosive components. The thermal battery may be activated by a percussion primer or an electrical squib.

5–5A.3 FUNCTIONING.

a. The M20 sensing device may be set for a high (HI) or low (LO) burst option. When set for HI, the element will function from 100 to 160 feet above the target. When set for LO, the element will function from 20 to 60 feet above the target.

b. The M20 sensing device operates from electric power supplied by a thermal battery. The thermal battery can be activated electrically by an electric squib, or mechanically by a percussion primer.

c. For mechanical initiation, an arming wire is inserted in the striker rod and attached to the aircraft. When the bomb is released, the arming wire is withdrawn from the spring-loaded striker rod. The striker rod initiates the percussion primer which, in turn, activates the thermal battery.

d. For electrical initiation, the safety pin is left in place in the striker rod. The sensing element receives its initial RF pulse from the aircraft charging system. This RF pulse initiates the electric squib (electric match) which, in turn, activates the thermal battery.

e. Mechanical or electrical initiation of the power supply of the sensing device depends on the selection of fuze and bomb with which it is used.

f. As the bomb approaches the target, the sensing element receives the proper reflected signal at a predetermined distance from the target, and the target discriminating circuit generates a voltage signal. This signal, which is applied to the control grid of the thyratron tube, discharges the firing capacitor through the firing transformer. The firing transformer, through the firing lead, electrically initiates the firing train of the accompanying fuze.

5–5A.4 SAFETY PRECAUTIONS.

a. Waiting time, before approaching the M20 sensing element, will be in accordance with that prescribed for the accompanying fuze, but in no case less than 20 minutes.

b. Observe safety precautions applicable to the fuze used in conjunction with the M20 sensing element.

5-6 BUTTERFLY BOMB FUZES.

Butterfly bomb fuzes M129, M130, M130A1, M131, and M131A1 are covered in this paragraph.

5-6.1 IDENTIFICATION.

5-6.1.1 TYPE.

a. M129. This fuze is a direct arming (arming vane) impact or mechanical time (aerial or ground burst) firing (selective) type.

b. M130 or M130A1. This fuze is a direct arming (arming vane), mechanical time firing (long delay) type.

c. M131 or M131A1. This fuze is a direct arming (arming vane), mechanical time firing, antidisturbance type.

5-6.1.2 PAINTING AND MARKING. The fuzes are unpainted. Fuze M129 can be identified by the selector switch and the markings "GROUND" and "AIR" on the top surface of the caps. The M130 or M130A1 and M131 or M131A1 are not distinguishable.

5-6.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes are shown in figures 5-50 and 5-51.

5-6.1.4 WEIGHTS. The weight of a fully loaded fuze is approximately 6.3 ounces.

5-6.1.5 MATERIALS. The fuze caps are zinc die castings.

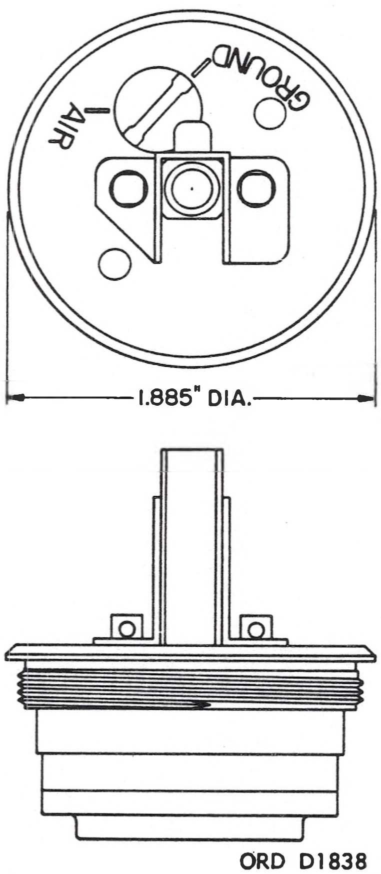
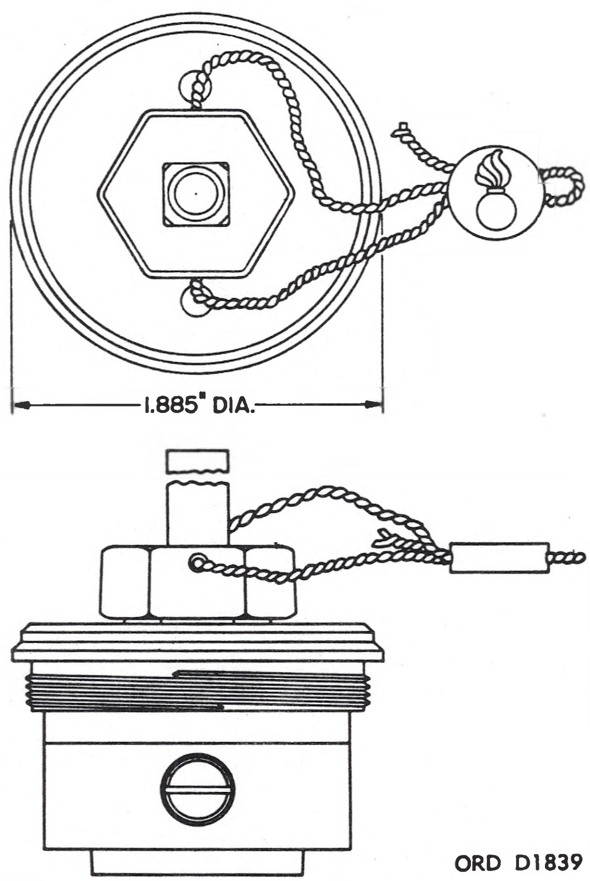


Figure 5-50 Dimensional Characteristics of Fuze M129



Figures 5-51 Dimensional Characteristics of Fuze M130 and M131

5–6.2 HAZARDOUS COMPONENTS.

5–6.2.1 The primer charge is composed of lead azide and primer mixture.

5–6.2.2 The booster charge is composed of approximately 0.4 ounce tetryl.

5–6.3 FUNCTIONING. When a fuze is installed in a "Butterfly" bomb, (figure 5–52), the arming pin clip is removed from the fuze. When the bomb is released from the cluster, the vane assembly springs open and engages the square head on the arming pin. The vane assembly (rotated by the airstream) unscrews the arming pin.

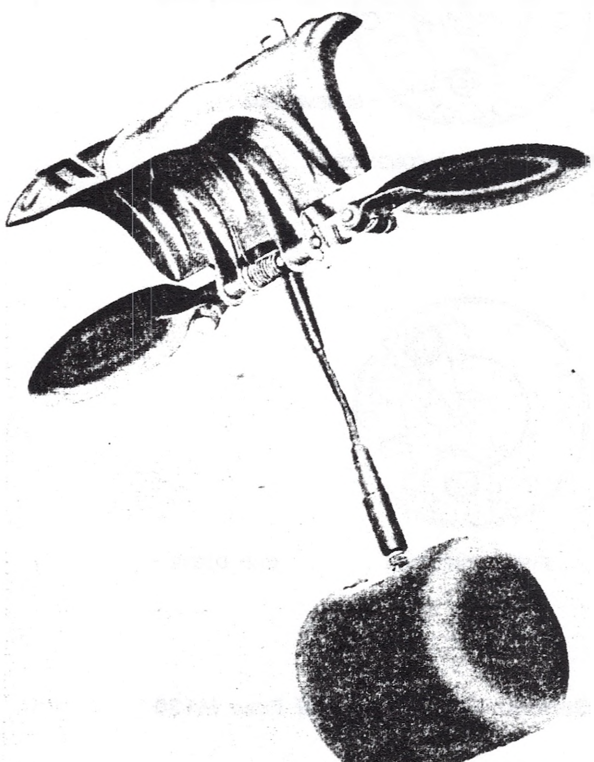


Figure 5-52 "Butterfly" Fragmentation Bomb M83

5-6.3.1 Fuze M129. (figure 5-53).

a. Ground burst setting. After the arming pin has unscrewed approximately ¼ inch, it releases the segment gear. The force of a spring-loaded firing pin cup on the half round section of the cam shaft turns the cam shaft, which is connected in the segment gear. The segment gear (regulated by a timing mechanism) allows the cam shaft to turn for approximately 2.5 seconds. The segment gear then strikes the segment gear stop, thus halting the rotation of the cam shaft. The segment gear stop is prevented from rotating by the projection of the safety pellet. The fuze is now fully armed. Upon impact the safety pellet is forced down by inertia forces, thus permitting the segment gear stop and segment gear to be rotated further. The cam shaft turns until it releases the spring-loaded firing pin cup. The firing pin spring drives the firing pin into the primer charge, thus initiating the explosive train.

b. Air burst setting. When the setting plug is set for "Air" burst the fuze operates as described above, except that the safety pellet has already been depressed. The fuze fires approximately 2.5 seconds after the arming stem has unscrewed approximately ¼-inch.

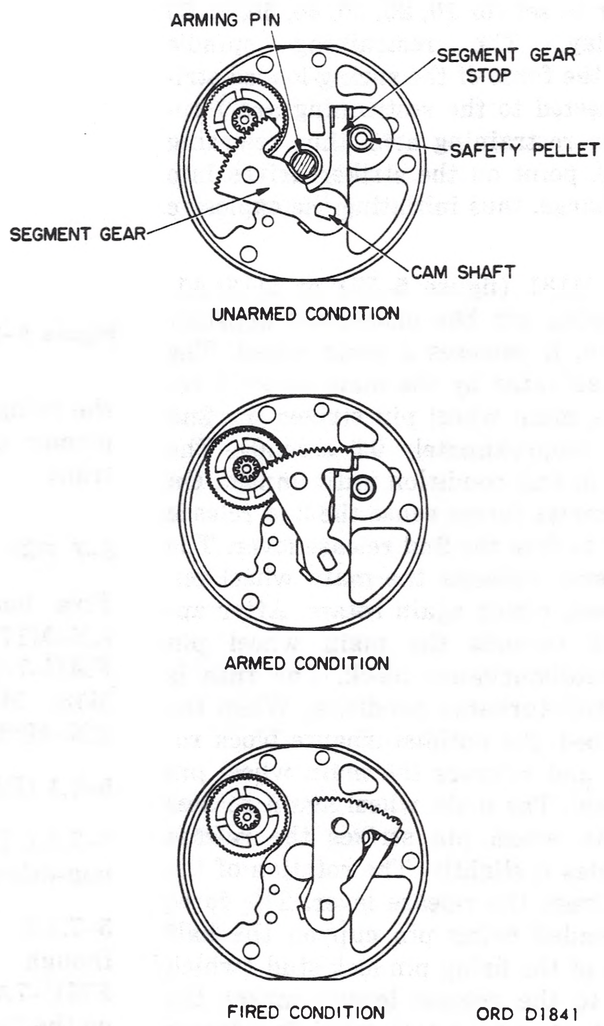


Figure 5-53 General Arrangement of Fuze M129

5-6.3.2 Fuze M130 (figure 5-54) or M130A1. After the arming pin has unscrewed approximately ¼-inch, it releases the arming lever. The arming lever moves until it is centered over the hole previously occupied by the arming stem and releases the timing mechanism. The main wheel is now rotated by the timing mechanism. With a maximum setting time of 60 minutes, the main wheel index pin engages the first slot of the geneva cam as the main wheel completes its first revolution and rotates the cam slightly. The main wheel index pin rotates the geneva cam further for each revolution of the main wheel until the geneva cam releases the restraining arm. The number of main wheel revolutions required before the restraining arm is released, depends on the factory fuze setting. The fuze may be set for 10, 20, 30, 40, 50, or 60 minutes delay. The restraining spindle (actuated by the force of the spring-loaded striker and connected to the restraining arm) rotates with the restraining arm, thus releasing the striker. A point on the striker drives into the primer charge, thus initiating the explosive train.

5-6.3.3 Fuze M131 (figure 5-55) or M131A1. After the arming pin has unscrewed approximately ¼-inch, it releases a main wheel. The main wheel (actuated by the main spring) rotates until the main wheel pin strikes the 2nd release lever (approximately 0.5 second). The fuze remains in this condition until impact. On impact, the inertia forces cause the 2nd release lever plunger to free the 2nd release lever. The 2nd release lever releases the main wheel pin and main wheel, which again rotate. After approximately 5 seconds the main wheel pin strikes an antidisturbance block. The fuze is now in an antidisturbance condition. When the fuze is disturbed, the antidisturbance block rotates slightly and releases the main wheel pin and main wheel. The main wheel again rotates until the main wheel pin strikes the release pawl and rotates it slightly. The rotation of the release pawl frees the release lever. The force of a spring-loaded firing pin cup on the half round section of the firing pin lock stud (which is connected to the release lever) causes the firing pin lock stud to rotate until it releases the firing pin cup. The firing pin drives into the primer charge, thus initiating the explosive train.

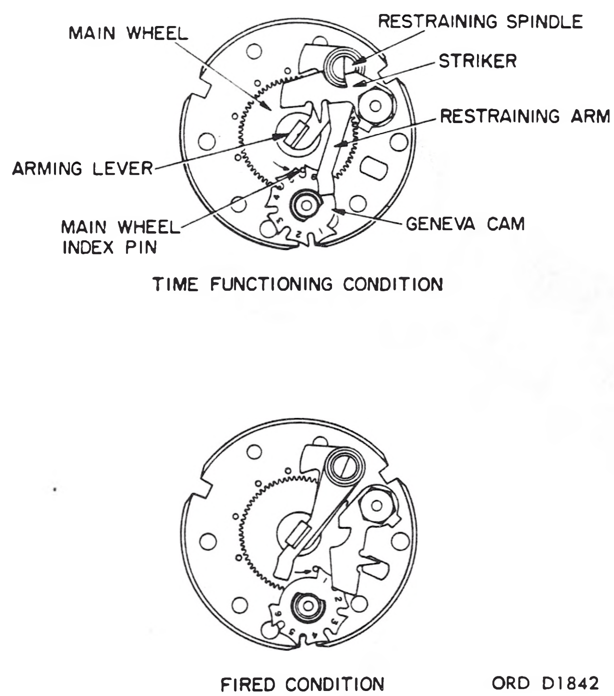


Figure 5-54 General Arrangement of Fuze M130

5-7 FIRE BOMB FUZES

Fire bomb fuzes M154, M157, AN-M173, AN-M173A1, AN-173 MOD, FMU-7A/B, FMU-7/B, and FMU-7B/B, with Igniters M13, M14, AN-M15, AN-M16, M23, and AN-M23A1 are covered in this paragraph.

5-7.1 IDENTIFICATION.

5-7.1.1 TYPE. These fuzes are all-ways action, non-delay, impact fired fuze systems.

5-7.1.2 PAINTING AND MARKING. Although the fuze model number of fuze FMU-7A/B or FMU-7/B is stenciled in black on the fuze head, the other fuzes covered herein

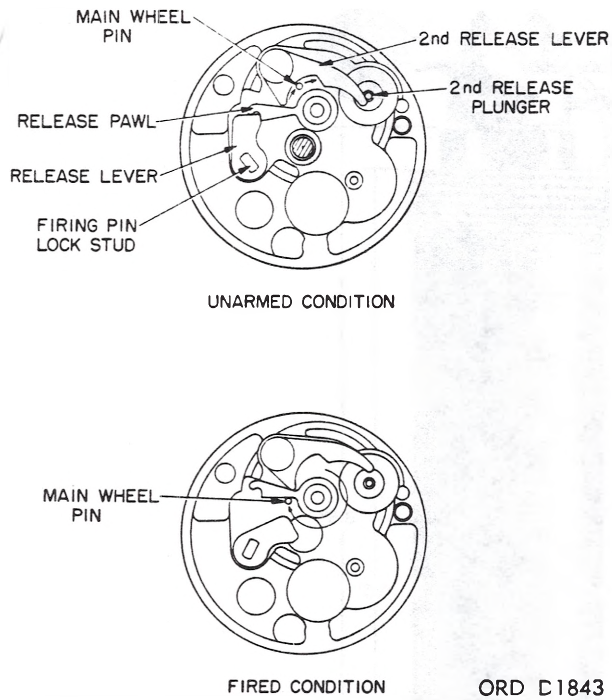


Figure 5–55 General Arrangement of Fuze M131

may or may not be marked. The igniter AN–M123A1 or M23 is painted light green or has a single light green circumferential band. Designation, symbol of filler and loading information are stenciled in red. The other igniters are marked by stenciling in purple or light red and a single band matching the color of the markings may be painted around the igniter body.

5–7.1.3 FITTINGS AND FEATURES. The general physical characteristics of the fuzes and igniter are shown in figure 5–56.

5–7.1.4 MATERIALS. All of these fuzes have a zinc-alloy body. The head and arming pin of the fuze M154 are brass. The head and vanes of the anemometer type fuzes are either brass or zinc alloy and the bodies of the igniters are made of sheet steel.

5–7.2 HAZARDOUS COMPONENTS. The hazardous components of igniter/fuze assemblies are listed below. The modified fuze AN–M173 contains all the hazardous components of the fuze AN–M173 except the booster charge.

Igniter		Fuze	
Designation	Hazardous Components	Designation	Hazardous Components
M13 and M14 AN–M15 and AN–M16	Burster (2.5 grams of tetryl) and White Phosphorus (WP) or Sodium (Na) filler.	M154 M157	Primer M26 and a 0.75 gram black powder charge.
M23 AN–M23A1	White Phosphorus (WP) filler.	AN–M173 FMU–7/B FMU–7A/B FMU–7B/B AN–M173A1	Primer M26, Detonator M31 Booster 12 grams of tetryl.

5–7.3 FUNCTIONING.

5–7.3.1 FUZE M154 (figure 5–57). When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze and remains with the aircraft. This action frees the fuze arming pin which moves under the action of the arming pin spring to free the safety pin. The compressed safety pin spring expands forcing the safety pin into the center of the fuze. As the safety pin moves toward the center of the fuze, movement of the striker in the sleeve is no longer impeded and the fuze is armed. Upon impact from any angle, the striker and sleeve are forced together so that the firing pin impinges the primer, initiating the explosive and incendiary train.

5–7.3.2 FUZES M157, AN–M173, AN–M173–A1, and AN–M173 Modified (figures 5–58 and 5–59). When the bomb is released from the aircraft, the arming wire is withdrawn from the fuze and remains with the aircraft. This action releases the anemometer

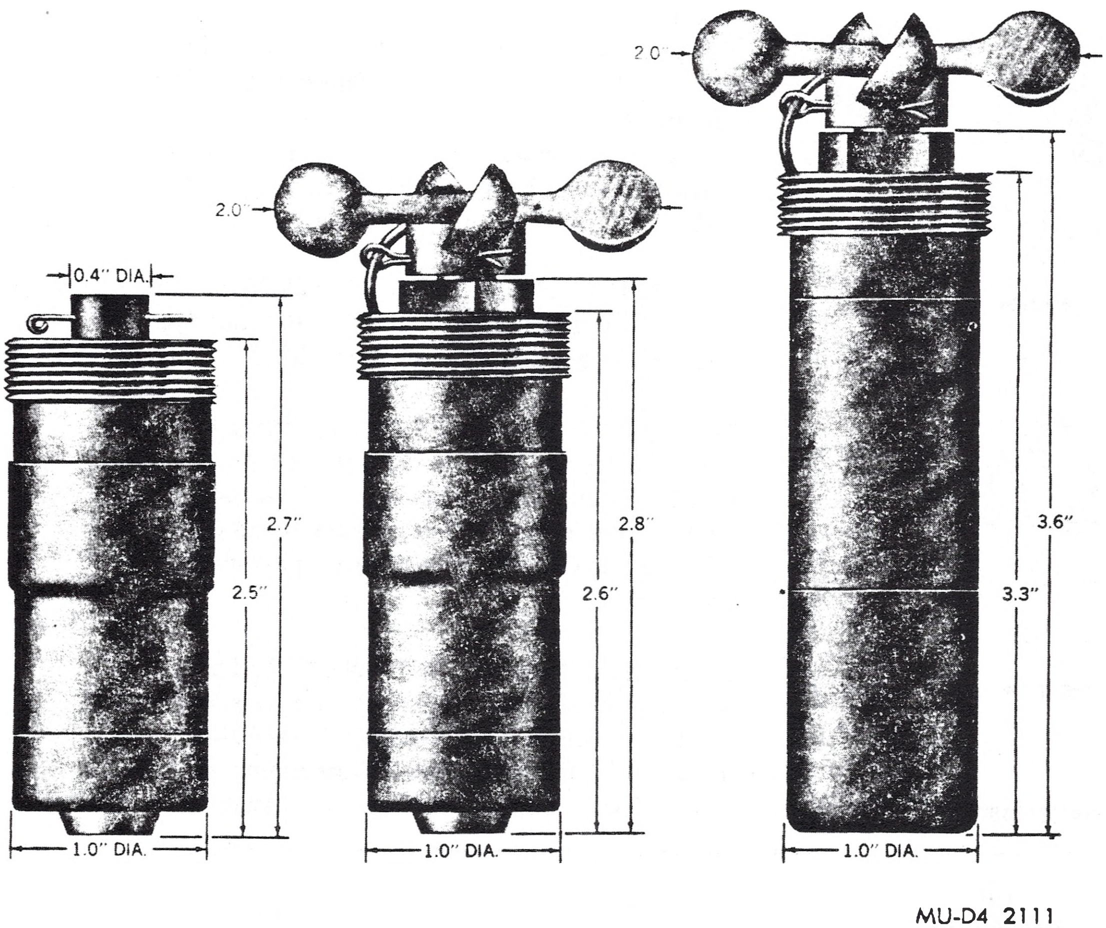


Figure 5–56 Dimensional Characteristics and External Features of Fuzes M154 (Left), M157 (Center), and AN–M173 (Right)

vanes of the fuze which are then rotated by the airstream. Rotation of the anemometer vanes turns the arming stem, causing it to unthread out of the fuze head. After approximately 20 revolutions, the arming stem clears the retaining balls. The retaining balls move inward, freeing the striker to move inside the sleeve, thereby arming the fuze. Continued rotation of the anemometer vanes causes the arming stem to unthread completely from the head and separate from the fuze. Upon impact from any angle, the striker and sleeve are forced together, so that the firing pin impinges the primer, initiating the explosive and incendiary train.

5–7.3.3 FUZES FMU–7/B, FMU–7A/B, AND FMU–7B/B.

When the bomb is ejected, the lanyard pulls the cap from the initiator and the pin restraining the camlock. With this pin removed, pressure applied by the striker spring rotates the camlock and drives the striker into the percussion primer, which initiates the thermal battery. Approximately 0.6 second after the thermal battery is energized, voltage through the cable assembly is high enough to initiate an explo-

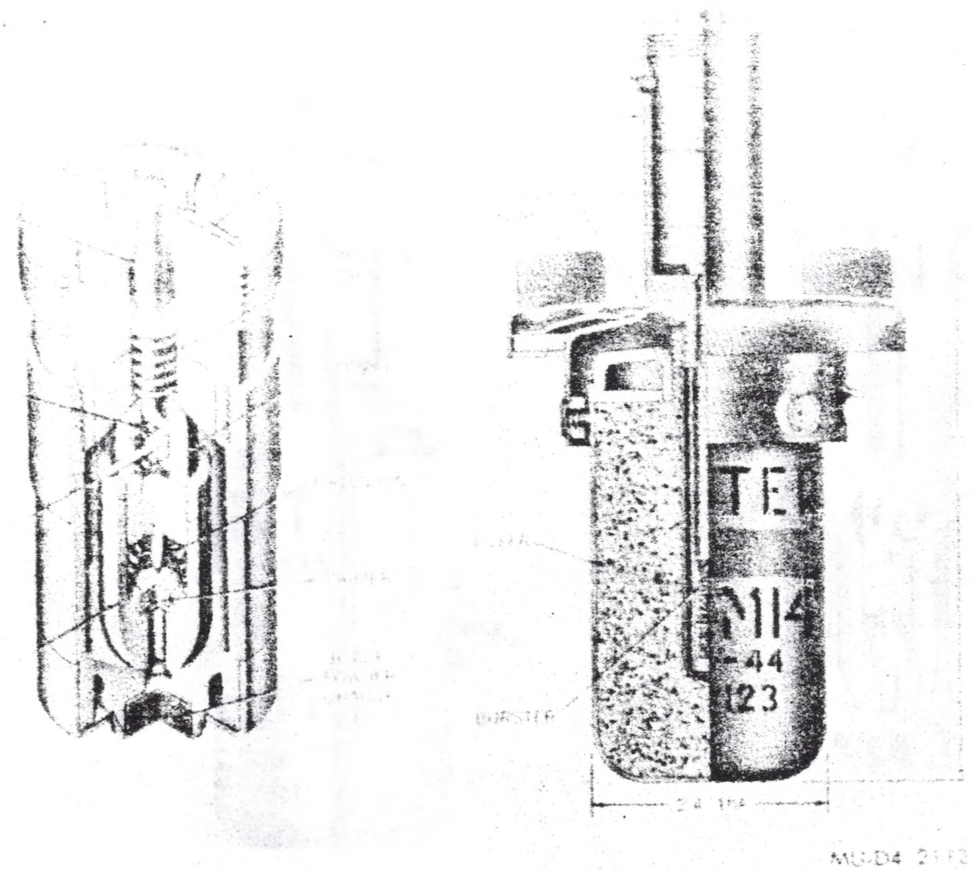


Figure 5-57 General Arrangement of Igniter/Fuze Assembly M14/M154

sive bellows motor in each fuze. As a bellows motor fires, it expands against the piston, which pushes the arming indicator pin through the fuze head cover and, simultaneously, withdraws the arming pin from the striker assembly. Withdrawal of the arming pin allows the restraining balls to move inward, freeing the striker to move inside the sleeve. The fuze is now armed and the firing pin is held away from the primer by the striker retaining spring until impact. On impact at any angle, the striker and the sleeve are forced together, and the firing pin impinges the primer to initiate the explosive and incendiary trains.

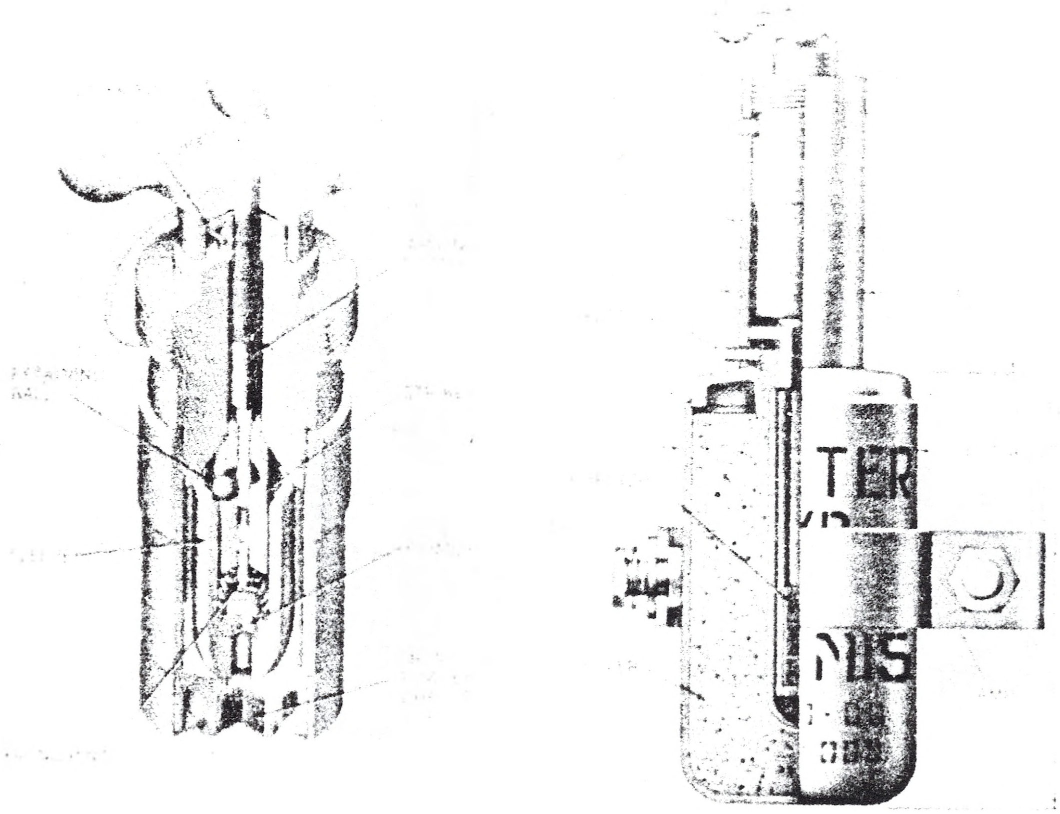


Figure 5-58 General Arrangement of Igniter/Fuze Assembly AN-M15/M157

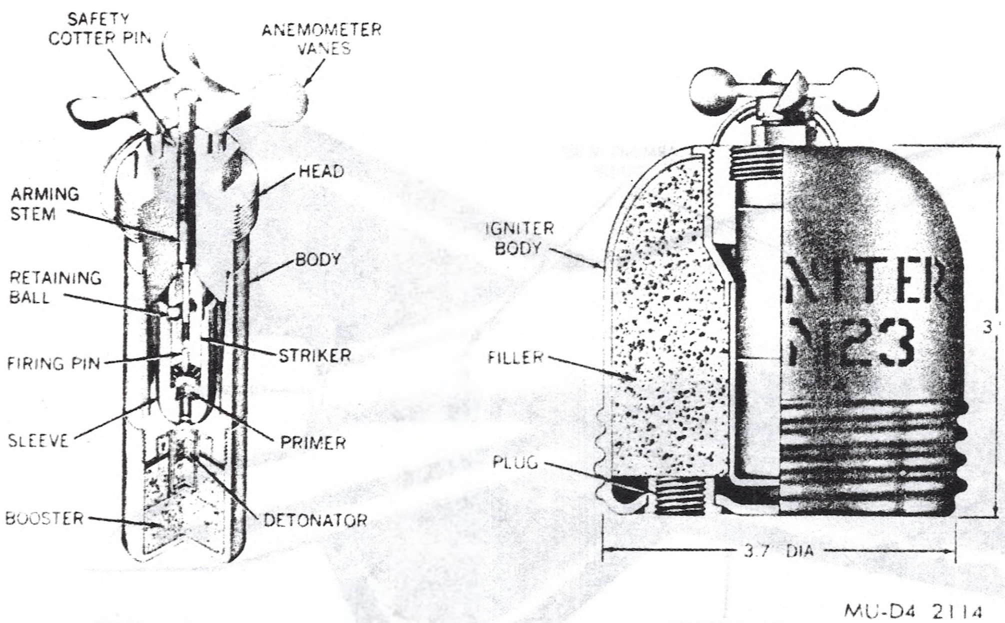


Figure 5–59 General Arrangement of Igniter/Fuze Assembly M23/AN–M173

5-8. CONICAL FIN ASSEMBLIES

Fin assemblies M126, M128, M128A1, M129, M130 and M135 are covered in this paragraph.

5-8.1 GENERAL. A conical fin assembly installed on a bomb completely covers the fuze body and must be removed to allow identification of the fuze and application of the rendering safe procedure.

5-8.2 IDENTIFICATION

5-8.2.1 TYPE. These fin assemblies are shaped as elongated cones. Four streamlined blades form an integral part perpendicular to the cone. They are longer than the box-type fins, hence require tail fuzes with a longer arming stem and tube.

5-8.2.2 MARKING. The model designation, size of bomb, and lot number are stenciled on the cone.

5-8.2.3 FITTINGS AND FEATURES. The general physical characteristics of a conical fin assembly are shown in figure 5-60.

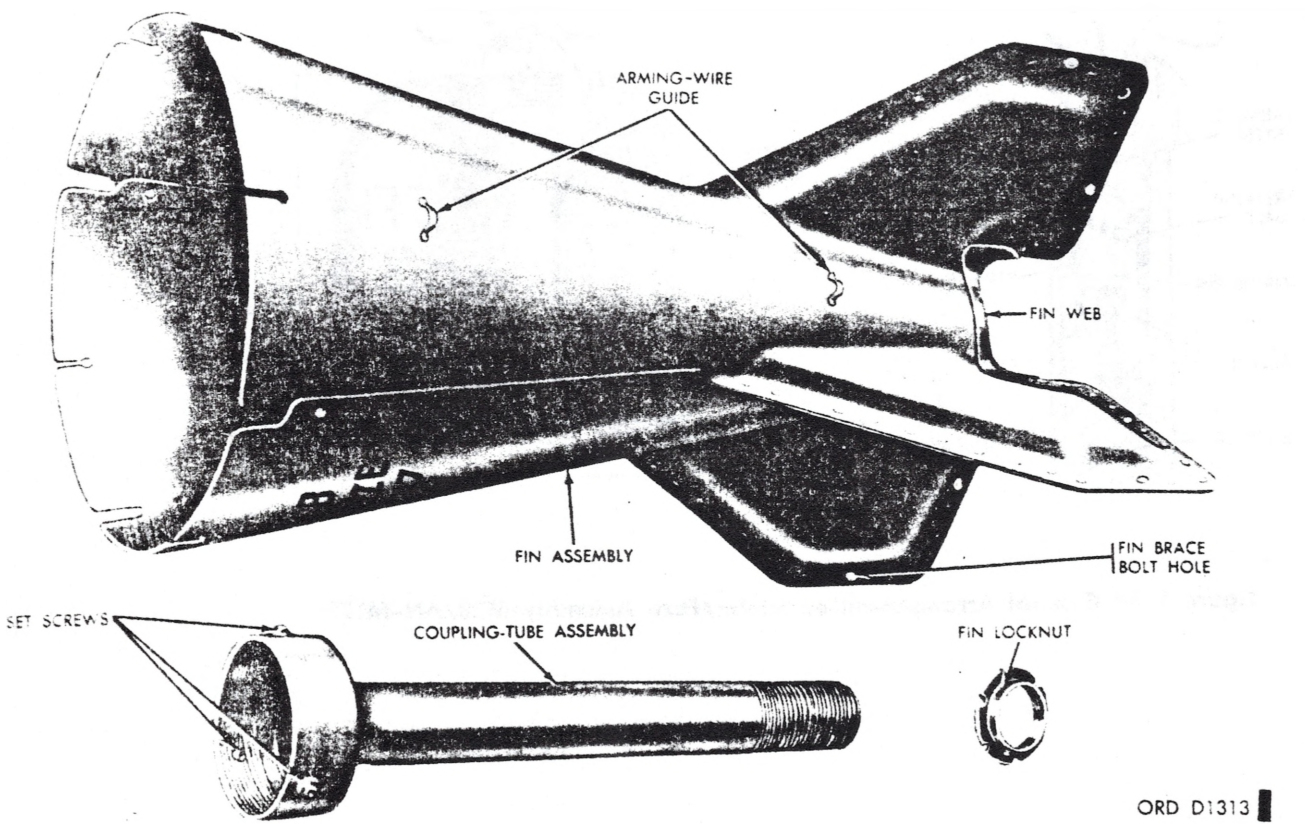


Figure 5-60 Fin Assembly: Conical

5-9 PRACTICE BOMBS

Practice bombs, Type MB-4 and M124 are covered in this paragraph.

5-9.1 BOMB, PRACTICE, SMALL, TYPE MB-4.

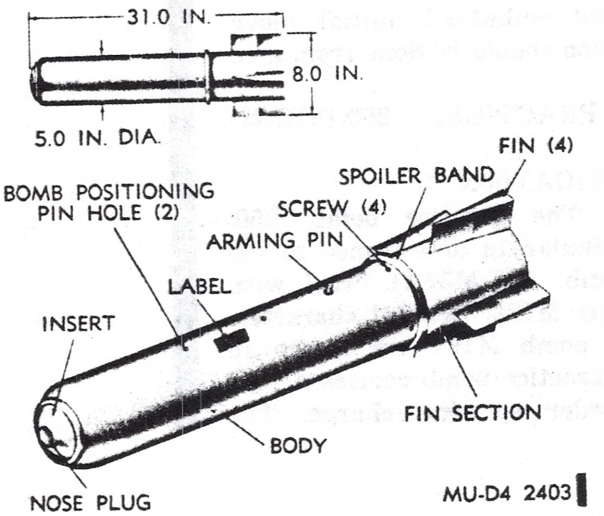


Figure 5-61 External Characteristics of Practice Bomb, MB-4

5-9.1.1 IDENTIFICATION.

5-9.1.1.1 TYPE. The practice bomb, Type MB-4 is cylindrical in shape, with a nose plug and insert set into the forward end of the bomb body. A hollow fin section, with a spoiler band and four fins, is attached to the tail end of the bomb. The bomb contains a spotting charge.

5-9.1.1.2 PAINTING AND MARKING. The bomb is painted black. The bomb designation, manufacturing data and evidence of inspection are shown on a label located on the bomb body between the two bomb positioning pinholes.

5-9.1.1.3 WEIGHT. The Type MB-4 practice bomb weighs 128 pounds.

5-9.1.1.4 MATERIAL. The bomb is made of ferrous metal.

5-9.1.2 HAZARDOUS COMPONENTS. The MA-1 spotting charge used in the MB-4 practice bomb contains a 6-pound charge of black powder and aluminum powder, and an initiator assembly consisting of a detonator and a length of detonating cord.

5-9.1.3 FITTINGS AND FEATURES. The general physical characteristics and location of the component parts are shown in figures 5-61 and 5-62.

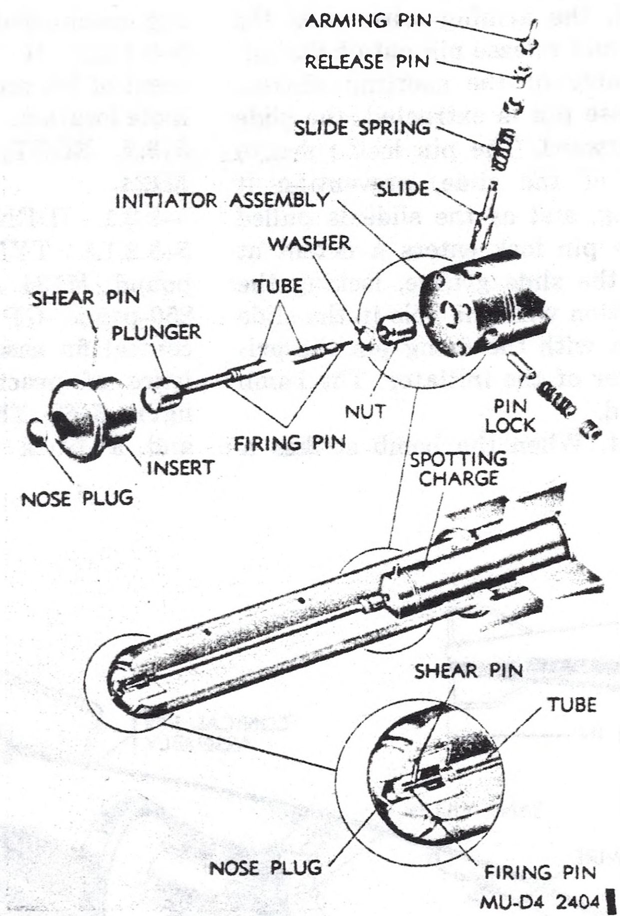


Figure 5-62 Detailed Views of Component Parts of Practice Bomb, MB-4

5-9.1.3.1 The Type MB-4 practice bomb is composed of two major assemblies: the bomb body, and the fin section. The bomb body is made of solid metal except for space provided for the insert and the firing pin assembly. The fin section is hollow to accommodate the spotting charge and is secured to the bomb body by four equally spaced screws around the perimeter.

5-9.1.4 FUNCTIONING.

a. Prior to release from aircraft. The arming pin and release pin being in place, prevents the hole in the slide from aligning between the firing pin and the primer-detonator, keeping the bomb in the unarmed condition. An arming wire is passed through the arming pin.

b. Release from aircraft. Upon release from the aircraft, the arming wire pulls the arming pin and release pin out of the initiator assembly of the spotting charge. As the release pin is extracted, the slide is pulled outward. The pin lock rides in the groove of the slide, preventing it from turning, and as the slide is pulled outward the pin lock enters a detent at the end of the slide groove, locking the slide in position with the hole in the slide in alignment with the firing pin the primer-detonator of the initiator. The bomb is now armed.

c. Upon impact. When the bomb strikes a target, the nose plug and insert are crushed, driving the firing pin into the initiator assembly, firing the spotting charge.

5–9.1.5 SAFETY PRECAUTIONS.

5–9.1.5.1 General safety precautions regarding unexploded ordnance must be observed.

5–9.1.5.2 If found embedded, initial movement of the munition should be done from a remote location.

5–9.2 BOMB, PRACTICE, 250-POUND, M124.

5–9.2.1 IDENTIFICATION.

5–9.2.1.1 TYPE. The practice bomb, 250-pound, M124 is similar in appearance to the 250-pound GP bomb, AN–M57A1 fitted with conical fin assembly M126. General characteristics of practice bomb M124 are shown in figure 5–63. This practice bomb carries a fuze and a black powder spotting charge. The

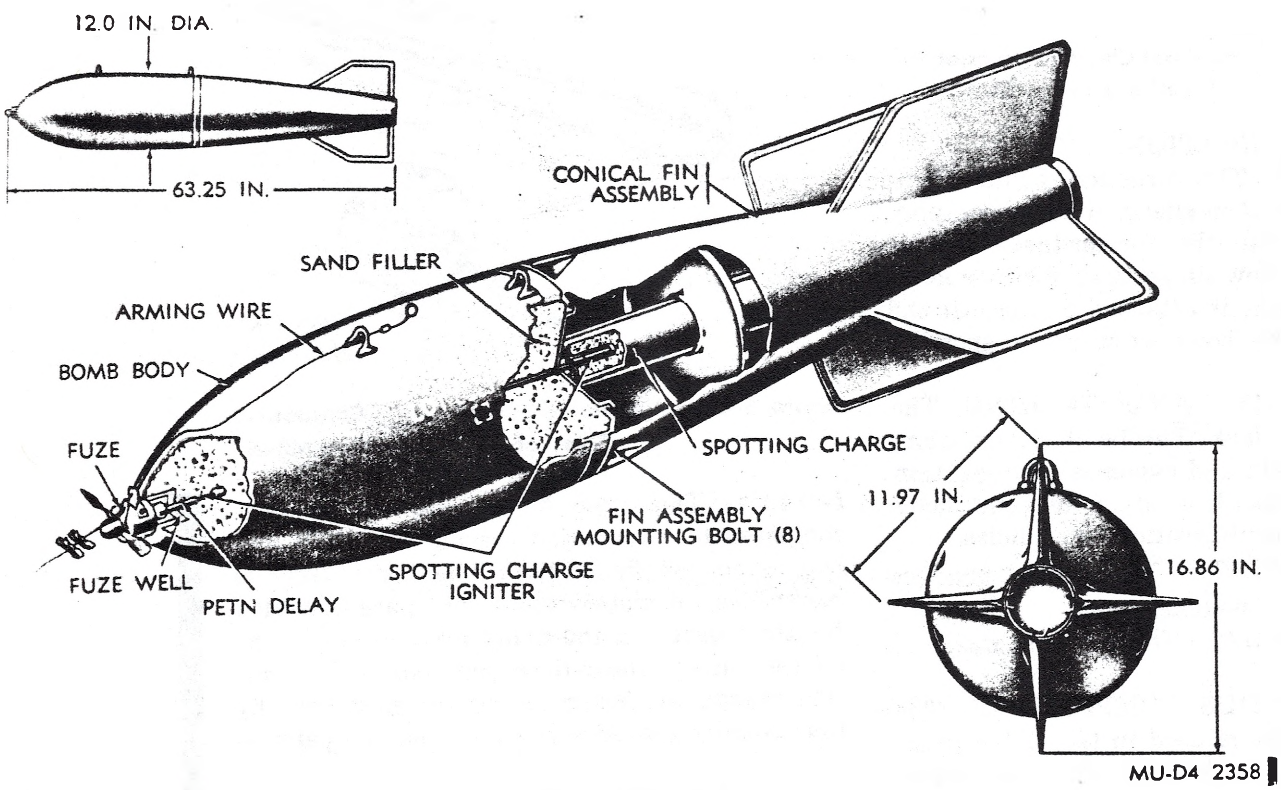


Figure 5–63. General Characteristics of Practice Bomb, M124

weight of the GP bomb is simulated by loading the practice with approximately 191 pounds of sand and gravel.

5-9.2.1.2 PAINTING AND MARKING. The bomb is painted blue with nomenclature markings painted in white.

5-9.2.1.3 WEIGHT. The M124 practice bomb weights approximately 264 pounds.

5-9.2.1.4 MATERIAL. The bomb is constructed of sheet steel.

5-9.2.2 HAZARDOUS COMPONENTS. The M193 fuze contains a detonator and a tetryl booster. The M32 spotting charge igniter consists of approximately 58.4 inches of detonating cord, fitted at each end with an aluminum cap containing a small amount of PETN. The spotting charge contains approximately 8 pounds of black powder mixed with 2 pounds of aluminum powder.

5-9.2.3 FITTINGS AND FEATURES. The general physical characteristics and location of component parts are shown in figure 5-63.

5-9.2.3.1 The practice bomb, M124 is composed of the following major assemblies: Fuze, Bomb, Nose, M193 (impact); the bomb body; the spotting charge igniter, M32; the spotting charge, M39A1 and the conical fin assembly, M140. The aft end of the fin assembly is fashioned to accept the 3.44 inches diameter spotting charge and a spring-loaded spotting charge retainer plate.

5-9.2.4 FUNCTIONING.

a. As the bomb is released from the aircraft, the arming wire is withdrawn from the fuze and the airstream rotates the arming vane. After approximately 440 revolutions of the vane, the fuze is armed.
b. Upon impact, the fuze functions, initiating the primacord of the spotting charge igniter, which, in turn, ignites the spotting charge.

5-9.2.5 SAFETY PRECAUTIONS.

5-9-2.5.1 General safety precautions regarding unexploded ordnance must be observed.

5-9.2.5.2 If found embedded, initial movement of the munition should be done from a remote location.

5-9.2.5.3 The M193 fuze must be rendered safe before other procedures for rendering safe are performed on the bomb.

5-10 ELECTRIC FUZES.

Electric bomb fuzes M990C, M990D, M990D1, M990D2, M990E, M990E1, M990E3, and M990E4 with the Mk26 Mod 0 safety device are covered in this paragraph.

5-10.1 IDENTIFICATION.

5-10.1.1 TYPE. All M990 series fuzes have the same external characteristics and are used with the Mk26 Mod 0 safety device. Except for the M990C (figure 5-64), all the fuzes are shipped with the safety device installed. These are electric, impact (instantaneous or short delay) bomb fuzes designed for use in bombs containing 3-inch diameter fuze wells and internal plumbing. They may be used independently or in conjunction with other fuzes or proximity nose elements.

5-10.1.2 PAINTING AND MARKING. Fuze designation and loading information are stenciled in black or stamped on the side of the fuze housing. The fuze housing is olive green; the safety device is anodized in a gold color.

5-10.1.3 FITTINGS AND FEATURES. The fuze consists essentially of a cylindrical aluminum housing which contains the electronic assembly, the rotor assembly and the booster. The booster end of the fuze is closed by an aluminum cover which includes an aluminum foil seal covering the charging receptacle of the fuze. When the fuze is installed in the bomb, the foil seal is broken to permit connection of the fuze plug of the cable assembly and the charging receptacle of the fuze. The Mk26 Mod 0 safety device (figure 5-65) consists of a flanged, threaded housing assembly, a knurled assembly cap, and a spring-loaded safety pin assembly. The safety device is secured to the fuze by the knurled cap assembly.

5-10.1.5 MATERIALS. External components of the fuze are of aluminum. The safety device is of steel.

5-10.2 HAZARDOUS COMPONENTS. These fuzes contain two explosive bellows, an electric detonator, and a 0.27-pound tetryl booster.

5-10.3 FUNCTIONING. Upon release of the bomb from the aircraft, the arming wire is

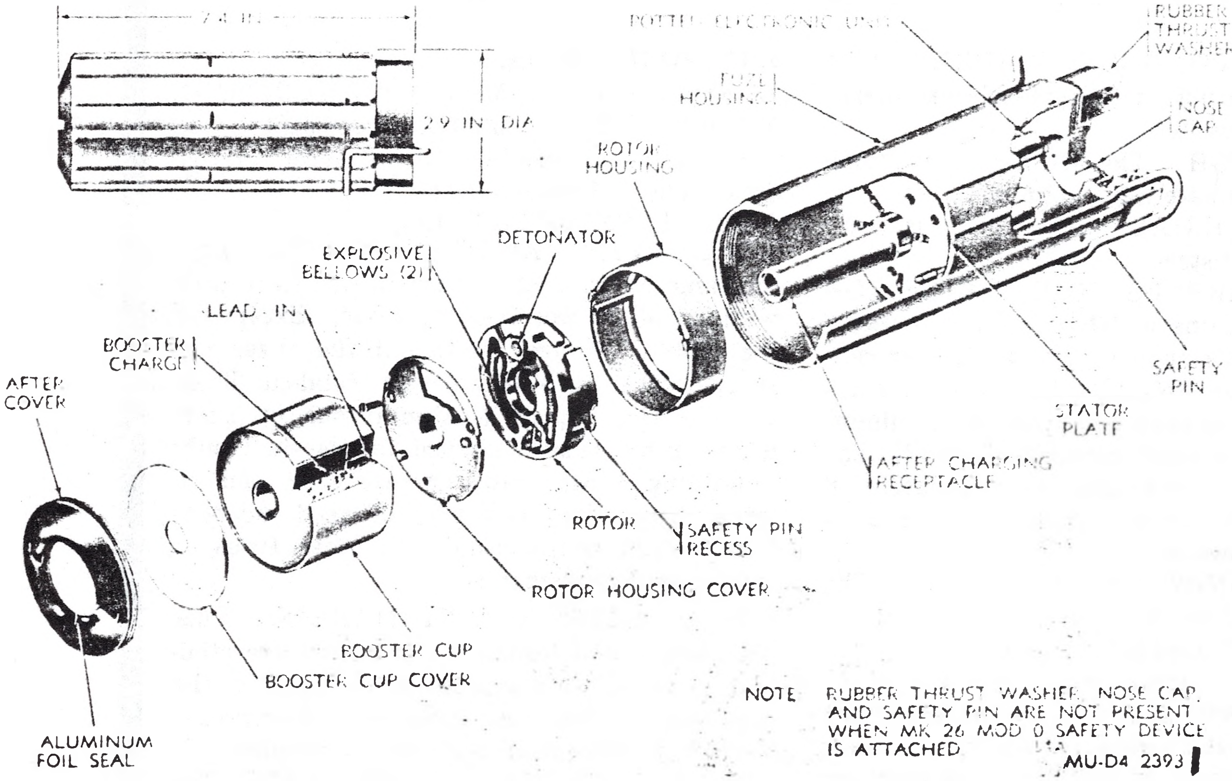


Figure 5–64. Exploded View of M990C Bomb Fuze

withdrawn from the safety device. This causes the spring-loaded safety rod to be pushed out of the fuze, freeing the detonator rotor so that is may be rotated to the armed position at the expiration of the arming delay time. At the same time, DC voltage is applied through the electrical cable assembly to charge a capacitor in the electronic unit of the fuze. After the preselected arming delay (up to 20 seconds), the capacitor discharges into the bellows motors. Firing of the motors causes the detonator rotor to rotate. This aligns the detonator with the booster lead-in and electrically connects the detonator into the firing circuit. Upon impact, the impact switch closes. If an instantaneous firing option has been selected, the capacitor discharges directly into the detonator, initiating the explosive train. If a delay firing option has been selected, the capacitor fires an explosive switch in the delay circuit. After a predetermined firing delay (up to 20 seconds) a capacitor in the delay circuit discharges into the detonator, initiating the explosive train. If impact occurs before the detonator rotor has rotated into alignment, an auxiliary tremble switch closes and shorts the capacitors in the arming and firing circuits, duddling the fuze.

5–10.4 SAFETY PRECAUTIONS

a. Wait at least 24 hours before attempting manual removal of an armed fuze or manually moving a bomb with an armed fuze. The capacitors in the M990 series fuzes will discharge in 24 hours.

b. Observe electromagnetic radiation precautions in the immediate vicinity of the fuze, and in areas through which the fuze is to be transported.

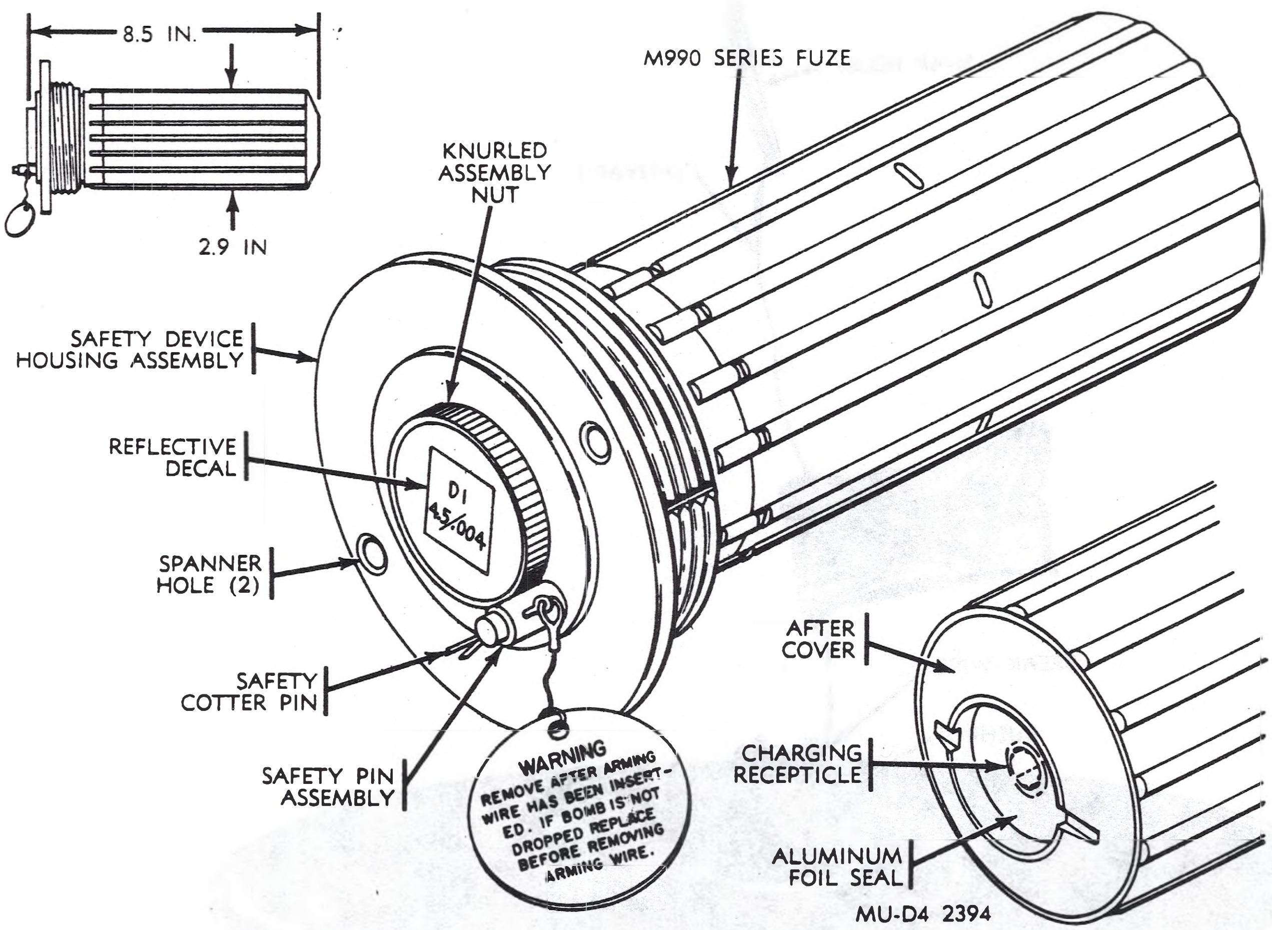


Figure 5–65 External Characteristics of M990D1 Fuze with Mk26 Mod 0 Safety Device Installed

5–11 XM925 BOMB FUZE AND BURSTER SYSTEM

The XM925 bomb fuze and burster system consists of the XM923 fuze (modified M173 fuze), the XM55 burster and modified 55-gallon drum containing non-pyrotechnic CS powder (figure 5–66).

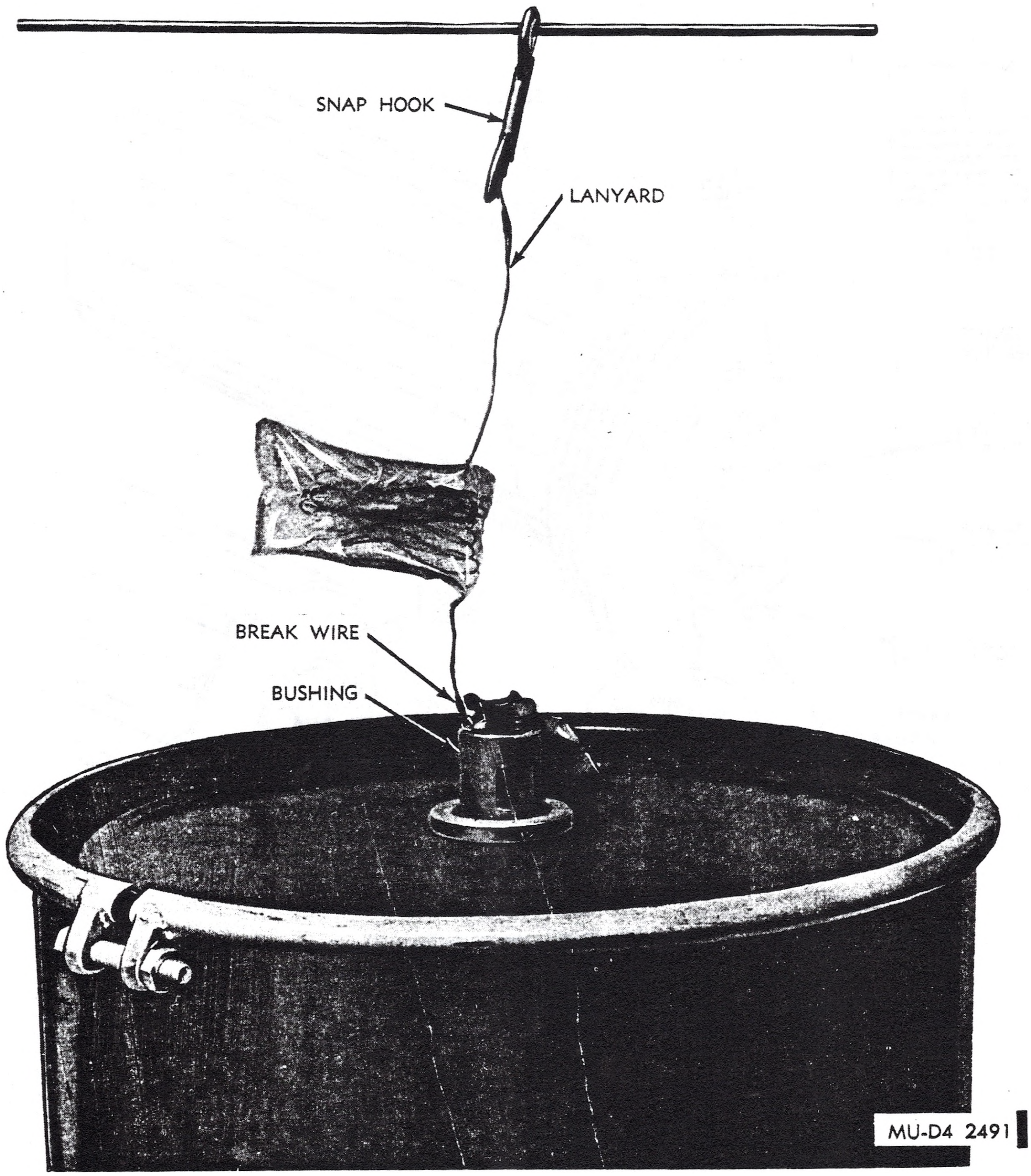


Figure 5–66 XM925 Bomb Fuze and Burster System

5-11.1 IDENTIFICATION.

5-11.1.1 TYPE.

a. XM923 Fuze. The fuze is an impact fuze of the direct-arming, arming-vane type and functions at any angle of impact.

b. XM55 Burster. The burster is a metal tube containing Composition B, TNT and Oxamide.

c. CS. The non-pyrotechnic CS powder is contained in a modified 55-gallon drum.

5-11.1.2 PAINTING AND MARKING

a. XM923 Fuze. The fuze is unpainted and

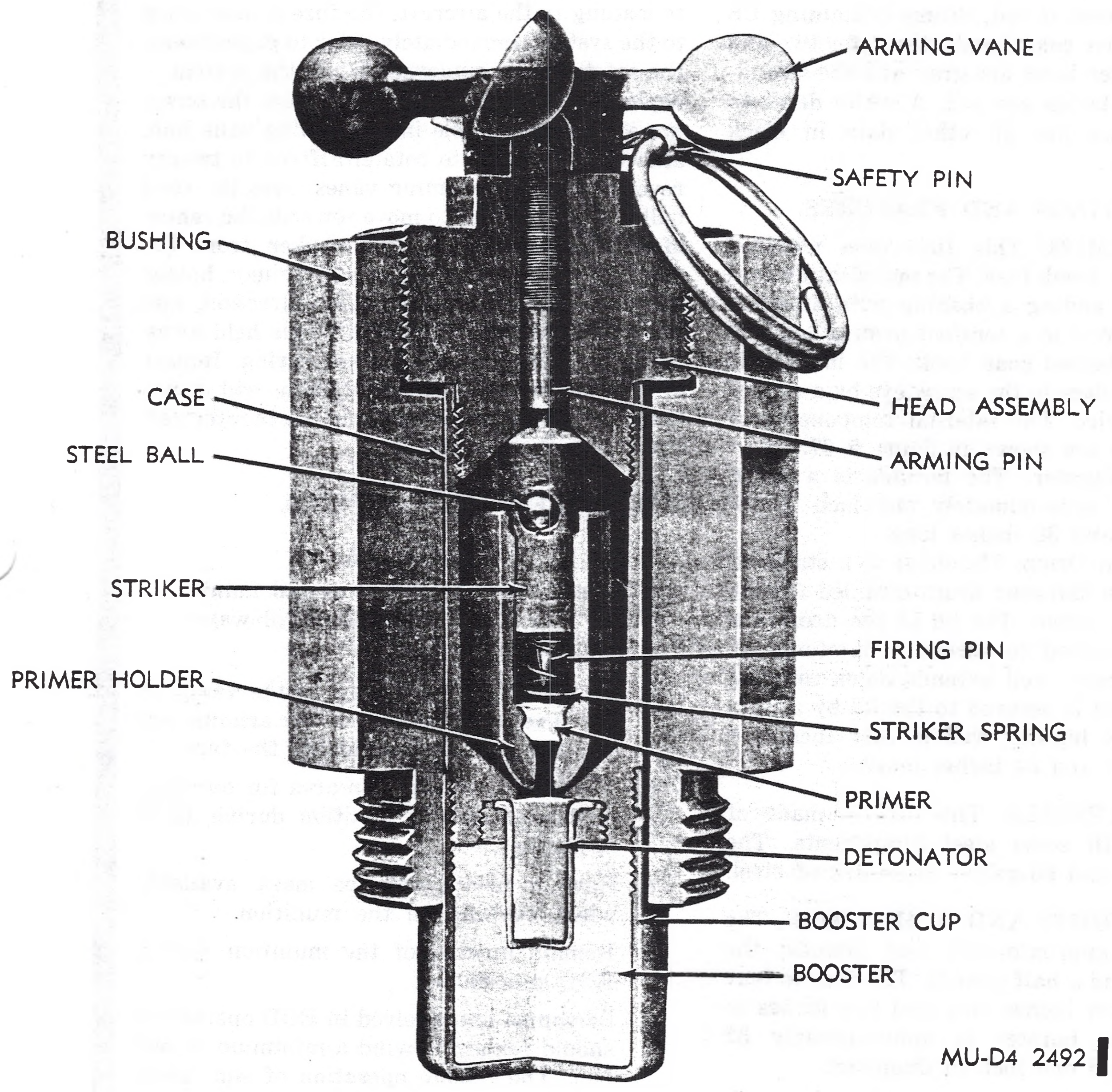


Figure 5-67 Fuze XM923—Cutaway View

the marking is stamped in the aluminum body.

b. XM55 Burster. The burster is unpainted and the marking is near the top end of the tube.

c. CS Filled Drum. The basic color of the drum is black. The color code marking for drums containing CS 1 have three color bands, the outer two are gray and the center band is red; drums containing CS 2 have five color bands, the outer two and the center band are gray and the two alternate bands are red. A white decal on the drum has all other data in black marking.

5–11.1.3 FITTINGS AND FEATURES.

a. Fuze XM923. This fuze is a modified M173A1 bomb fuze. The modification consists of adding a bushing with attached screw eye and a ten-foot arming lanyard with attached snap hook. The lanyard is held in place to the screw eye by a copper break wire. The internal components of the fuze are shown in figure 5–67.

b. XM55 Burster. The burster is a metal cylinder approximately one inch in diameter and 32 inches long.

c. CS Filled Drum. The drum is a standard 55-gallon shipping drum modified for the XM925 system. The lid of the drum has been modified to accept a burster well. The burster well extends down into the drum and is secured to the lid by a locknut. The burster well is four inches in diameter and 34 inches long.

5–11.1.4 MATERIALS. The fuze is made of aluminum with some steel components. The burster body and 55-gallon drum are of steel.

5–11.1.5 WEIGHTS AND DIMENSIONS. The fuze weighs approximately two pounds; the burster one and a half pounds. The fuze is four and one quarter inches long and two inches in diameter. The burster is approximately 32 inches long and one inch in diameter.

5–11.2 HAZARDOUS COMPONENTS. The fuze contains an M26 primer, an M31A1 detonator and a booster containing approximately twelve grams of tetryl. The burster contains one and one half pounds of a mixture composed of Composition B, TNT and Oxamide. The loaded drum contains approximately 80 pounds of CS 1 or CS 2 powder.

5–11.3 FUNCTIONING. (figure 5–67) Prior to loading in the aircraft, the fuze is assembled to the system. Immediately prior to deployment, the safety pin is removed. When the system is deployed, the lanyard pulls free from the screw eye and from the hole in the arming vane hub, allowing the vanes to rotate. Fifteen to twenty revolutions of the arming vanes frees the steel balls, allowing them to move towards the center of the fuze, unlocking the striker from the primer holder. The striker and primer holder are then free to move in either direction, and the fuze is armed. The firing pin is held away from the primer by the striker spring. Impact of the system in any orientation will cause the fuze to function, detonating the burster and dispersing the CS powder.

5–11.4 SAFETY PRECAUTIONS.

WARNING

Do not bump or jar an armed munition. The XM923 fuze is an all ways acting, impact type fuze.

a. Do not attempt to screw in the vanes of the fuze as it will force the arming pin into the primer, functioning the fuze.

b. If possible, evacuate an area for one mile downwind of the munition during EOD operations.

c. Have a field protective mask available when working on the munition.

d. Remain upwind of the munition during EOD procedures.

e. Personnel not involved in EOD operations should remain upwind a minimum of 500 feet. The remote operation of equipment should be accomplished from this distance.

5-12. INCENDIARY AND SMOKE BOMBS.

Bomb, Incendiary or Smoke. 100 pounds, AN-M47 Series is covered in this paragraph.

5-12.1 IDENTIFICATION.

5-12.1.1 TYPE. The bomb, 100 pound, M47 Series is a box fin type, thin walled, with a burster extending the length of the bomb. The bomb may be fuzed with Fuze, Bomb: Nose, M126A1 or AN-M159. The bomb may be filled with PT, NP, WP, or PWP.

5-12.1.2 PAINTING AND MARKING. Bombs filled with WP or PWP manufactured prior to 1960 were painted gray overall with one yellow band and markings in yellow. Bombs manufactured after 1960 and filled with WP or PWP are painted light green overall with one yellow band and markings in light red. Bombs filled with PT, or NP manufactured prior to 1960 were painted gray overall with one purple band and markings in purple. Bombs manufactured after 1960, filled with PT or NP are painted light red overall with one yellow band and markings in black.

5-12.1.3 WEIGHTS AND DIMENSIONS. When loaded with PT, or NP, the total weight is 68 pounds. The weight of the filler is 42 pounds. When loaded with WP the total weight is 131 pounds. The weight of the filler is 100 pounds. When loaded with PWP, the total weight is 105 pounds. The weight of the filler is 74 pounds. The bomb is 51.7 inches overall and 11 inches at its widest part.

5-12.2 FITTINGS AND FEATURES. The general physical characteristics and component location of the bomb are shown in figures 5-68 and 5-69.

5-12.3 HAZARDOUS COMPONENTS. In addition to the PT and NP filler, the burster in this bomb contains 435-grams of magnesium-black powder mixture. In addition to the WP and PWP fillers, these bombs contain 250-grams of tetryl pellets.

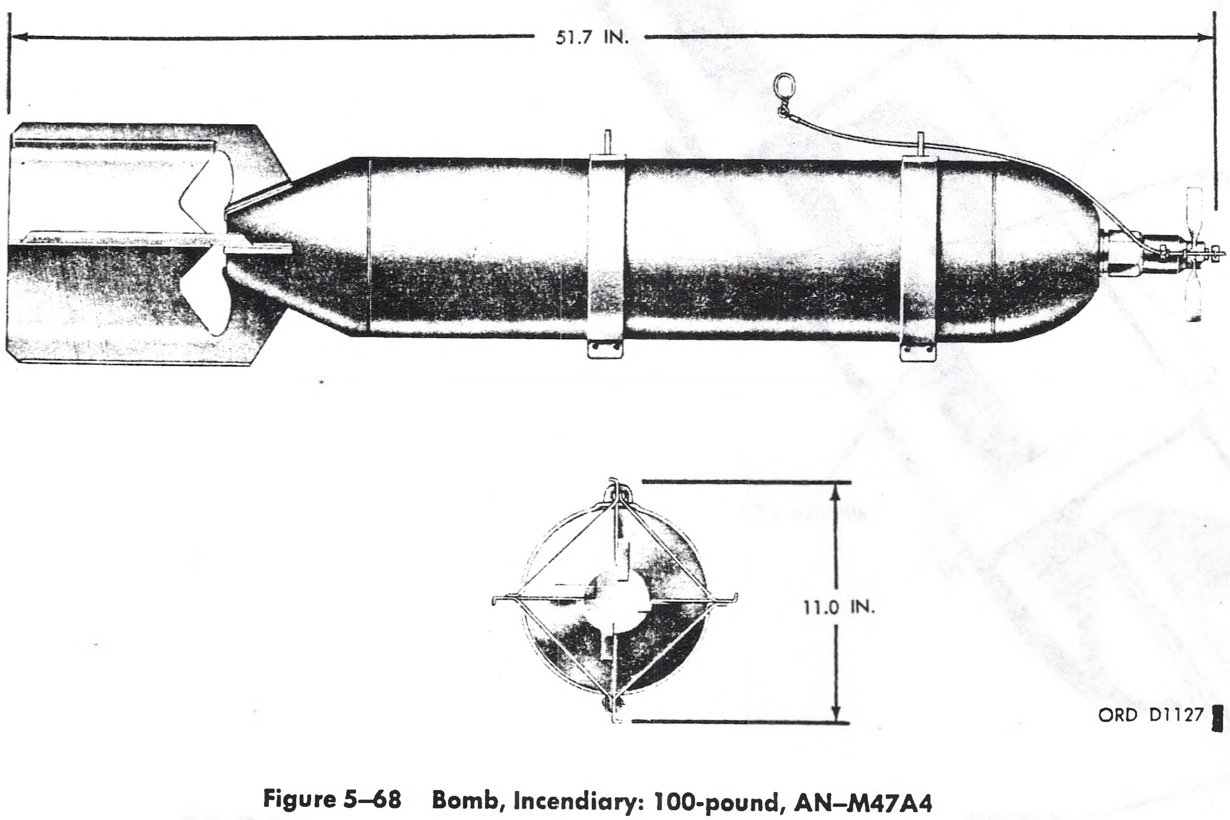


Figure 5-68 Bomb, Incendiary: 100-pound, AN-M47A4

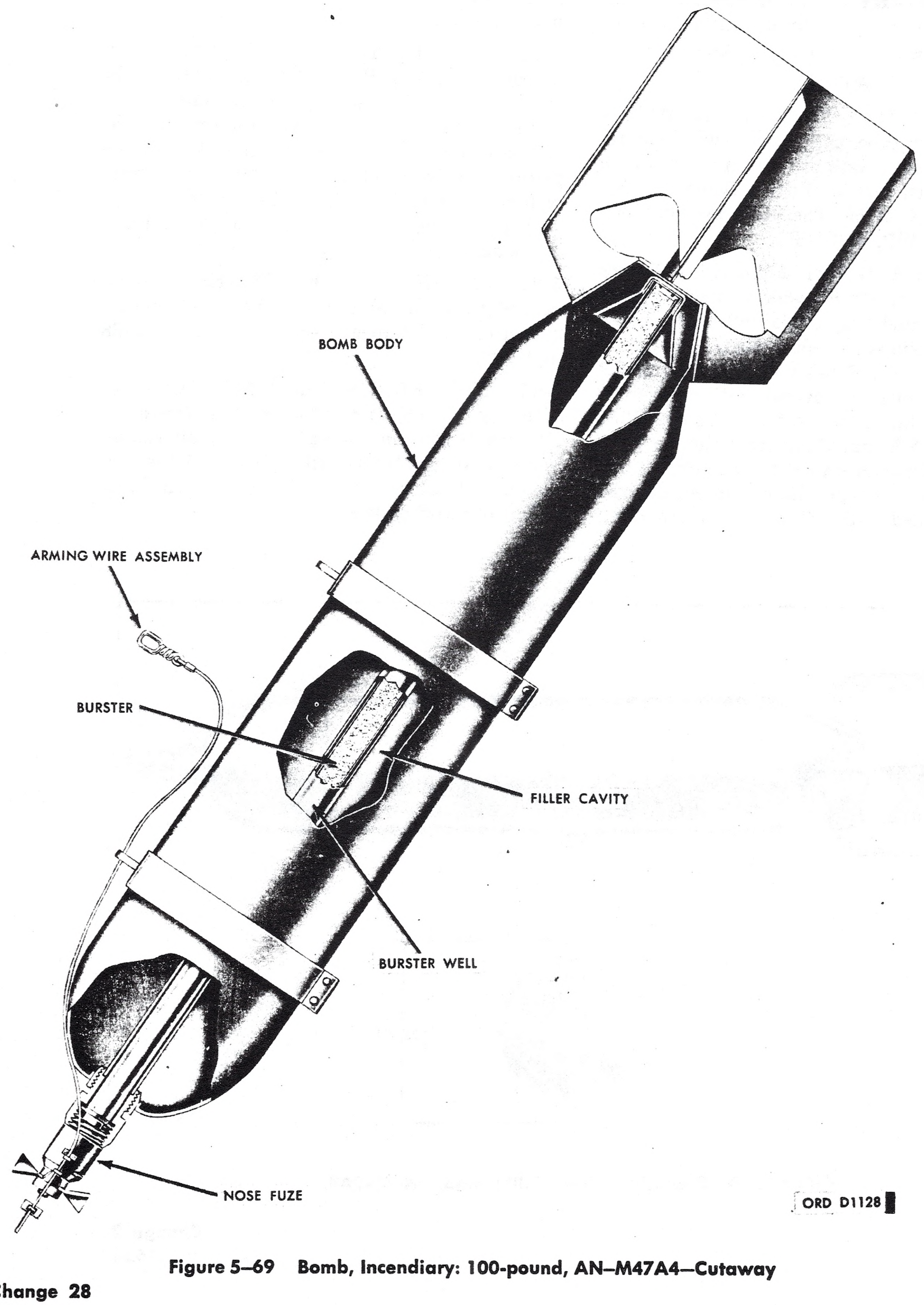


Figure 5–69 Bomb, Incendiary: 100-pound, AN–M47A4—Cutaway

5–12.4 MATERIAL. The bomb body, burster tube, and tail fins are sheet steel.

5–12.5 FUNCTIONING. After the fuze has armed, impact drives the fuze striker into the detonator ignites the burster which in turn ignites and scatters the filler. In bombs loaded with WP or PWP the detonator initiates the booster which in turn initiates the burster. The burster ruptures the bomb case and disperses the filler which ignites when exposed to air.

5–12.6 SAFETY PRECAUTIONS. These bombs present a fire and an explosive hazard.

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SECTION 6

DEMOLITION MATERIALS

6-1. PROJECTED CHARGE DEMOLITION KITS

Projected charge demolition kit M173 and projected charge practice demolition kit M174 are covered in this paragraph.

6-1.1 IDENTIFICATION.

6-1.1.1 TYPE

a. M173. This kit is designed to clear minefields remotely by projecting a linear charge over a minefield by means of rocket motor. The M173 is fitted wit M1134 mechanically armed electricall initiated fuze.

b. M174. This kit is a practice item for th M173. The linear charge and fuze ar inert.

6-1.1.2 PAINTING AND MARKING. K M173 is painted olivedrab with markings i

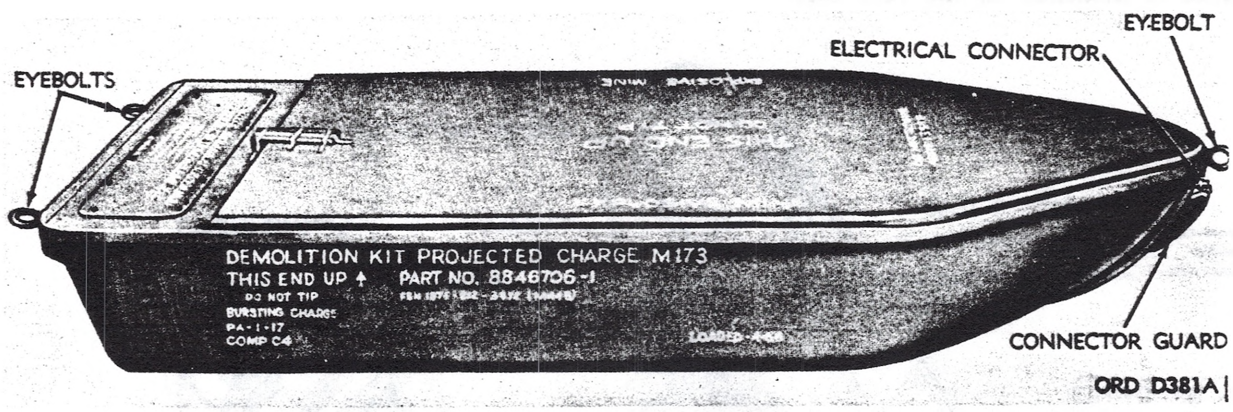


Figure 6-1 Projected Charge Demolition Kit M173

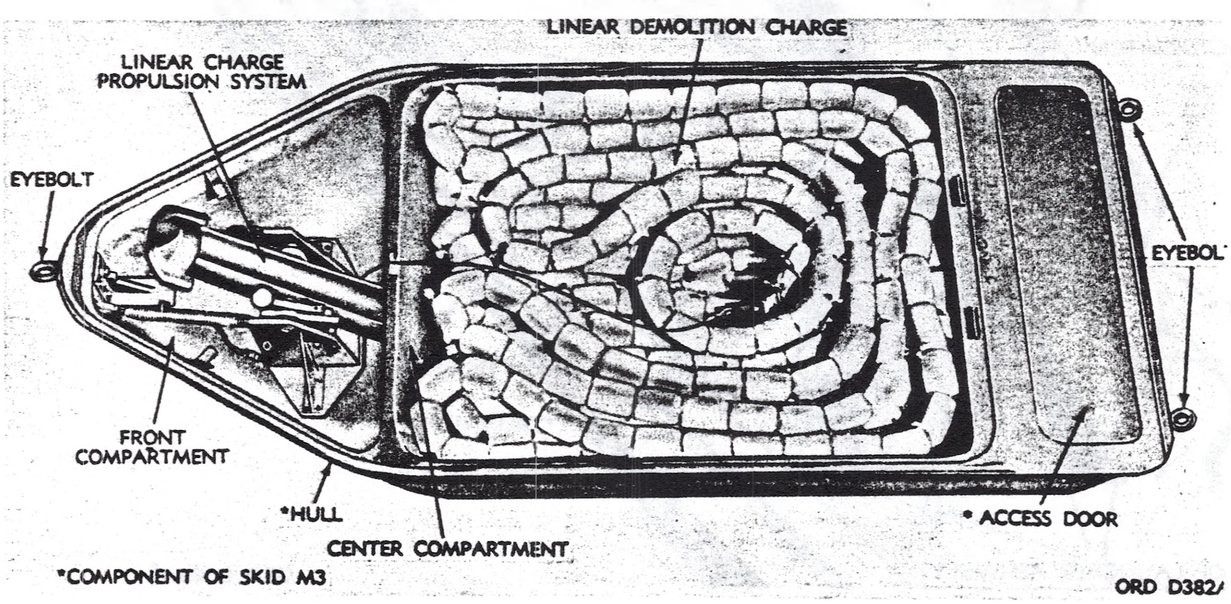


Figure 6-2 Projected Charge Demolition Kit M173—Main Cover Removed

yellow. Kit M174 is painted blue with white markings and 2 brown bands, 3 inches wide, on sides and cover.

6–1.1.3 FITTINGS AND FEATURES. The general physical characteristics of the kits are shown in figures 6–1 through 6–4. Each demolition kit consists of a waterproof skid (hull), a linear propulsion system (rocket motor and launching tube), propellant actuator, a linear demolition charge consisting of 800 blocks (400 pairs) of composition C–4. A core of three-strand detonating cord and a nylon cord runs through the entire length of the charge. The M1134 fuze is attached to the rearmost block of C–4 by two detonating cord leads. In additon, the charge contans the necessary towing and firing accessories.

6–1.1.4 WEIGHT. The complete demolition kit weighs approximately 3,100 pounds.

6–1.1.5 MATERIALS. The hull and covers of the kit are fiberglas.

6–1.2 HAZARDOUS COMPONENTS.

a. Linear demolition charge—1,500 pounds of composition C–4.

b. Detonating cord, approximately 45 pounds PETN.

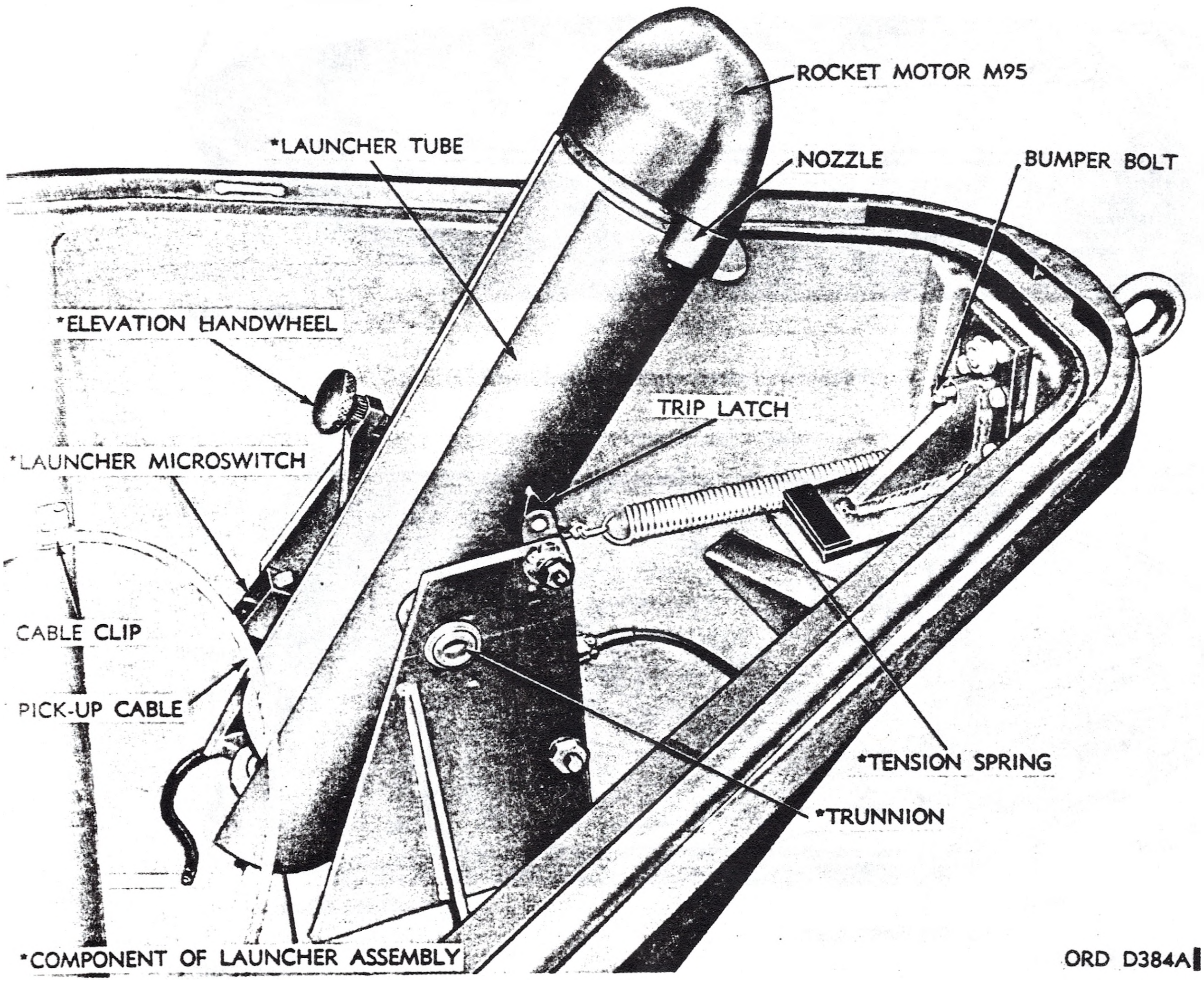


Figure 6–3 Launcher Assembly and Rocket Motor M95 in Elevated Position

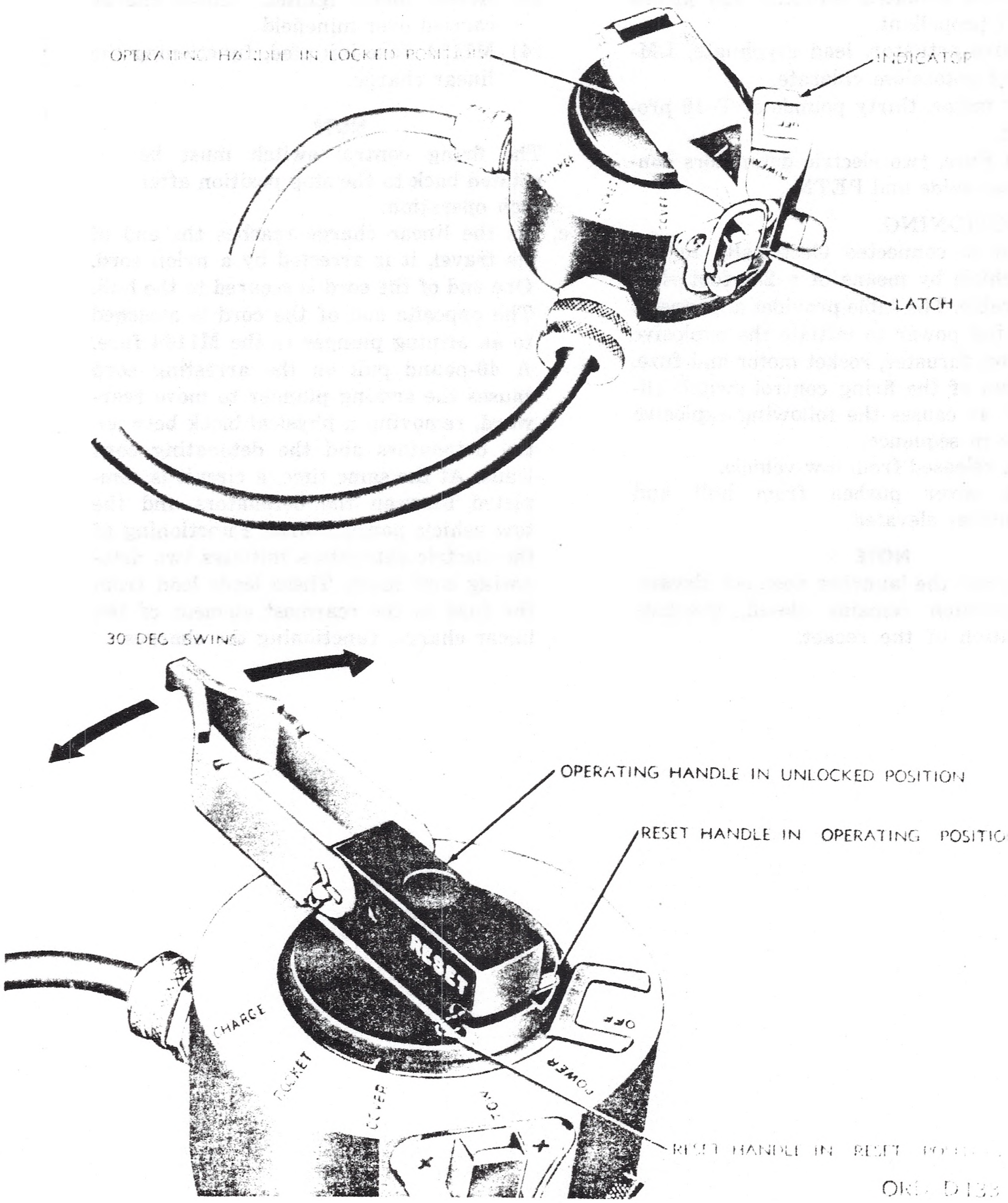


Figure 6–4 Fire Control Switch

c. Propellant actuated thruster, 124 grams of M–7 propellant.
d. Explosive actuator, lead styphnate, LM-NR and potassium chlorate.
e. Rocket motor, thirty pounds of T–16 propellant.
f. M1134 Fuze, two electric detonators contain lead azide and PETN.

6–1.3 FUNCTIONING.

a. The kit is connected electrically to the tow vehicle by means of a 250-foot electrical cable. The cable provides a means of supplying power to initiate the explosive actuator, thruster, rocket motor and fuze.
b. Rotation of the firing control switch (figure 6–4) causes the following explosive actions in sequence:
 (1) Kit released from tow vehicle.
 (2) Kit cover pushed from hull and launcher elevated.

NOTE

In the event the launcher does not elevate, a microswitch remains closed, preventing ignition of the rocket.

 (3) Rocket motor ignited. Linear charge carried over minefield.
 (4) M1134 Fuze initiated, functioning the linear charge.

NOTE

The firing control switch must be rotated back to the stop position after each operation.

c. As the linear charge reaches the end of its travel, it is arrested by a nylon cord. One end of the cord is secured to the hull. The opposite end of the cord is attached to an arming plunger in the M1134 fuze. A 40-pound pull on the arresting cord causes the arming plunger to move rearward, removing a physical block between the detonators and the detonating cord leads. At the same time, a circuit is completed between the detonators and the tow vehicle power source. Functioning of the electric detonators initiates two detonating cord leads. These leads lead from the fuze to the rearmost element of the linear charge, functioning the charges.

SECTION 7

GRENADES AND GRENADE-TYPE ITEMS

7-1. 40-MM GRENADE LAUNCHER CARTRIDGES

This paragraph contains information on identification, functioning, and safety precautions for cartridges fired by 40-mm grenade launchers. Each cartridge is issued fixed (i.e., completely assembled and ready to fire). Figure 7-1 illustrates a typical 40-mm cartridge.

7-1.1 IDENTIFICATION

Refer to table III for cartridge characteristics.

7-1.1.1 CARTRIDGES

7-1.1.1.1 Cartridges M381 and M406 are high explosive, antipersonnel, groundburst rounds and are similar except for their fuzing systems. Cartridge M381 contains a PD fuze M552, which arms at 2.4 to 3 meters from the launcher, after firing. Cartridge M406 contains a PD fuze M551, which arms at 14 to 27 meters from the launcher, after firing. Each round also contains an ogive, a ball and skirt assembly, and a cartridge case M118.

7-1.1.1.2 Cartridges M382 and M407A1 are similar to the rounds described in paragraph 7-1.1.1 except they are practice rounds loaded with inert filler and a yellow dye. Upon impact, the dye is expelled in the form of a yellow cloud of smoke. Cartridge M382 has the same fuzing system as the cartridge M381. Cartridge M407A1 has the same fuzing system as the cartridge M406.

7-1.1.1.3 Cartridge M384 (figure 7-2) is a high

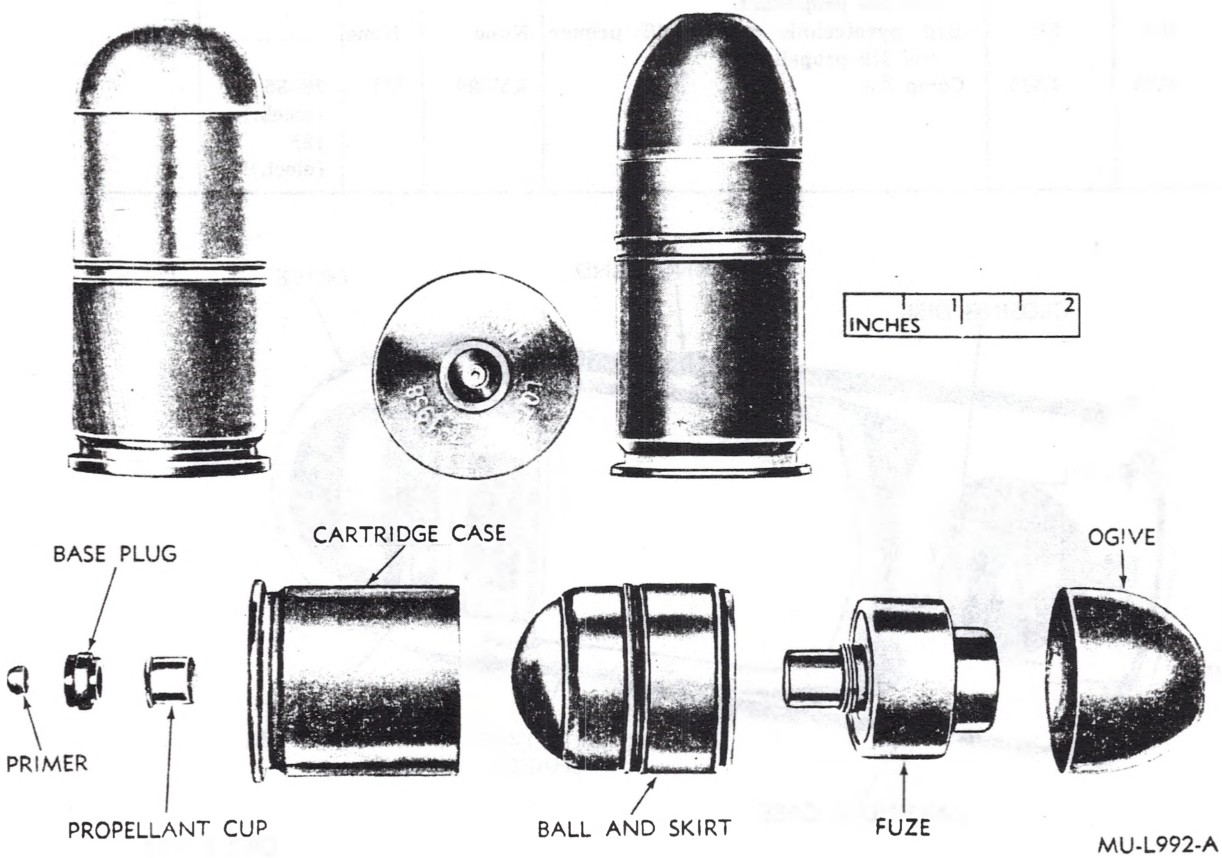


Figure 7-1 Typical 40-mm Cartridge

Table III
Cartridge Characteristics

Model	Complete round		Explosive charge	Fuze model	Fuze type	Arming delay	
	Weight (lb)	Length (in.)				Distance (meters)	Time (seconds)
M381	0.5	4	Comp B	M552	PD	3	
M382	0.5	4	None	M552	PD	3	
M384	0.75	4.5	Comp A5	M538	PD	13–36	
M385	0.75	4.5	None	None	None	----------	
M406	0.5	4	Comp B	M551	PD	14–27	
M407A1	0.5	4	None	M551	PD	14–27	
M428E1	0.75	4.5	50/50 red phosphorus and magnesium	None	None	----------	
XM576	0.5	2.5	None	None	None	----------	
XM588	0.5	5	Pyrotechnic	None	None	----------	5.0
XM585	0.5	5	Pyrotechnic	None	None	----------	5.0
XM574E2	0.75	4.5	WP filler w/RDX booster	M533	PD	18–36	
XM651	0.68	4.5	CS pyrotechnic mixture	XM581E1	PD	30	
XM676	0.8	5¼	Yellow pyrotechnic with M42 primer and M9 propellant.	None	None	----------	2.0
XM679	0.8	5¼	Green pyrotechnic with M42 primer and M9 propellant.	None	None	----------	2.0
XM680	0.8	5¼	White pyrotechnic with M42 primer and M9 propellant.	None	None	----------	2.0
XM681	0.8	5¼	Violet pyrotechnic with M42 primer and M9 propellant.	None	None	----------	2.0
XM682	0.8	5¼	Red pyrotechnic with M42 primer and M9 propellant.	None	None	----------	2.0
XM684	0.75	4.415	Comp A5	XM596	VT	18–36 (mech.) 125 (elect.)	

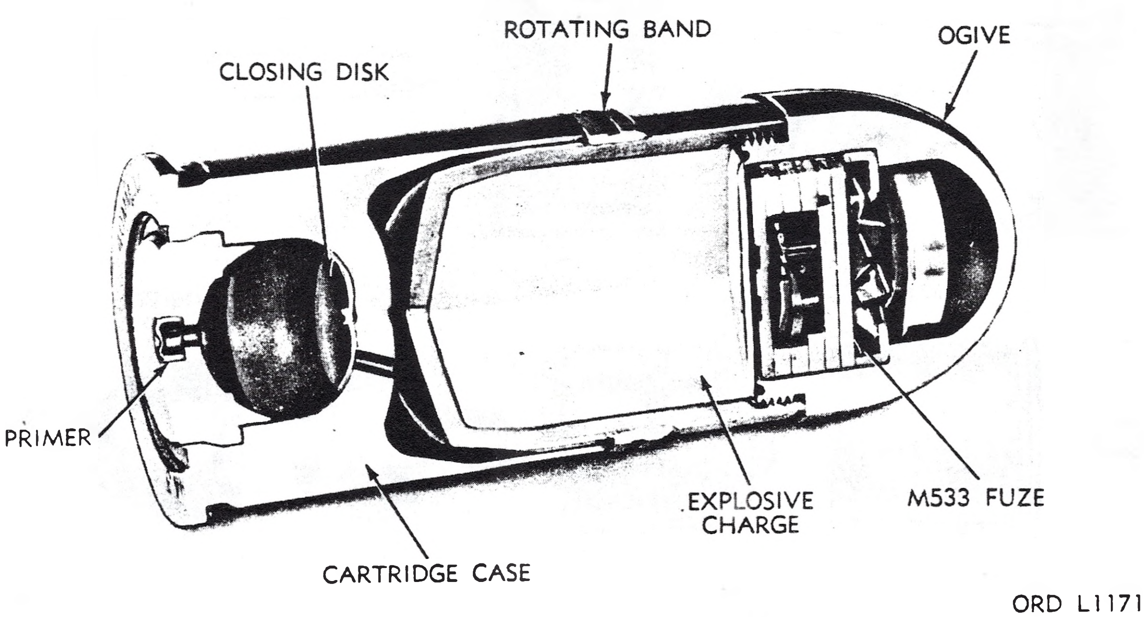


Figure 7–2. Cartridge M384—Cutaway View

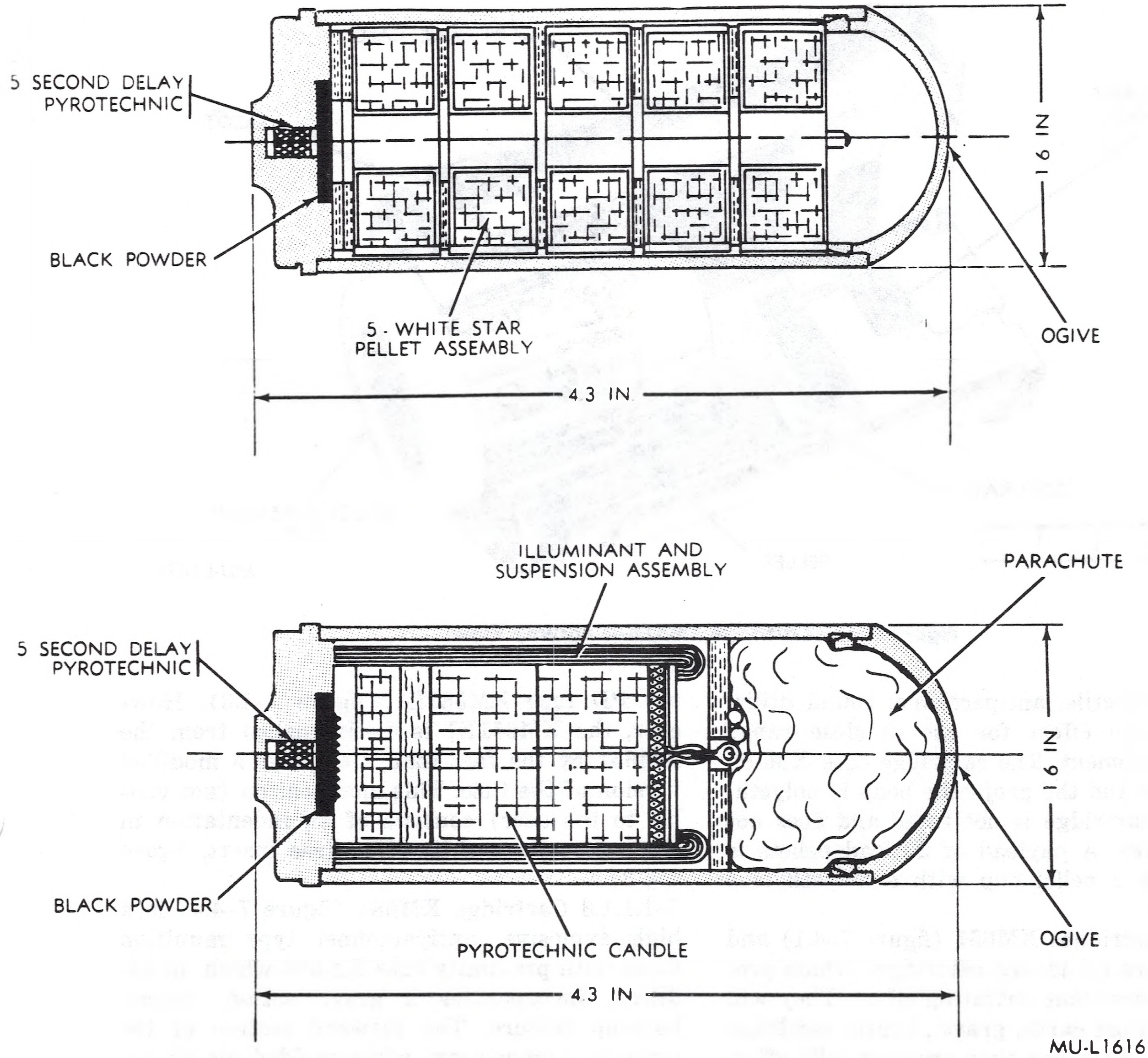


Figure 7–3. Cartridge XM583 and XM585—Cross-Sectional View

explosive, antipersonnel type munition. The projectile ogive and the cartridge case M169 are aluminum; the projectile body is steel. The round contains a PD fuze M533.

7-1.1.1.4 Cartridge XM574E2 is a WP round fuzed with the M533 PD fuze. The ogive and cartridge case M169 are aluminum and the projectile body is steel.

7-1.1.1.5 Cartridges XM583 and XM585 (figure 7-3) provide a pyrotechnic ground illumination and/or signaling capability utilizing a 5 second delay ignition. This cartridge case XM195 is aluminum with a plastic snap-on ogive and a phenolic coated kraft paper wound projectile body.

7-1.1.1.6 Cartridge XM576 (figure 7-4) is a

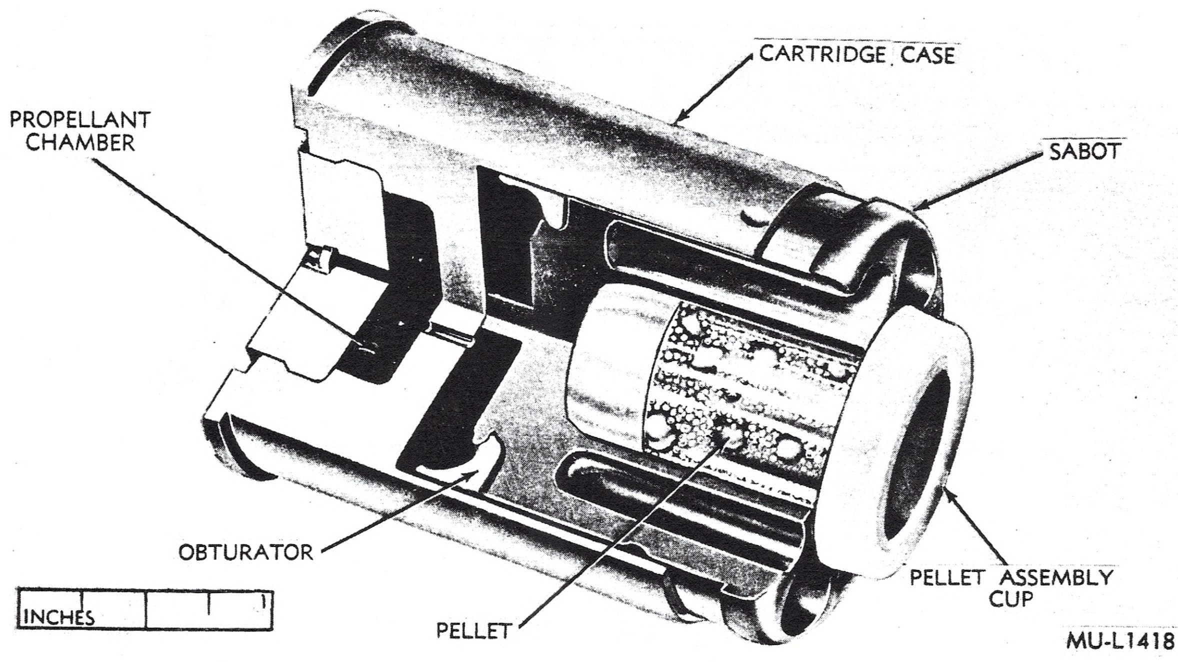


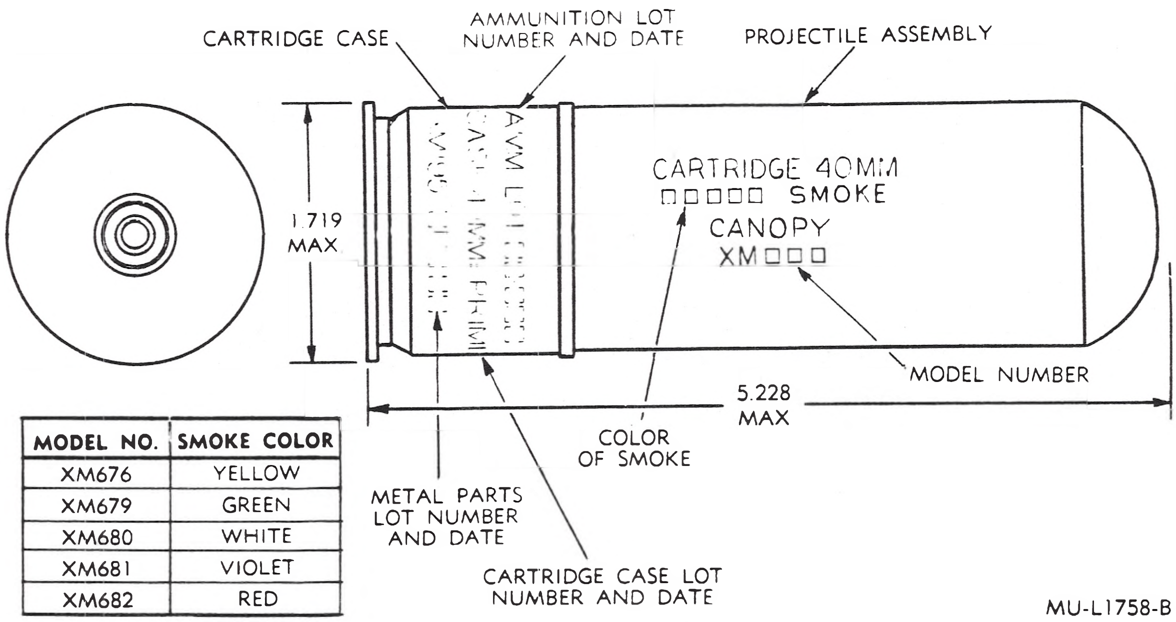
Figure 7–4. Cartridge XM576—Cutaway View

multiple projectile, antipersonnel round utilizing a shotgun effect for use in close range enemy engagement. The cartridge case XM199 is aluminum and the projectile body is polyethylene. The cartridge is not fuzed and does not have an ogive. A payload of 20 lead pellets is contained in a pellet cup with a polyethylene snap-on cap.

7–1.1.1.7 Cartridges XM651 (figure 7–4.1) and XM651E1 are CS-loaded cartridges which produce a nonpersistent irritating effect. They will function against earth, gravel, brush, sandbags and bamboo; however, they are especially effective when fired into an inclosed area. These cartridges are distinguished by a flat-nosed aluminum projectile circled by two rotating bands 3/16 of an inch apart. The payload (2 oz of CS pyrotechnic mixture) is loaded into the projectile body. There is a 3/8 inch vent hole in the base of the projectile which is closed by a round plastic plug (figure 7–4.2). The projectile is assembled to a cartridge case containing a percussion primer and a propelling charge. The cartridge case base is ringed with 6 equally spaced notches. Both XM651 series cartridges use PD fuze XM581E1 (figure 7–4.3). However, the XM651E1 is distinguished from the XM651 by the fact that it employs a modified version of the fuze. This modification (not visible to the user) consists of an indentation in the top surface of the fuze (see insert, figure 7–4.3).

7–1.1.1.8 Cartridge XM684 (figure 7–4.4) is a high explosive, antipersonnel type munition fitted with proximity fuze XM596 which, in addition, incorporates a graze action, impact back-up feature. The forward section of the ogive is a translucent white molded plastic radome. The rear portion of the ogive is copper plated steel with a stamped teardrop shaped indentation. The cartridge case M169 is aluminum.

7–1.1.1.9 Cartridges, XM676, XM679, XM680, XM681 and XM682 (figures 7–4A and 7–4B) are unfuzed, nose ejection, pyrotechnic type cartridges. These cartridges are designed to be fired through a jungle canopy and eject a smoke candle. The candle will be suspended in the canopy by the candle parachute. The cartridge cases are aluminum. The body assembly



MODEL NO.	SMOKE COLOR
XM676	YELLOW
XM679	GREEN
XM680	WHITE
XM681	VIOLET
XM682	RED

Figure 7–4A 40-mm Canopy Smoke Cartridge

is phenolic coated paper assembled to a base of similar composition. The ogive and parachute protector are plastic.

7–1.1.2 FUZES. The fuzes used to detonate the projectiles are graze-sensitive, centrifugally armed, impact fuzes designed to fire at compar-

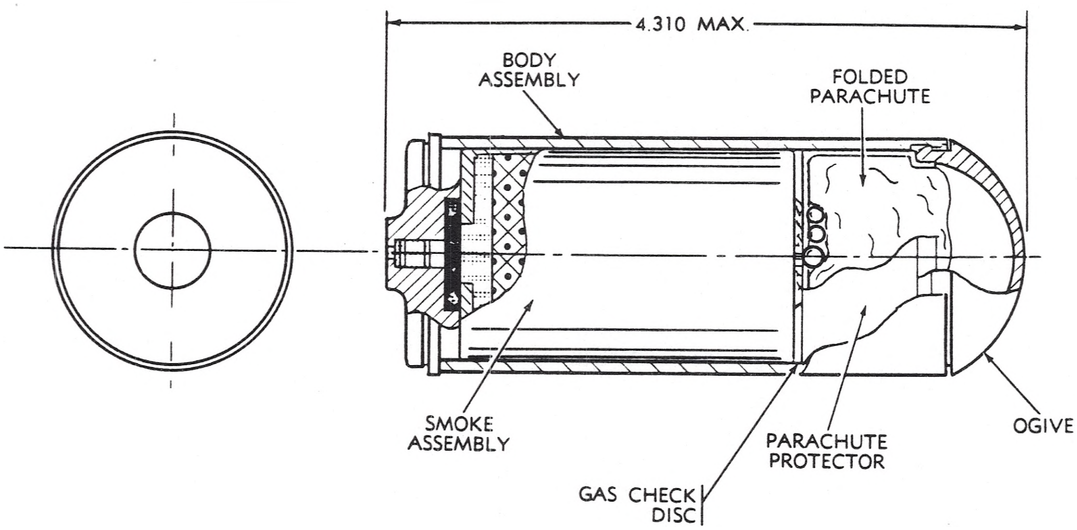


Figure 7–4B 40-mm Projective Assembly

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atively low energy rates at either high or low angles of obliquity.

7-1.1.2.1 PD FUZE M533. This fuze (figure 7-5) used in the cartridge M384, has a mechanical escapement arming delay to provide a minimum arming distance of 60 feet from the launcher muzzle. Detonation will occur at angles of impact from 90 degrees to a low graze angle.

7-1.1.2.2 PD FUZE M551. The fuze (figure 7-6), used in the cartridges M406 and M407A1, is a second-generation, long arming delay fuze which employs setback and centrifugal forces to accomplish arming. It has minimum and maximum arming distances of 14 to 27 meters, respectively.

7-1.1.2.3 PD FUZE M552. This fuze, used in the cartridges M381 and M382 is a first-generation fuze. Figure 7-7 is a cutaway view of the fuze in the unarmed condition. It is a short-arming delay fuze which is armed by the rotational forces provided by the spinning projectile. It is fully armed at approximately 10 feet from the muzzle of the launcher.

7-1.1.2.4 PD FUZE XM581E1 (figure 7-4.3) This fuze, used in the XM651 series cartridges, consists essentially of a rotor assembly, firing pin, detonator, percussion primer and ignition mixture. A combination of setback and spin arms the fuze approximately 30 meters from the launcher.

7-1.1.2.5 PROXIMITY FUZE XM596. This fuze (figures 7-7.1 and 7-7.2) is a wet energized type VT fuze incorporating a S and A device similar to that contained in the M533 fuze. The proximity portion of the fuze employs solid state circuitry, battery plates, liquid electrolyte contained in a glass ampoule and an electric defonator. The S and A device contains a spring driven, out-of-line detonator rotor which houses the nonelectric detonator, an escapement mechanism and a firing pin assembly.

7-1.1.3 COLOR AND MARKINGS.

7-1.1.3.1 CARTRIDGES, M381, M382, M384, M406, AND M407A1. The cartridge case and projectile are chemically finished to obtain an olive-drab color. The ogive for the HE cartridges is colored yellow and for the practice cartridges it is colored grey. Identification markings are stenciled on the projectile with yellow stencil ink; markings are also stamped in yellow on the base of the cartridge case. Figure 7-8 illustrates markings on the cartridge M384. The other cartridges are similarly marked.

7-1.1.3.2 CARTRIDGE M385. The aluminum projectile is anodized blue with an anodized green cartridge case M169. Identification markings are in white stencil ink.

7-1.1.3.3 CARTRIDGE XM428E1. The projectile body and ogive are colored blue. The ogive has a white tip. The cartridge case is anodized green. Identification markings on the cartridge are stenciled with white stencil ink. Figure markings on the cartridge case are stenciled in yellow.

7-1.1.3.4 CARTRIDGE XM574E2. The projectile ogive is colored light green and the body green. The cartridge case is anodized green. Identification markings on the cartridge are stenciled light red. Markings on the cartridge case are stenciled yellow.

7-1.1.3.5 CARTRIDGE XM576. The plastic projectile is pigmented with a black filler. The cartridge case is anodized green. Identification markings on the cartridge case are stenciled with white stencil ink.

7-1.1.3.6 CARTRIDGES XM583 AND XM585. The projectiles are painted with white enamel. The cartridge case is chemically finished to obtain a green color. Identification markings on the cartridge case are stenciled in black ink.

7-1.1.3.7 CARTRIDGES XM651 AND XM651E1. The projectile body and ogive are painted gray. A red band circles the projectile just forward of the rotating band and all markings are in red (figure 7-4.1). The cartridge case is olive drab with markings in black.

7-1.1.3.8 CARTRIDGE XM684. The fuze housing is copper colored with a white translucent

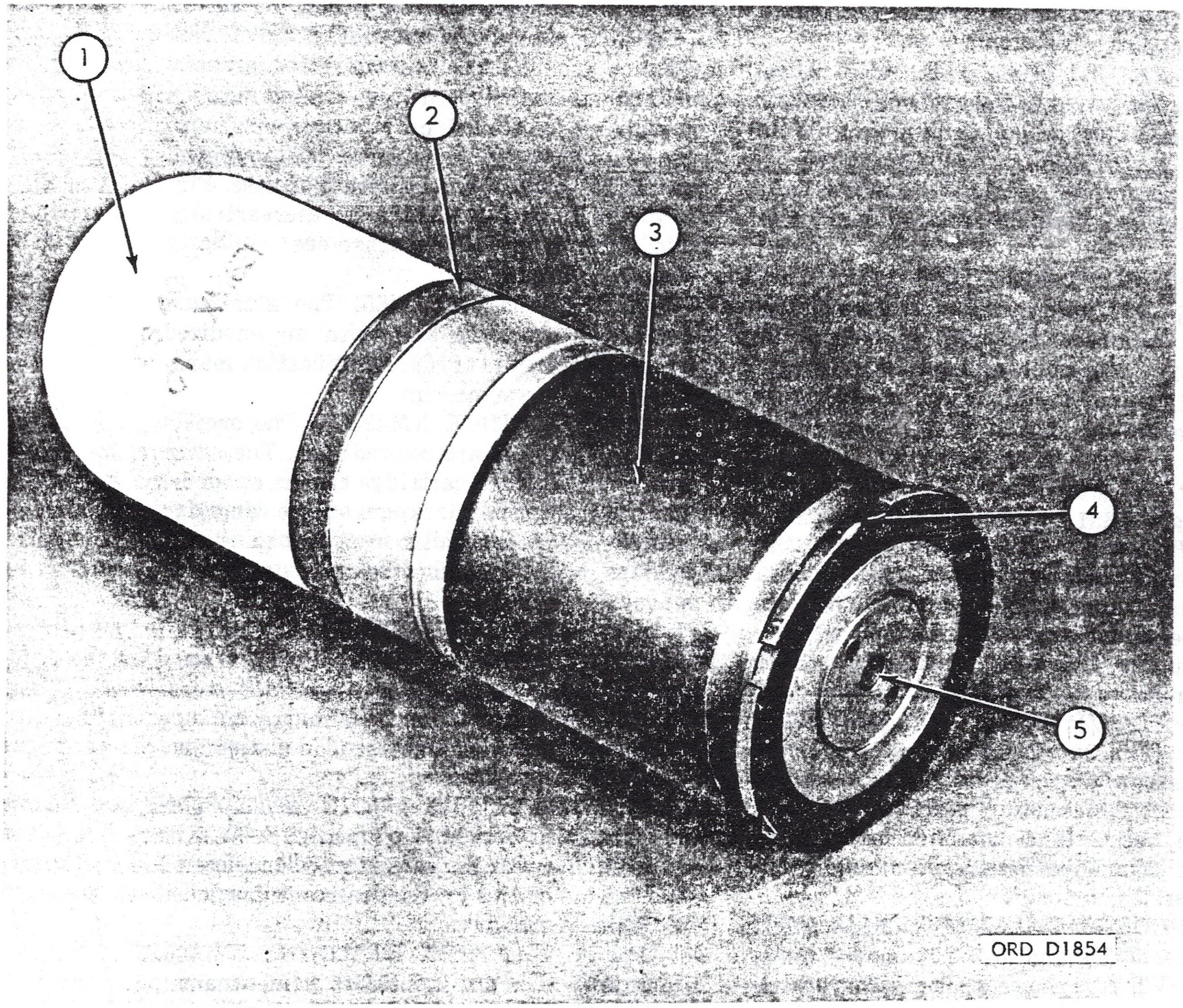


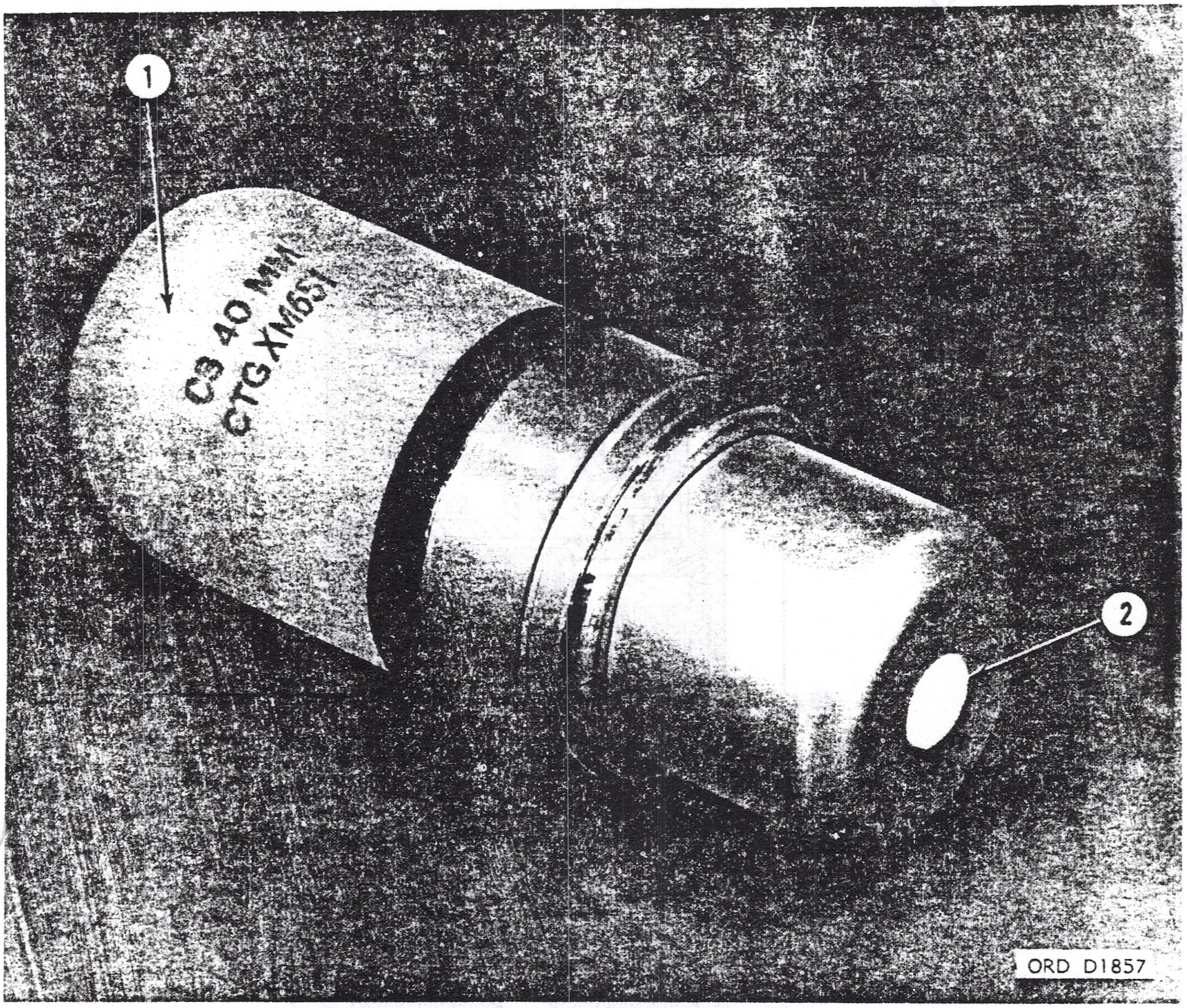
Figure 7-4.1 CS Cartridge XM651

radome. The cartridge case is anodized green, the projectile body is green. All identification markings are in yellow (figure 7-8.1).

7-1.1.3.9 CARTRIDGES, XM676, XM679, XM680, XM681 AND XM682. The projectile assembly is painted pale green, the cartridge case is olive drab. The color of the ogive denotes the color of the smoke. Markings are in black.

7-1.2 FUNCTIONING.

7-1.2.1 CARTRIDGES M381 AND M382. Before firing, the rotor ball assembly is held in an out-of-line position with respect to the explosive train by the firing pin (figure 7-7). As the projectile leaves the tube of the launcher, rotation of the projectile causes the hammer weights to overcome the resistance of the hammer weight spring allowing the imbalanced levers to rotate outward. The firing pin spring then expands, withdrawing the firing pin from the rotor ball assembly and permitting the



1 Ogive 2 Plastic plug

Figure 7–4.2 Projectile XM651

rotor ball assembly to align the detonator with the remainder of the explosive train. The fuze becomes armed after the projectile has traveled approximately 3 meters from the launcher. Upon graze or impact, the inertial ring acts on the push pins, pivoting the levers inward, forcing the firing pin into the detonator, thereby initiating the explosive train. The cartridge M381 bursts into fragments and the cartridge M382 produces a yellow cloud of smoke.

7–1.2.2 CARTRIDGE M384. Upon firing, setback force pulls the fuze setback pin out of the fuze rotor. However, at this point the rotor (figure 7–5) is prevented from moving by the centrifugal lock which engages the star wheel of the timing mechanism. When the projectile has attained sufficient spin, three bracket

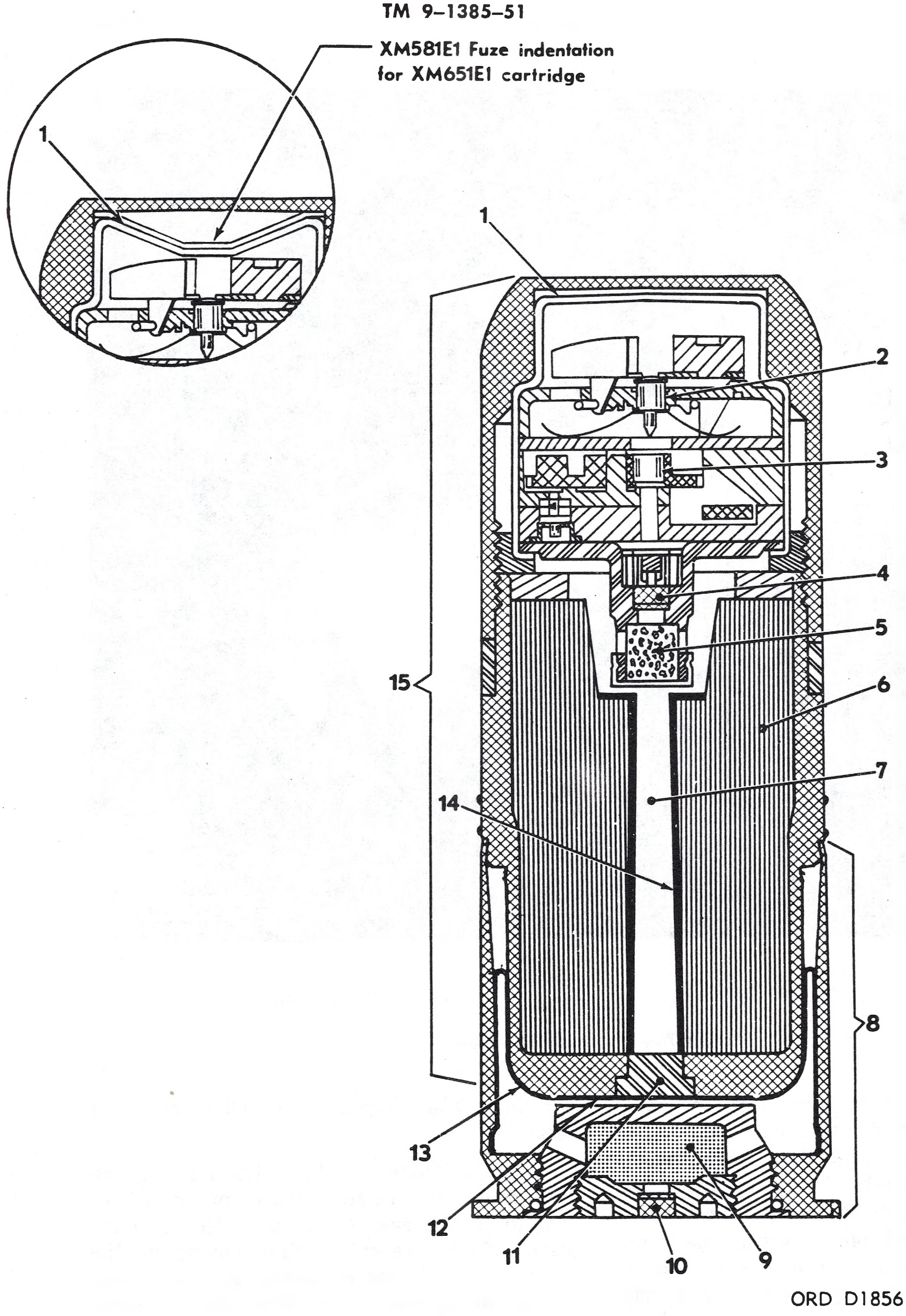


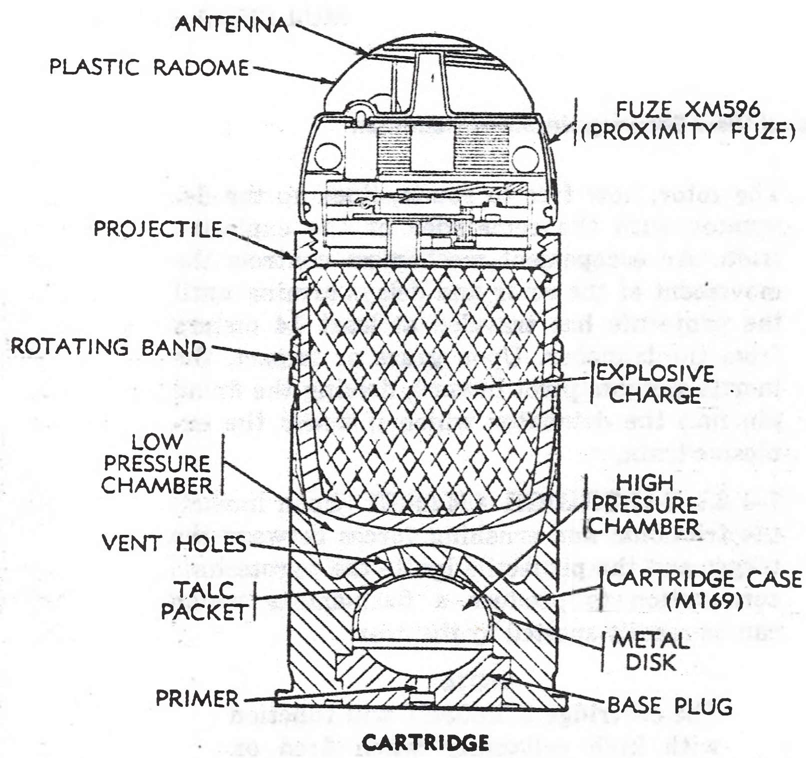
Figure 7-4.3 Cartridge XM651 and XM651E1, Cross Section

1 XM581E1 fuse	6 CS-pyrotechnic mixture	11 Plastic plug in vent hole
2 Firing pin	7 Flash hole	12 Disk
3 Detonator	8 Cartridge case	13 Driver cup
4 Percussion primer	9 Propellent charge	14 First-fire mixture
5 Ignition mixture	10 Percussion primer	15 Projectile.

Figure 7–4.3 (Continued)

weights pivot outward and release a push pin. The firing pin spring then lifts the firing pin out of the rotor slot. At the same time the centrifugal lock releases the arming mechanism and arming begins. The rotor spring starts rotation of the rotor which is then sustained by centrifugal force. An escapement assembly, which engages the rotor gear, delays the arming of the fuze until the projectile is 18 to 36 meters from the launcher. Upon graze or impact with the target the sudden deceleration of velocity and/or rotation causes the bracket weights to pivot inward, forcing the firing pin into the detonator, thereby initiating the explosive train.

7-1.2.3 CARTRIDGES M406 AND M407A1. Before firing, the rotor (figure 7-6) is held in the unarmed position by a firing pin, a centrifugal lock, and setback pin. Upon firing, setback force causes the setback pin to move rearward and clear the rotor. Rotation of the projectile causes three pivoted inertia weights and the centrifugal lock to move outward causing the spring-loaded firing pin and lock to retract from the rotor and gear train, respectively.



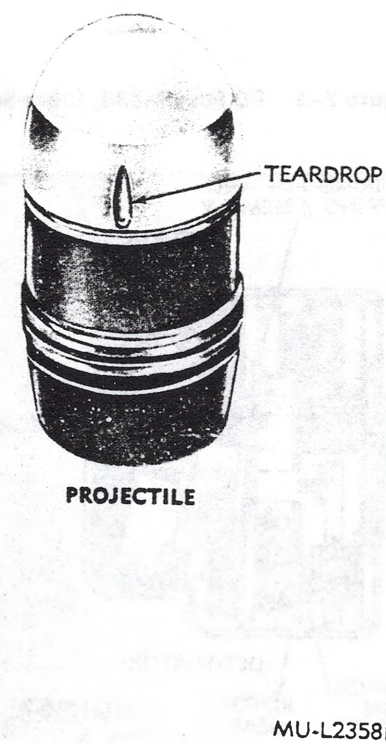


Figure 7–4.4 Cartridge XM684

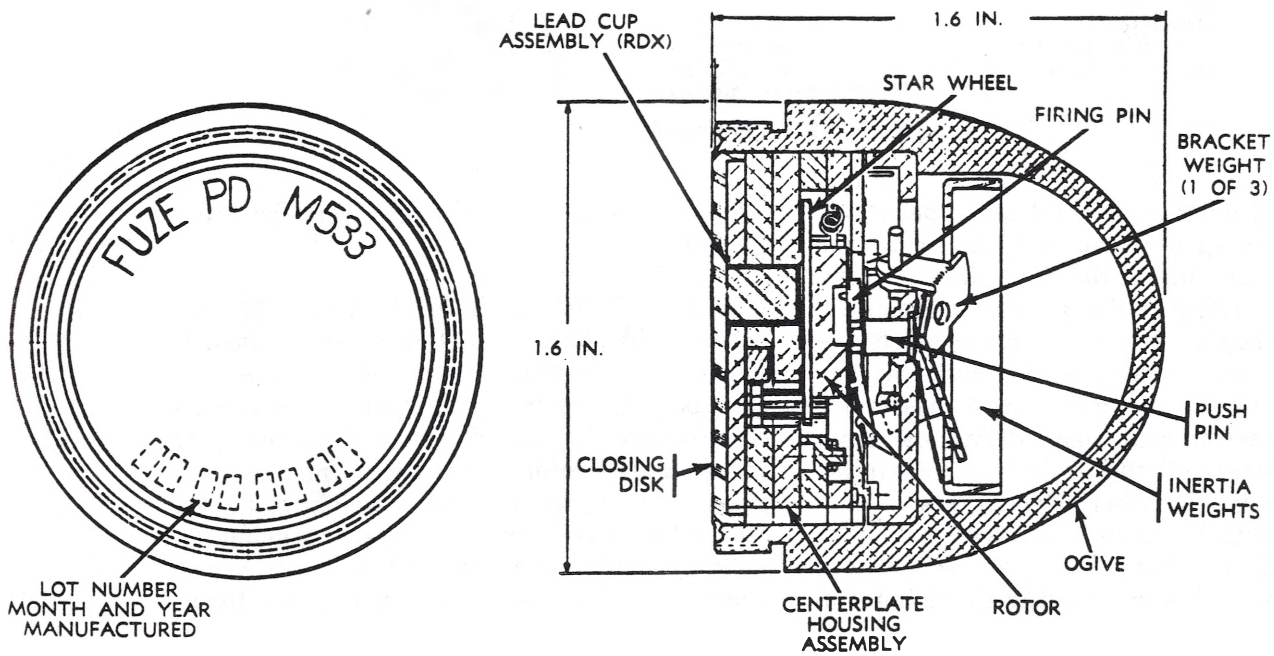


Figure 7–5 PD Fuze M533, Cross-Sectional View Showing Unarmed Condition

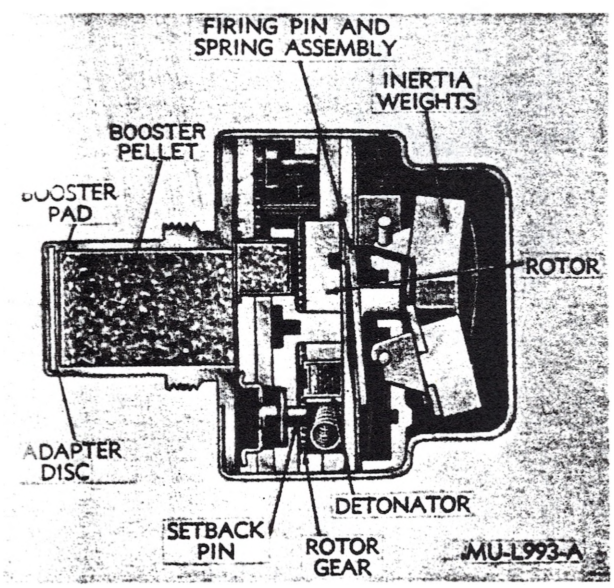


Figure 7–6 PD Fuze M551, Cutaway View Showing Unarmed Condition

The rotor, now free to rotate, lines up the detonator with the remainder of the explosive train. An escapement mechanism controls the movement of the rotor and delays arming until the projectile has traveled at least 14 meters from the launcher. Upon graze or impact, the inertia weights pivot inward, driving the firing pin into the detonator which initiates the explosive train.

7–1.2.4 CARTRIDGE XM428E1. Upon impact, the frictional and crushing forces between the target and the projectile ignite the pyrotechnic composition to produce a flash-smoke which can be readily spotted by the firer.

NOTE

The cartridge XM428E1 will function with high reliability when fired on very firm target media such as gravel or hardbaked clay.

7–1.2.5 CARTRIDGE XM574E2. Upon firing,

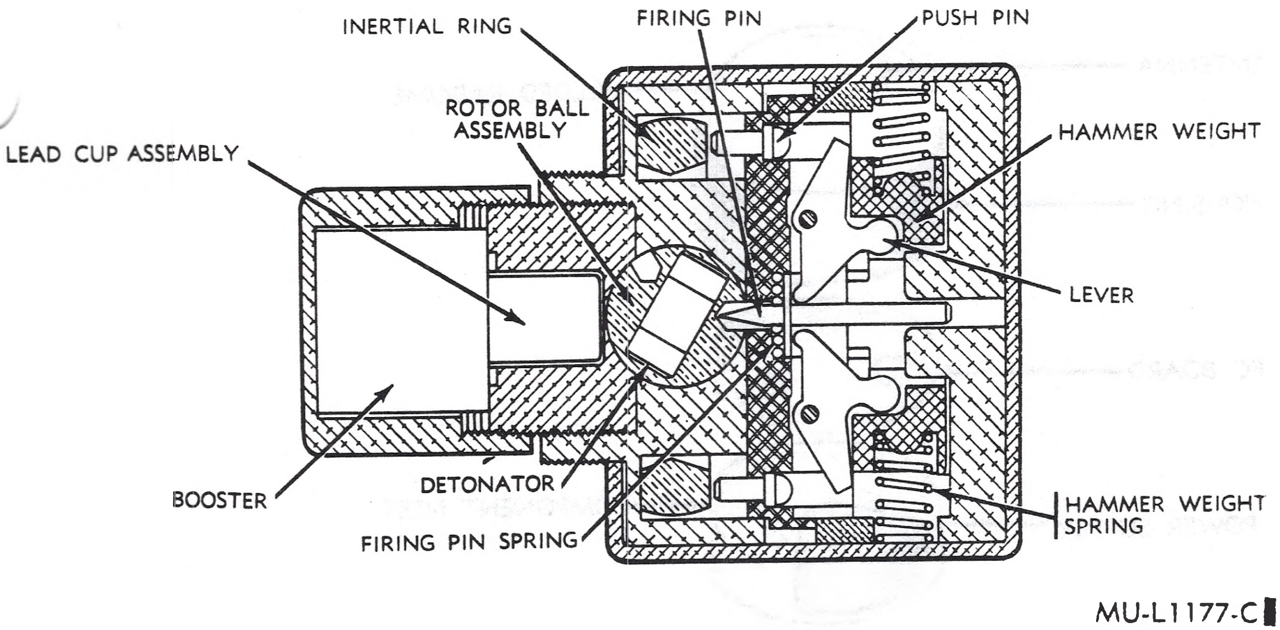


Figure 7–7. PD Fuze M552, Cutaway View Showing Unarmed Condition

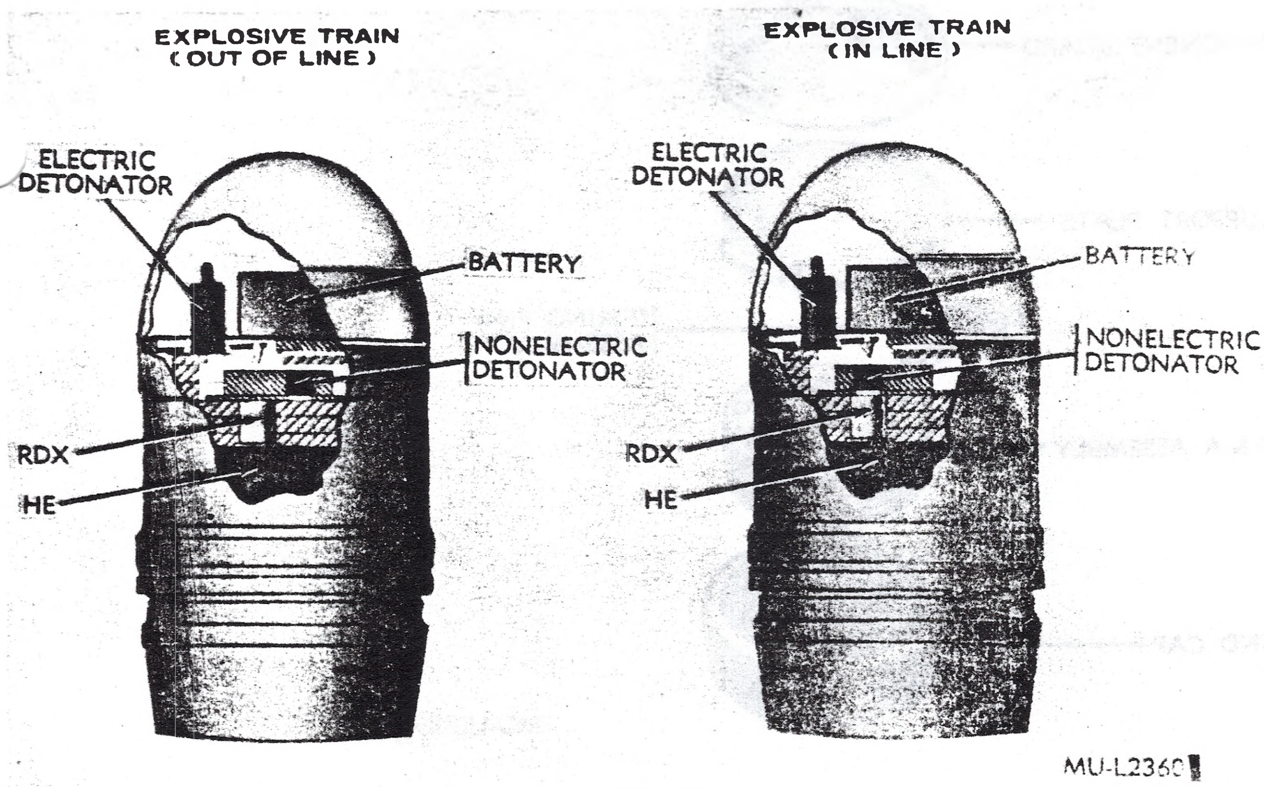


Figure 7–7.1. XM684 Explosive Train.

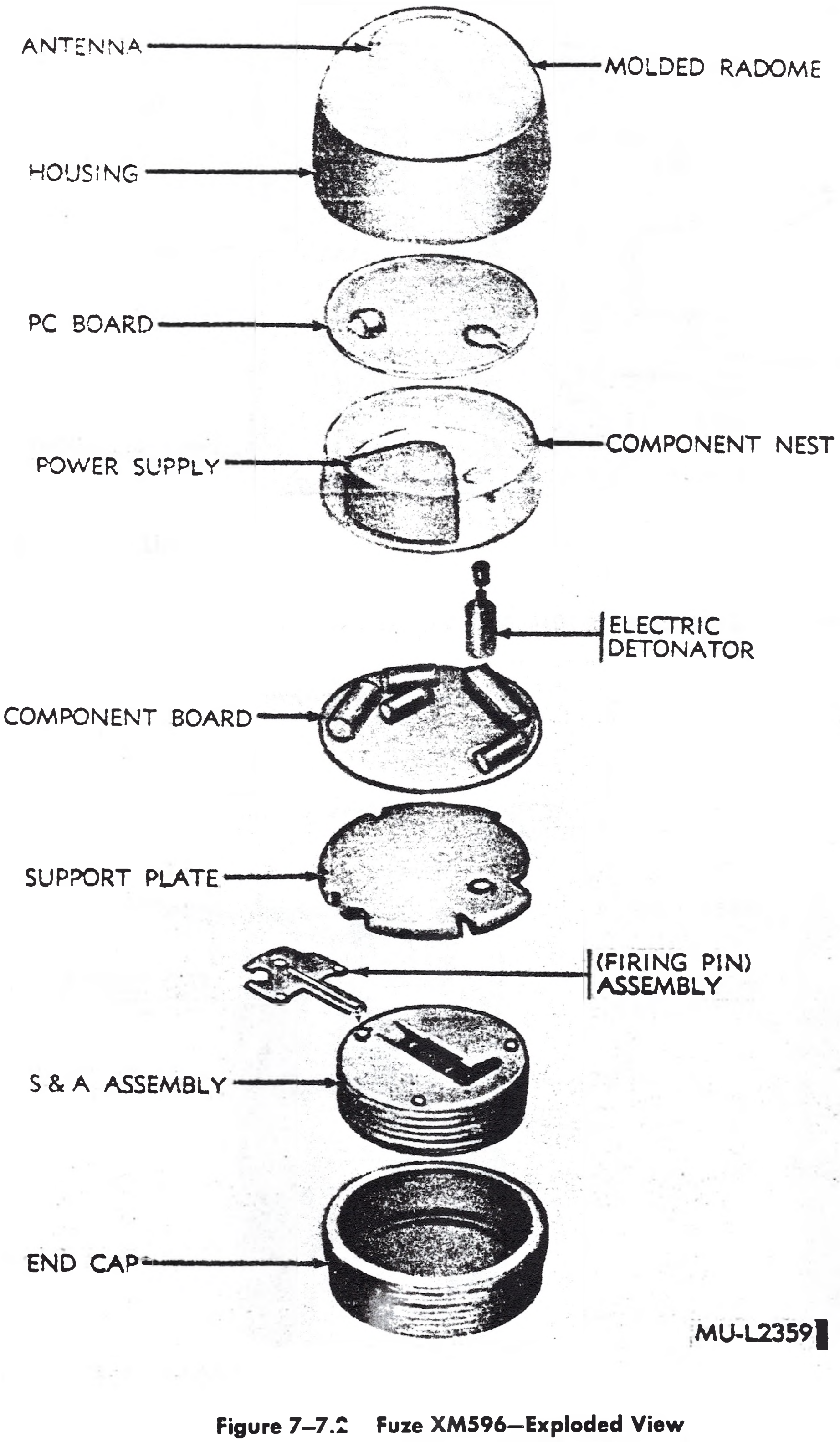
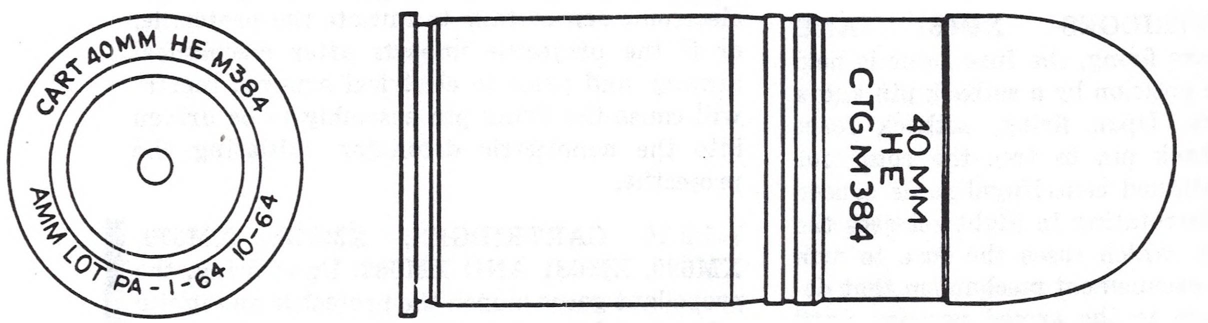


Figure 7–7.2 Fuze XM596—Exploded View

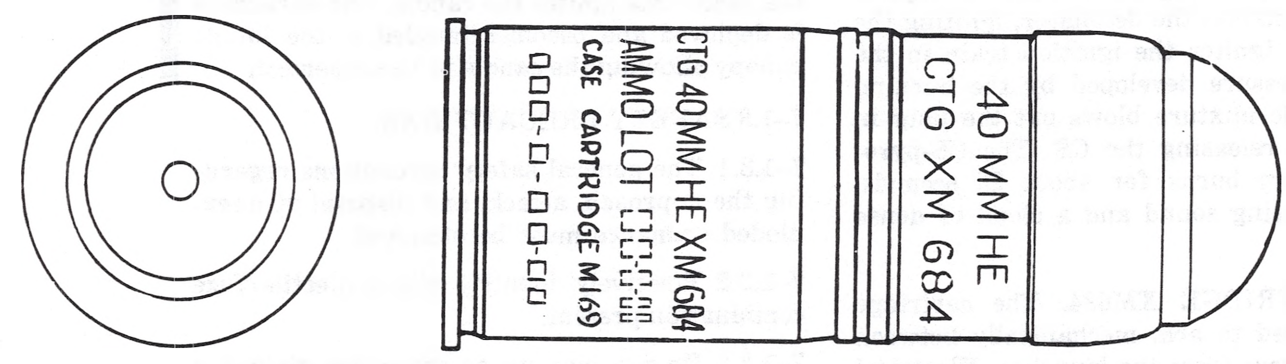
setback force pulls the fuze setback pin (figure 7-5) out of the fuze rotor. However, at this point the rotor is prevented from moving by the centrifual lock which engages the star wheel of the timing mechanism. When the projectile has attaind sufficient spin, three bracket weights pivot outward and release a push pin. The firing pin spring then lifts the firing pin out of the rotor slot. At the same time the centrifugal lock releases the arming mechanism and arming begins. The rotor spring starts rotation of the rotor which is then sustained by centrifugal force. An escapement assembly, which engages the rotor gear, delays the arming of the fuze until the projectile is 18 to 36 meters from the launcher. Upon graze or impact with the target the sudden deceleration of velocity and/or rotation causes the bracket weights to pivot inward, forcing the firing pin into the detonator, initiating the booster pellet which bursts the projectile body and disperses the WP charge. Upon contact with the air, the WP particles ignite spontaneously and continue to burn until they are completely consumed or cut off from oxygen.

7-1.2.6 CARTRIDGE XM576 (figure 7-4). Upon firing, setback causes the pellet cup as-



MU-L1174-B

Figure 7-8 Typical 40-mm Cartridge External View



MU-L2269

Figure 7-8.1 Markings on Cartridge XM684

sembly in the sabot carrier to move rearward. This movement causes disengagement of the snap-on cap from the pellet cup. Upon reaching the muzzle the sabot carrier and the pellet cup separate from the lead pellets and allow for free flight of the pellets to the target.

7–1.2.7 CARTRIDGES XM583 AND XM585 (figure 7–3). Upon firing, the propellant gases launch the projectile and ignite a 5 second delay in the base plug. At or near the zenith of the trajectory of the projectile, the delay column ignites the black powder ejection charge which in turn ignites the candle or stars, as applicable, and ejects same through the nose of the carrier.

7–1.2.8 CARTRIDGES XM651 AND XM651E1. Before firing, the fuze rotor is held in the unarmed position by a setback pin and a centrifugal lock. Upon firing, setback force causes the setback pin to free the rotor for movement. Continued centrifugal force caused by the projectile rotating in flight releases the centrifugal lock, which cases the fuze to arm by releasing an escapement mechanism that delays rotor motion to the armed position until the projectile has traveled 30 meters from the launcher. When the rotor moves into the armed position, the detonator lines up with the firing pin and the projectile ignition train. On impact, the firing pin strikes the detonator, igniting the primer which ignites the ignition train in the projectile. Pressure developed by the burning CS-pyrotechnic mixture blows out the plug in the vent hole releasing the CS. The CS-pyrotechnic mixture burns for about 25 seconds, creating a hissing sound and a cloud of dense white smoke.

7–1.2.9 CARTRIDGE XM684. The cartridge fuze is designed to arm mechanically between 18 and 36 meters from the launcher. Electrical arming occurs approximately 125 meters from the launcher. Prior to firing, the detonator rotor is held in the out-of-line position by a setback pin and a centrifugal lock. Upon setback the setback pin is removed from the detonator rotor.However, the rotor is prevented from turning by the centrifugal lock. Setbark also ruptures the ampoule containing the electrolyte. Centrifugal force removes the centrifugal lock from the rotor allowing the rotor spring to turn the rotor to the in-line position. The escapement mechanism slows down the rotor movement and provides a short arming delay. When the rotor completes its travel it is locked in the in-line position. The fuze is now mechanically armed. Continued centrifugal force causes the electrolyte to be distributed between the battery plates, energizing the power supply. The fuze is now electrically armed. Upon receipt of a proper signal, the electronic section will cause the electrical detonator to function when the projectile is at the proper height above the target. In the event the electronic sensor fails to initiate the projectile, or if the projectile imparts after mechanical arming, and prior to electrical arming, inertia will cause the firing pin assembly to be driven into the nonelectric detonator, initiating the projectile.

7–1.2.10 CARTRIDGES, XM676, XM679, XM680, XM681 AND XM682. Upon firing, the propellant gases launch the projectile and ignite a 2 second delay element in the base. Delay burn out initiates the black powder expelling charge. The expelling charge ejects the smoke candle through the nose of the body assembly and at the same time ignites the candle. The parachute is deployed and becomes tangled in the jungle canopy allowing the candle to be suspended.

7–1.3 SAFETY PRECAUTIONS.

7–1.3.1 The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

7–1.3.2 Positively identify the projectile/fuze combination present.

7–1.3.3 Do not pick up or otherwise disturb a fired projectile, since the fuzes incorporate a graze-sensitive feature (figure 7–9).

NOTE

If positive identification can be determined, projectiles from the cartridges M385, XM576, XM583, XM585, and

XM428E1 may be safely picked up and transported to a disposal area.

7-1.3.4 Take white phosphorus (WP) precautions with the cartridges XM574E2.

7-1.3.5 Wear a field mask or remain upwind when handling cartridges XM651 and XM651E1.

7-1.3.6 The pyrotechnic mixture in the XM651 Series cartridges constitutes a fire hazard and a CS exposure hazard.

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Figure 7-9 Typical 40-mm Projectile (Fired)

7-1.3.7 The 40-mm XM684 cartridge contains composition A-5 explosive and a liquid acid electrolyte battery which may or may not have been activated.

7-2 HAND GRENADES.

This paragraph contains information on identification, functioning and safety precautions for hand grenades. Hand grenades may be launched from a special adapter attached to a rifle, or thrown by hand.

7-2.1 IDENTIFICATION

7-2.1.1 M34 WP Smoke Grenade. This grenade is a bursting type, multi-purpose munition used as an antipersonnel incendiary or smoke producing device. This grenade is cylindrical, filled with WP, and fitted with an M206A2 fuze.

7-2.1.1.1 Fuze. The M206A2 fuze has a 4-5 second pyrotechnic delay and a high explosive burster similar to those used in high-explosive fragmentation grenades.

7-2.1.1.2 Color and Markings. The grenade body is painted light green with one yellow band. Markings are in light red.

7-2.1.1.3 Functioning. When the safety pin is withdrawn and the grenade released, the fuze striker, which is under spring tension, forces the safety lever out of its path; the safe lever separates from the grenade, freeing t striker to fire the primer. The primer ignit the delay element which burns for 4 or 5 se onds before igniting the detonator. The deton tor ruptures the grenade body and releases t WP filler.

7-2.1.2 AN-M8 HC Smoke Grenade. This gr nade consists of a cylindrical metal contain 2.5 inches in diameter and 4.5 inches lon filled with 11.5 ounces of HC smoke mixtu Four emission holes in the top of the grena are covered with tape. An M201A1 ignitio type fuze is threaded into an adapter in the t of the grenade. A plastic cup containing starter mix is centered under the fuze.

7-2.1.2.1 Fuze. The M201A1 fuze is a delay-i nition type with a delay time of 1.2-2.0 se onds.

7-2.1.2.2 Color and Marking. The grenade bod is painted light green. All markings and lette ing are in black.

7-2.1.2.3 Functioning. When the safety pin an safety lever are in place, the spring-loade striker is held clear of the primer. When th safety pin is removed, the striker, driven b the spring, throws the safety lever out of lin and strikes the primer. The primer ignites th delay element which ignites the ignition mi ture. The ignition mixture ignites the start mixture which ignites the HC filler, in tur The pressure created by the burning HC blow off the tape covering the emission holes and r leases the HC.

7-2.1.3 XM54 CS GRENADE

7-2.1.3.1 IDENTIFICATION. Type XM5 Tactical CS Grenade. The XM54 is a burnin type grenade that is fitted with the XM226 I nition Type Fuze. The XM226 has an 8 to 1 second delay. The XM54 Grenade is designe to be dispensed from a modified SUU-14/ (XM18) Dispenser. The XM27 Dispenser an Grenade System is comprised of 72 XM54 Gr nades in the XM18 Dispenser. However, th XM 54 Grenade may be hand dropped fro aircraft or launched from a rifle using a gr nade launcher.

7–2.1.3.2 PAINTING AND MARKING. The grenade is painted gray overall with one red band around the lower portion of the body. All markings are in red.

7–2.1.3.3 FITTINGS AND FEATURES. The M54 Grenade (figure 7–9.1) consists of the XM226 Fuze and a grenade body filled with a CS fuel mixture. The XM226 Fuze is a modified M208 Fuze. The modification consists of lengthening the fuze safety lever.

7–2.1.3.4 WEIGHT AND DIMENSIONS

Length—5.75 inches
Diameter—2.5 inches
Weight—16 ounces approximately

7–2.1.3.5 MATERIALS. The safety lever and the grenade body are steel. The fuze body is zinc.

7–2.1.3.6 MAJOR COMPONENTS (figure 7–9.2). The XM54 Grenade consists of a body assembly (1, figure 7–9.2) with five emission holes (5), and the XM226 Fuze. It is filled with a fuel mixture (3), a starter mixture (4) and CS pellets (2). The XM226 Fuze consists of a safety lever (13) a striker (9), a striker spring (8), a primer (7), a fuze body (10) and a delay ignition train. The delay ignition train consists of a first-fire mixture (11), delay mixture (12) and an ignition mixture (14).

7–2.1.3.7 FUNCTIONING. Prior to installation in the modified SUU–14/A (XM18), the safety pin is withdrawn while the safety lever is held in place, and the grenade is inserted into one of the modified SUU–14/A (XM18) Tubes. Upon ejection from the tube, the striker driven by the striker spring forces the safety lever out of its path; the safety lever separates from the grenade, allowing the striker to fire the primer, which ignites an 8-to-12-second delay train. The delay ignites the ignition mixture which, in turn, ignites the starter mixture and grenade filler. Pressure developed by the burning filler forces the tape from the five emission holes. The grenade burns for 15 to 25 seconds.

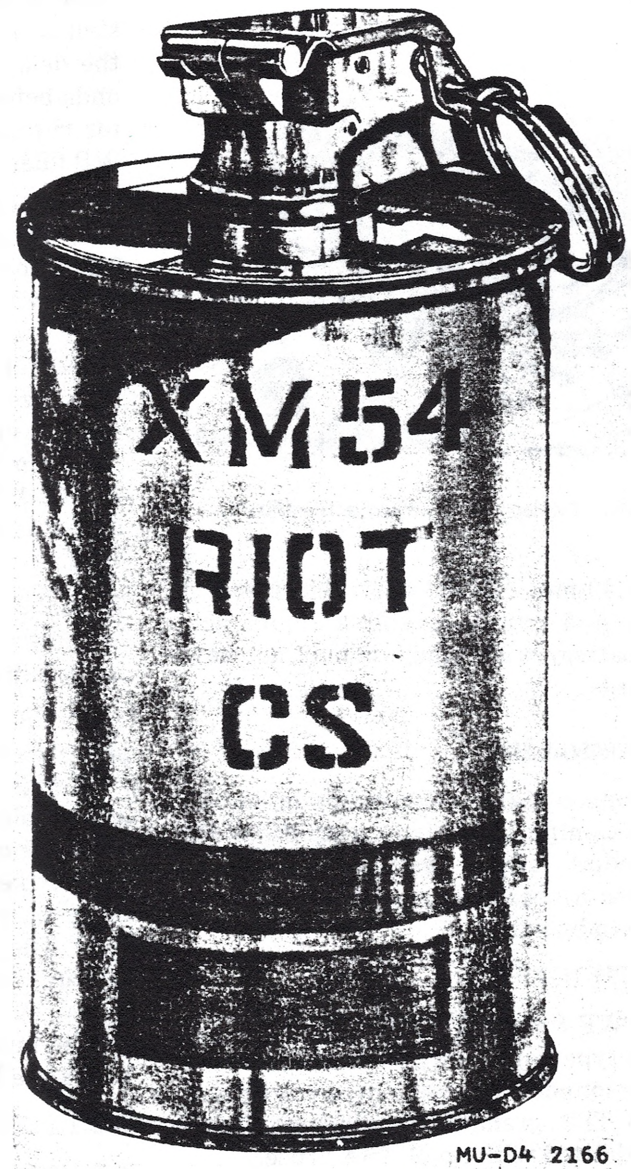
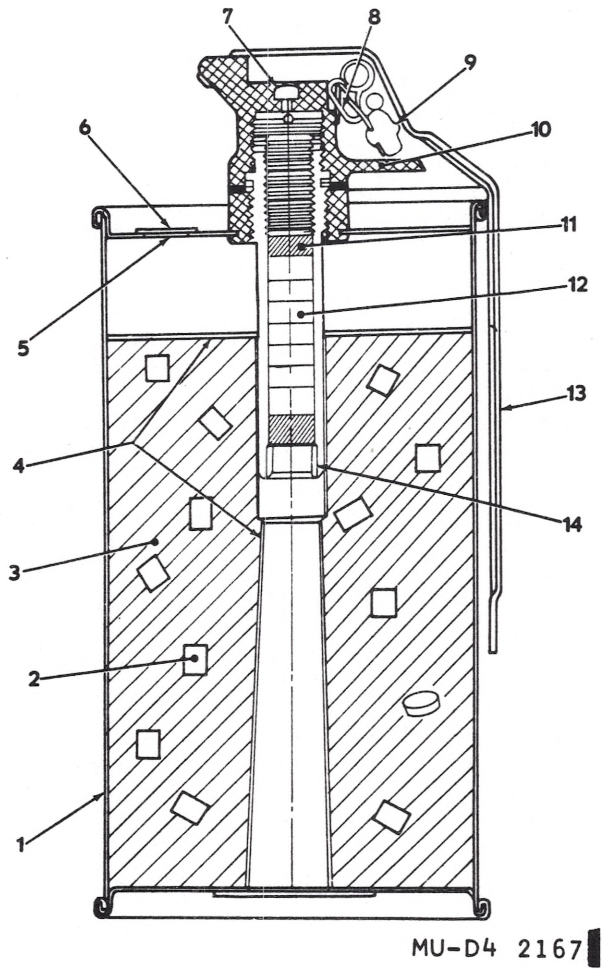


Figure 7–9.1 XM54 CS Grenade



1 Body assembly
2 CS pellets
3 Fuel mixture
4 Starter mixture
5 Emission holes
6 Pressure-sensitive tape
7 Primer
8 Striker spring
9 Striker
10 Fuze
11 First-fire mixture
12 Delay mixture
13 Safety lever
14 Ignition mixture

Figure 7–9.2 XM54 CS Grenade (Cross Section)

7-2.1.3.8 SAFETY PRECAUTIONS AND HAZARDS.

7-2.1.3.8.1 Observe burning-type grenade precautions. Ignited CS grenades constitute a fire hazard and CS explosive hazard.

7-2.1.3.8.2 Remain upwind and have a protective field mask available when disposing of CS-filled munitions.

7-2.1.4 HAND GRENADE FUZES. The hand grenade fuzes M213, M215, M217, M204 series, and XM228 are covered in this paragraph.

7-2.1.4.1 IDENTIFICATION.

7-2.1.4.1.1 TYPE. The fuzes M215 (figure 7-9.3) and M204 series (figure 7-9.4) are delay-detonating silent type fuzes used in fragmentation hand grenades M61 and M26A1. The fuze M217 (figure 7-9.5) is an electric, impact-functioning fuze with an over-riding delay function. The M217 is used in the fragmentation hand grenades M26A2, M59 (M33A1), and M68. The fuze M213 (figure 7-9.6) is a pyro-

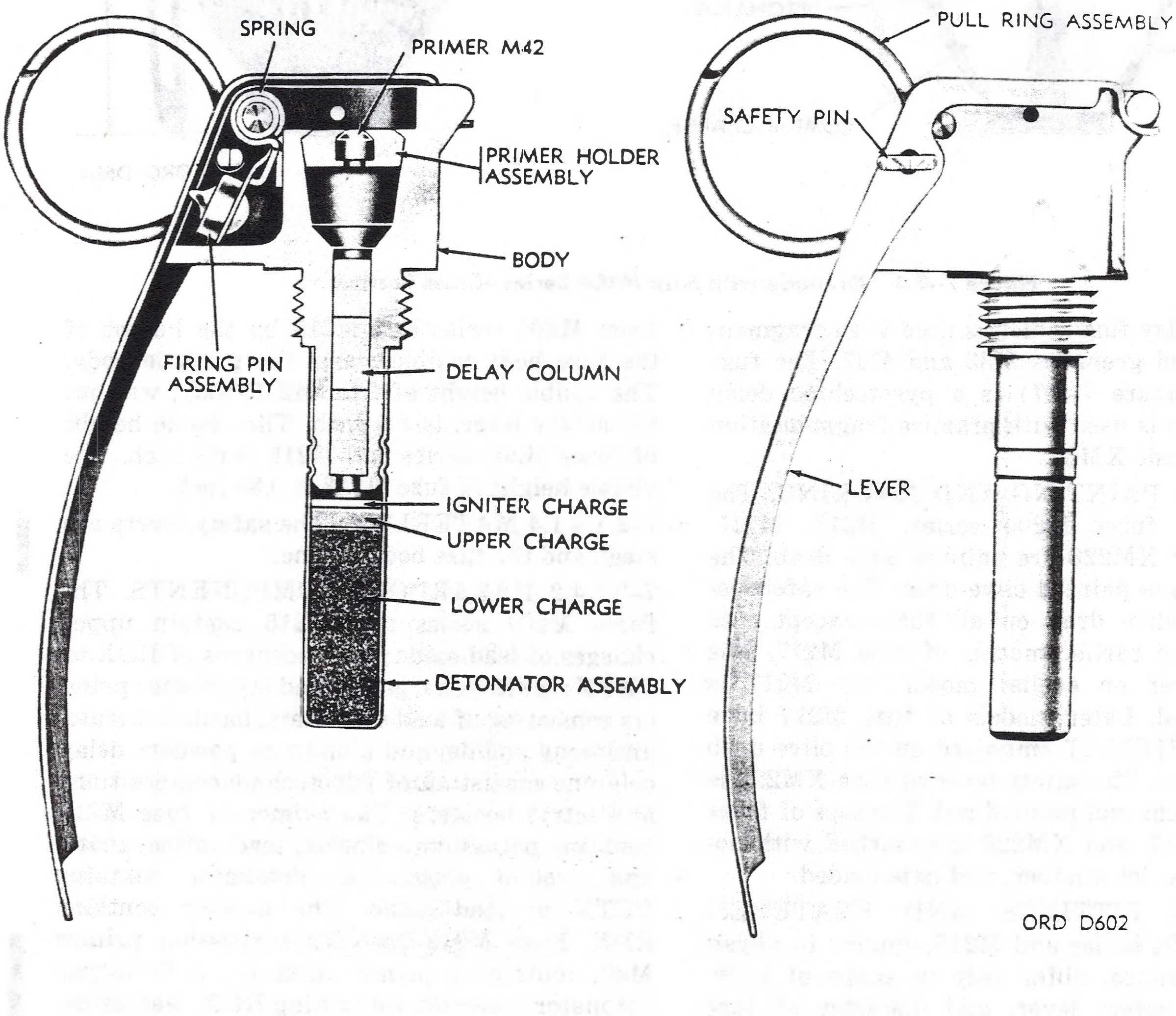


Figure 7-9.3 Grenade Fuze M215—Cross Section

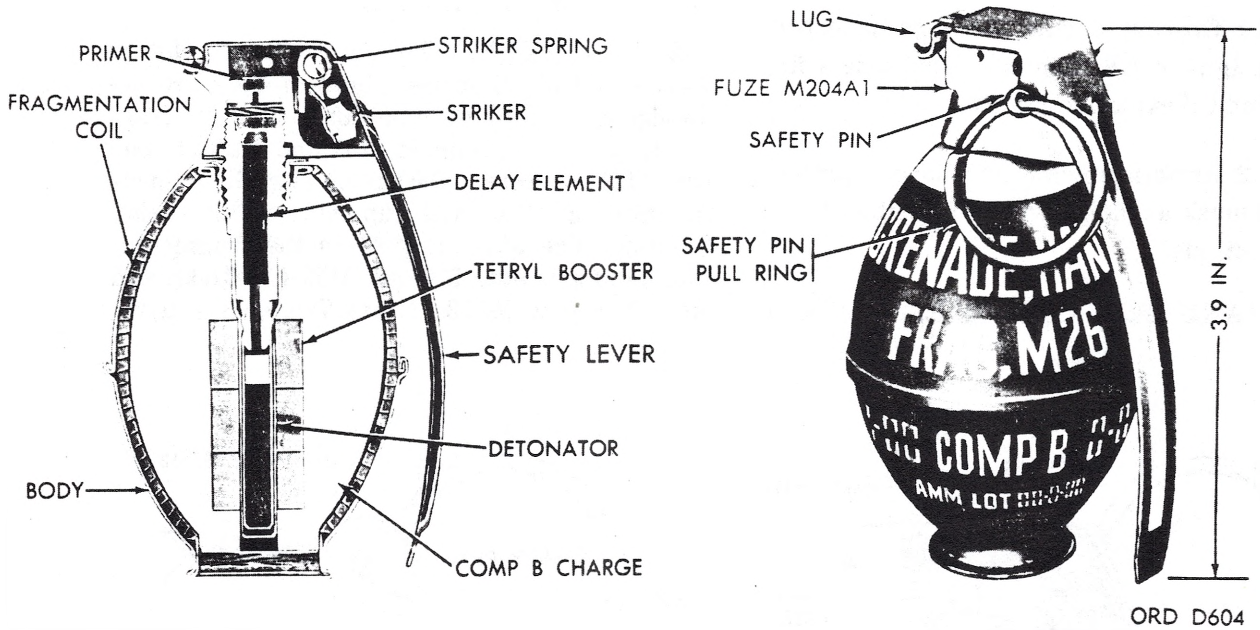


Figure 7-9.4 Grenade with Fuze M204 Series—Cross Section

technic delay fuze which is used with fragmentation hand grenades M33 and M67. The fuze XM228 (figure 7-9.7) is a pyrotechnic delay fuze which is used with practice fragmentation hand grenade XM69.

7-2.1.4.1.2 PAINTING AND MARKING. The bodies of fuzes M204 series, M213, M215, M217, and XM228 are painted olive drab. The safety clip is painted olive drab. The safety levers are olive drab on all fuzes except fuze XM228 and earlier models of fuze M217. The safety lever on earlier model fuze M217 is painted red. Later models of fuze M217 have the word IMPACT embossed on the olive drab safety lever. The safety lever of fuze XM228 is blue with the end painted red. The tops of fuzes M213, M217, and XM228 are marked with nomenclature, lot number, and date loaded.

7-2.1.4.1.3 FITTINGS AND FEATURES. Fuzes M204 series and M215, similar in physical appearance, differ only in shape of body, shape of safety lever, and diameter of fuze threads. The fuze M217 may be distinguished from M204 series and M215 by the height of the fuze body visible above the grenade body. The visible height of fuze M217 body, without the safety lever, is 0.5 inch. The visible height of fuzes M204 series and M215 is 0.9 inch. The visible height of fuze M213 is 0.85 inch.

7-2.1.4.1.4 MATERIALS. The safety levers are steel, and the fuze body is zinc.

7-2.1.4.2 HAZARDOUS COMPONENTS. The fuzes M204 series and M215 contain upper charges of lead azide; lower charges of RDX or PETN; igniter charges of lead styphnate; primers consisting of lead styphnate, barium nitrate, antimony sulfide, and aluminum powder; delay columns consisting of pyrotechnic composition; and tetryl boosters. The primer of fuze M217 contains potassium chlorate, lead sulfocyanate, and ground glass. The detonator contains PETN or lead azide. The booster contains RDX. Fuze M213 contains percussion primer M42, containing primer mixture; a flash-type detonator assembly containing RDX, lead azide, and lead styphnate; and a delay column con-

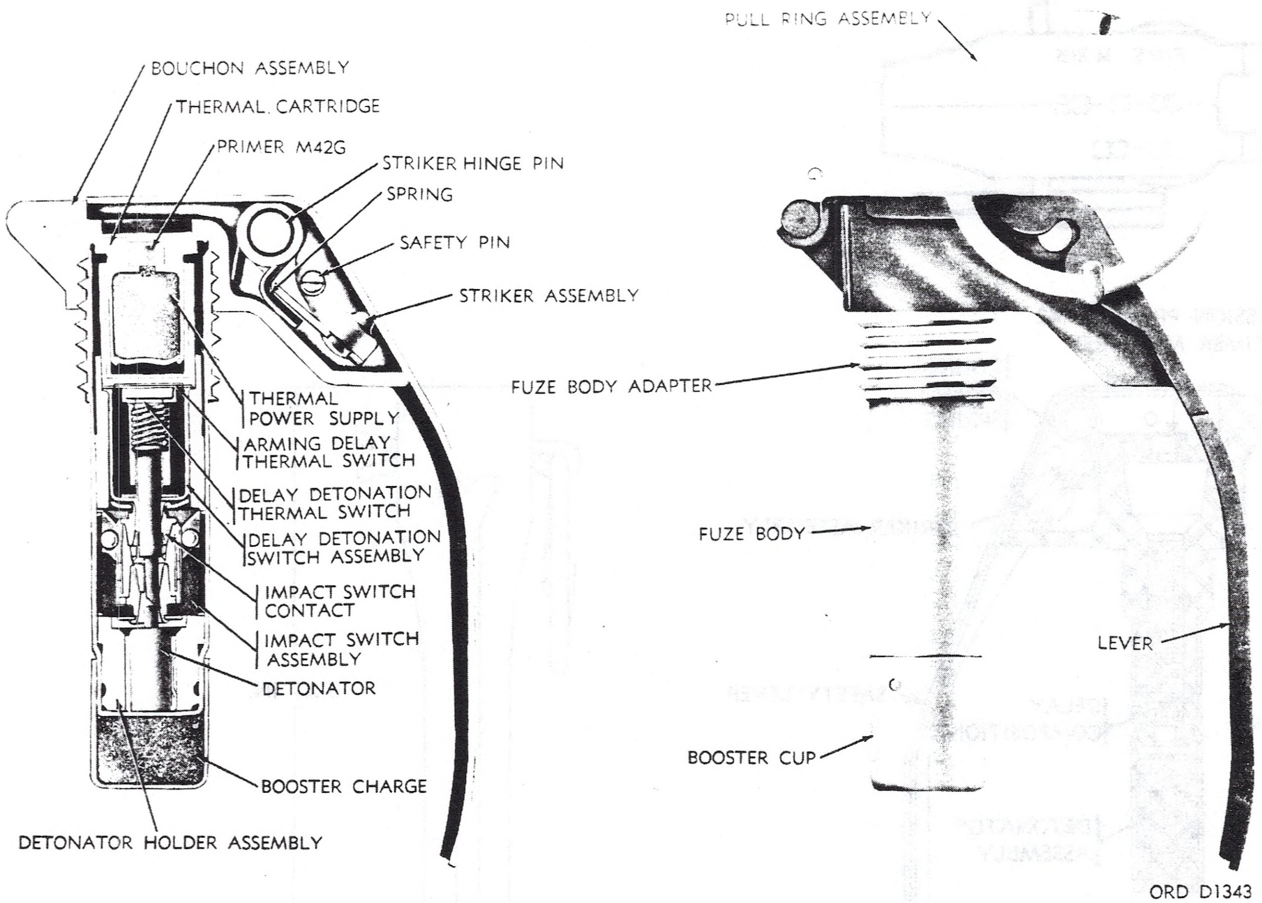


Figure 7–9.5 Grenade Fuze M217—Cross Section

taining delay composition. Fuze XM228 contains percussion primer M42, containing primer mixture; a delay column containing delay composition; and an igniter case assembly containing a small black powder charge.

7–2.1.4.3 FUNCTIONING.

7–2.1.4.3.1 ELECTRIC IMPACT-DELAY FUZE M217.

a. Impact Feature. When all safeties are removed and the grenade is released, the striker assembly spring forces the fuze safety lever free, allowing the striker to initiate the primer. Flash from the primer ignites the thermal power supply. After approximately 2 seconds, voltage is applied to one side of the electric detonator. Upon impact, displacement of any of the inertia balls will cause at least one of the leaf springs of the leaf spring switch to complete the circuit through the detonator back to the thermal power supply. Upon completion of the electrical circuit, the detonator is initiated which, in turn, initiates the booster. The booster is an integral part of fuze M217.

b. Delay Feature. If impact occurs prior to arming or if impact is insufficient to cause the inertia balls to close the leaf spring switch, the fuze will function after approximately 3–7 second delay in the following manner: at the same time that

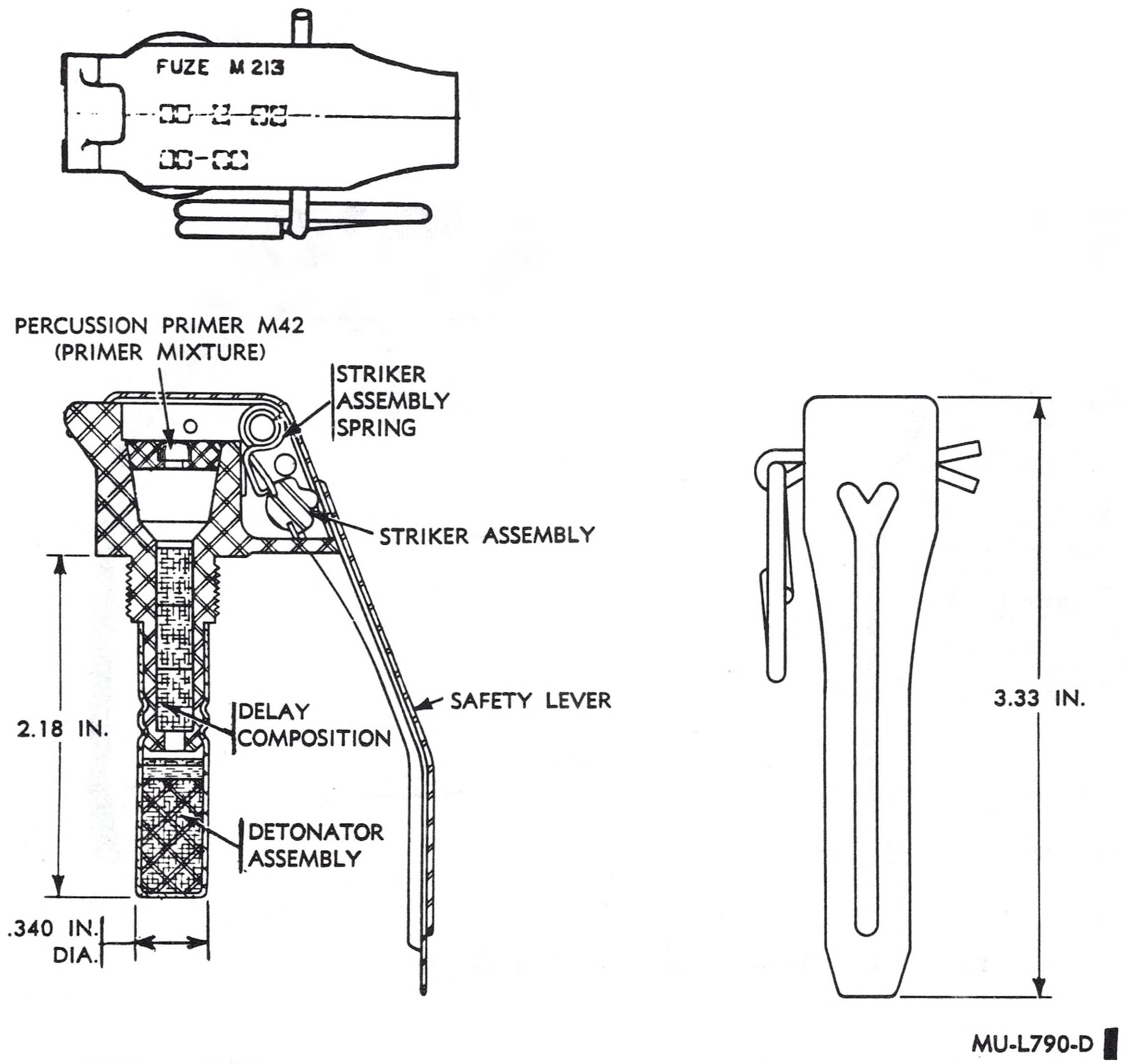


Figure 7–9.6 Fuze M213—Cross-Sectional View

the thermal power supply furnishes voltage to one side of electrical detonator, it is also dissolving the arming delay pellet located on the top of the delay compression spring. When the delay pellet is completely dissolved, the compression spring expands and makes contact with the delay housing. The contact of the compression spring with the delay housing allows voltage to flow through the detonator and the delay pin assembly back to the thermal power supply, functioning the detonator and booster.

7–2.1.4.3.2 DELAY FUZES M213, M215, M204 SERIES, AND XM228. When all safeties are removed and the grenade is released, the striker assembly spring forces the safety lever free, allowing the striker to initiate the primer, which, in turn, ignites the delay element. After approximately 5 seconds, the delay element initiates the detonator charge which, in turn, initiates the explosive filler in all fuzes except fuze XM228. In this fuze, upon completion of burning, the delay element initiates a low-explosive, black powder charge.

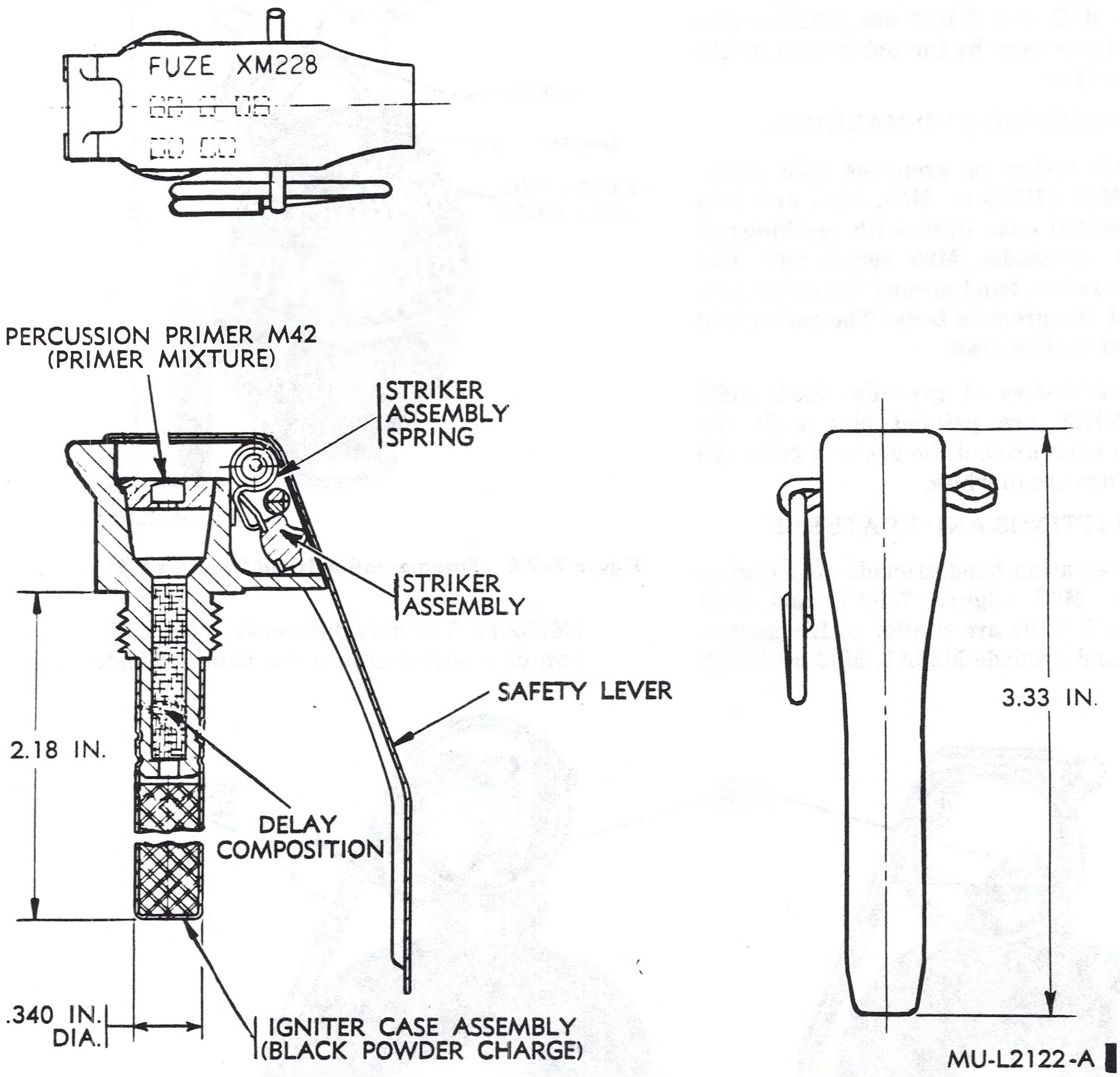


Figure 7-9.7 Fuze XM228—Cross-Sectional View

7-2.1.4.4 SAFETY PRECAUTIONS. Wait at least 30 minutes before approaching an initiated, unfunctioned, hand grenade.

7-2.1.5 FRAGMENTATION AND PRACTICE HAND GRENADES. Fragmentation hand grenades M26 series, M33, M59 (M33A1), M61, M67, and M68 and practice hand grenades M30, M62, and XM69 are covered in this paragraph.

7-2.1.5.1 IDENTIFICATION.

7-2.1.5.1.1 TYPE. Grenades M26 series and M61 are designed to be thrown by hand or launched from a rifle using a special adapter.

Grenades M33, M59 (M33A1), M67, and M68 are designed to be thrown by hand only. Grenades M30, M62, and XM69 are practice grenades. The fuzes may be the delay type or the impact-delay type.

7–2.1.5.1.2 PAINTING AND MARKING.

a. Grenade bodies of grenades M26 series, M33, M59 (M33A1), M61, M67, and M68 are painted olive drab with markings in yellow. Grenades M26 series and M61 have a yellow band around the upper portion of the grenade body. The safety clip is painted olive drab.

b. Grenade bodies of grenades M30, M62, and XM69 are painted blue with one brown band around the grenade body. All markings are in white.

7–2.1.5.1.3 FITTINGS AND FEATURES.

a. Fragmentation hand grenade M61 (figure 7–9.8), M67 (figure 7–9.9), and M68 (figure 7–9.10) are similar to fragmentation hand grenade M26A1, M33, and M59 (M33A1). The only difference is the addition of a safety clip to the hand grenade

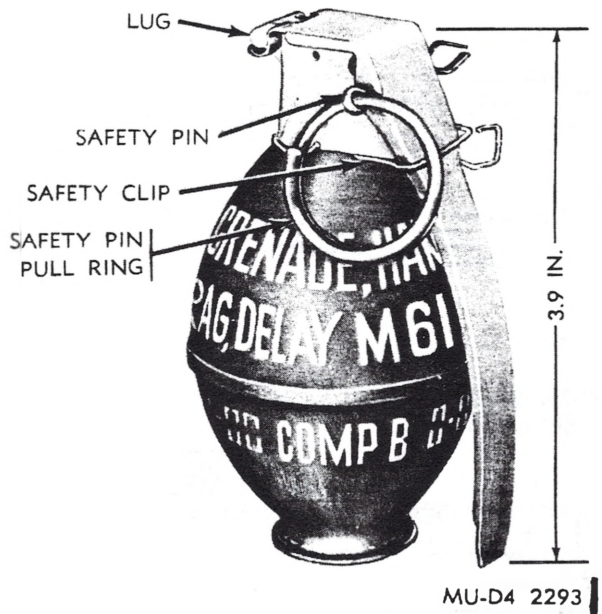


Figure 7–9.8 Fragmentation Hand Grenade M61

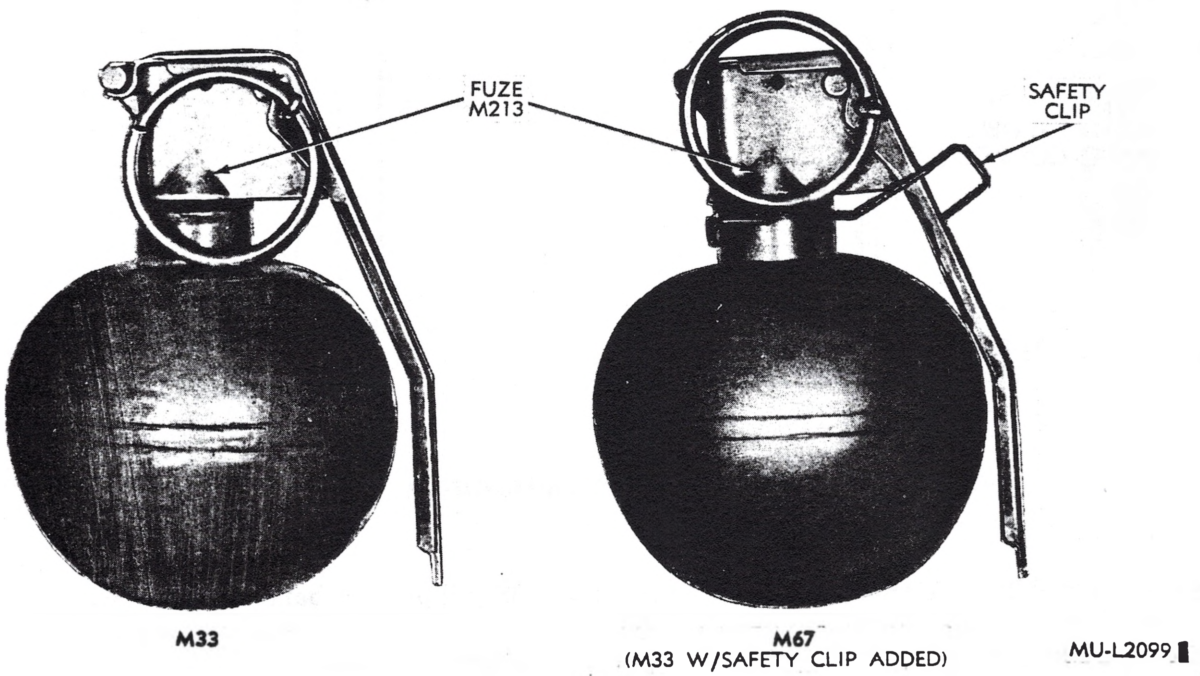


Figure 7–9.9 Hand Grenades M33 and M67

M61, M67, and M68. Basically, these grenades consist of a body, explosive charge, and fuze. The body of grenades M26 and M61 is a smooth, sheet-steel shell, lined with notched fragmentation wire coil. The body of grenades M33, M59 (M33A1), M67, and M68 is a steel sphere.

b. Practice hand grenade M62 is a practice grenade M30 with a fuze safety clip added. These grenades have the same configuration as the HE loaded grenades M61 and M26 series. The basic difference is in the filler of the practice grenades, which is black powder. Grenade XM69 (figure 7-9.11) is the practice version of grenades M33 and M67, and this practice grenade has a safety clip attached. The black powder charge for grenades XM69 is contained in the fuze rather than in the grenade body.

7-2.1.5.1.4 WEIGHTS AND DIMENSIONS.

7-2.1.5.1.4.1 Grenades M61 and M26 series have an overall length of 3.81 inches and weigh approximately 1 pound with the fuze installed. Grenades M33, M59 (M33A1), M67, and M68 are sphere shaped with a diameter of 2.5 inches. Each of these grenades weighs approximately 14 ounces (loaded and fuzed).

7-2.1.5.1.4.2 The dimensions and weights of grenades M30, M62, and XM69 are the same as their HE counterparts.

7-2.1.5.1.5 MATERIALS. The bodies of fragmentation grenades and the practice grenade XM69 are steel. All other practice grenade bodies are iron.

7-2.1.5.2 HAZARDOUS COMPONENTS.

7-2.1.5.2.1. Fragmentation hand grenades M61 and M26 series contain 6.3 ounces of composition B. Fragmentation hand grenades M33, M59 (M33A1), M67, and M68 contain 6.5 ounces of composition B.

7-2.1.5.2.2. Practice hand grenades M62 and M30 contain 21 grains of black powder. Practice hand grenade XM69 contains 12 grains of black power in fuze XM228. Avoid alining the hole in the bottom of grenade with one's body.

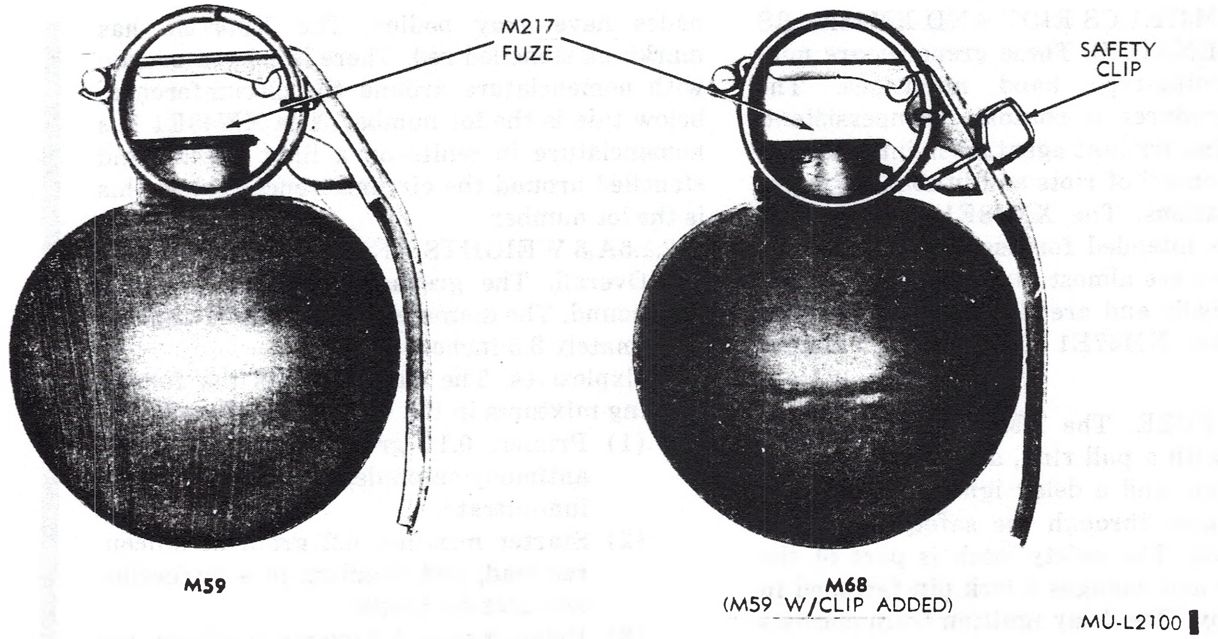


Figure 7-9.10 Hand Grenades M59 (M33A1) and M68

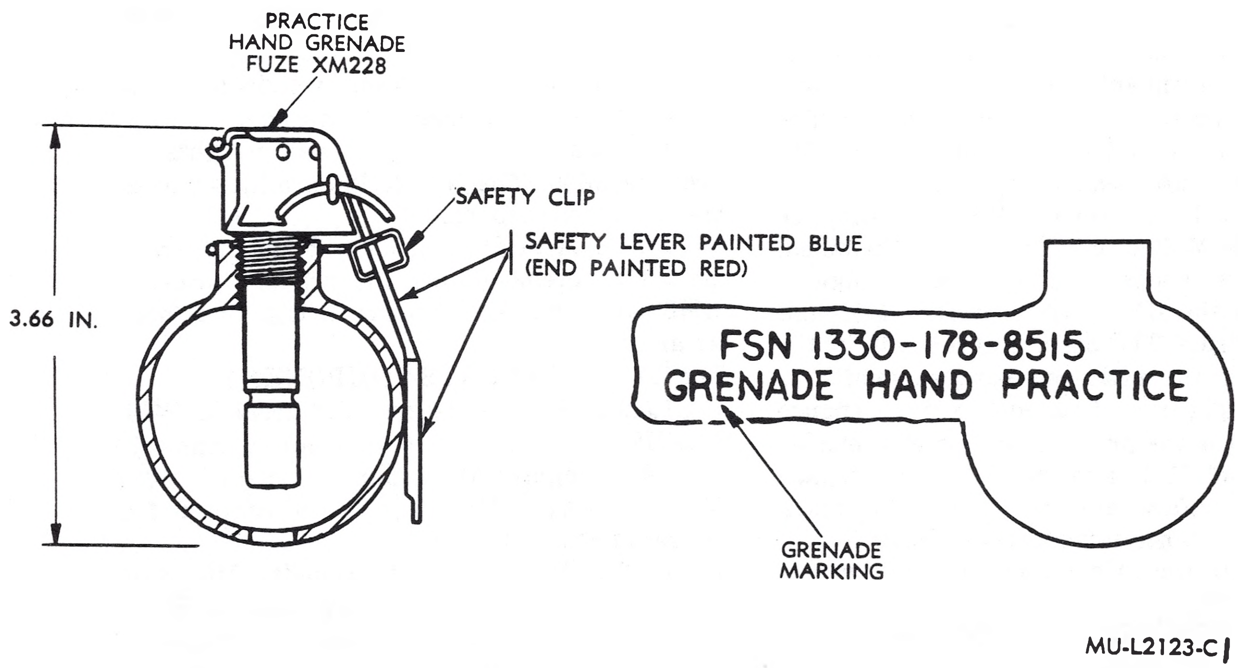


Figure 7–9.11 Practice Hand Grenade XM69

7–2.1.5A XM47E1 CS RIOT AND XM48E1 RS HAND GRENADES. These grenades are nonlethal, burning-type hand munitions. The XM47E1 produces a nontoxic, nonpersistent, incapacitating irritant agent; it is intended for use in the control of riots and in counter-insurgency operations. The XM48E1 produces red smoke; it is intended for use in training. The two grenades are almost identical; they resemble rubber balls and are slightly larger than a baseball. An XM47E1 is shown in figure 7–9.11.2.

7–2.1.5A.1 FUZE. The XM227E1 fuze has a safety pin with a pull ring, a safety lever with a safety latch, and a delay ignition train. The safety pin goes through the safety latch and the fuze body. The safety latch is part of the safety lever and engages a lock pin fastened in the fuze body. The delay ignition train consists of a primer, a starter mixture, a delay charge, and an ignition mix.

7–2.1.5A.2 COLOR AND MARKING. Both grenades have gray bodies. The XM47E1 has markings stenciled red. There is a band broken with nomenclature around the circumference; below this is the lot number. The XM48E1 has nomenclature in white on a light green band stenciled around the circumference; below this is the lot number.

7–2.1.5A.3 WEIGHTS AND DIMENSIONS.

a. Overall. The grenades weigh about 0.75 pound. The diameter of the body is approximately 3.5 inches.

b. Explosives. The fuze contains the following mixtures in the amounts indicated.

(1) Primer. 0.11 gram of lead styphate, antimony sulphide, tetracene, and barium nitrate.

(2) Starter mixture. 0.2 gram of silicon, red lead, and titanium in a nitrocellulose acetone binder.

(3) Delay charge. 1.2 grams of silicon, red lead, and diatomaceous earth in a nitrocellulose acetone binder.

(4) Ignition mix. 0.2 gram of iron oxide,

titanium, and zirconium in a nitrocellulose acetone binder.

c. Pyrotechnic Mixtures. The grenade bodies are filled as indicated.

(1) XM47E1. 200 grams of an intimate mixture of CS agent and pyrotechnic mixture.

(2) XM48E1. 150 grams of red dye mix, potassium chlorate, sulphur sodium bicarbonate, and a nitrocellulose acetone binder.

7-2.1.5A.4 MATERIALS. The grenade body is rubber. The safety lever and latch, the arming pin and spring, and the firing pin and spring are steel.

7-2.1.5A.5 HAZARDS.

a. Burning grenades heat to approximately 600° F. (300° C.).

b. The arming pin and spring are ejected at 22 feet per second.

c. The XM47E1 constitutes a CS exposure hazard.

7-2.1.5A.6 FUNCTIONING. The grenades function identically. The safety pin is pulled out by means of the pull ring, the safety latch is moved outward along the safety lever, and the grenade is thrown. When the grenade leaves the hand the safety lever is released allowing the arming pin spring to expand. This expansion forces the arming pin against the safety lever, and the safety lever, the arming pin, and the arming pin spring separate from the body assembly. After the arming pin is ejected the force of the expanding firing pin compresses the upper portion of the firing pin and drives the point of the firing pin into the primer. This initiates the primer; then the starter mixture, the delay charge, and the ignition mix burn in succession. The ignition mix burns through the aluminum shield at the bottom of the fuze and ignites the pyrotechnic mixture. The pressure resulting from the burning of the pyrotechnic mixture opens the four emission holes in the body approximately 2 seconds after the release of the safety lever. The emission last from 8 to 20 seconds and causes the grenade to move erratically.

7-2.1.5A.7 SAFETY PRECAUTIONS.

a. Have a field protective mask available.

b. Wait 30 minutes before approaching a grenade which has to function.

c. Stay upwind.

7-2.1.5B XM58, CS, RIOT, POCKET, GRENADE.

7-2.1.5B.1 IDENTIFICATION. Type CS Riot, Pocket, XM 58 is a hand-thrown, burning type grenade.

7-2.1.5B.2 PAINTING AND MARKING. The body of the grenade is painted grey. A 1/4 inch wide red band encircles the lower part of the grenade body. Nomenclature and lot number are stenciled in red and black respectively on the upper part of the grenade body.

7-2.1.5B.3 FITTINGS AND FEATURES. The XM58 Grenade consists of a grenade body and a fuze. The major components of the Grenade XM58, and the Fuze M201A1E1 are shown in fig 7-9.11.0.1.

7-2.1.5B.4 WEIGHTS AND DIMENSIONS.

a. Length 3 1/2 inches approximately.

b. Diameter 1 1/4 inches.

c. Weight 1 1/4 pound approximately.

7-2.1.5B.5 MATERIALS. The safety lever is steel, the grenade body is aluminum. The fuze body is zinc.

7-2.1.5B.6 HAZARDOUS COMPONENTS. The Grenade XM58 contains a primer, a first fire mixture, a delay mixture, an ignition mixture, and a CS-pyrotechnic mixture weighing 40 grams.

7-2.1.5B.7 FUNCTIONING. While the safety lever is held in place, the safety pin is withdrawn. When the grenade is thrown, the safety lever is released allowing the striker to hit the primer which ignites the ignition train which in turn, ignites the CS-pyrotechnic mixture. The pressure generated by the burning pyrotechnic mixture blows the pressure-sensitive tape from the emission hole. The grenade burns for approximately 8 to 28 seconds.

7-2.1.5B.8 SAFETY PRECAUTIONS AND HAZARDS.

a. Have a field protective mask available when performing EOD operations.

b. The CS-pyrotechnic mixture constitutes a fire hazard and CS exposure hazard.

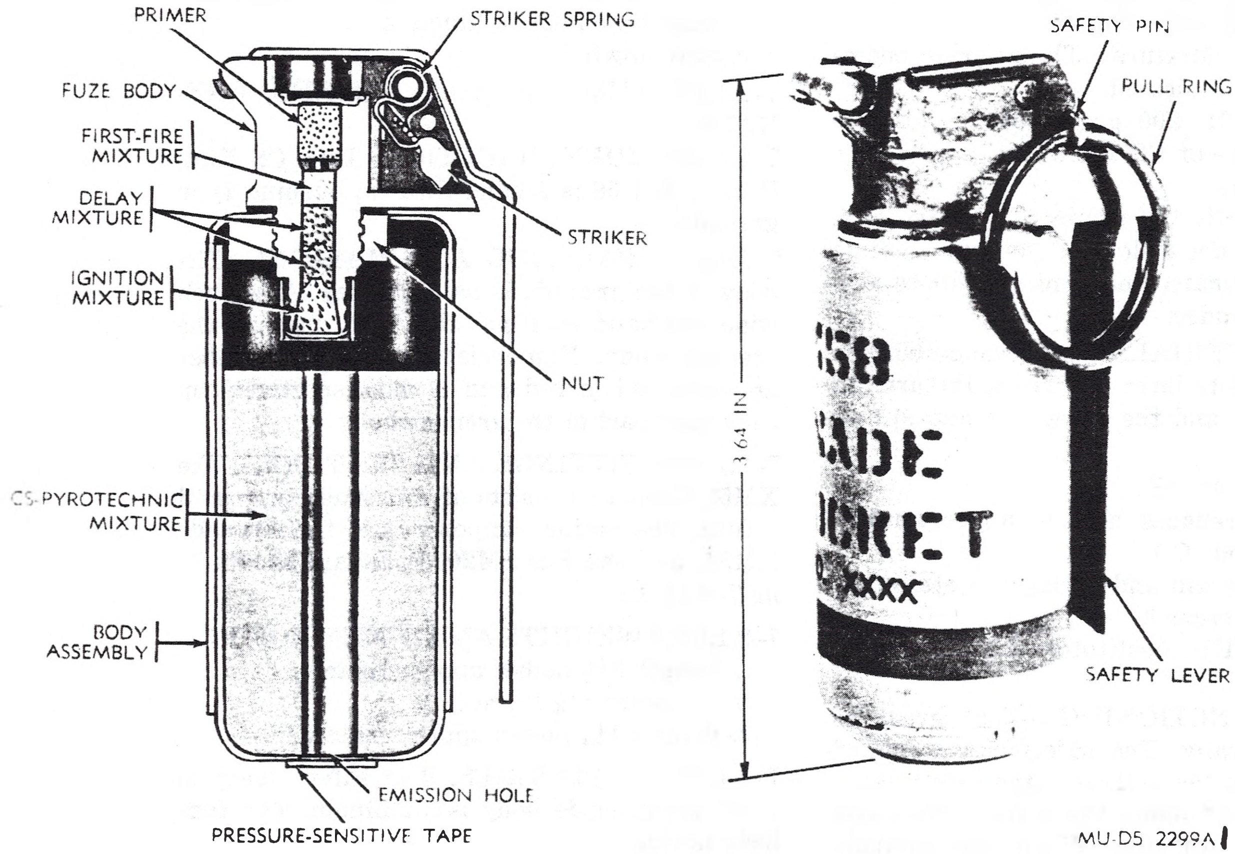


Figure 7-9.11.0.1 Grenade, hand: pocket, riot, CS, XM58.

7-2.1.6 MINIATURE CS GRENADE.

7-2.1.6.1 IDENTIFICATION.

7-2.1.6.1.1 TYPE. This munition is a miniature, CS-loaded, burning-type grenade.

7-2.1.6.1.2 PAINTING AND MARKING. The container is painted gray with all markings in red.

7-2.1.6.1.3 FITTINGS AND FEATURES (figure 7-9.12). The fuel pellet and CS capsules are wrapped in aluminum foil and are located in the bottom of the container. One end of the fuze is attached to the fuel pellet; the other end feeds through the igniter cap and contains a match head. The match head is held in place by the igniter cap. The retaining ring secures these components in place. The striker ring, used to ignite the match head, is stored on top of the retaining ring and is secured by the cover.

7-2.1.6.1.4 WEIGHTS AND DIMENSIONS.

a. Length .... 1.8 inches.
b. Diameter .... 1.25 inches.
c. Weight .... 35 grams (approx)

7-2.1.6.1.5 MATERIALS. The container is made of aluminum.

7-2.1.6.2 HAZARDOUS COMPONENTS.

Fuel pellet .... 10 grams (dechlorane, zinc oxide, aluminum powder, ammonium perchlorate, and vinyl alcohol acetate resin).

Fuze .... Thermalite-type igniter cord.

Chemical agent ...6 grams CS.

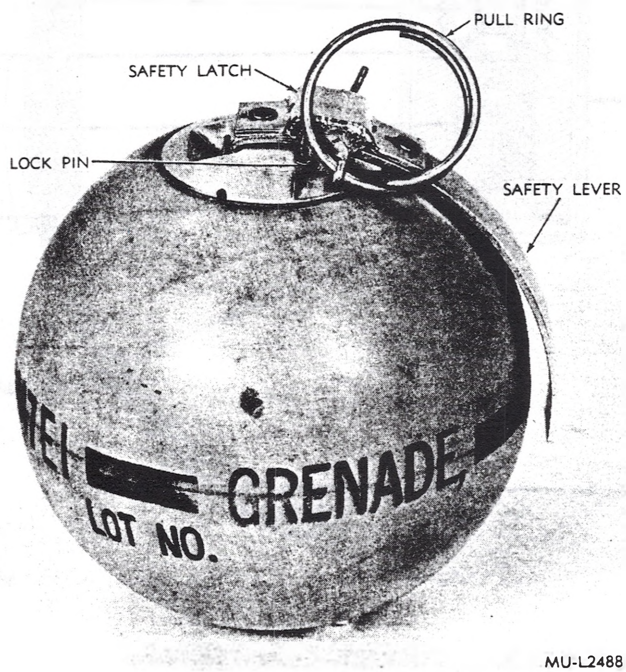


Figure 7-9.11.1. XM47E1 CS Riot Hand Grenade.

7-2.1.6.3 FUNCTIONING. The match head is ignited by the striker ring or other means. The fuse burns for approximately 4 seconds and ignites the fuel pellet. The burning fuel pellet causes CS to be emitted for approximately 6 seconds.

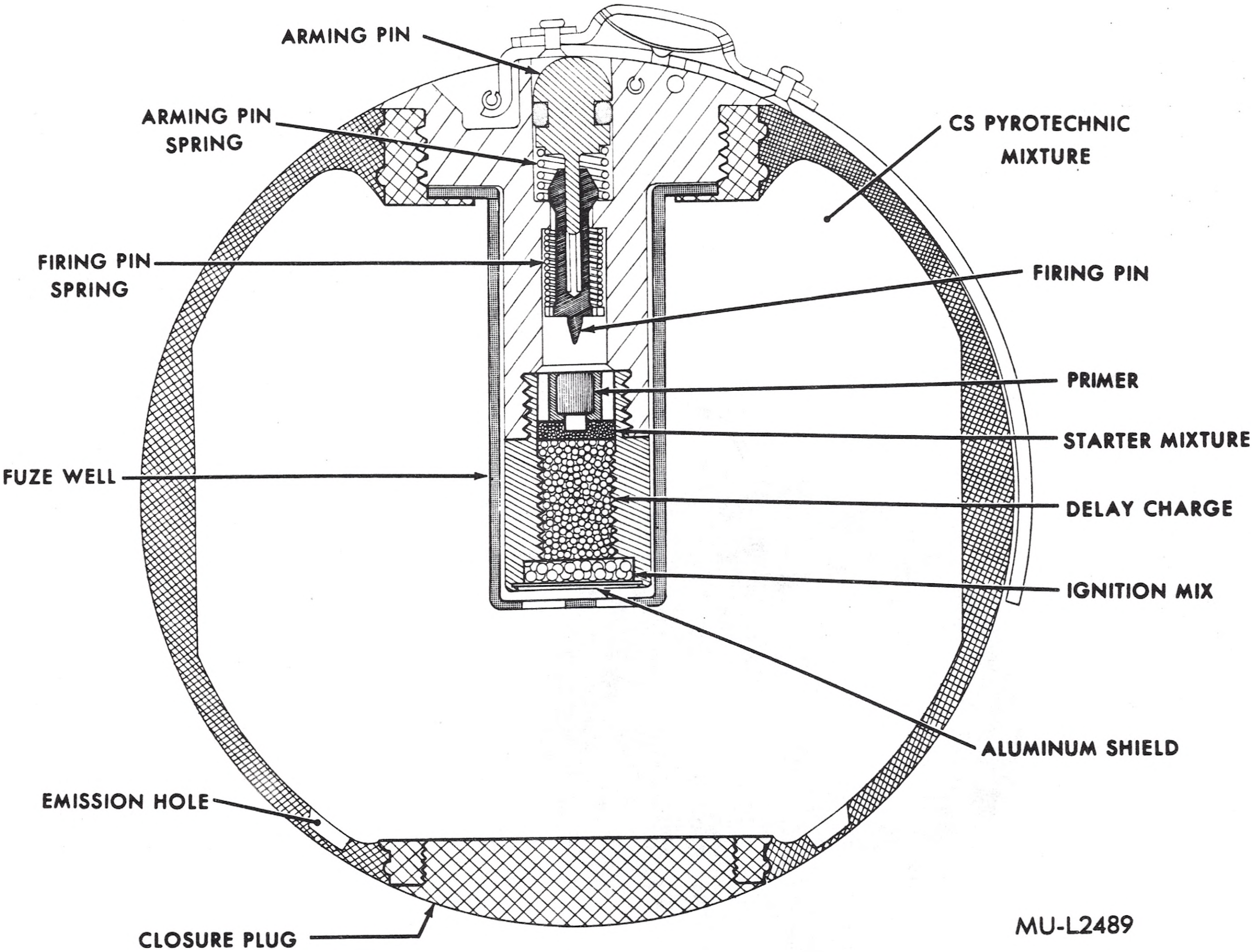


Figure 7-9.11.2. XM47E1—Cross Section.

7-2.1.6.4 SAFETY PRECAUTIONS.

a. Wait at least 30 minutes before approaching an initiated, unfunctioned hand grenade.

b. Remain upwind and have a protective field mask available when disposing of CS-filled munitions.

7-2.2 M25 SERIES, RIOT CONTROL, CN_1, DM_1 or CX_1 Hand Grenade is covered in this paragraph.

7-2.2.1 IDENTIFICATION.

7-2.2.1.1 TYPE. This grenade is spherical shaped, bursting type, riot control grenade filled with an irritant agent.

7-2.2.1.2 PAINTING AND MARKING. The grenade is painted gray overall. A broken red band encircles the grenade body. Markings between the breaks are in red. In addition there is a yello band below the broken red band.

7-2.2.2 WEIGHTS AND DIMENSIONS. Tł grenade weighs approximately 8-ounces and 2.96-inches in diameter. The filler varies i weight; 3.2 ounces of CN_1, 2-ounces of CS or 2.3 ounces of DM_1. The detonator contains precussion primer, 0.7-grains of lead styphinat 4 grains of lead azide and 6.3 grains of tetry

7-2.2.3 FITTINGS AND FEATURES. The ger eral arrangement and components of the M2 series grenade are shown in figure 7-9.11.3. Tł grenade body is two hemispheres cemented tc gether. An upper half sleeve and a lower ha sleeve are molded parts of the two hemispher The half-sleeves together form a detonator w and a slider housing. A closure plug with a integral firing pin is threaded into the base c

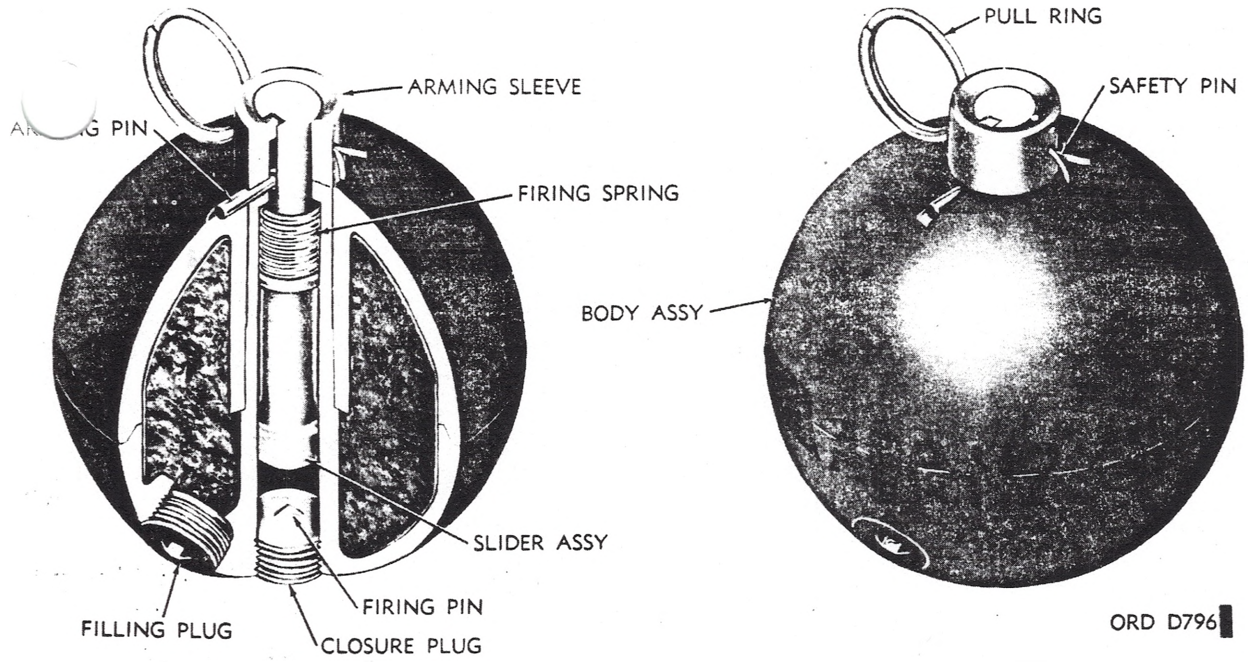


Figure 7–9.11.3. Grenade, Hand: Riot CN, ABC–M25A2.

e grenade. A detonator burster is located in base of the slider assembly. An arming pin, . e[illegible] of which is ball shaped, fits into a re-ss[illegible] e slider assembly. The arming pin re-ains perpendicular to the slider as long as the der is held in place by the safety pin, or as ng as pressure is maintained on the arming eve.

2.2.4 HAZARDOUS COMPONENTS. In ad-ion to the irritant filler, the grenade contains detonator with lead azide, lead styphnate and ryl.

2.2.5 MATERIAL. The arming sleeve is alumi-m, the arming pin is brass. The firing spring, ll ring, and safety pin are steel. The remainder the grenade is plastic.

2.2.6 FUNCTIONING. With the safety pin d arming pin in place, the firing spring is npressed between upper half of the sleeve and e slider assembly. When the firing pin is with-awn, the grenade will not function as long as essure is maintained on the arming sleeve. nen the grenade is released, the firing spring ves the slider containing the detonator, down-rd. As the slider moves downward, the arm-pin pivots upward forcing the arming sleeve ay[illegible]n the grenade. At the end of slider ve[illegible]e detonator is driven into the fixed firing pin, functioning the detonator, dispersing the grenade filler.

7–2.2.7 SAFETY PRECAUTIONS.

a. Have a field mask available when performing procedures on this grenade.

b. In addition to the irritant agent, this grenade presents a fragmentation hazard.

7–3. XM176 GRENADE LAUNCHER

The XM176 grenade launcher with its payload is identified in this paragraph.

7–3.1 IDENTIFICATION. The launcher is a sealed, cylindrical metal container 15 inches long and 3 11/16 inches in diameter. The launcher contains an M34 WP hand grenade and an AN–M8 HC hand grenade encased in a sabot. The launcher is attached to the exterior of an assault vehicle turret. Each launcher is held in place by a strap and a retainer. The launcher may be initiated electrically or manually. Each launcher is provided with an electric solenoid for electric initiation. Current for the solenoid is provided by the vehicle through an electrical harness. The launcher itself is unfuzed.

7–3.2 PAINTING AND MARKING. The grenade launcher is painted olive drab with mark-

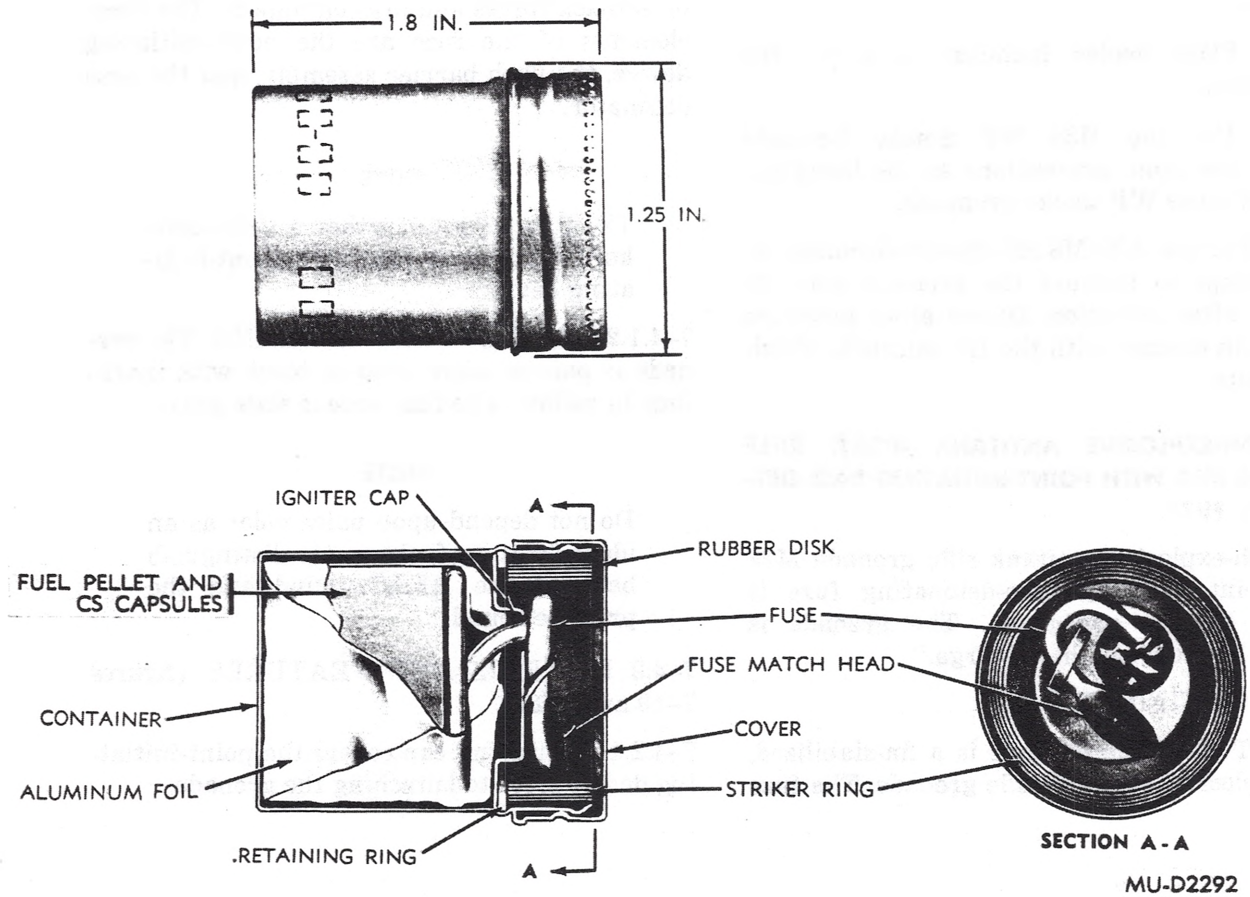


Figure 7-9.12 Miniature CS Grenade

ings in red. One yellow and one light green band circle the tube.

7-3.3 FITTINGS AND FEATURES. The launcher consists basically of a tube assembly and a sabot. The tube assembly contains a cap, an XM225 propellant cartridge, a cartridge seal, and an obturator gas seal. The sabot, located inside the tube, contains a WP and an HC grenade.

7-3.4 WEIGHT. The launcher with grenades weighs approximately 5 pounds.

7-3.5 MATERIALS. The launcher tube and sabot assembly are polypropylene (plastic). The launcher cap is aluminum.

7-3.6 HAZARDOUS COMPONENTS. The launcher tube contains an XM225 cartridge. The sabot contains a WP and an HC hand grenade with their safety pins removed.

7-3.7 FUNCTIONING. The XM225 cartridge is actuated by a solenoid plunger located in the launcher mount assembly. Propellant gases generated by the cartridge, force the sabot assembly through the end cap and out of the launcher. During flight, the sabot assembly separates, permitting the grenades to become activated.

7-3.8 SAFETY PRECAUTIONS

7-3.8.1 Do not attempt to disassemble an XM176 grenade launcher.

7–3.8.2 Wear a protective mask and stay upwind when destroying a fully loaded launcher.

7–3.8.3 Place loaded launcher in a pit for destruction.

7–3.8.4 For the M34 WP Smoke Grenade observe the same precautions as the bursting-type and other WP smoke grenades.

7–3.8.5 For the AN–M8 HC Smoke Grenade, do not attempt to retrieve the grenade until 30 minutes after initiation. Do not allow moisture to come in contact with the HC mixture, which may ignite.

7–4. HIGH-EXPLOSIVE ANTITANK (HEAT) RIFLE GRENADE M28 WITH POINT-INITIATING BASE-DETONATING FUZE.

The high-explosive antitank rifle grenade M28 with point-initiating base-detonating fuze is covered in this paragraph. The grenade is commonly known as the "Energa."

7–4.1 IDENTIFICATION.

7–4.1.1 TYPE. The grenade is a fin-stabilized, high-explosive, antitank rifle grenade. The fuze is a three-element, point-initiating, base-detonating, "spit-back," nondelay type which arms by setback forces and fires on impact. The three elements of the fuze are the point-initiating device, the flash barrier assembly, and the base detonator.

NOTE

The fuze may use either a drive-striker type or an inertia type, point-initiating devices.

7–4.1.2 PAINTING AND MARKING. The grenade is painted olive drab or black with markings in yellow. The fuze nose is slate gray.

NOTE

Do not depend upon paint color as an identification feature to distinguish between the HEAT round and the practice round.

7–4.2 FITTINGS AND FEATURES (figures 7–10 and 7–11).

7–4.2.1 A shipping cap covers the point-initiating device prior to launching the grenade.

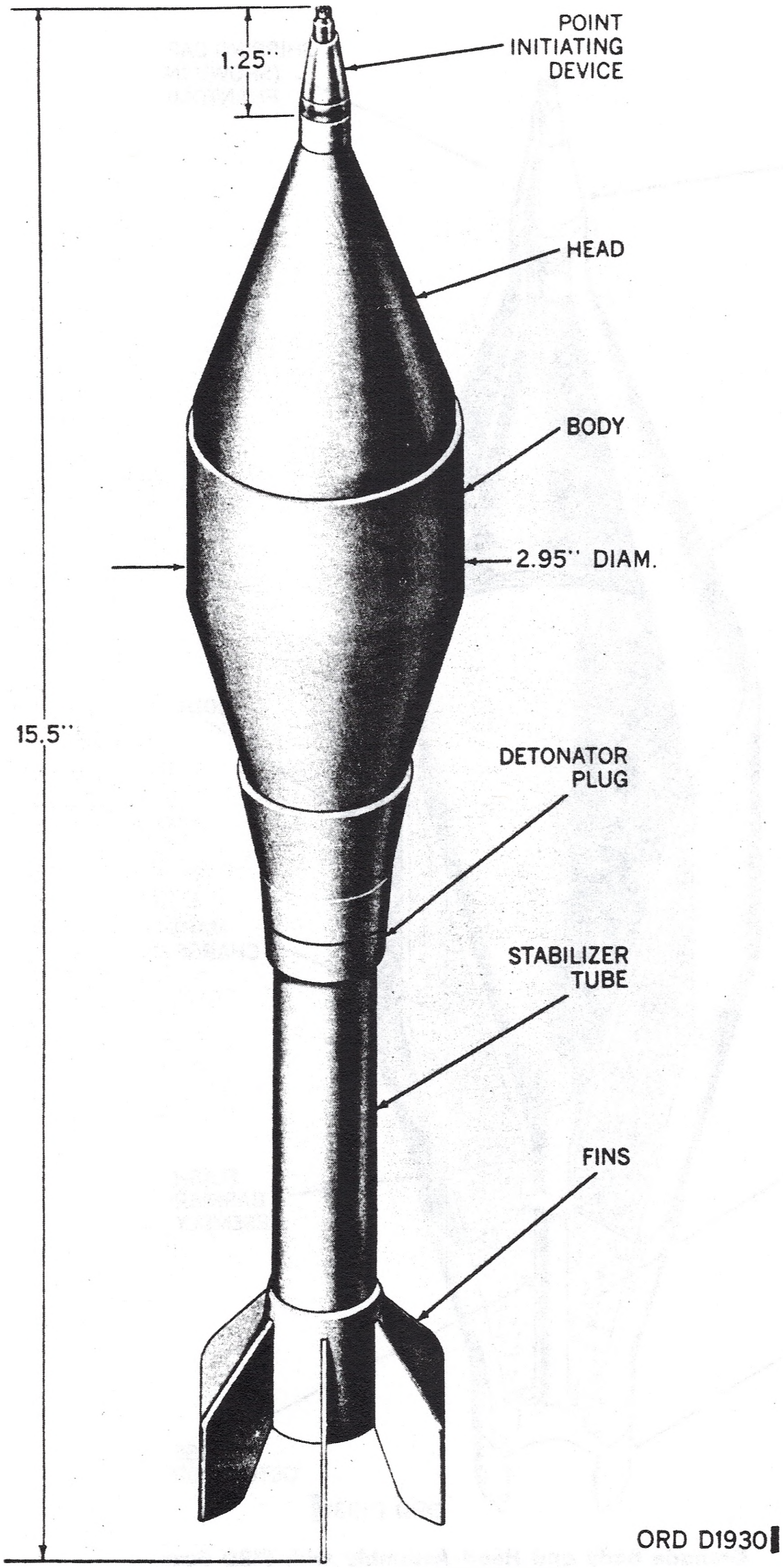


Figure 7-10 Major Components and Dimensions of Rifle Grenade M28

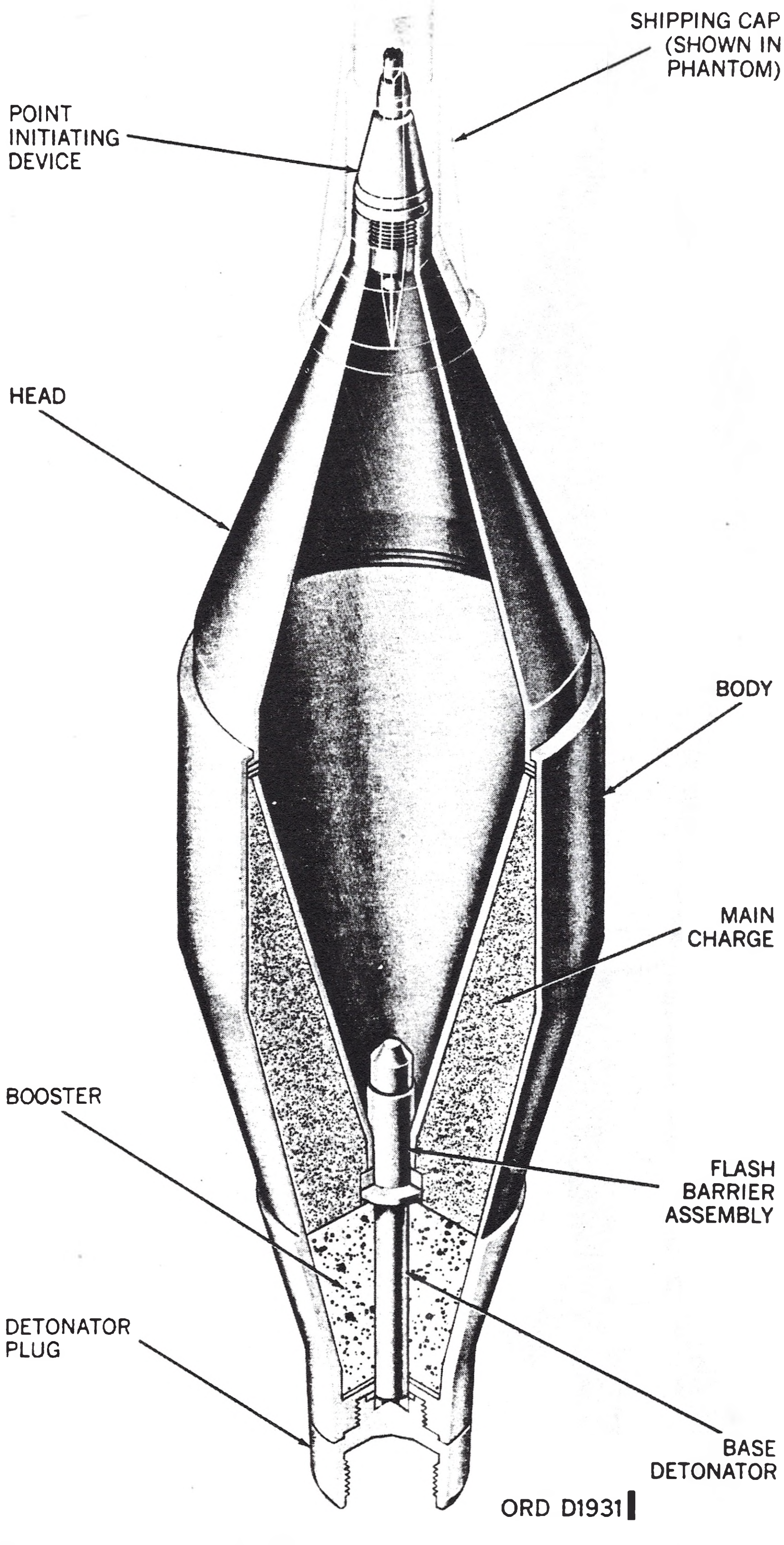


Figure 7–11 Grenade Body and Head Assembly with PIBD Fuze (Shipping Cap in Phantom)—Cutaway View

7-4.2.2 The striker head has a serrated tip.

7-4.2.3 The detonator plug forms the connection between the stabilizer tube and the grenade body.

7-4.2.4 The fin assembly consists of six fins.

7-4.3 WEIGHTS. The grenade weighs approximately 1.5 pounds.

7-4.4 MATERIALS. The fuze point-initiating device and the grenade are made of aluminum. The striker, which forms the nose of the fuze, has a serrated tungsten-carbide tip. The shipping cap is made of molded rubber.

7-4.5 HAZARDOUS COMPONENTS.

7-4.5.1 The hazardous components are as follows:

7-4.5.1.1 The initiating detonator, located in the point initiating device in the fuze.

7-4.5.1.2 The two-stage base detonator, consisting of an upper detonator and a main detonator, located in the base of the body section, just forward of the stabilizer tube.

7-4.5.1.3 The booster, surrounding the two-stage base detonator.

7-4.5.1.4 The main charge, forming the shaped charge in the body section.

7-4.5.2 The detonators contain a mixture of mercury fulminate and RDX, the booster is a 93/7 mixture of RDX/TNT, and the main charge is an 80/20 mixture of RDX-TNT.

7-4.5.3 The total explosive weight is approximately one pound.

7-4.6 FUNCTIONING. Functioning of the two point-initiating devices and the flash barriers assembly is as follows:

7-4.6.1 Point-Initiating Device (figure 7-12). The grenade may be assembled with either an inertia type or a driven-striker type point-initiating device. In either device, the setback sleeve moves rearward

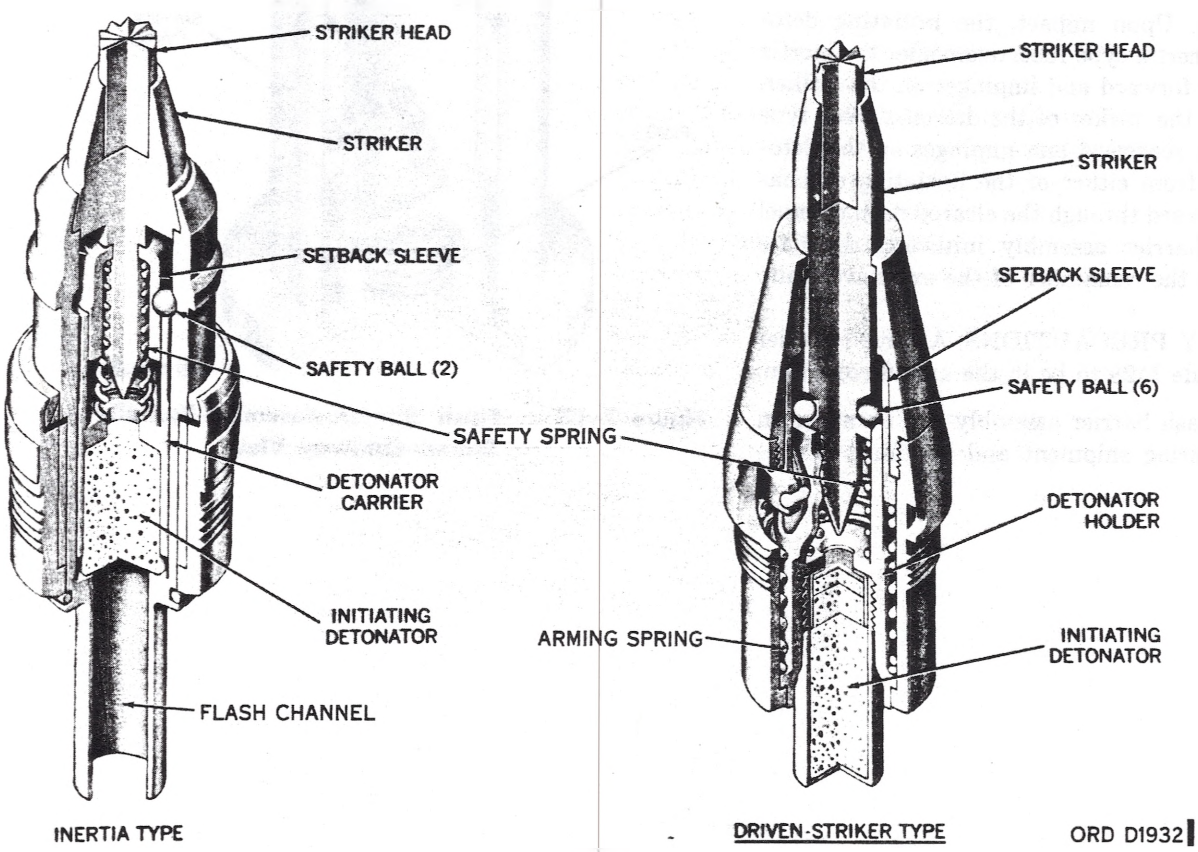


Figure 7-12 Point-Initiating Devices-Cutaway Views

when the grenade is launched. The safety balls of the inertia type point-initiating device are released from the groove in the body and move in on top of the setback sleeve. As the grenade decelerates, the setback sleeve moves forward, carrying the safety balls with it, thereby releasing the detonator carrier. The safety balls of the driven-striker type point-initiating device move out of the groove in the striker and into the space above the setback sleeve, thereby releasing the striker.

7–4.6.2 Flash Barrier Assembly (figure 7–13). Initially, the barrier pins are at the dead ends of the grooves in the timing sleeve, and the barrier cannot move forward. At setback the barrier moves rearward until the barrier pins are in the sections of the grooves nearest the base of the timing sleeve. As the grenade decelerates, the barrier spring moves the barrier forward and the barrier pins slide in the zig-zag portion of the grooves. When the barrier pins reach the open ends of the grooves, the barrier, together with the spring and plug, is ejected, clearing a flash channel in the flash barrier assembly.

7–4.6.3 Firing. Upon impact, the initiating detonator, in the inertia type fuze, overcomes the inertia spring, moves forward and impinges on the striker. Upon impact, the striker of the driven-striker type fuze, is driven rearward and impinges on the detonator. Flame from either of the initiating detonators spits rearward through the cleared flash channel in the flash barrier assembly initiating the base detonator and the remainder of the explosive train.

7–4.7 SAFETY PRECAUTIONS. Always consider the rifle grenade M28 to be in the armed condition.

7–4.7.1 The flash barrier assembly has been known to function during shipment and handling. Movement of an ejected barrier inside the grenade can be detected if the grenade is moved.

7–4.7.2 The point-detonating device has no provision for an external safety and its firing train is alined at all times.

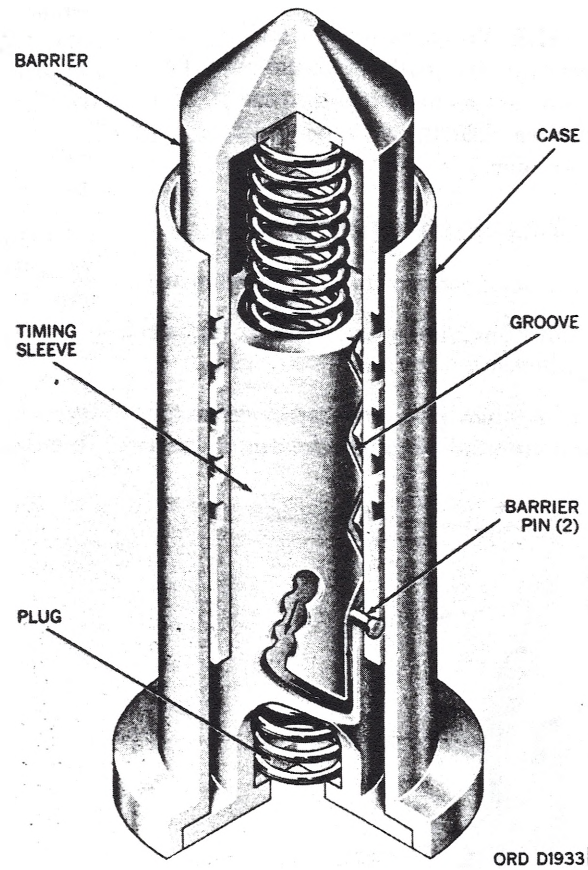


Figure 7–13 Flash Barrier Assembly-Partially Armed–Cutaway View

Change 6

7-5 30-MM CARTRIDGES

The following 30-mm cartridges are covered in this paragraph:

High-explosive 30-mm cartridge XM552 (A, figure 7-14)

Practice 30-mm cartridge XM554 (B, figure 7-14)

Training 30-mm cartridge XM639 (C, figure 7-14)

7-5.1 IDENTIFICATION.

7-5.1.1 TYPE.

a. The cartridge XM552 is a high-explosive, dual-purpose (fragmentation and shaped charge), impact-initiated round. The cartridge contains a point-initiating, base-detonating (PIBD) fuze XM79 which is graze sensitive.

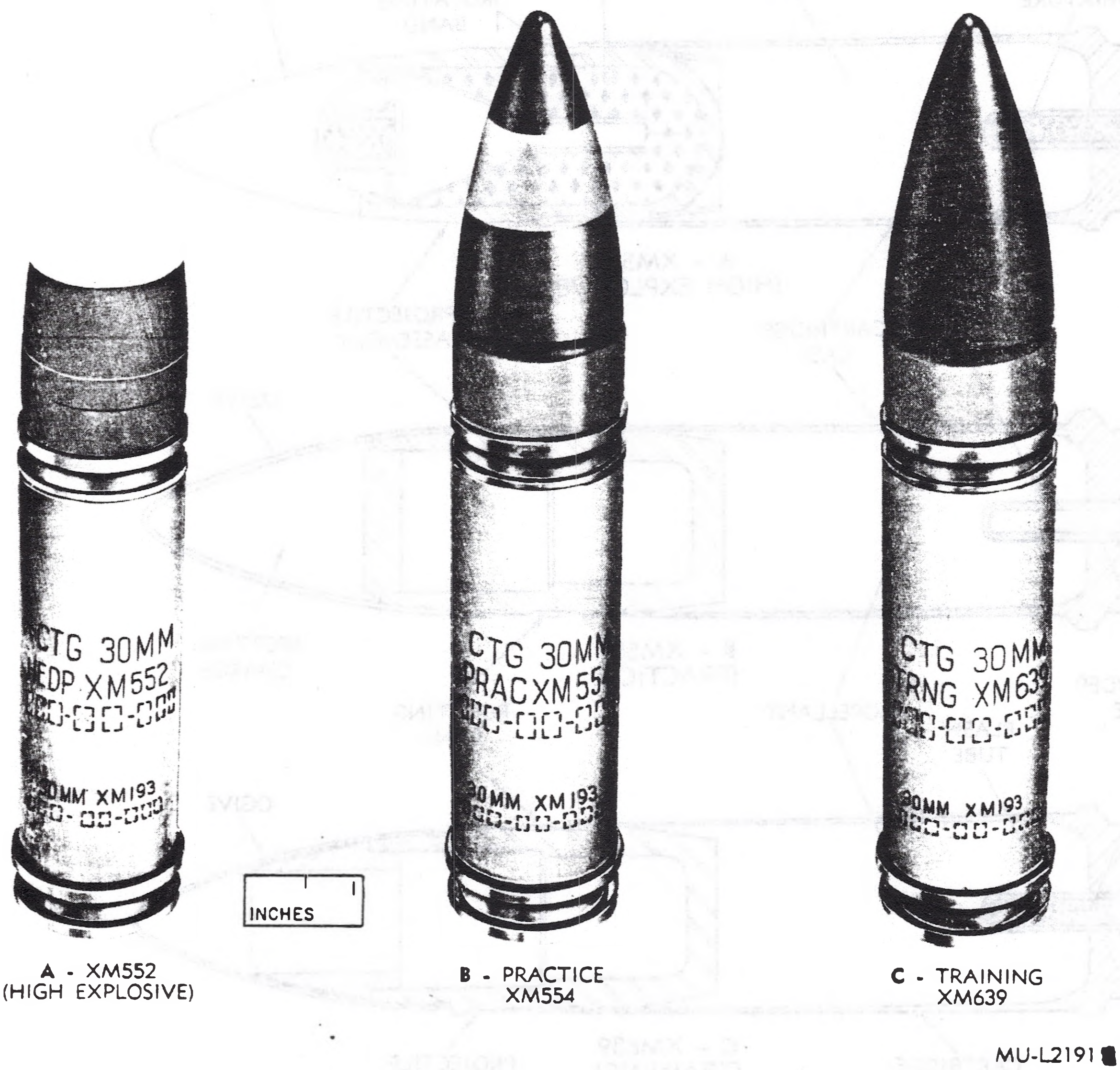


Figure 7-14. 30-mm Cartridges

b. The cartridge XM554 is a practice and spotting round for the high-explosive cartridge XM552.

c. The cartridge XM639 is a training round which contains a propellant charge and inert projectile.

7–5.1.2 PAINTING AND MARKING.

a. High-Explosive Cartridge XM552. The ogive is painted yellow. The projectile body is painted olive drab. The cartridge case is unpainted brass with markings in black.

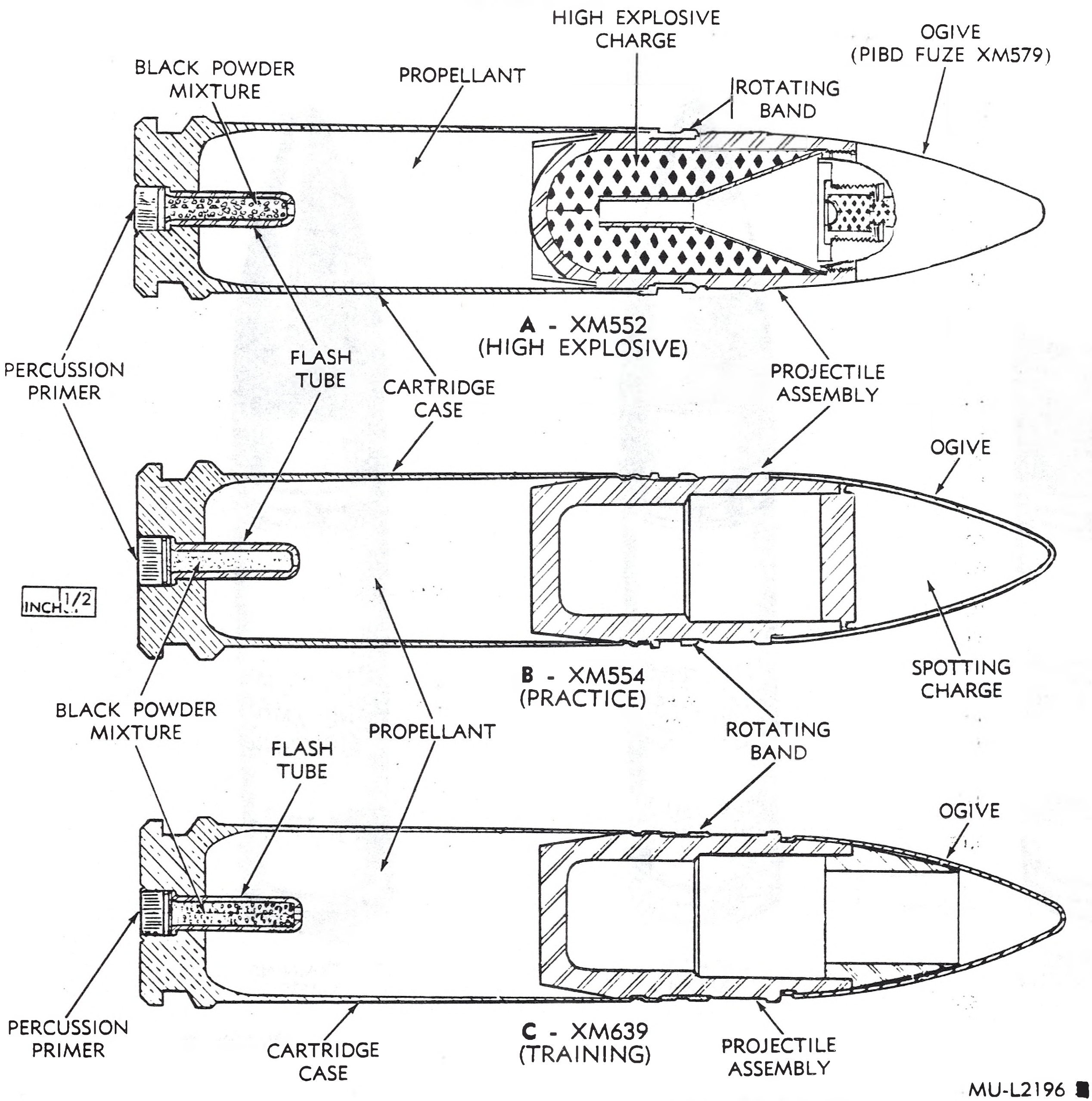


Figure 7–15 30-mm Cartridges—Cross Sections

b. Practice Cartridge XM554. The ogive and projectile body are painted blue. A painted brown band encircles the blue ogive. The cartridge case is unpainted brass with markings in black.

c. Training Cartridge XM639. The ogive and the projectile body are painted blue. The cartridge case is unpainted brass with markings in black.

7-5.1.3 FITTINGS AND FEATURES (figure 7-15).

a. High-Explosive Cartridge XM552. This cartridge consists of a cartridge, a projectile, and a point-initiating, base-detonating fuze XM579. The fuze will detonate the projectile at angels of impact, from 90 degrees to a low-graze angle. The cartridge contains a primer, a propellant charge, and a high-explosive projectile.

b. Practice Cartridge XM554. This cartridge is the practice and spotting round for the 30-mm high-explosive cartridge XM552. It has the same ballistic characteristics as the high-explosive cartridge XM552. It employs the same primer and brass cartridge case assembly as the high-explosive round. This cartridge does not contain a fuze.

c. Training Cartridge XM639. This cartridge contains a primer and propellant charge. The projectile is inert. It employs the same primer and brass cartridge case assembly as the high-explosive round. It does not contain a fuze.

7-5.1.4 WEIGHTS AND DIMENSIONS.

Cartridges XM552, XM554, and XM639:

Weight	0.9 lb
Length	6.963 in.

7-5.1.5 MATERIALS.

Cartridges M552, XM554, and XM639:

Projectile body	Steel
Ogive	Aluminum
Cartridge case	Brass

7-5.2 HAZARDOUS COMPONENTS.

High-Explosive Cartridge M552:

Propellant	608 grains IMR EX8261
Projectile	30 grams HMX
Fuze:	
Detonator	M55
Spitback lead assembly	60 milligrams RDX, 300 milligrams HMX

Practice Cartridge XM554:

Propellant	608 grains IMR EX8261
Projectile (spotting mixture)	10 grams red phosphorus, magnesium, and barium nitrate.

Training Cartridge XM639:

Propellant	608 grains IMR EX8261
Projectile	Inert

7-5.3 FUNCTIONING.

7-5.3.1 HIGH-EXPLOSIVE CARTRIDGE XM552. The detonator M55 in the rotor of the PIBD fuze XM579 (figure 7-16) is kept out of line by a detent pin, a firing pin, and a setback tab. When a projectile is fired, the setback tab collapses down out of the way of the rotor. Centrifugal force pushes three steel arming balls outward against the camming surface of the firing pin assembly, retracting the firing pin from the rotor. Meanwhile, the soft aluminum delay ribbon, which controls arming delay, is unwound by centrifugal force, releasing a detent pin holding the rotor. The rotor is then free to rotate to the armed position. Upon impact, the firing pin strikes the detonator, initiating the explosive train. The shaped charge produces an antimateriel effect and the frag-

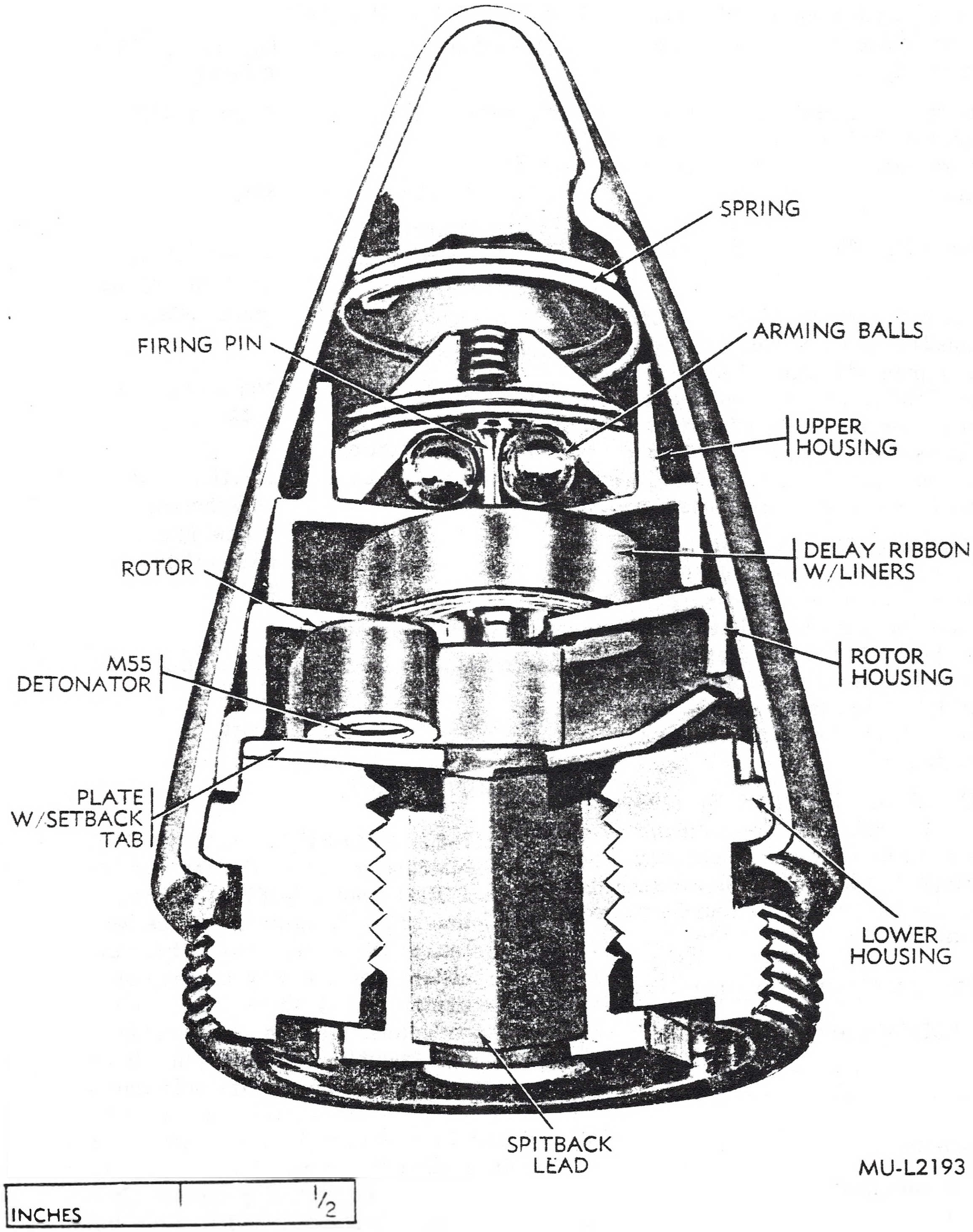


Figure 7–16 PIBD Fuze XM579—Cross Section

mentation of the projectile body causes an antipersonnel effect.

7-5.3.2. PRACTICE CARTRIDGE XM554.

This cartridge does not contain a fuze. Upon impact, the projectile bursts, producing a bright flash.

7-5.3.3 TRAINING CARTRIDGE XM639. This cartridge does not contain a fuze. The projectile is inert.

7-5.4 SAFETY PRECAUTIONS.

The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

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SECTION 8

GUIDED MISSILES

8-1 ANTIAIRCRAFT GUIDED MISSILE M6 WITH HIGH-EXPLOSIVE WARHEAD M17 (T45) (NIKE-HERCULES).

8-1.1 IDENTIFICATION

8-1.1.1 TYPE. Nike-Hercules is a two-stage, surface-to-air, supersonic (Mach 3.5), ground-command guided, acceleration-armed, ground-command or fail-safe fired, solid-propellant missile which carries a high-velocity fragmentation and blast-type warhead. This missile may also carry a nuclear warhead.

8-1.1.2 PAINTING AND MARKING.

a. Painting. The exterior surface of the missile is painted white; the booster cluster assembly is painted olive drab.

b. Marking. The majority of the markings on the missile appears either on the right or left sides; all markings are painted in dull black. In addition to the markings listed below, markings for those access doors utilized in the rendering safe procedures are as given in the subparagraphs which describe those procedures.

(1) The words "U.S. ARMY," in letters 8 inches high, are painted on the missile in four places—top, bottom, and both sides.

(2) The missile lot number is on the left horizontal centerline just aft of the forward end of the engine section.

(3) The warhead lot number is on the left horizontal centerline just aft of the forward end of the warhead assembly.

(4) The body GM XM number and the GS number are on the horizontal centerline on both sides of the missile between the forward tips of the forward fins.

8-1.1.3 FITTINGS AND FEATURES.

8-1.1.3.1 GENERAL. Figure 8-1 shows the general appearance of Nike-Hercules, and dimensions. The top centerline of the missile can be considered as an imaginary line running over the indexing pin on the thrust limiter mounting plate at the aft end of the control section, and between the two hoist attach points on the nose of the missile (figure 8-2, top view); these two attach points contain flathead screws. The bottom centerline runs through the umbilical receptacle access door.

8-1.1.3.2 EXTERNAL FITTINGS. The four sides of the missile (top, bottom, right and left) are illustrated in figure 8-2, any given "side" being the surface between two adjacent fins. The right and left sides are determined by looking forward from the aft end of the missile. External fittings and access provisions peculiar to this missile can be identified by reference to figure 8-2. In addition, where access to major components or systems is required during the rendering safe and defueling procedures, provision for that access is illustrated and described in detail.

8-1.1.3.3 FEATURES. The Nike-Hercules missile is made up of four major structural groups: the nose, the warhead assembly, the body and the booster cluster assembly. Each of these groups is composed of two or more smaller sections or subassemblies as described in a through d below.

a. Nose. The nose of the missile consists of the forward and the aft nose sections; it is illustrated in figure 8-3. The forward nose section is made up of two rings and a conical aluminum skin attached to the rings by rivets. The aft nose section is similar in construction to the forward nose section. The conventional nose tip, which is used with the warhead M17 (T-45), is attached to a ring in the forward nose section by means of a threaded boss.

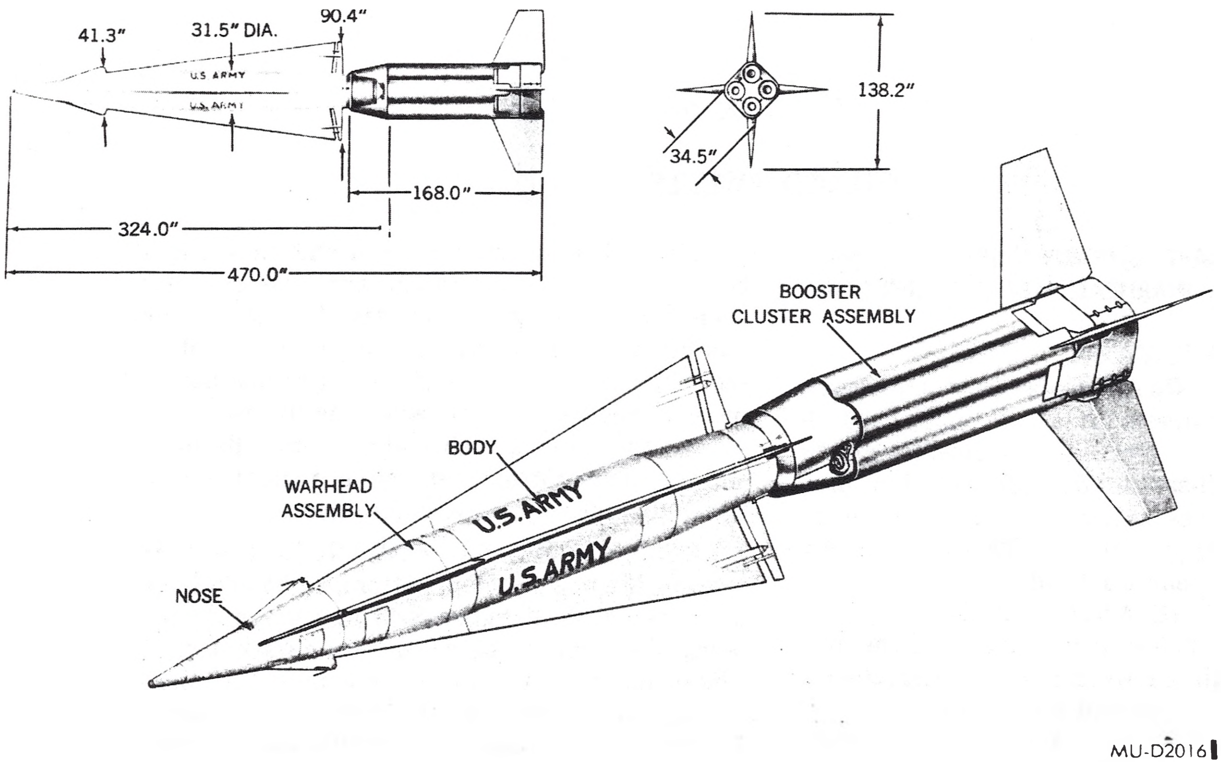

Figure 8–1 Nike-Hercules—General Appearance and Dimensions

The forward nose section is attached to the aft nose section by four bolts. The four forward fins, which are attached to the aft nose section, are in line with the main fins of the missile. An antenna is mounted on each of the forward fins, two antennae for receiving and two antennae for transmitting. The missile guidance set is located in the aft nose section; it is attached to the missile structure by six bolts. A wiring harness is connected to the guidance set by a 48-pin plug. An inertia safety and arming switch is located on the lower left side (looking forward) of the aft nose section. There are two crush ring assemblies in the nose of the missile, one forward and one aft. When a surface-to-surface mission has been selected, the crush ring cable assemblies provide a means of activating the circuit which detonates the warhead upon target impact. However, these crush rings have no functional use in missiles containing conventional warheads.

b. Warhead assembly. The warhead assembly (figure 8–4) consists of two sections, a forward section and an aft section. The two sections, constructed of rings and aluminum skin, are joined with 12 bolts. The warhead M17 (T45) is cantilever mounted, and is attached to a frame by a ring which is an integral part of the warhead. Two large filling holes in the base of the warhead are closed by two circular cover plates. The housing for the two safety and arming devices is attached to the lower right side of the forward warhear section skin. A contoured quick-release door provides access to these devices. In addition to the warhead and safety and arming devices, a fail-safe box is located in the forward portion of the warhead

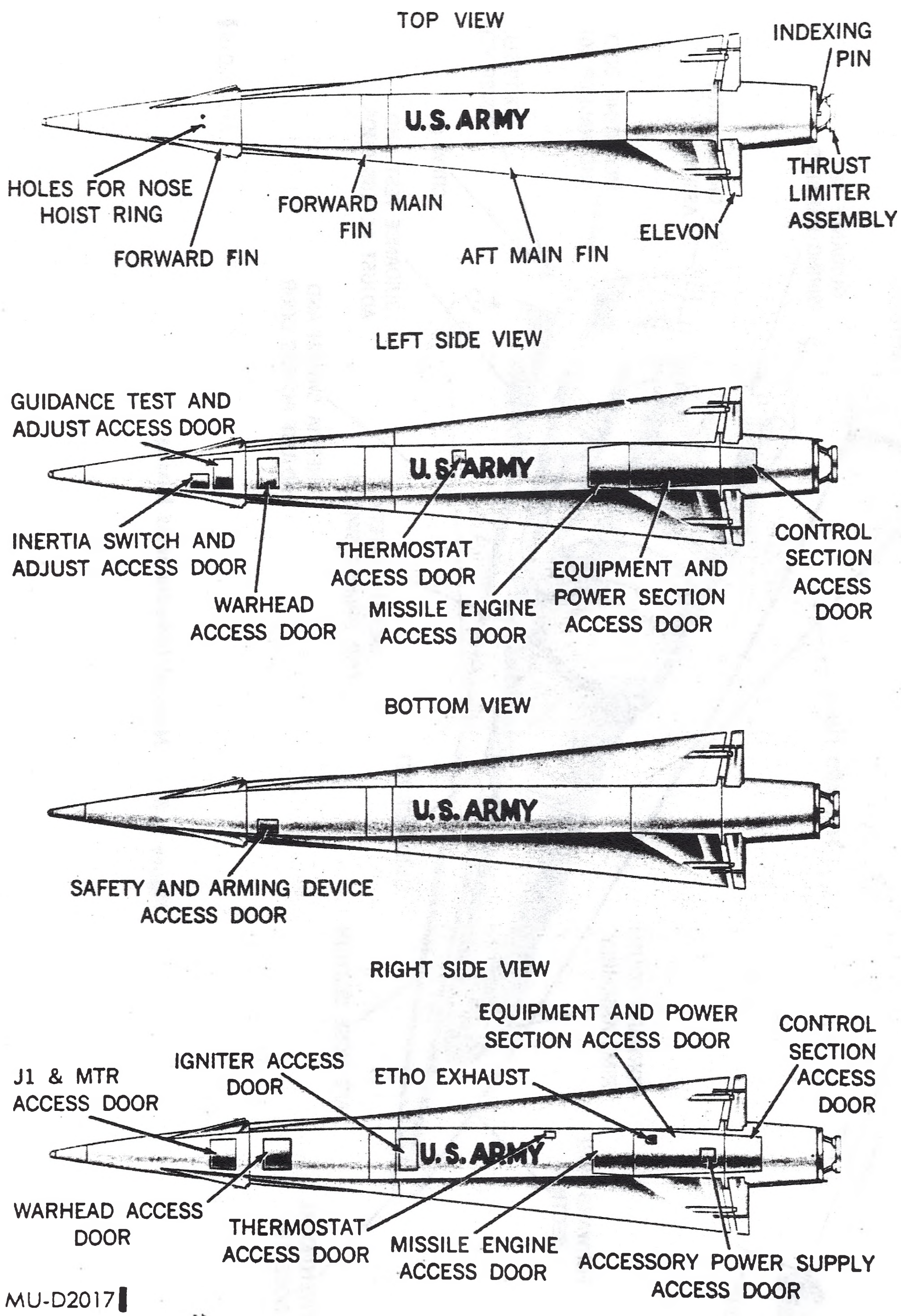

Figure 8–2 External fittings and Access Provisions for Nike-Hercules Missile

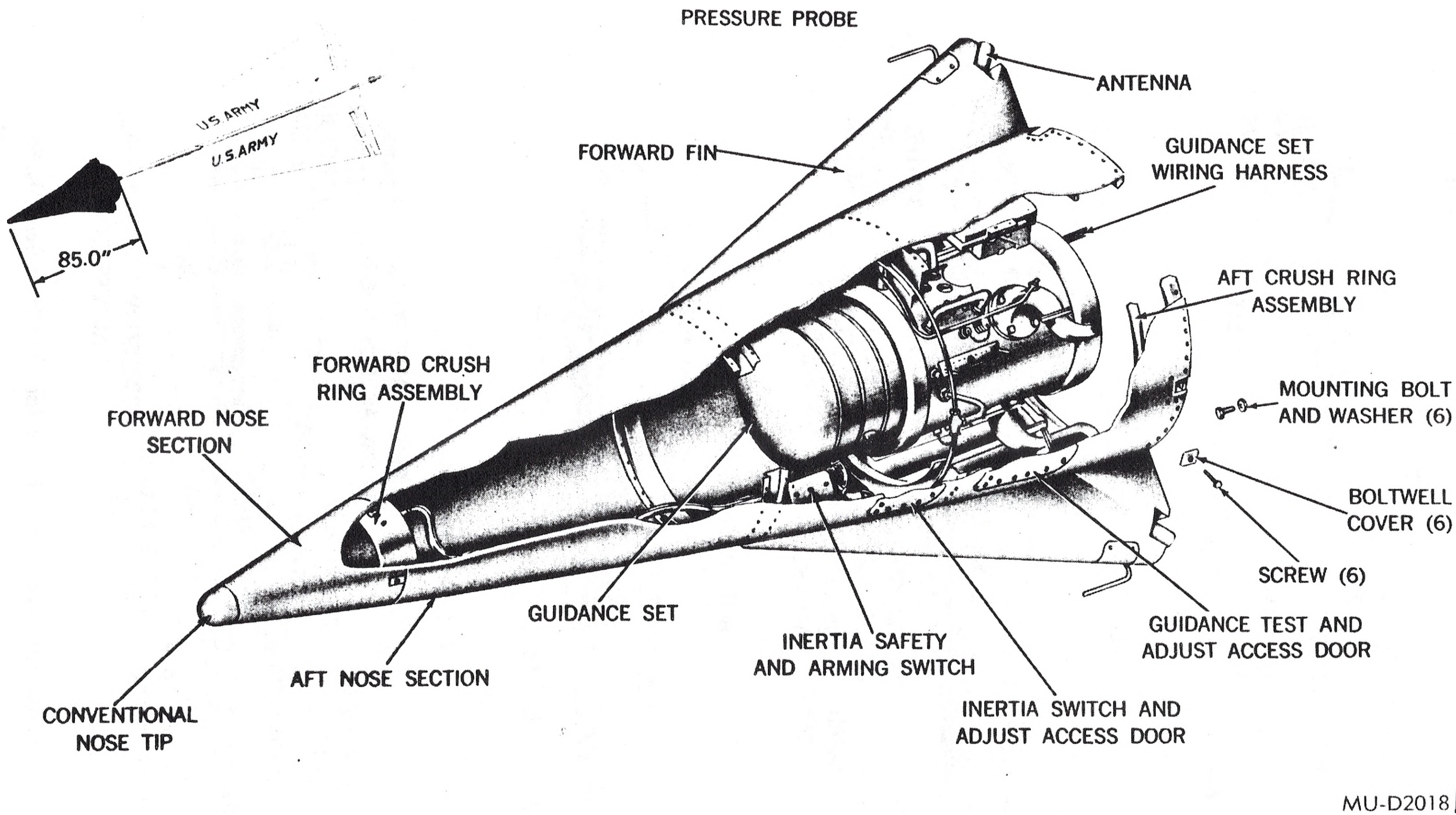

Figure 8–3 Nose of Nike-Hercules Missile

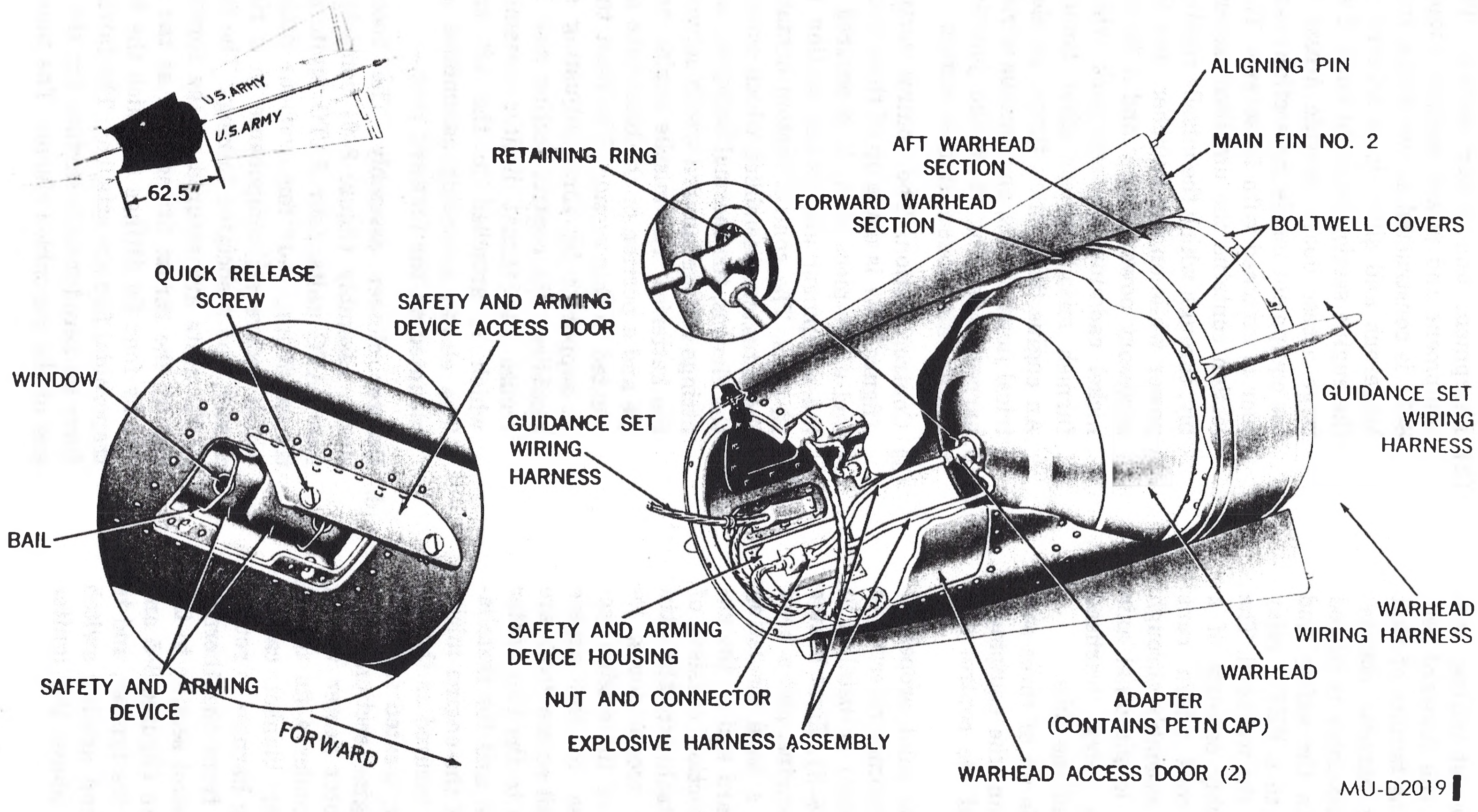

Figure 8–4 Warhead Assembly Nike-Hercules

assembly. The guidance set wiring harness is routed through the forward section and is secured to the bottom of that section by two wiring harness clamps. The explosive harness assembly is routed from two receptacles in the safety and arming device housing to a PETN relay assembly in the nose of the warhead. The warhead booster assembly consists of a length of detonating cord which runs from the PETN relay assembly through a steel tube along the longitudinal axis of the warhead to a tetryl warhead booster in the aft end of the tube.

c. Body. The body is made up of three sections; the engine section, the equipment and power section, and the control section.

(1) Engine section. The solid propellant missile engine (sometimes referred to as the sustainer motor) is installed in this section (figure 8–5). Eight heater blankets cover the engine, and a head heater blanket and a head insulating cap cover the forward end of the engine. The engine section consists of structural rings attached to the skin with rivets. Large access doors, located on each side of the engine section, permit access to the engine mounting ring. Small access doors are provided for access to the two heater blanket thermostats, and for installation and removal of the engine initiators. The engine is secured to the engine mounting ring, located near the aft end of the engine section, with eight bolts. The motor heater wiring harness is routed under a fin to the three engine heater blanket cables. The initiator wiring harness is routed under another fin from the thermal batteries in the control section to the two engine initiators (figures 8–5 and 8–6) in the side of the igniter, and to an inertia safety and arming switch located inside and above the igniter access door.

(2) Equipment and power section. The equipment and power section (figure 8–7) is constructed of two rings, four longerons and skin; it is secured to the engine section with 20 bolts. Two large access doors provide access to the equipment inside the section; each door is attached with 54 screws. This section contains the umbilical assembly, through which the missile receives power while on the launcher, and the accessory power supply and a 28-volt nickel cadmium battery pack which furnish missile power after launch. An engine delay start timer, an electrical junction box, and various wiring harnesses leading from the junction box are also housed in this section.

(3) Control section. The control section (figure 8–8) is made up of three rings and a two-piece skin. It is secured to the equipment and power section by 12 bolts. The control section contains the actuator assemblies which control the elevons, the thermal batteries, and fittings for the lanyard which actuates the batteries. The missile engine nozzle and a portion of the blast tube are located in this section. The blast tube is supported by three adjusting assemblies. The control section also includes the thrust limiter assembly which is attached to the aft end. The elevon actuating assemblies are mounted on the forward ring.

d. Booster cluster assembly. The booster cluster assembly (figure 8–9) consists of four JATO units, four JATO igniters, a thrust fitting, four fins, various fittings which secure all components in a rigid cluster, and associated fairings. The four JATO units are secured at the forward end by the thrust fitting, and at the aft end by four fin fittings to which the four trapezoidal fins are attached. The fairings form an aerodynamic surface for the aft end of the assembled cluster. The tapered

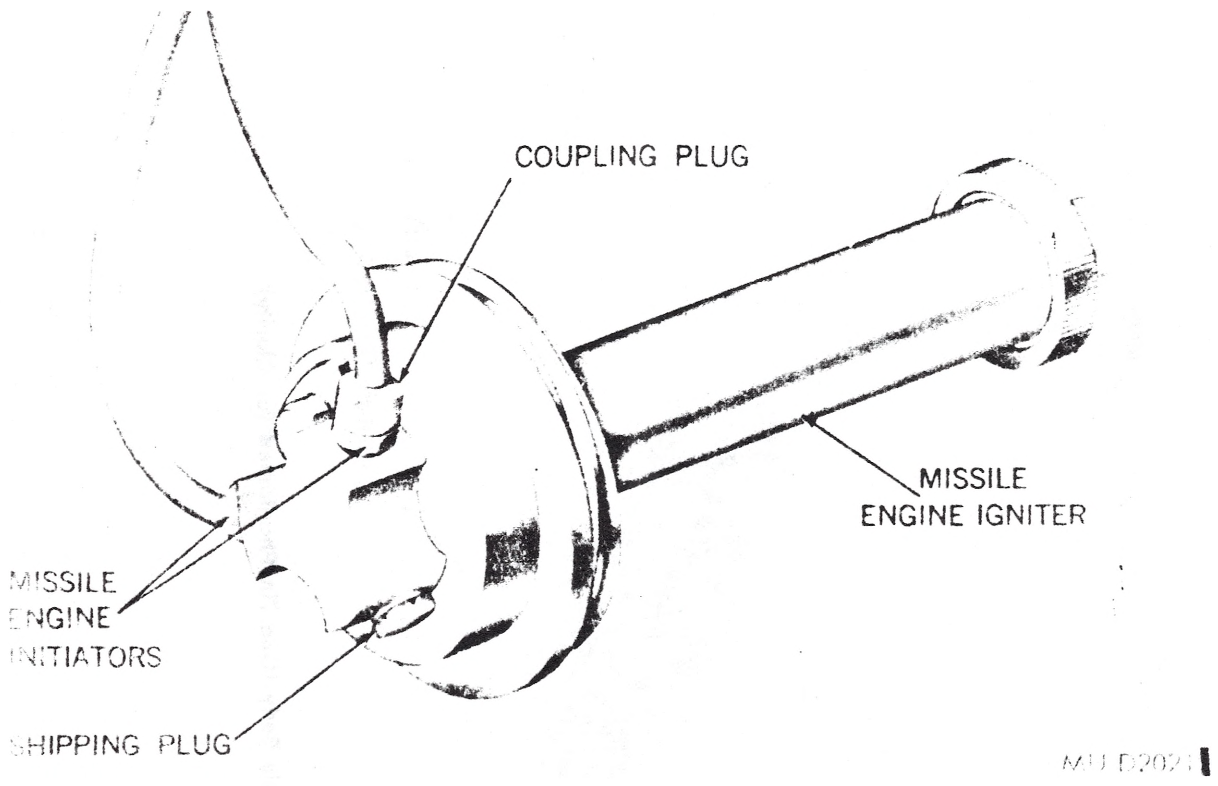

Figure 8-6 Missile Engine Initiators and Igniter

internal opening in the forward end of the thrust fitting mates with the tapered aft end of the missile. The missile and booster cluster assembly are kept in alignment by an indexing pin (figure 8-8) on the aft end of the missile which engages a recess in the interior of the thrust fitting. Four elevon locks on the forward end of the thrust fitting prevent movement of the elevons until the booster cluster assembly separates from the missile. A bracket is provided on the thrust fitting for the lanyard assembly which is attached to the thermal batteries in the missile. An igniter access opening on each side of the thrust fitting permits installation and removal of the JATO igniters.

8-1.1.4 WEIGHTS.

a. Complete Missile and Booster Cluster Assembly. The complete missile and booster cluster assembly weights approximately 10,550 pounds.

b. Missile. The missile weighs approximately 5,250 pounds.

c. Booster Cluster Assembly. The booster cluster assembly weighs approximately 5,300 pounds.

8-1.1.5 MATERIALS.

a. Missile. The missile is constructed of aluminum alloy and magnesium alloy airframe components.

b. Booster cluster assembly. Each of the four JATO units consists of a welded cylinder of steel with a steel head disc and nozzle assembly. The thrust structure at the forward end of the assembly is made of magnesium alloy castings and aluminum alloy skin sections. All fairings are of aluminum alloy; the fins are aluminum.

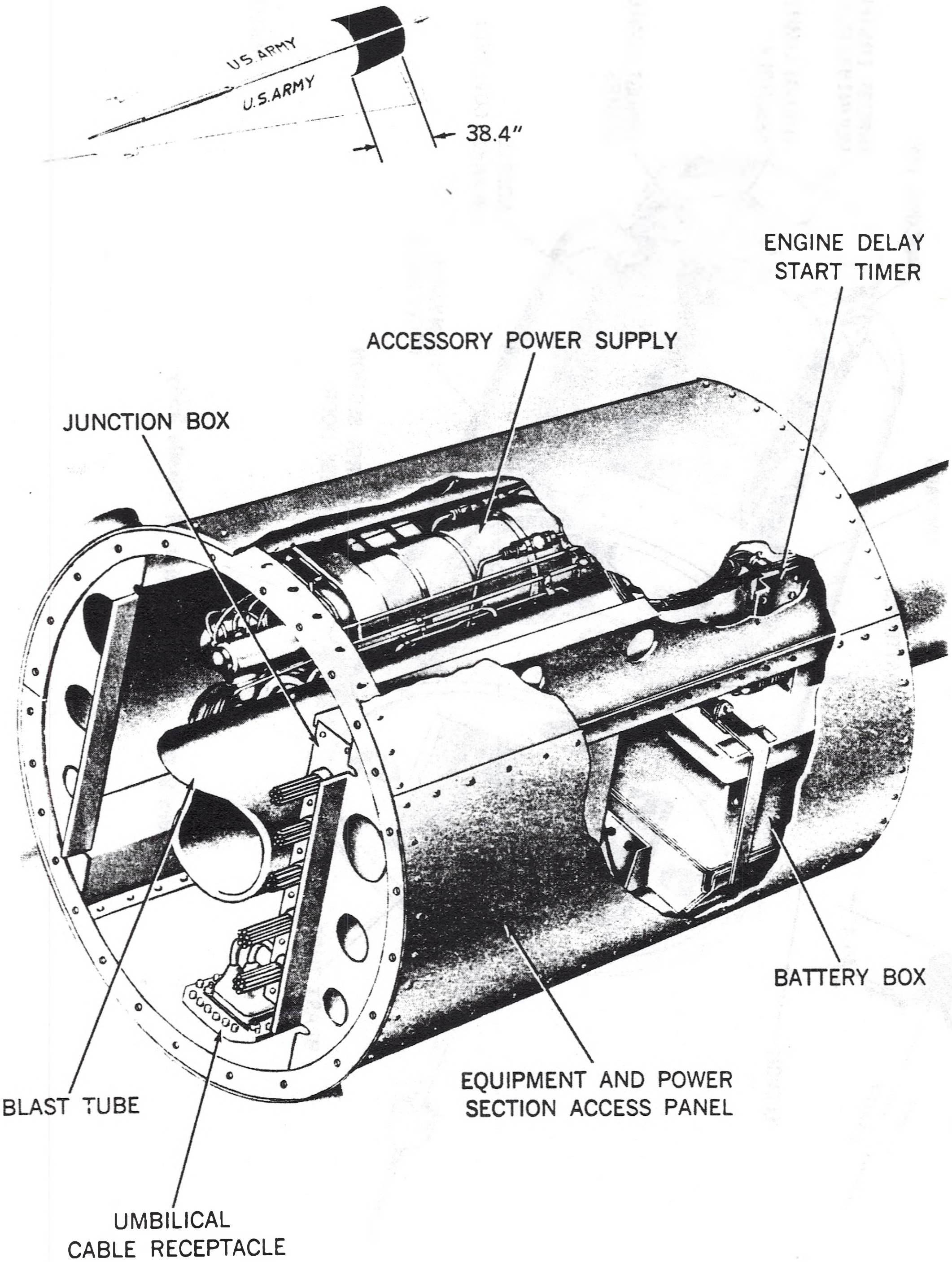

Figure 8-7 Equipment and Power Section of Mission Body

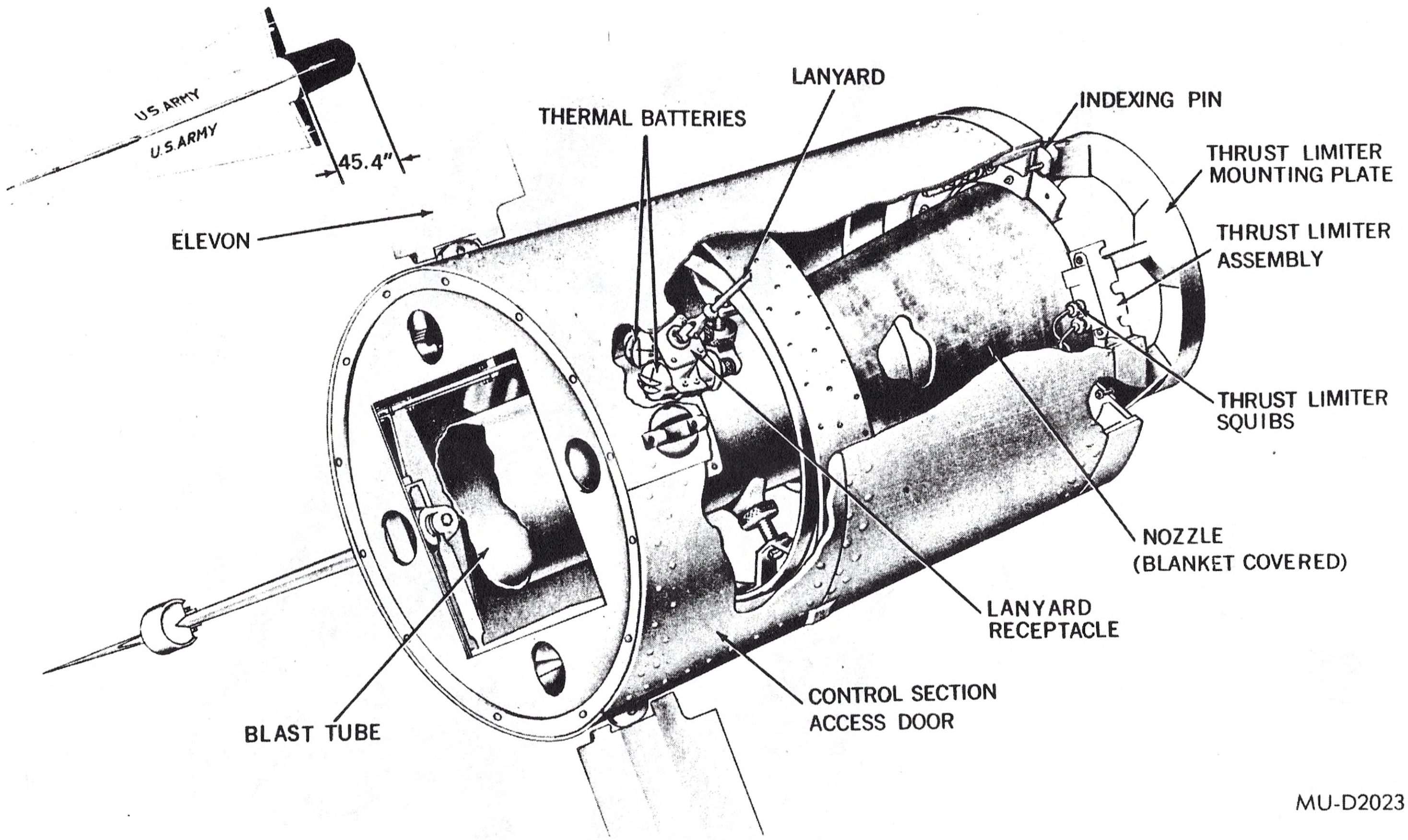

Figure 8–8 Control Section of Missile Body

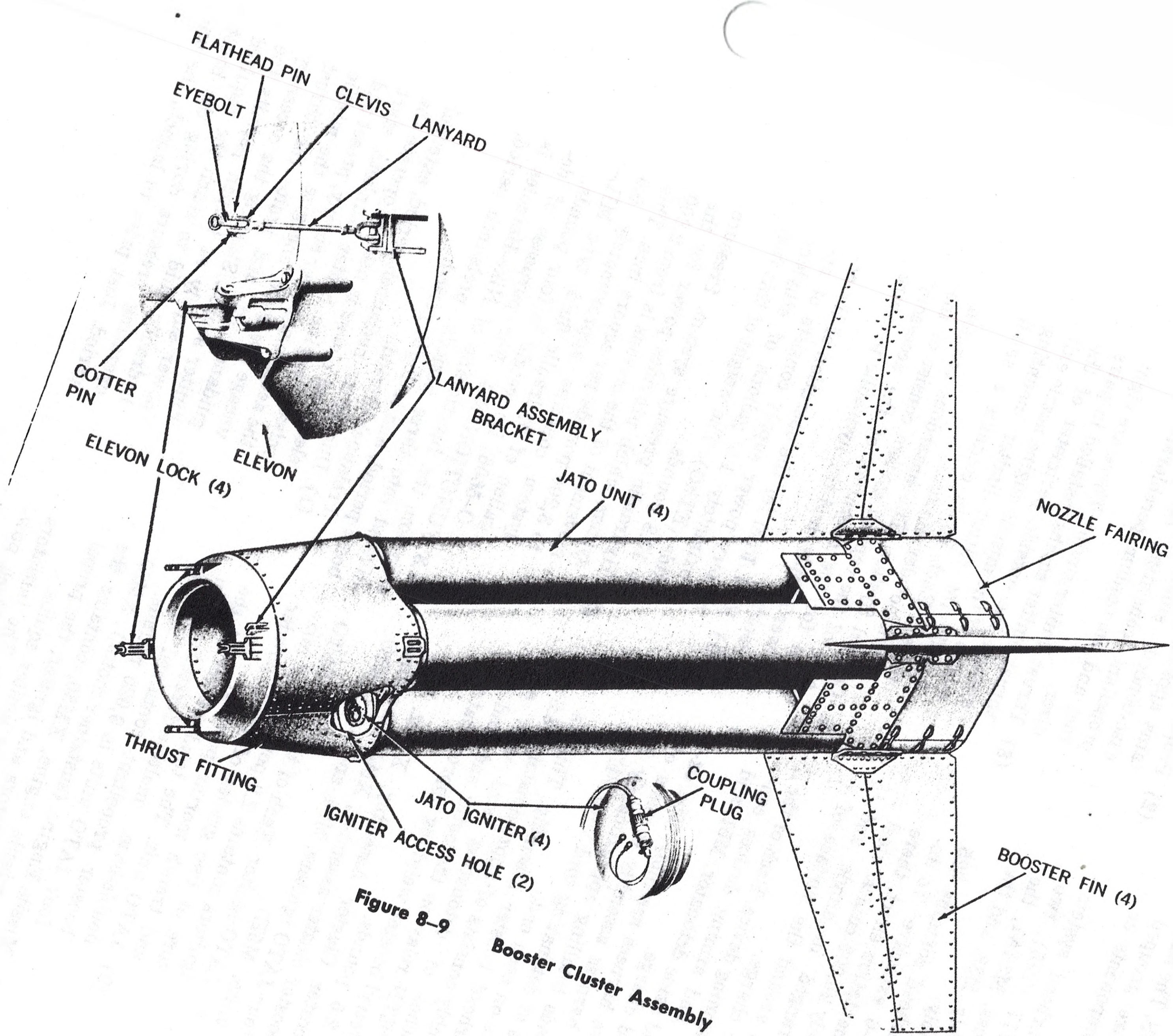

Figure 8–9 Booster Cluster Assembly

8–1.2 HAZARDOUS COMPONENTS. The hazardous components listed below are grouped in accordance with the major components or system to which they pertain.

a. Warhead System. The warhead system contains the warhead, M17 (T45), two safety and arming devices, M30A1, the explosive harness assembly, M38, and the warhead booster assembly.

(1) Warhead. The warhead contains 625 pounds of HBX–6 explosive. To increase the fragmentation effect, there are approximately 20,000 cubical steel fragments arranged in single and double layers around the surface of the explosive charge.

(2) Safety and arming device. Each of the two safety and arming devices contains a lead azide detonator, M51, and tetryl lead charge.

(3) Explosive harness assembly. The explosive harness assembly consists of two leads totalling approximately 20 inches of detonating cord with PETN relays on each end.

(4) Warhead booster assembly. This assembly consists of approximately 18.3 inches of detonating cord with a PETN relay on the outer end, and a tetryl booster weighing approximately 2.6 pounds.

b. Booster Cluster Assembly, XM42. The booster cluster assembly, XM42, contains four JATO igniters, M24, and four JATO units, M5E1.

(1) JATO igniter. Each of the four JATO igniters contains 2.2 pounds of a mixture of two grades of black powder and trench mortar powder.

(2) JATO unit. The total weight of the double-base, multiperforated grain booster propellant contained in the four JATO units is 3,020 pounds.

c. Missile Engine (sustainer motor), XM30. The missile engine, XM30, contains the engine initiators and igniter, the propellant and the thrust limiter squibs.

(1) Initiators and igniter. The initiators contain small amounts of black powder, and the igniter contains 0.7 ounce of polysulfide-perchlorate type propellant.

(2) Propellant. The missile engine contains approximately 2,196 pounds of case-bonded, single-perforated solid propellant consisting of polysulfide fuel and ammonium perchlorate oxidizer.

(3) Thrust limiter squibs. There are eight thrust limiter squibs installed in pairs around the outside perimeter of the mouth of the missile engine nozzle exit (inside the thrust limiter mounting plate). Each squib contains a small black powder charge.

d. Control System. The hazardous components of the control system consist of the fuel for the operation of the accessory power supply, and the hydraulic pressure system.

(1) Fuel. Fuel for the operation of the accessory power supply consists of approximately 1.6 gallons of ethylene oxide (EThO). The weight of this fuel is 10.8 pounds.

(2) Hydraulic pressure system. Pressure system which provides power for the movement of the elevons is from 2,800 to 3,200 pounds per square inch. This system contains approximately 0.6 gallon of hydraulic fluid, type MIL–O–5606; its weight is four pounds.

8–1.3 FUNCTIONING. For purposes of description, the functioning of Nike-Hercules is divided into three periods: prelaunch period, boost period, and in-flight period.

a. Prelaunch Period.

(1) During the prelaunch period, external electrical power is used to operate the missile engine heater blankets, start the accessory power supply, preset and uncage the gyro, energize the missile guidance set, and ignite the thrust limiter squibs. Starting the accessory power supply at launch permits the hydraulic fluid to reach the required operating pressure during the boost period. Just prior to launch, the un-

caged gyro establishes the reference trajectory plane in which steering commands are to be given by the ground computer.

(2) If a surface-to-low-altitude mission has been selected, a signal to activate the engine delay start timer is sent to the missile, and the eight thrust limiter squibs are ignited one-fourth of a second before the FIRE command. The thrust limiter squibs secure the thrust limiter (figure 8–8) to the control section at the aft end of the missile, thus reducing missile engine thrust. For the normal surface-to-air mission, however, the thrust limiter drops off at booster cluster assembly separation.

b. Boost Period.

(1) When the missile-booster cluster assembly firing circuit is closed, external electrical power fires the igniters which initiate combustion of the propellant grain of the four JATO units, and the missile and booster cluster assembly move along the erected launching rail. As this movement begins, the umbilical cable plug shears at the missile skin, and a launching-rail release assembly pivots out of the way, providing a clear path for the missile and booster cluster assembly.

(2) During acceleration of the missile-booster cluster assembly combination, rearward movement of inertia weights in the two safety and arming devices is retarded by delay escapement ascapement assemblies, so that sustained acceleration is required for the devices to arm. At the end of their travel, the weights are locked in position, the explosive trains are aligned, the shorts in the electric leads to the devices have been removed, and the warhead system is armed.

(3) During this same period, an inertia safety and arming switch located in the nose of the missile transfers the roll control circuit in the missile guidance set from the preset to the flight condition, and another inertia safety and arming switch located in the forward portion of the missile engine section completes the operating circuit of the initiator cable assembly. This action permits the firing of the missile engine initiators as soon as the thermal batteries are activated upon booster cluster assembly drop-off.

NOTE

During the boost period, the ground computer does not sent any steering commands, and the elevons are locked mechanically by elevon locks on the booster thrust fitting.

c. In-Flight Period.

(1) At burnout, the booster cluster assembly is separated from the missile by aerodynamic drag. The separation of the booster cluster assembly from the missile pulls a lanyard, actuating the thermal batteries which energize the missile engine initiators. The initiators ignite pyrotechnic pellets which, in turn, spread combustion to the missile engine igniter and to the propellant of the missile engine.

(2) The elevons are released at booster separation. As soon as the elevons are released from mechanical lock, the missile rolls until it is oriented with respect to the reference trajectory plane. The gyro maintains missile stabilization with respect to the reference trajectory plane throughout the remainder of the in-flight period. For each group of command signals received by the missile guidance system, a signal is returned to the missile tracking radar in order to facilitate tracking. Command signals from the missile tracking radar include those for steering in both yaw and pitch; these steering signals are given with respect to the reference trajectory plane, as maintained by the gyro. The control system accepts the electrical

signals and converts them to a mechanical (hydraulic) output which is applied to the elevons.

(3) Detonation of the warhead is effected by a burst command transmitted by the missile tracking radar. In addition, a fail-safe device in the warhead assembly provides self-detonation of the warhead if ground guidance is terminated for a period of three seconds, or three seconds after the occurrence of a malfunction within the missile.

NOTE

In all of these cases, detonation must be preceded by the arming of at least one of the safety and arming devices.

8-2 ANTIAIRCRAFT GUIDED MISSILE M1 WITH HIGH-EXPLOSIVE WARHEADS (NIKE-AJAX).

8-2.1 IDENTIFICATION

8-2.1.1 TYPE. Nike-Ajax (figure 8-10) is two-stage, surface-to-air, supersonic, ground-command guided, acceleration armed, liquid fuel propelled missile with a solid propellant booster. The Nike-Ajax carries three warheads that are explosively connected with detonating cord leads, and two safe and arming (S and A) devices. The Nike-Ajax also has a fail-safe feature in which self-destruct can be accomplished automatically or by ground-command.

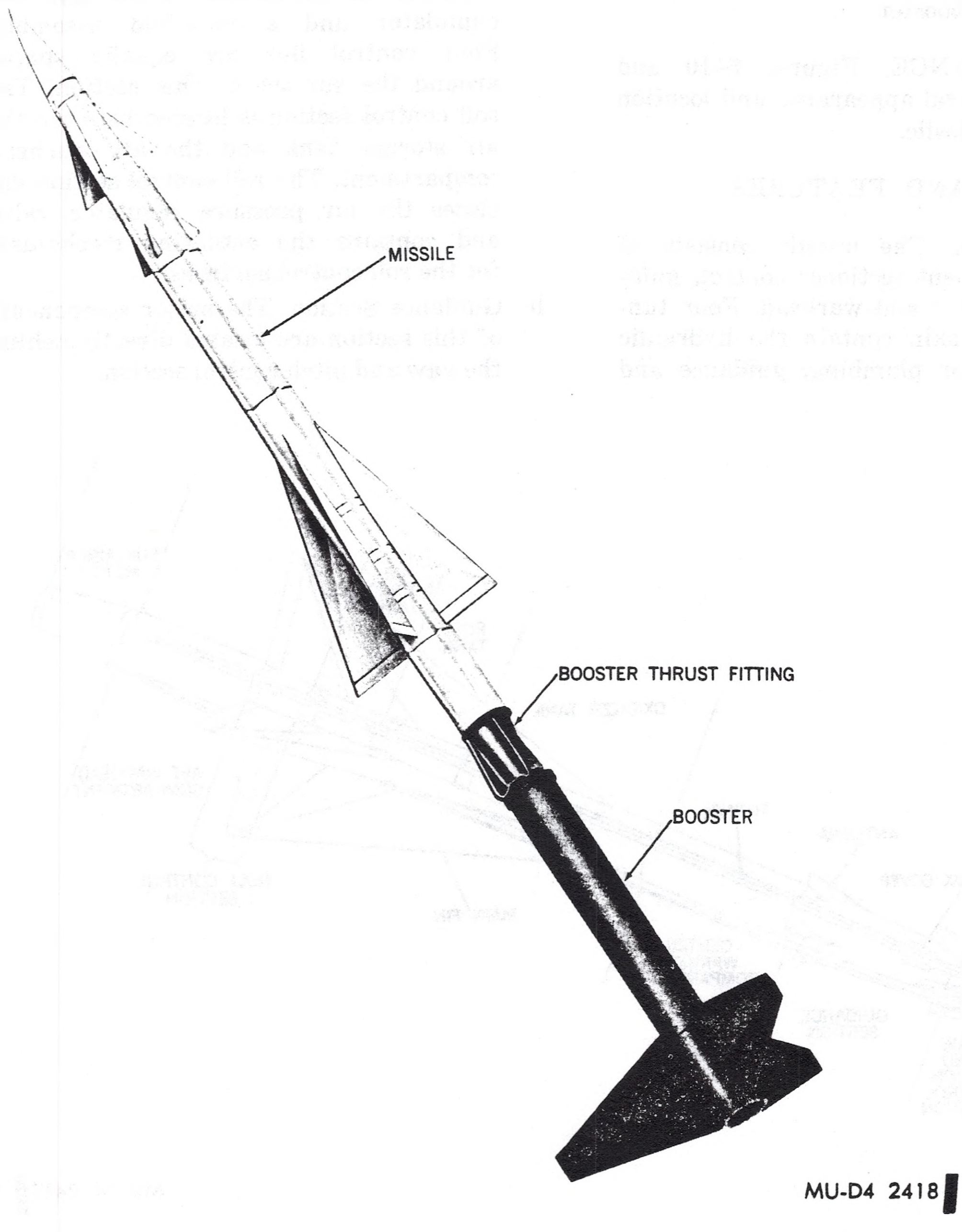

Figure 8-10 General Appearance of the Nike-Ajax Missile-Booster Combination

8–2.1.2 PAINTING AND MARKING. The exterior surface of the missile is painted white. The booster assembly is painted olive drab. All markings are in black. In addition, at the center warhead section there are four rows of 2-inch yellow squares, 90° apart, each row containing three squares. The booster has four 4-inch yellow squares, 90° apart, encircling the forward end of the booster.

8–2.1.3 APPEARANCE. Figures 8–10 and 8–11 show the general appearance and location of sections of the missile.

8–2.2 FITTINGS AND FEATURES.

8–2.2.1 GENERAL. The missile consists of four major component sections: control, guidance, sustainer motor and warhead. Four tunnels on the outer skin contain the hydraulic and sustainer motor plumbing, guidance and control wiring and the warhead system detonating cord leads.

a. Control System. The control system consists of the yaw and pitch control section and the roll control section. The yaw and pitch control section is located to the rear of the forward warhead compartment. This section also houses the hydraulic accumulator and a manifold assembly. Four control fins are equally spaced around the surface of this section. The roll control section is located between the air storage tank and the aft warhead compartment. The roll control section encloses the air pressure regulator valve and contains the actuating mechanism for the roll control surfaces.

b. Guidance Section. The major components of this section are located directly behind the yaw and pitch control section.

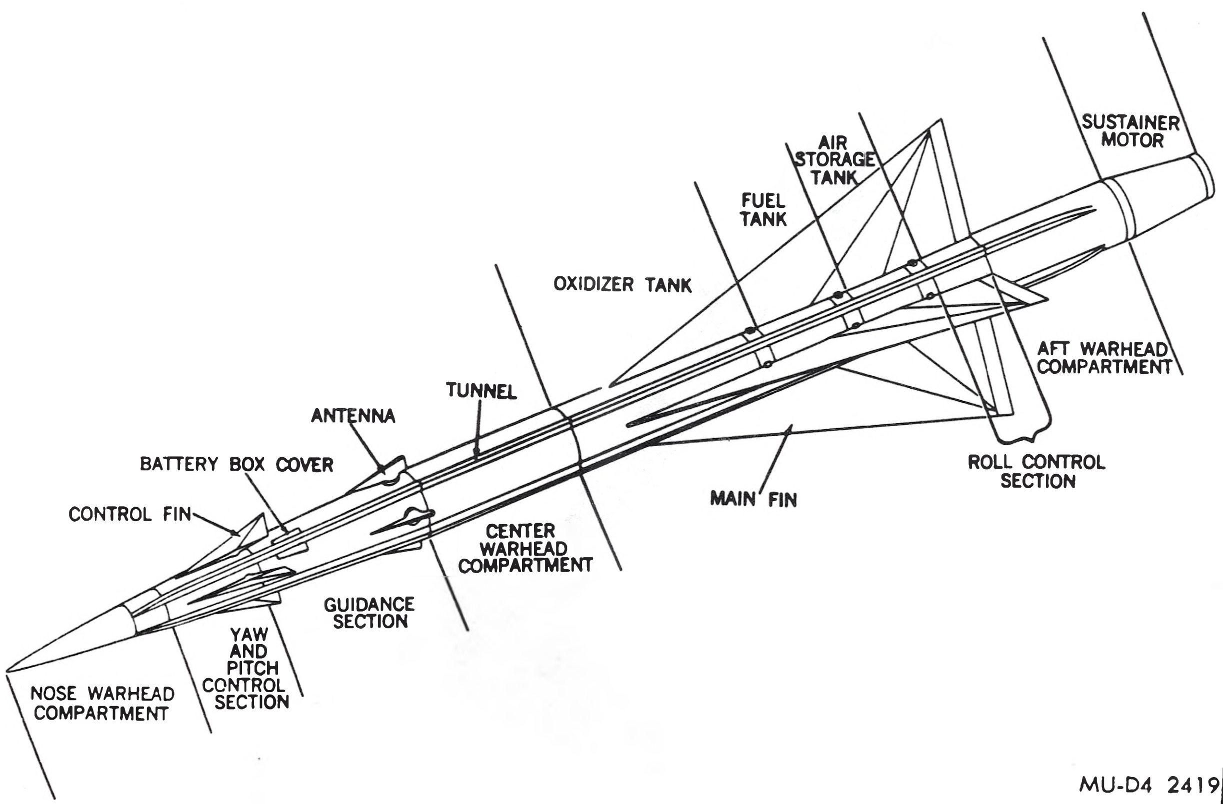

Figure 8–11 Sections and Compartments of the Missile

c. Sustainer Motor Section. The sustainer motor is mounted in the aft end of the missile. This section contains the oxidizer tank (RFNA), fuel tank (M3 fuel), starting fuel tank (UDMH) and the air storage tank (high-pressure air).

d. Warhead System. The components of this system are shown in figure 8–12. The system consists of three warheads (nose, center and aft), two S and A devices, a five-way detonating cord connector and five lengths of detonating cord.

e Missile Tunnels. There are four tunnels running lengthwise along the missile skin, spaced 90° apart. They are numbered in a clockwise direction looking toward the nose from the aft end of the missile.

(1) Tunnel Number One. This tunnel is the reference point for the other tunnels. It runs above the battery box cover on the guidance section. This tunnel covers the low-pressure air lines located along the oxidizer and fuel tanks.

(2) Tunnel Number Two. This tunnel covers the missile control system air-pressure line, the oil return line and the air filler and oxidizer line that extends from the oxidizer tank to the sustainer motor.

(3) Tunnel Number Three. This tunnel covers the electrical cables and the stagnation pressure line located along the guidance section.

(4) Tunnel Number Four. This tunnel covers the nose and aft warheads' detonating cord leads, the control system oil-pressure line that extends from the pitch and yaw control section, the starting fuel expansion chamber and the fuel line which ex-

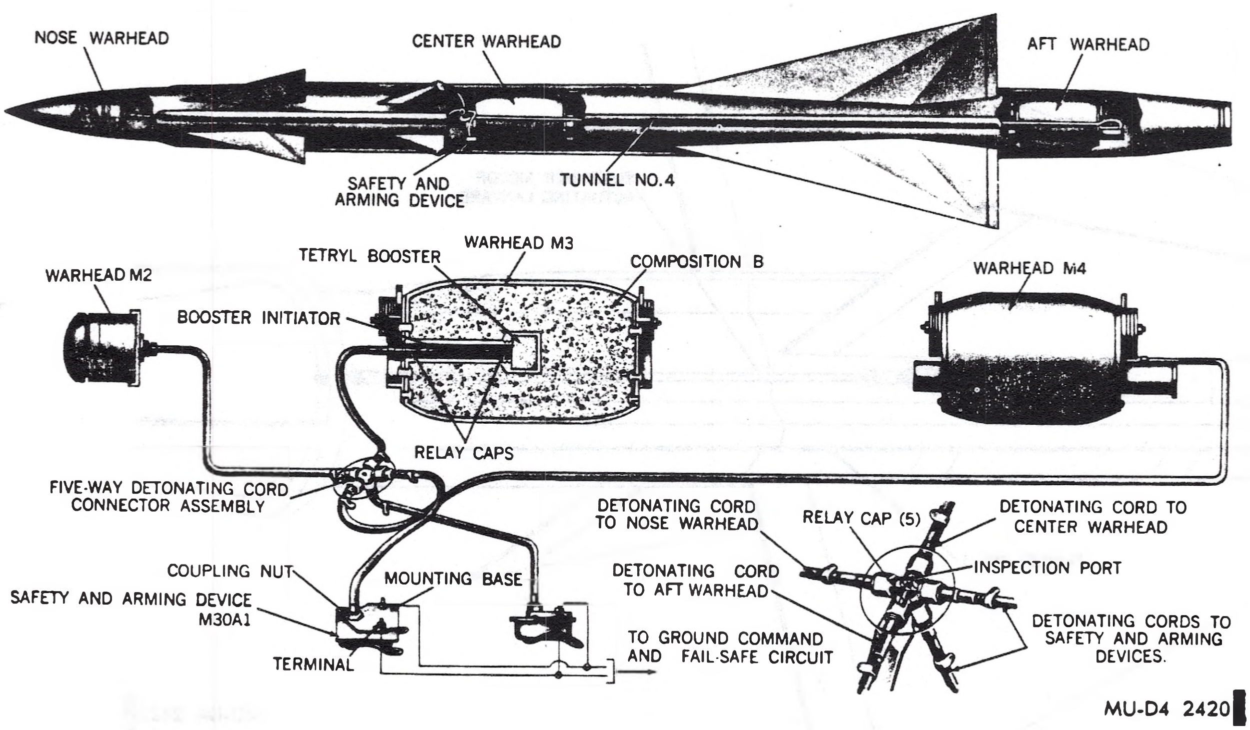

Figure 8–12 Warhead System for the Nike-Ajax

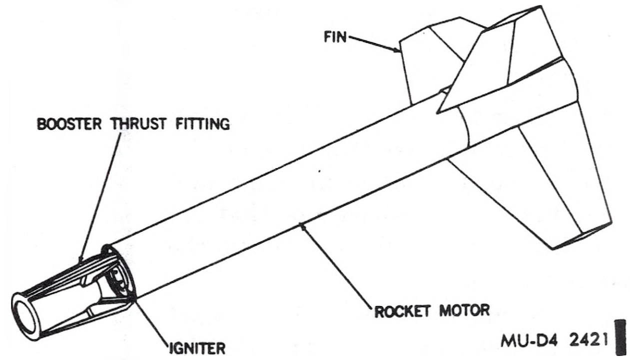

Figure 8–13 Booster Assembly for Nike-Ajax

tends from the fuel tank to the sustainer motor.

f. Booster Assembly. The main components of the booster assembly are shown in figure 8–13. The booster assembly is mated to the missile by the thrust fitting. One end of the sustainer motor actuating lanyard is attached to the thrust fitting as shown in figure 8–14. The booster rocket motor contains a double base solid propellant grain. The igniter contains a black powder charge and four electric squibs. The squibs are connected to an electrical plug on the face of the igniter. Two igniter wires run from the electrical plug through holes in the propellant grain to an outside connection for firing.

8–2.3 DIMENSIONS AND WEIGHT. The missile with booster is 33 feet long and weighs approximately 2,400 pounds. The missile is 21 feet long and weighs approximately 1,190 pounds. The booster is 13.2 feet long and weighs approximately 1,198 pounds.

8–2.4 MATERIAL. The missile skin is aluminum alloy. The booster casing is steel.

8–2.5 Hazardous Components.

a. Warheads. The missile contains three warheads filled with Composition B. The nose warhead contains 4.4 pounds, the

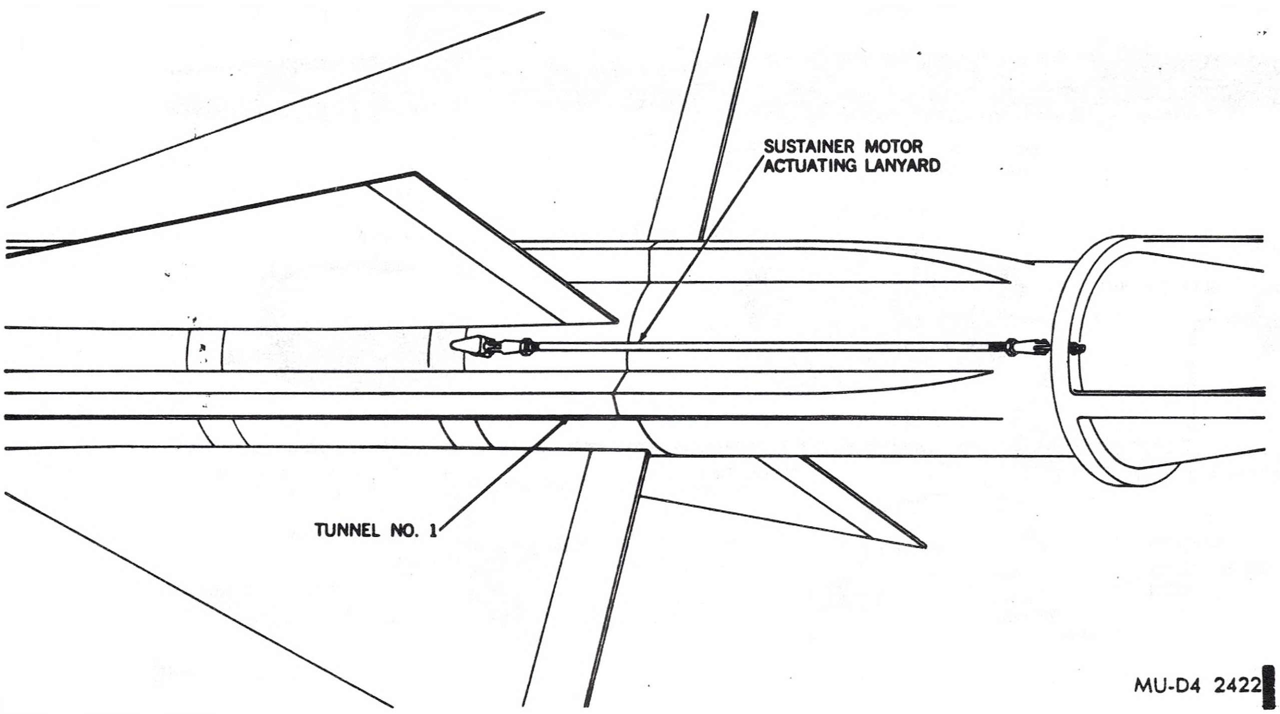

Figure 8–14 Location of Sustainer Motor Actuating Lanyard

center warhead contains 92 pounds and the aft warhead contains 59 pounds.

b. M30A1 S and A Device. The two S and A devices each contain a tetryl lead-in charge and an M51 detonator containing lead azide and PETN.

c. Detonating Cord Harness. There are five lengths of detonating cord connected to a common five-way detonating cord connector. The opposite ends of the five detonating cords are connected to the two S and A devices and the three warheads (figure 8–12).

d. Oxidizer, Fuel and High-Pressure Air. The missile contains 19 gallons (222 pounds) of red fuming nitric acid (RFNA), 7.9 gallons (47.7 pounds) of M3 fuel, unsymmetrical dimethylhydrazine (UDMH) and the air storage tank which contains air pressurized at 3,000 to 4,600 p.s.i.

e. Booster. The booster motor contains a 740-pound, double base, solid propellant grain. The igniter contains 2.2 pounds of black powder.

-2.6 FUNCTIONING. At missile launch, a anyard is pulled, causing the hydraulic system to become operative. During missile acceleration, a G-weight and slide, in each S and A device, function at a controlled rate. At the end of the G-weight travel, the weight is locked in place by a latch, and the slide snaps into position against the G-weight. This action aligns the electric detonator with the lead-in charge and closes the circuit to the detonator, arming the missile. The missile is unguided until booster separation. At booster separation, the sustainer motor actuating lanyard pulls free and pressurized air forces RFNA and UDMH into the combustion chamber. The hypergolic reaction of RFNA and UDMH starts the sustainer motor. Combustion is maintained when M3 fuel enters the chamber. At booster separation the guidance system also becomes operative and missile controls are functional. Detonation of the warhead is effected by a burst command transmitted by the missile tracking radar. In addition, a fail-safe device in the missile provides self-detonation if ground guidance is lost.

8–2.7 SAFETY PRECAUTIONS AND HAZARDS.

If it is suspected that residual fuel and oxidizer are present, protective clothing must be worn. For recommended protective clothing refer to TM 9–1385–211. Air lines may contain high-pressure air.

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SECTION 9

ANTITANK AND ANTIPERSONNEL MINES

9-1 ANTITANK MINE AND ANTITANK MINE FUZE

Antitank mine M21 and antitank mine fuze M607 are covered in this paragraph.

9-1.1 IDENTIFICATION.

9-1.1.1 TYPE.

a. *Mine.* The mine M21 is a cylindrical, metallic antitank mine which utilizes the Misznay-Schardin principle of high explosive wave shaping to propel a concave steel plate at extremely high velocity. The mine is effective against the underside of armored vehicles as well as the tracks or wheels.

b. *Fuze.* The fuze M607 is a combination-type fuze which functions either by a horizontal tilt load applied to an extension rod or by a vertical pressure load applied to the pressure ring.

9-1.1.2 PAINTING AND MARKING. The outer surface of the mine is painted olive drab. The mine designation, as well as other loading information, is marked in yellow on the top surface of the mine.

9-1.1.3 FITTINGS AND FEATURES. The general physical characteristics of the mine and fuze are shown in figure 9-1. The top cover of the mine is scored in a pattern to facilitate fragmentation of the mine cover. A filling plug seals the filling hole in the side of the mine case. The mine is provided with a carrying strap secured to the side of the mine case.

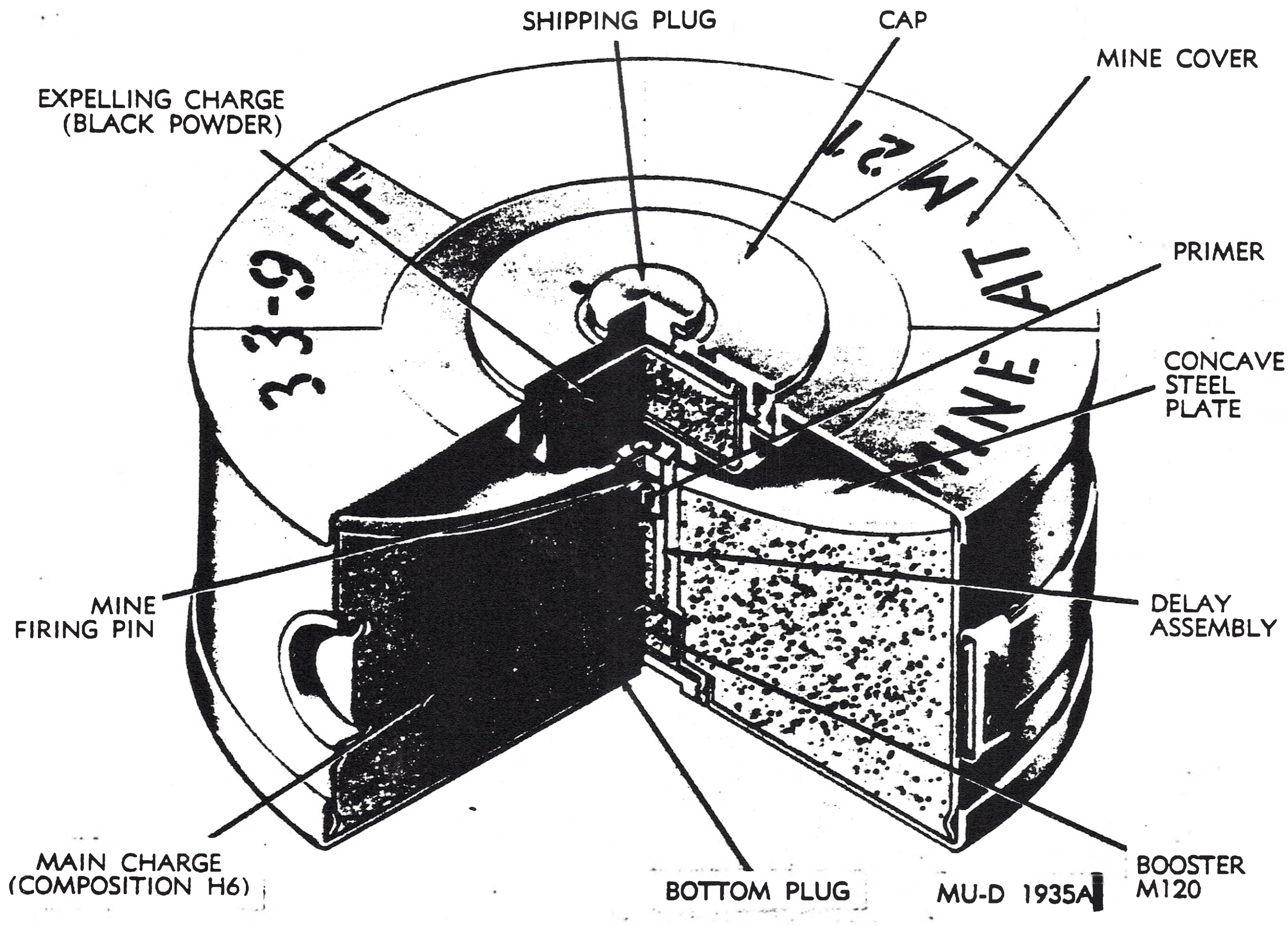

Figure 9–2 Mine M21 (w/o fuze)—Cutaway View.

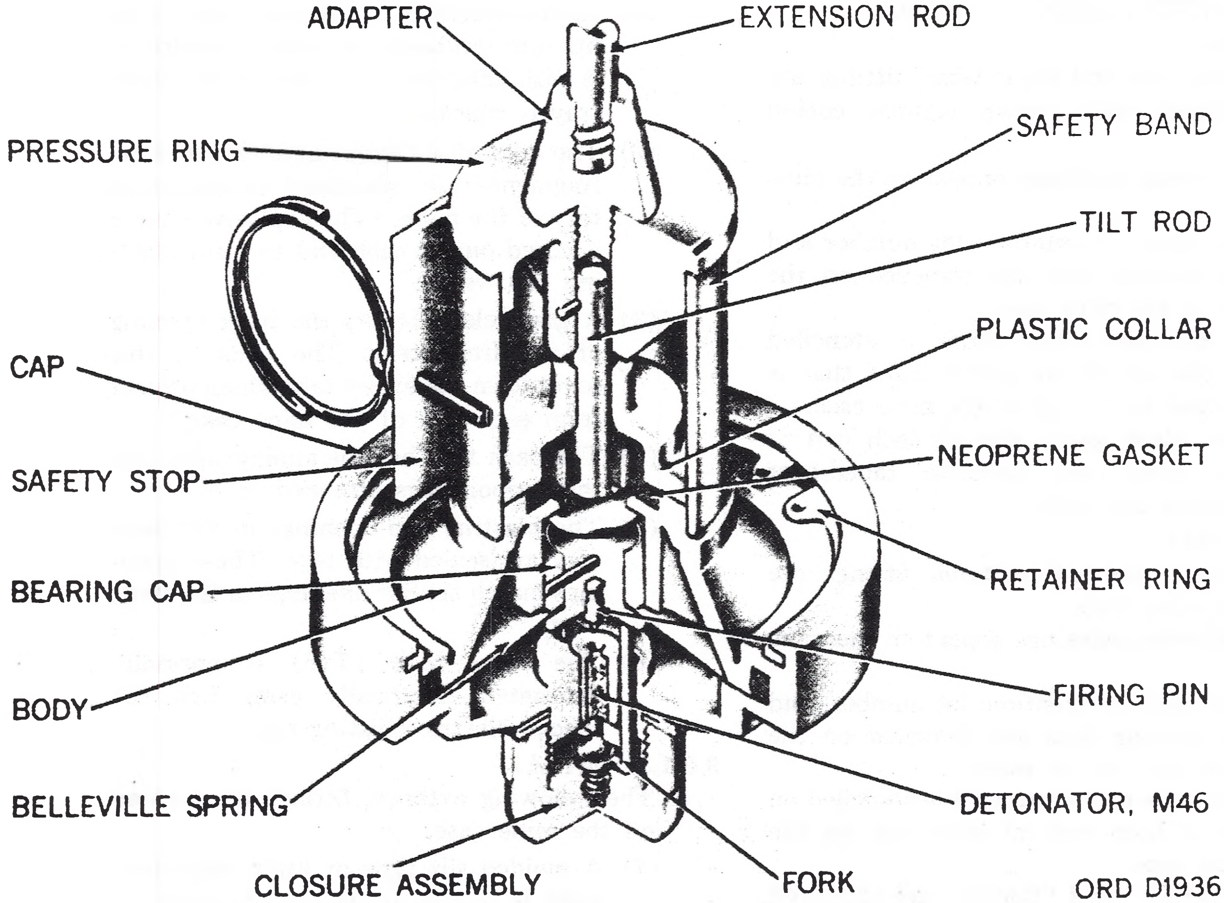

Figure 9-3 Fuze M607 in Unarmed Condition—Cutaway View

9-1.4 SAFETY PRECAUTIONS.

9-1.4.1 The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

9-1.4.2 Carefully investigate for the presence of booby traps.

9-1.4.3 Determine the condition of the fuze.

9-1.4.4 Extreme care should be taken during explosive ordnance disposal operations to see that no part of the body touches the extension rod, since a horizontal force of about 3 to 6 pounds (7° tilt) exerted against the extension rod will detonate the mine.

9-1.4.5 Examine the fuze, particularly the plastic collar, carefully to determine if it has been damaged. If the fuze is found to be damaged, the explosive ordnance disposal procedures should be applied.

9-1.4.6 Never store or transport fuzed mines on top of each other.

9-2 ANTIPERSONNEL MINE

Antipersonnel mine M18 or M18A1 is covered in this paragraph.

9-2.1 IDENTIFICATION.

9-2.1.1 TYPE. The mine M18 (T-48) or M18A1 is a directional, fragmentation, control-fired, electrically (or nonelectrically) initiated antipersonnel mine. This mine may be surface-emplaced or attached to an object.

9-2.1.2 PAINTING AND MARKING.

9-2.1.2.1 M18.

a. The mine case and the external fittings are camouflaged with brown colored cotton flock.

b. The following markings appear on the mine case:

(1) The mine designation, lot number and the loading date are stenciled on the top of the mine case.

(2) A direction-of-fire arrow is stenciled on the top of an aiming sight that is secured to the top of the mine case.

(3) Two black spots, one at each end of the mine case, indicate taped-over blasting cap wells.

9-2.1.2.2 M18A1.

a. The mine case and external fittings are painted olive drab.

b. The following markings appear on the mine case:

(1) The mine designation, lot number, and the loading data are stenciled on the back tray of the mine.

(2) Direction of fire arrows are stenciled on top at both ends of mine case on the mine case.

(3) "FRONT" and "BACK" are indicated on the mine case.

9-2.1.3 FITTINGS AND FEATURES. The general physical characteristics of the mine are shown in figures 9-4, 9-5, and 9-6.

9-2.1.3.1 *M18.*

a. The following external fittings are attached to mine case:

(1) A block-shaped aiming sight, containing a slot sight with a "V" notch, is secured by two metal rivets to the top center of the mine case.

(2) Three folding steel legs are secured by bracket and rivet combination to the bottom of the mine case.

(3) A glass cloth tab containing a metal eyelet projects from each end of the mine case.

b. The mine M18 (T48) case is composed of two laterally curved trays designated as front and back tray.

(1) In the assembled mine, the front tray fits into the back tray and is bonded to it with adhesive. (The face of the front tray is concave.)

(2) The explosive charge and cubical steel fragments are contained in the front tray of the mine. (The explosive charge is cored out at each end to form blasting cap wells.)

(3) A glass cloth covers the back opening of the front tray. The ends of this cover form the eyelet tabs which project from each end of the mine case.

(4) The back tray has the aiming sight and the support legs attached to it.

(5) The blasting cap openings in the back tray are sealed with tape. These openings match similar openings in the front tray.

(6) The mine M18 (T48) is normally detonated electrically using two (2) special electric blasting caps.

9-2.1.3.2 *M18A1.*

a. The following external fittings are located on the mine case.

(1) A molded slit type or knife edge peep sight is located on top of the mine.

(2) Two pairs of scissor-type folding legs are secured by bracket and rivet combinations to the bottom of the mine case.

(3) Two detonator wells located on the top of the mine, are sealed by the plug ends of the shipping plug priming adapters.

b. The mine M18A1 case is composed of two laterally curved trays designated as front and back tray.

(1) In the assembled mine, the front tray fits into the back tray and is bonded to it by adhesive.

(2) The explosive charge and steel spheres are contained in the front of the mine.

(3) The front tray has the aiming sight and the folding legs attached to it.

(4) The blasting cap openings (detonator wells) are located on top of the front tray. These openings are sealed by shipping plug priming adapters.

(5) The mine M18A1 is normally detonated electrically using two (2) special electric blasting caps.

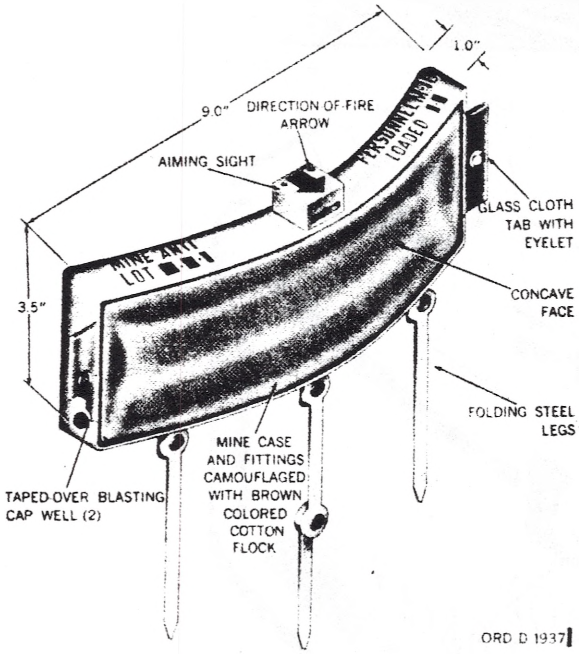

Figure 9-4 Antipersonnel Mine, M18-External view

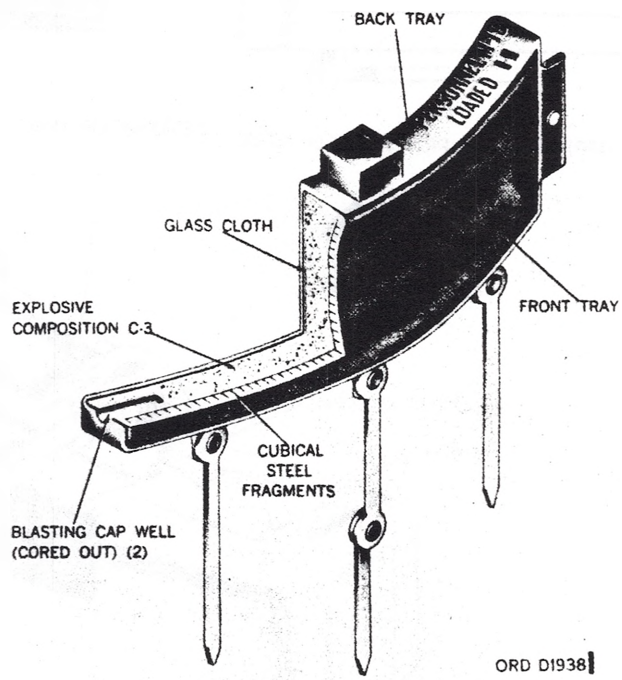

Figure 9-5 Antipersonnel Mine, M18-Cutaway View

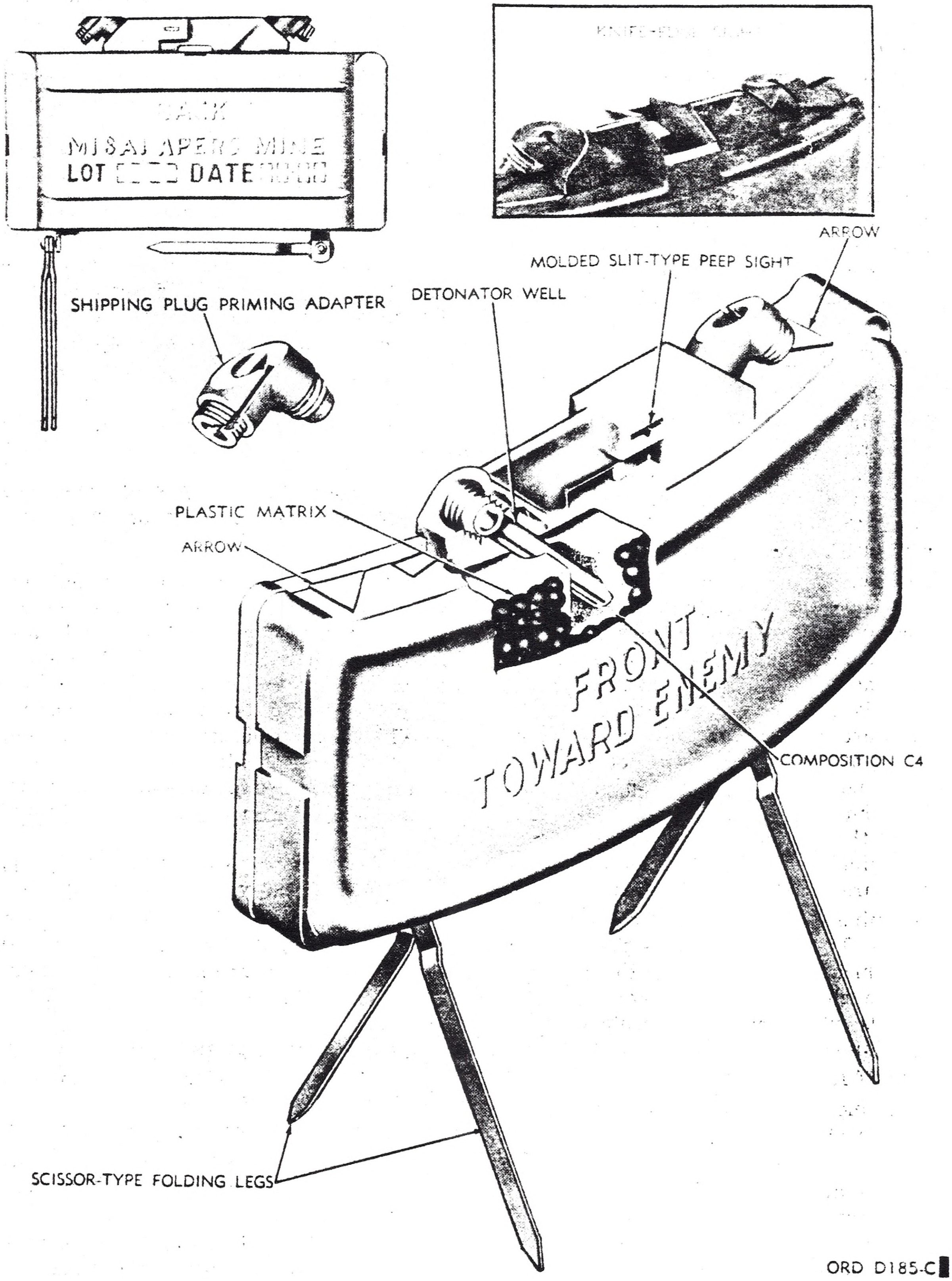

Figure 9-6 Antipersonnel Mine M18A1

9-2.1.4 WEIGHT. The overall weight of the mine M18 including explosive is approximately 2.5 pounds. The mine M18A1 weighs approximately 3.5 pounds.

9-2.1.5 MATERIALS. The mine case is plastic.

9-2.2 HAZARDOUS COMPONENTS. The explosive contained in the mine M18 (T48) is composition C-3; total weight of explosive is approximately 0.8 pound. The mine M18A1 contains approximately 1.5 pounds of composition C-4.

9-2.3 FUNCTIONING.

9-2.3.1 M18.

a. The mine is primed for firing by puncturing a taped-over blasting cap well in the mine case, and inserting a blasting cap in the well. To ensure detonation of the mine, the mine may be double-primed, using both wells and two blasting caps.

b. After being primed, the mine is emplaced and is aimed by sighting through the aiming sight. A stenciled arrow on the aiming sight indicates the direction of fire and travel of fragments. After the mine is emplaced and aimed, its firing leads are laid out carefully to a position which affords safety to the operator of the mine from back blast and from objects hurled around due to back blast when the mine is detonated. Arming of the mine is completed when the firing leads are connected to the firing source.

c. The mine is fired by actuating the firing source. This action initiates the blasting cap which in turn detonates the mine explosive charge. The resultant explosion propels cubical metal fragments outward in a fan-shaped pattern.

9-2.3.2 M18A1.

a. The mine is primed for firing by reversing the shipping plug priming adapters and inserting blasting caps into the wells.

b. The two arrows on top of mine case indicate direction of fire.

c. Refer to subparagraph 9-2.3.1 for other functioning information.

9-2.4 SAFETY PRECAUTIONS.

9-2.4.1 The general safety precautions regarding the approach, attack and disposal of unexploded ordnance must be observed.

9-2.4.2 Positively identify the mine and determine its condition.

9-2.4.3 Approach the mine from the rear. When in the mine area, consider the mine to be armed (until positively determined otherwise) if blasting cap wires, firing lead wires, detonating cord, or time fuse extend in the direction of the suspected mine emplacement.

9-2.4.4 Carefully examine the mine for the presence of boobytraps.

9-2.4.5 Cut and short out blasting cap or firing leads.

9-3 ANTIPERSONNEL MINE, POP-UP, PWP, XM54 WITH FUZE M605 AND/OR ELECTRIC SQUIB M1A1.

9-3.1 IDENTIFICATION.

9-3.1.1 TYPE. The XM54 antipersonnel mine is a combination type mine which may be functioned mechanically by the M605 combination mine fuze or electrically by the M1A1 squib assembly. Either the mine fuze or the squib assembly or both may be assembled to the mine. The XM54 mine consists of the XM55 mine and other components (paragraph 9-3.2). When initiated, the mine pops up and fires, projecting it's PWP filler and metal fragments in all directions.

9-3.1.2 PAINTING AND MARKING. The outer surface of the XM54 mine is light green with a yellow band on the base, and the markings are in light red. The outer surface of the XM55 mine is gray with a yellow band around the circumference, and the markings are in light red.

9-3.1.3 FITTINGS AND FEATURES. The general physical characteristics of the mine and fuze are shown in figure 9-7.

9-3.1.4 WEIGHT AND DIMENSIONS. The mine weighs approximately 30 pounds and is approximately 5 inches high and 13 inches in diameter.

9-3.1.5 MATERIALS. The mine is composed mainly of steel with a plastic cover.

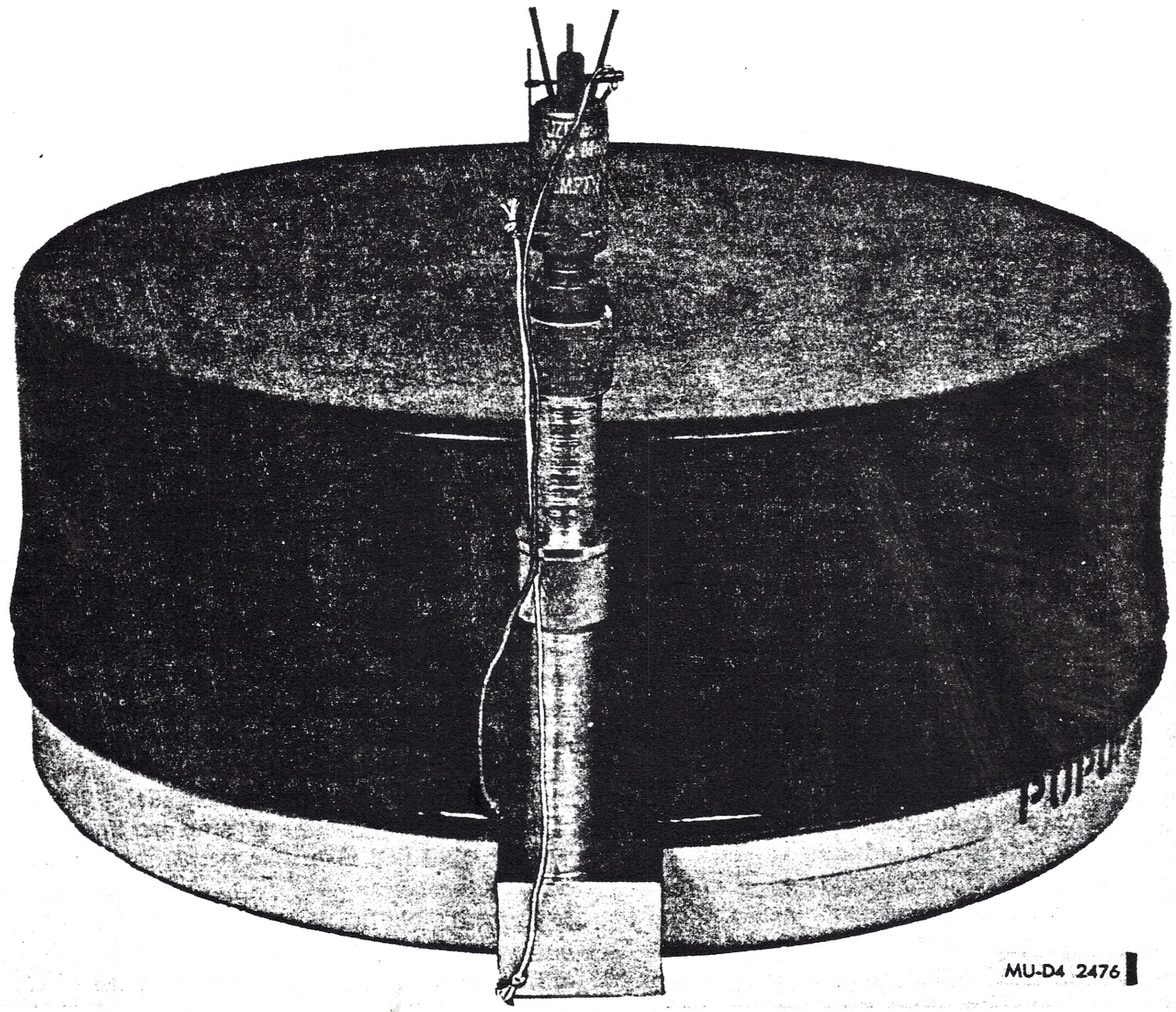

Figure 9-7 XM54 Pop-Up PWP Antipersonnel Mine with M605 Fuze

9-3.2 GENERAL. The XM54 mine (figure 9-8) consists of four major components: the XM44 landmine adapter-projector; the XM55 PWP antipersonnel mine; the M605 combination mine fuze and the M1A1 squib assembly.

9-3.2.1 XM44 Land Mine Adapter-Projector. The XM44 consists of (figure 9-8) a case (1), a cover (2), a fuze holder assembly (17) and a flash tube and igniter mixture (19) as major components. An integral carrying handle (not shown) is located on the bottom of the case.

9-3.2.2 XM55 PWP Antipersonnel Mine. The XM55 mine (3, figure 9-8) contains an M120 booster (7), M38 burster (6) and PWP filling (4).

9-3.2.3 M605 Combination Mine Fuze. The various components of the fuze are shown in figures 9-8 and 9-9.

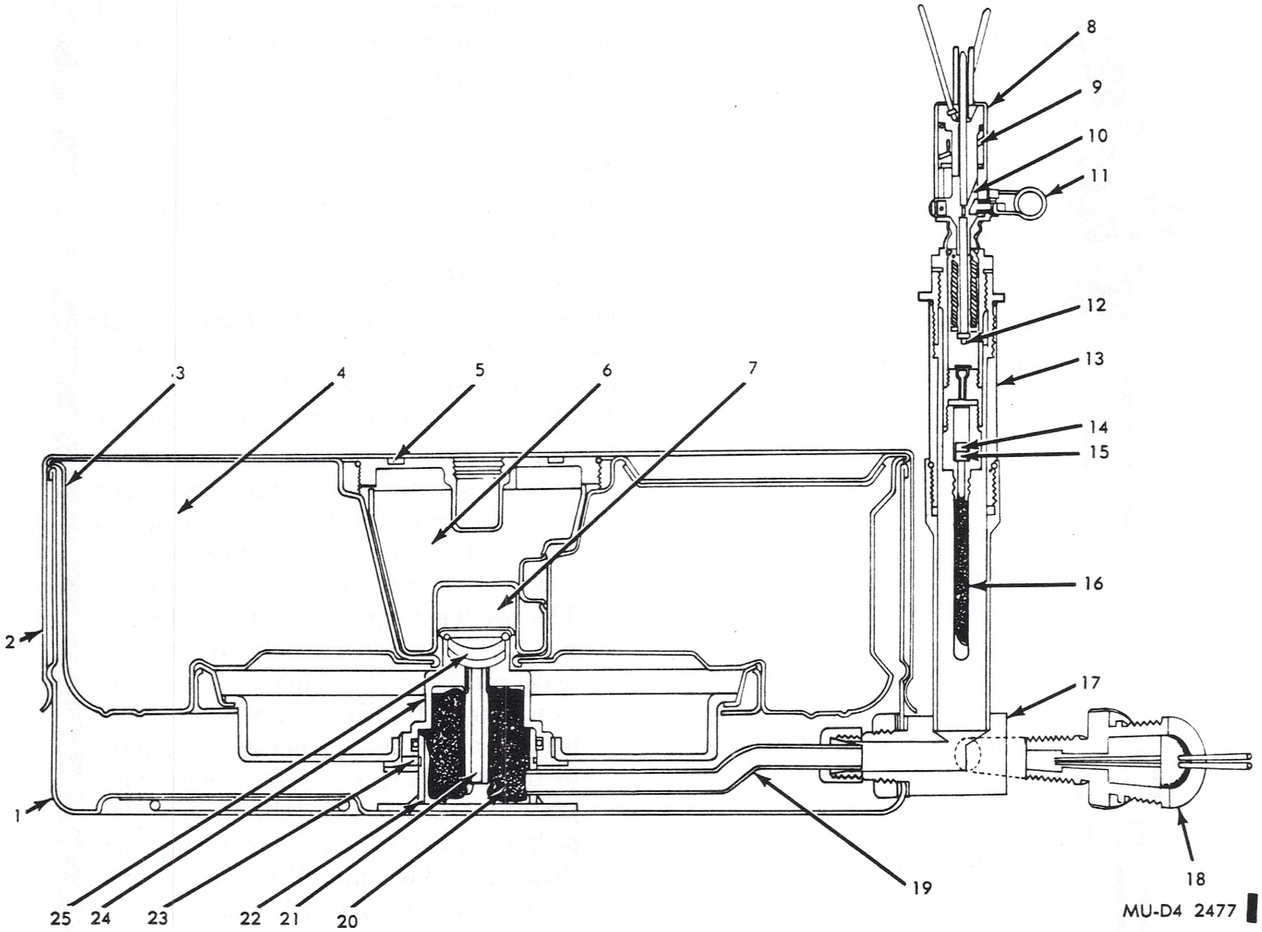

Figure 9-8 XM54 Pop-Up PWP Antipersonnel Mine—Cross-Sectional View

1 Case
2 Cover
3 XM55 PWP Antipersonnel Mine
4 PWP
5 Spanner Wrench Holes
6 M38 Burster
7 M120 Booster
8 M605 Combination Mine Fuze
9 Pressure Spring
10 Trigger Pin
11 Release Pin Ring
12 Firing Pin
13 Fuze Extension
14 Delay Charge
15 Relay Charge
16 Flash Igniter Charge
17 Fuze Holder Assembly
18 M1A1 Squib Assembly
19 Flash Tube and Igniter Mixture
20 Black Powder Propellant Charge
21 Delay Detonator
22 Propulsion Chamber and Tube Assembly
23 Shear Screws
24 Propulsion Chamber
25 Explosive Disks

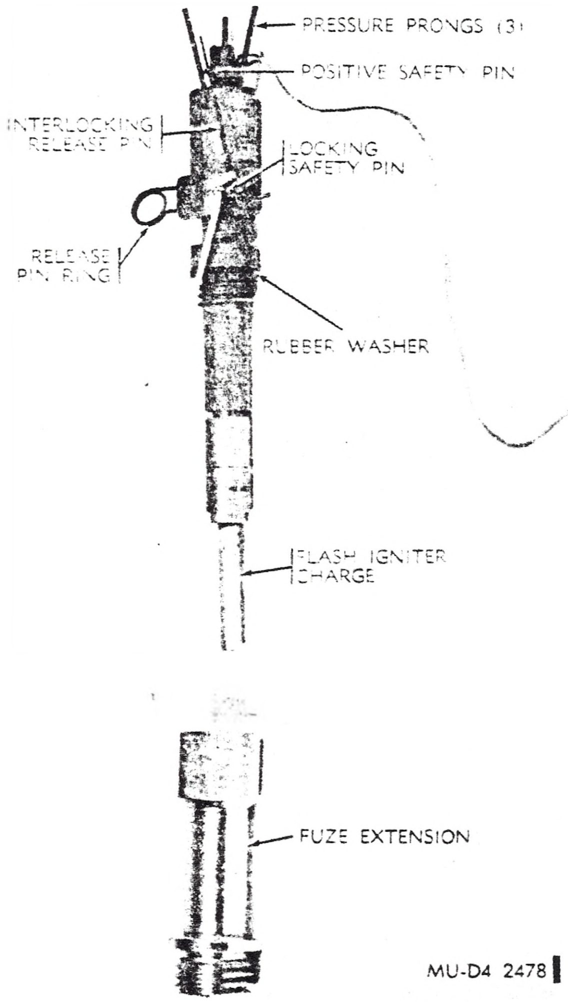

Figure 9-9 M605 Combination Mine Fuze

9-3.2.4 M1A1 Squib Assembly. The components of the squib assembly are shown in figures 9-8 and 9-10. The RF shields are discarded when the squib assembly is used.

9-3.3 HAZARDOUS COMPONENTS.

9-3.3.1 The M605 fuze contains a relay-delay mix and a black powder flash igniter charge.

The XM44 adapter-projector contains an ignition mix of titanium, iron oxide, and zirconium as a slurry, a propellant charge of 15 grams of black powder, a delay detonator of lead azide, barium chromate and RDX and two discs of deta (R) sheet.

The XM55 mine contains 15 pounds of PWP, 12 ounces of Composition B in the M38 burster and 11 grams of RDX in the M120 booster.

NOTE

The mine has a dispersion area of 50 meters and the PWP filling constitutes a fire hazard.

9-3.3.2 FUNCTIONING.

a. M605 Combination Mine Fuze (figure 9-9). This fuze may be functioned by either pressure or pull, as follows, with numbered callouts as shown in figure 9-8:

(1) Pressure. A pressure of 8 to 20 pounds on any one of the three pressure prongs causes the pressure spring (9) to be sufficiently compressed to force the trigger pin (10) downward. The wedge-shaped tip of the trigger pin forces the release pin and the release pin ring (11) outward to a position where the firing pin (12) is released, allowing the firing pin spring to force the firing pin downward, impinging and initiating the primer. The primer initiates the remaining fuze elements consisting of the delay charge (14), relay charge (15), flash igniter charge (16) and the igniter mix slurry (19) in the flash tube. The slurry causes the propellant charge (20) to ignite, which propels the XM55 mine (3) into the air. At the same time, the delay detonator (21) is ignited and when the mine is approximately 10 feet above the ground, the detonator burns through, initiating the explosive disks (25). The disks detonate the M120 booster (7) which, in turn, explodes the M38 burster (6) which causes the shattering of the mine body, projecting the PWP filling and metal fragments in all directions.

(2) Pull. A pull of three to ten pounds on the release pin ring (11) causes the release pin to move to a position where the firing pin (12) is released. The

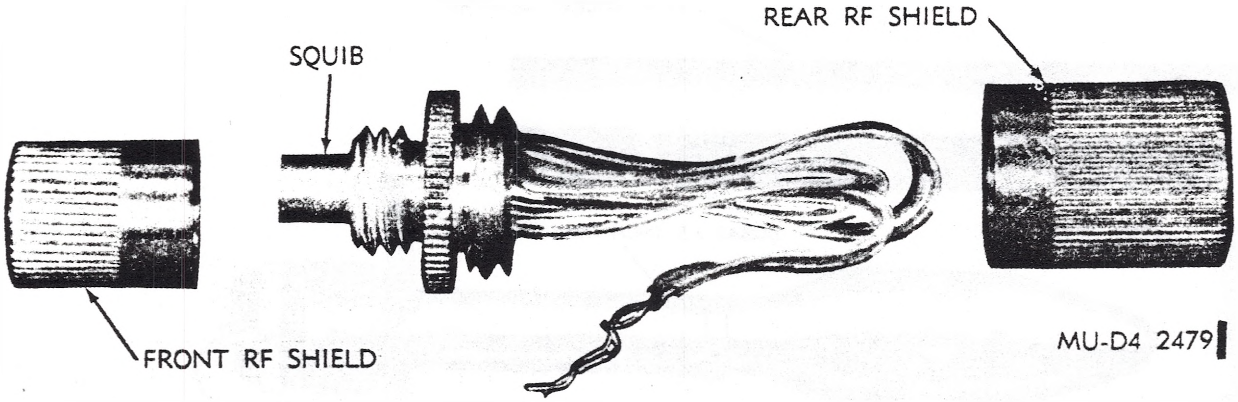

Figure 9–10 M1A1 Squib Assembly

remaining sequence of functioning is identical to that described in paragraph 9–3.3.2a(1).

b. M1A1 Squib Assembly. Electrical energy is applied to the lead wires of the squib (18) causing it to ignite; this, in turn, ignites the igniter charge (19). The remaining sequence of functioning is identical to that described in 9–3.3.2a(1).

9–3.4 SAFETY PRECAUTIONS.

WARNING

The M1A1 squib assembly is susceptible to RF energy.

a. Never place any portion of the body over the mine when performing EOD operations.

b. Damaged XM54 mines must be transported and stored under water.

c. Never cut a taut trip wire until the other end has been examined to see that it is not attached to another mine or boobytrap.

9–4 ANTITANK MINE M24

9–4.1 IDENTIFICATION.

9–4.1.1 TYPE. The M24 antitank mine is a remotely actuated, off route antitank mine system utilizing a 3.5 inch HEAT rocket.

9–4.1.2 PAINTING AND MARKING. The rocket is painted olive drab with markings in yellow.

9–4.1.3 FITTINGS AND FEATURES. The M24 antitank mine consists of an M2 antitank discriminator, an M61 demolition firing device, an M143 rocket launcher, an M28A2 3.5 inch HEAT rocket (all shown in figure 9–11); and an elevation and azimuth sighting assembly (not shown).

a. M2 Antitank Mine Discriminator. The M2 discriminator is composed of pressure sensitive tape, 27 inches long, containing four switch elements. One end of the discriminator is attached to 70 feet of the wire which is designed to connect to the M61 demolition firing device.

b. M61 Demolition Firing Device. The firing device consists of an ARM-SAFE toggle switch, an indicator light, a rocket cable assembly connector, a discriminator wire connector, a battery cover and two BA 30 batteries (figure 9–12).

c. M143 Rocket Launcher. The launcher is a tube of polyvinyl chloride, 24 inches long with walls 1/8 inch thick.

d. M28A2 3.5 Inch HEAT Rocket (figure 9–13). The M28A2 rocket utilizes the M404A1 base detonating fuze (figure 11–

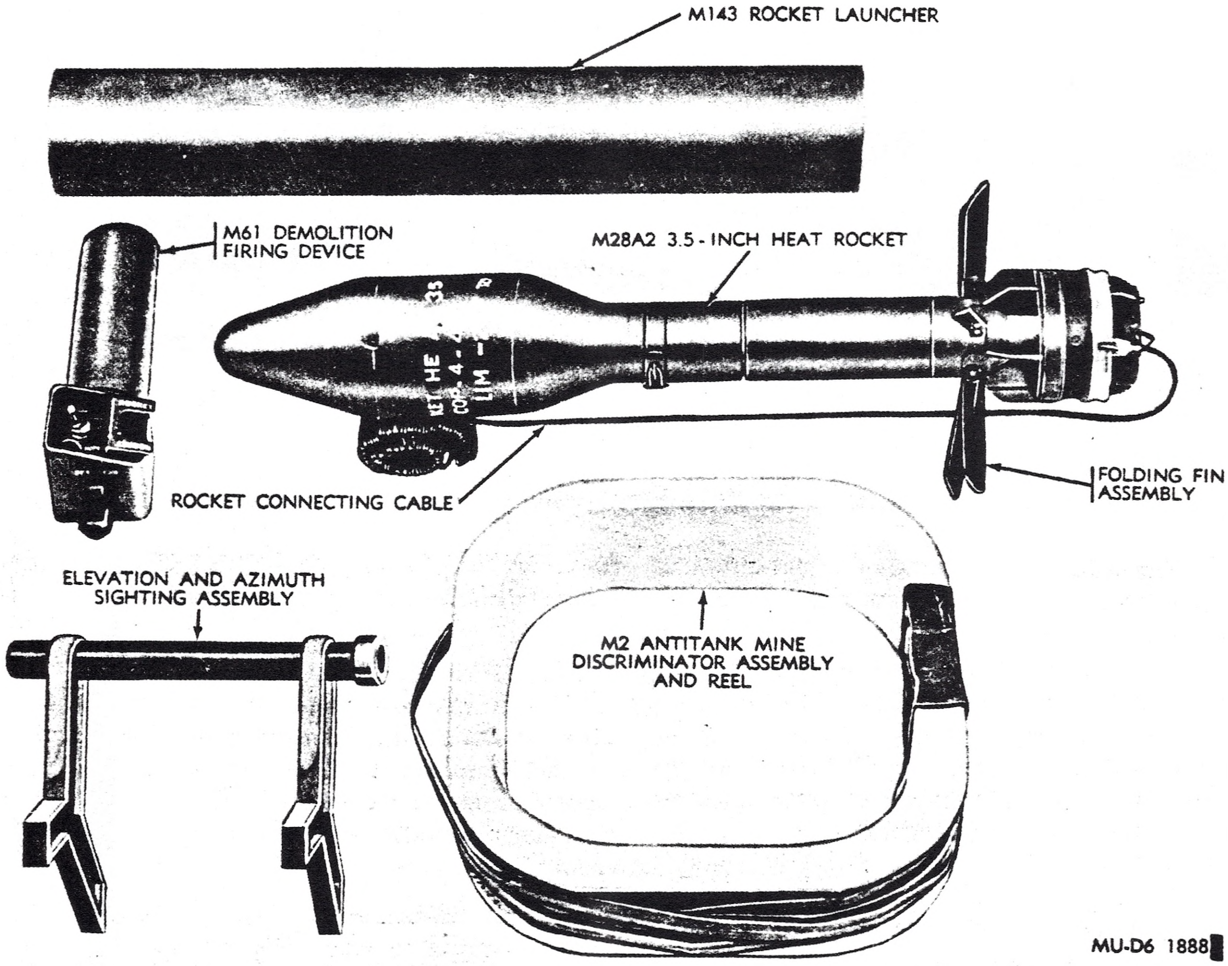

Figure 9-11 M24 Antitank Mine Less the Elevation and Sighting Assembly

29). The fuze arms on setback and functions with a non-delay action on impact. A spring loaded ejection pin prevents movement of the internal parts of the fuze during shipping and handling. The ejection pin is held in place by a safety band which is removed prior to emplacement of the mine. A folding fin assembly with six spring loaded extendable fins has been added to the M28A2 rocket. A 50 foot long rocket cable assembly leads from the rocket motor and terminates in a connector for attachment to the M61 firing device.

e. Elevation and Azimuth Sighting Assembly. The sighting assembly is used to assure proper positioning of the rocket and it's launcher in relation to the target impact area.

9-4.1.4 WEIGHTS AND DIMENSIONS. The M24 antitank mine in it's nylon carrying case weighs 18 pounds. The M28A2 3.5 inch rocket is 23.6 inches long and weighs approximately 9 pounds.

9-4.2 HAZARDOUS COMPONENTS. The M28A2 rocket contains 1.9 pounds of Composition B and .35 pound of propellant.

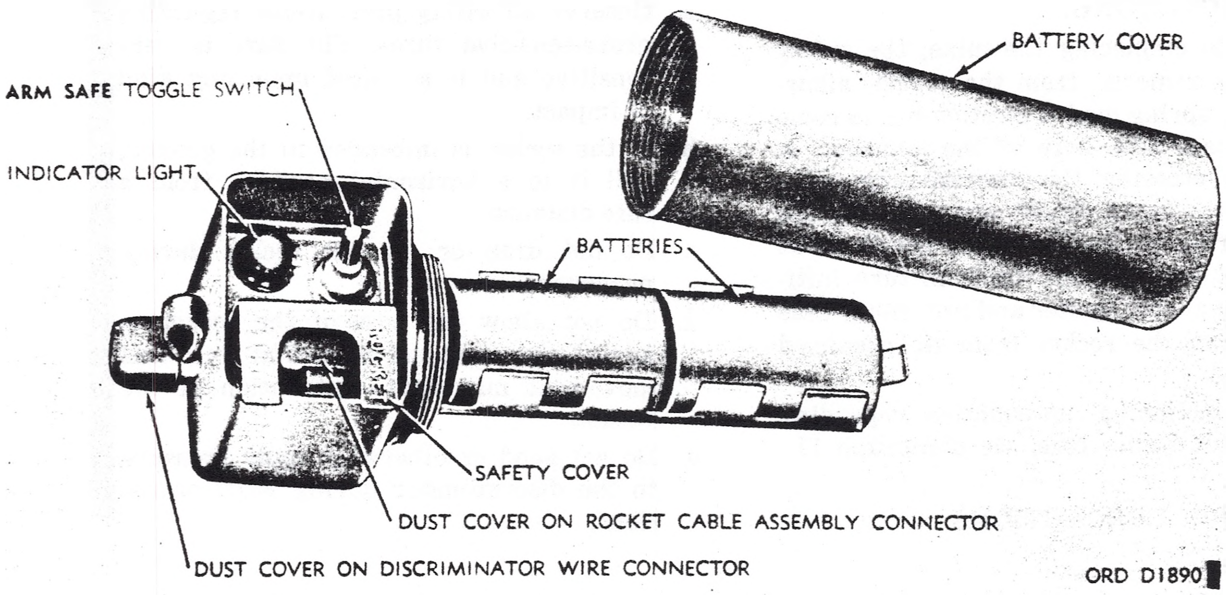

Figure 9–12 M61 Demolition Firing Device

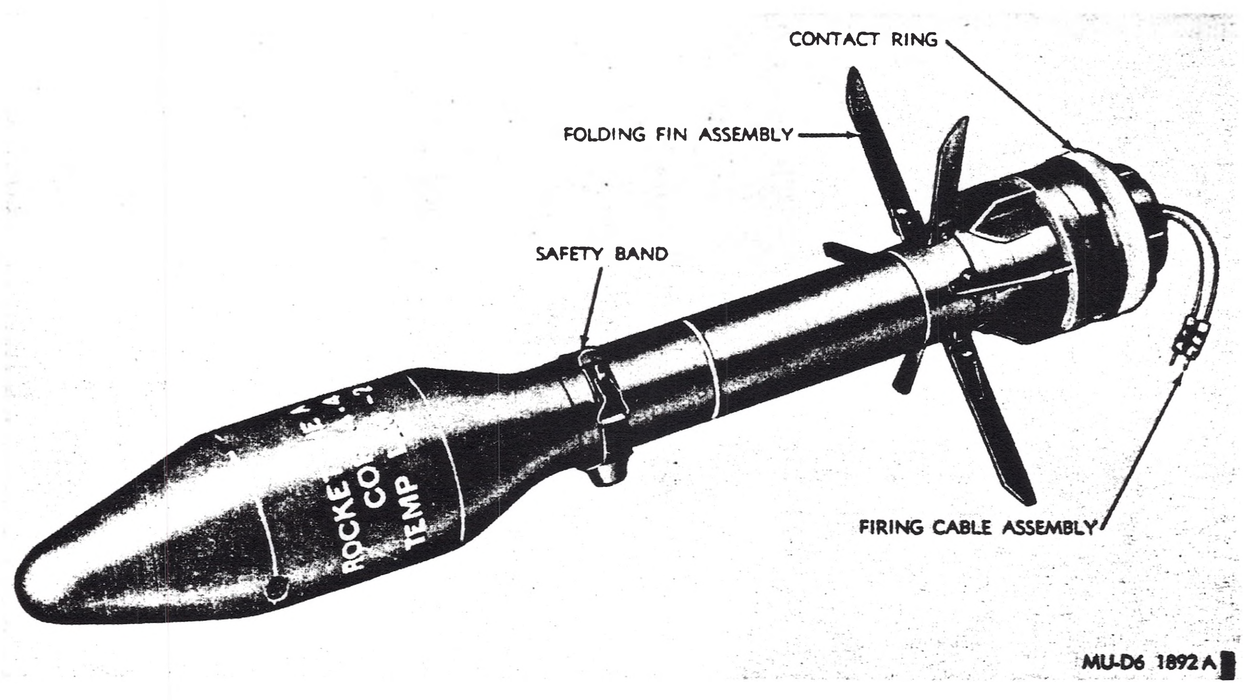

Figure 9–13 M28A2 3.5 Inch HEAT Rocket Modified for M24 Antitank Mine

9-4.3 FUNCTIONING.

a. Prior to emplacing the mine, the safety band is removed from the rocket, allowing the spring loaded ejection pin to come in contact with bore of the launcher. A vehicle crossing the discriminator completes the firing circuit and activates the M61 firing device. The firing device sends current to the squib which in turn initiates the rocket igniter and propellant thus launching the rocket from its preaimed position.

b. For functioning information regarding the M404 Series fuze, see paragraph 11-8.3b.

9-4.4 SAFETY PRECAUTIONS.

a. Observe all safety precautions regarding graze-sensitive fuzes. The fuze is very sensitive and is actuated upon any kind of impact.

b. If the rocket is imbedded in the ground, pull it to a horizontal position from a safe distance.

c. Do not drop or jar the rocket during movement.

d. Do not allow the nose of the rocket to move lower than the horizontal since this movement may cause detonation of the rocket.

e. Do not bend or otherwise apply pressure to the discriminator during EOD operations.

SECTION 10

PYROTECHNICS

10-1 PYROTECHNICS ITEMS

The following pyrotechnic items are covered in this paragraph:

White Aircraft Smoke Signal XM176,

Red Aircraft Smoke Signal XM177,

Green Aircraft Smoke Signal XM178,

Yellow Aircraft Smoke Signal XM179, and

Violet Aircraft Smoke Signal XM180.

10-1.1 IDENTIFICATION.

10-1.1.1 TYPE. These smoke signals are modified, colored smoke hand grenades encased in a metal cylinder. The signals are designed to be hand released from helicopters.

10-1.1.2 PAINTING AND MARKING. The signals are painted light green. The colored signals are marked "Red Smoke," "Green Smoke," "Yellow Smoke," or "Violet Smoke," as applicable. The model designation is also marked on the signal.

10-1.1.3 FITTINGS AND FEATURES.

a. The smoke signals (figures 10-1 and 10-2) are cylindrical tubes, each containing three canisters (modified smoke hand grenades) of the applicable smoke mixture. Signal XM176 (figures 10-1) uses a modified Hand Grenade M8. Signals XM177, XM178, XM179 and XM180 (figures 10-2) use a modified Hand Grenade M18 filled with the appropriate smoke mixture. The modification of the grenades consists of the removal of the fuze assemblies. In addition, Hand Grenade M8 has a hole drilled through the base of the grenade body. A fuze and parachute assembly is contained within a retainer which is affixed to the forward end of the signal. The fuze and parachute assembly provides canister initiation and vertical trajectory.

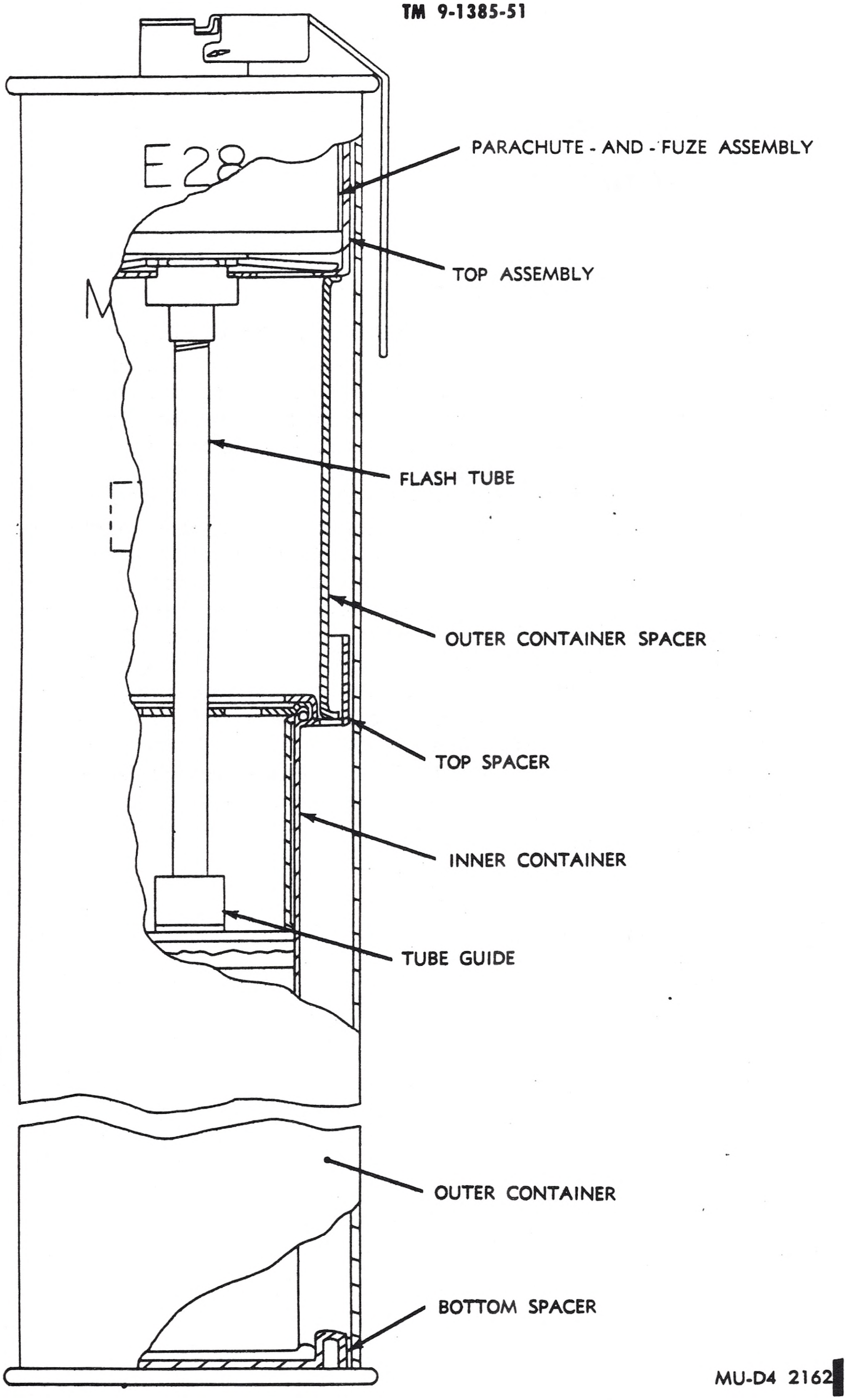

Figure 10-1. White Aircraft Smoke Signal XM176

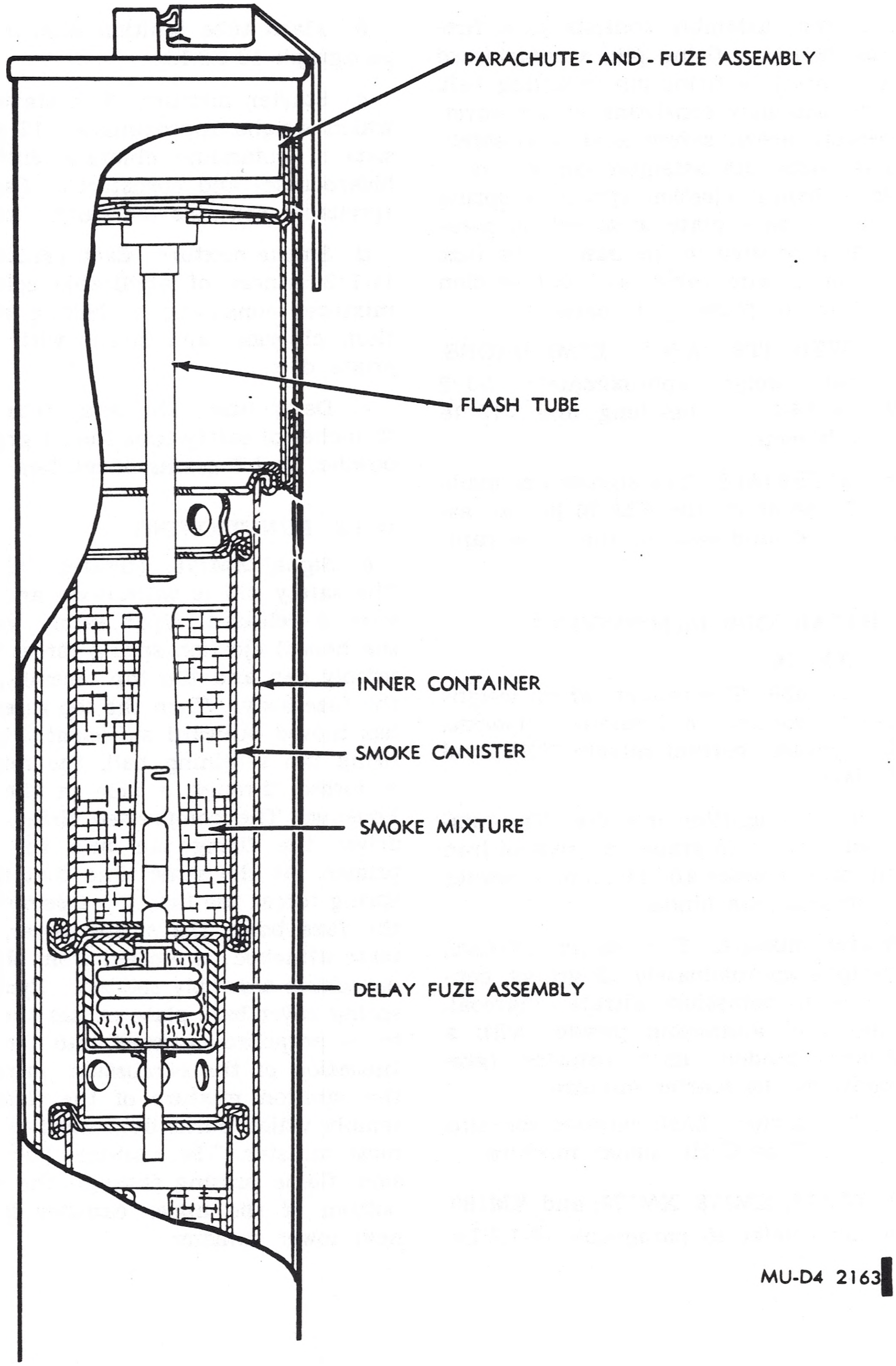

Figure 10-2. Aircraft Smoke Signal: Red XM177, Green XM178, Yellow XM179, or VIOLET XM180

b. The fuze assembly consists of a fuze body that houses a firing pin, a compressed firing-pin spring, a firing-pin retaining ball, and a top assembly consisting of top cover, top assembly sleeve, safety lever, and safety pin. The parachute assembly consists of a retainer, a helical ejection spring, a spring cover with a base plate attached, a parachute that it secured to the base of the fuze assembly by a wire cable, and four-section retainer liner to protect the parachute.

10-1.1.4 WEIGHTS AND DIMENSIONS. The signals weigh approximately 7-1/2 pounds, are 24-1/2 inches long, and 3-13/16 inches in diameter.

10-1.1.5 MATERIALS. The signals are made of steel. In addition, the XM176 has an asbestos sheet around each of the three canisters.

10-1.2 HAZARDOUS COMPONENTS.

10-1.2.1. XM176.

a. Primer M39. The primer, which weighs 0.026 grams, consists of potassium chloride, lead vial cyanide, barium nitrate, TNT, and ground glass.

b. Flash tube ignition mixture. The mixture, which weighs 15 grains, consists of iron oxide, titanium powder and zirconium powder with a nitrocellulose binder.

c. Starter mixture. The starter mixture, which weighs approximately 15 grains, consists of silicon, potassium nitrate, charcoal, iron oxide and aluminum powder with a nitrocellulose binder. Each canister (grenade) contains the starter mixture.

d. Smoke mixture. Each canister contains 19 ounces of Type C HC smoke mixture.

10-1.2.2 XM177, XM178, XM179, and XM180.

a. Primer. Refer to paragraph 10-1.2.1.a.

b. Flash tube ignition mixture. Refer to paragraph 10-1.2.1.b.

c. Starter mixture. The starter mixture, which weighs approximately 12 grains, consists of potassium chlorate, sulfur, sodium bicarbonate, and cornstarch. Each canister (grenade) contains the starter mixture.

d. Smoke mixture. Each canister contains 11-1/2 ounces of applicable colored smoke mixtures consisting of baking soda, potassium chloride, and sulfur with the appropriate dye.

e. Delay fuze. The delay fuze consists of 19 inches of safety time fuse, 1 grain of black powder, and 3 grains of ignition mixture.

10-1.3 FUNCTIONING.

a. Signal XM176. (figures 10-3 and 10-4). The safety pin is withdrawn and the safety lever is released. Upon safety lever release, the helical ejection spring forces the top assembly cap and the top assembly sleeve off the fuze body. When the top assembly sleeve has moved outward sufficiently to clear the firing pin retaining ball, the retaining ball is forced through a hole in the fuze body housing. The compressed firing pin spring drives the firing pin into the percussion primer. At the same time that the ejection spring forces the fuze top assembly cap from the fuze body, the spring cover, with base plate attached, is ejected from the fuze and parachute assembly retainer. Ejection of the spring cover base plate causes the parachute to be propelled outward into the airstream. Initiation of the percussion primer ignites the ignition mixture of the flash tube assembly which burns downward to the uppermost canister. The canisters burn in succession, flame passing through the hole in the bottom of the upper canister igniting the next lower canister.

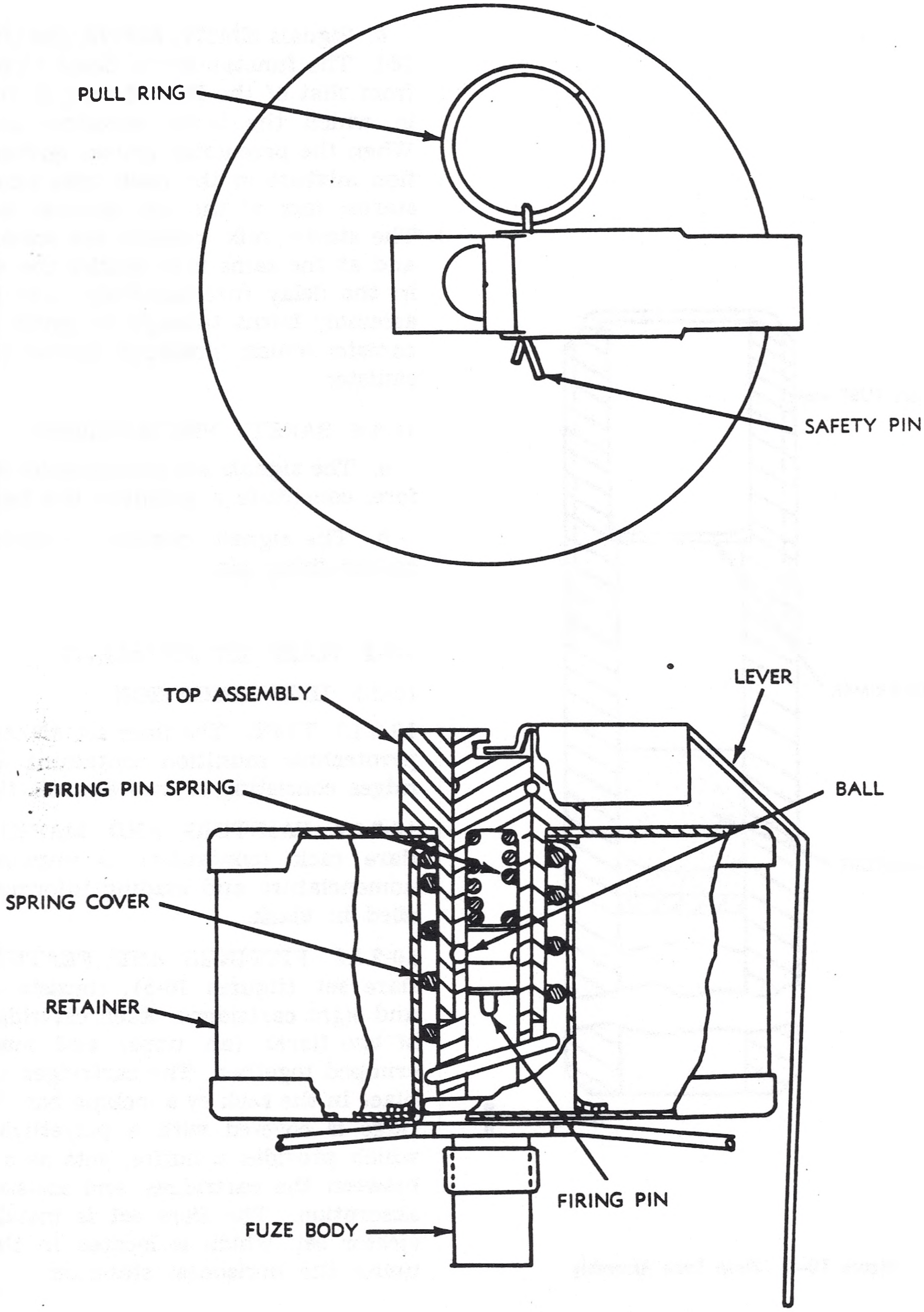

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Figure 10-3. Parachute-And-Fuze Assembly.

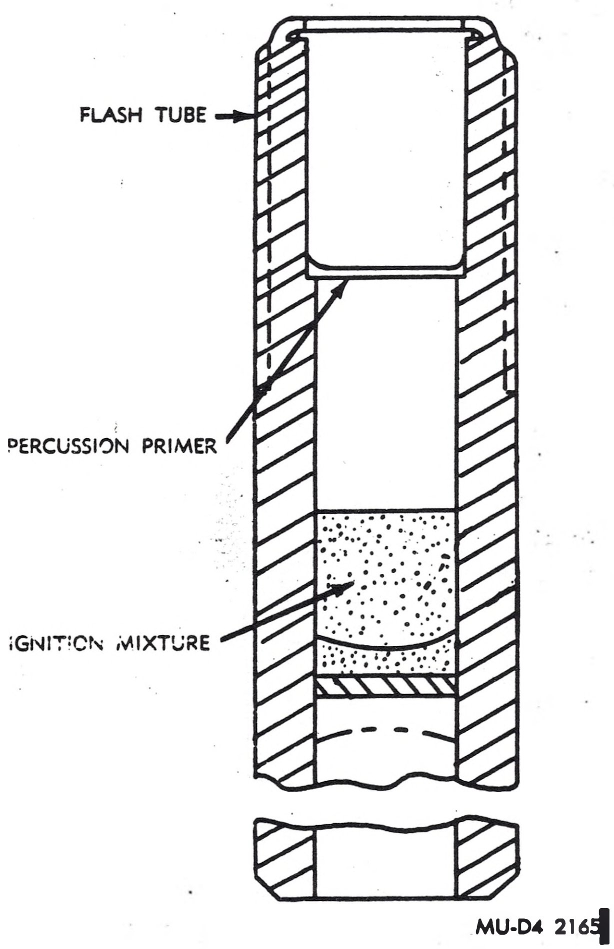

Figure 10-4. Flash Tube Assembly

b. Signals XM177, XM178, XM179 and XM-180. The functioning of these signals differs from that of the XM176 only in the manner in which the lower canisters are ignited. When the percussion primer ignites the ignition mixture in the flash tube assembly, the starter mix of the top canister is initiated. The starter mix initiates the smoke mixture and at the same time ignites the safety fuse in the delay fuze assembly. The delay fuze assembly burns through to ignite the center canister which, similarly, ignites the bottom canister.

10-1.4 SAFETY PRECAUTIONS.

a. The signals are pyrotechnics and, therefore, constitute a potential fire hazard.

b. The signals contain a spring-loaded-cocked firing pin.

10-2 FLARE SET AN/ALA-17

10-2.1 IDENTIFICATION.

10-2.1.1 TYPE. The flare set AN/ALA-17 is a pyrotechnic munition containing eight cartridges consisting of two aircraft flares each.

10-2.1.2 PAINTING AND MARKING. The flare rack (container) is unpainted, with nomenclature and loading information stenciled in black.

10-2.1.3 FITTINGS AND FEATURES. The flare set (figures 10-5), consists of a rack and eight cartridges. Each cartridge consists of two flares (an upper and lower flare), crimped together. The cartridges are held in place in the rack by a locking bar. Each cartridge is covered with a polyethylene sleeve which provides a buffer, acts as a lubricant between the cartridges, and assists in shock absorption. The flare set is installed in an ejector set, which is located in the aircraft under the horizontal stabilizer.

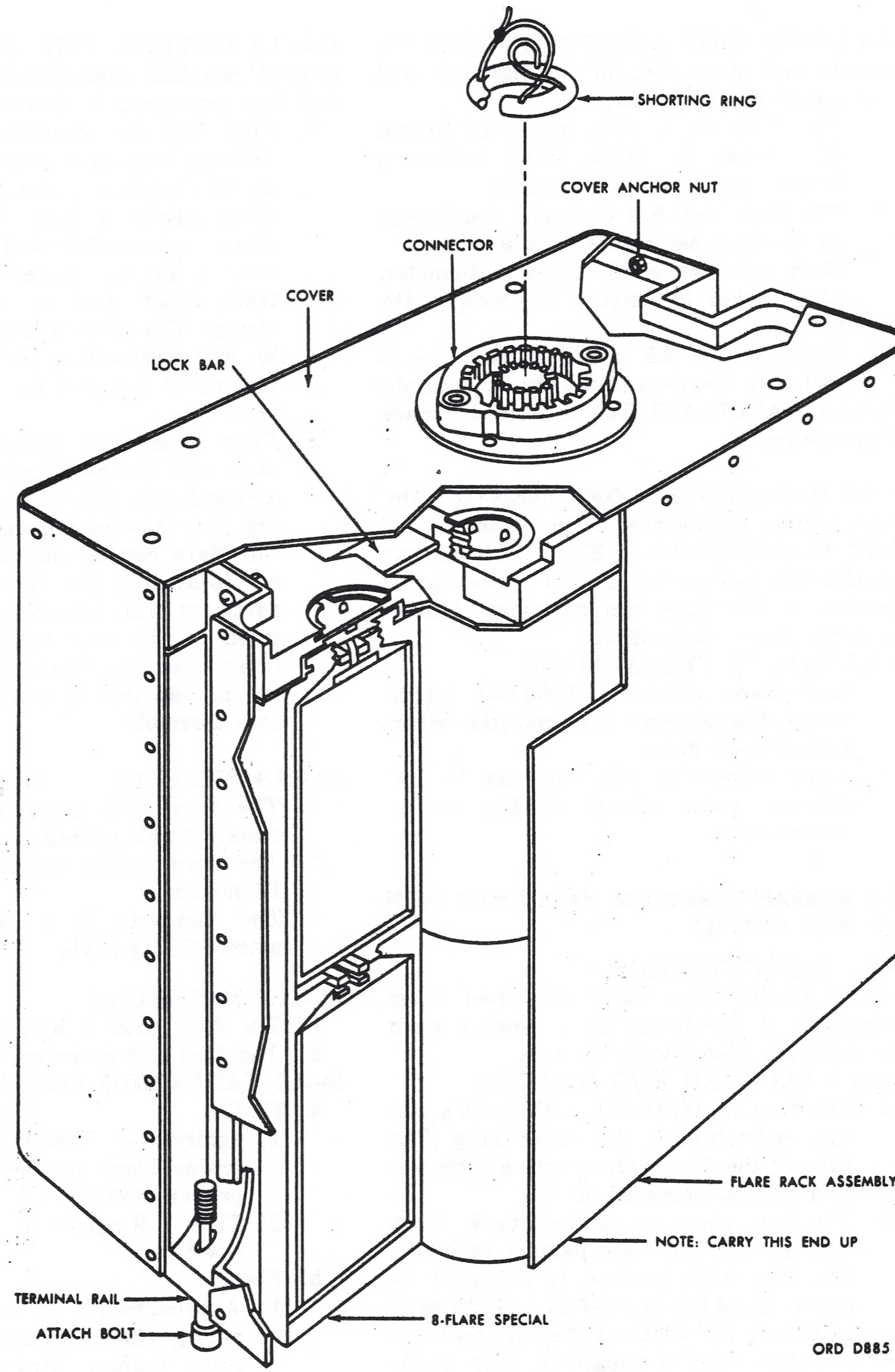

Figure 10-5 Flare Set AN/ALA-17

10–2.1.4 WEIGHTS AND DIMENSIONS. The weights and dimensions of the flare set and components are as follows:

a. The flare set is 12½ inches in length, 5⅝ inches in width, 12½ inches in height, and weighs 41 pounds.

b. The flare rack has the same dimensions as the flare set and weighs 9 pounds.

c. Each cartridge is 2.7 inches in diameter, 11¾ inches in length, and weighs 4¼ pounds.

d. Each flare is 2.5 inches in diameter, 5 inches in length, and weighs 1½ pounds.

10–2.1.5 MATERIALS. The flare rack is made of aluminum.

10–2.2 HAZARDOUS COMPONENTS. The flares contain pyrotechnic compositions.

10–2.3 FUNCTIONING. Electrical current initiates the ejection of one or more flares. Ejection of the flare simultaneously ignites the pyrotechnic composition.

10–2.4 SAFETY PRECAUTIONS.

a. Each flare generates 8,000,000 candle power. Use adequate eye protection when disposing of flares.

b. Avoid subjecting the flare set to RF energies, static electric charges, or excessive heat.

10–3 AIRCRAFT PARACHUTE FLARE XM182 WITH TIME FUZE XM590E2

10–3.1 IDENTIFICATION.

10–3.1.1 TYPE. The flare, dispensed from helicopters, is functioned by a powder train time fuze, for illuminating an area.

10–3.1.2 PAINTING AND MARKING.

a. The fuze is unpainted, with a time setting indicator on the upper ring. The base of the fuze body contains time setting figures embossed on it.

b. The fuze cover is painted black. Drop settings (in feet) are painted in white. The fuze safe position is indicated by the word SAFE printed on a white band extending the width of the safe position.

c. The flare body is unpainted, with markings on the body and decal in black.

10–3.1.3 FITTINGS AND FEATURES. The general physical characteristics of the flare and fuze are shown in figures 10–6 and 10–7.

a. *Fuze.* The fuze consists of a domed cylindrical fuze cover with a pull cable assembly, a shear sleeve connector, and a shear sleeve; a head that contains the firing pin assembly; and a body that contains a primer, upper and lower time train rings, and an expelling-ignition charge. The cover is attached to the fuze by five screws that thread through the fuze cover and into the lower time train ring.

b. *Flare.* The flare consists of an outer case, with a fuze adapter secured to the forward end, and an inner case consisting of a forward and rear compartment. The flare candle and ignition assembly are located in the forward inner compartment. The parachute assembly is located in the rear compartment of the inner case. The inner case is sealed by an end cap that is crimped to the outer case assembly.

10–3.1.4 WEIGHTS.

a. The fuze with cover weighs approximately three pounds.

b. The flare candle weighs approximately 17 pounds.

c. The complete flare weighs approximately 27.5 pounds.

10–3.1.5 MATERIALS.

a. The flare body is aluminum.

b. The fuze and cover are aluminum.

10–3.2 HAZARDOUS COMPONENTS.

a. FUZE.

(1) Ignition — Expelling Charge — 75 grains black powder and percussion primer M39A1.

(2) Time Rings—105 grains black powder.

b. Flare.

(1) Approximately 16 pounds of illuminating charge consisting of magnesium, sodium nitrate, and a binder solution.

(2) Approximately ¼-pound first fire charge consisting of a barium-nitrate mixture.

10-3.3 FUNCTIONING. Prior to release of the flare from the dispensing device, the fuze is set for the delay (feet of drop) and the safety pin is withdrawn. Upon release from the aircraft flare dispenser, pull is transmitted through the pull cable assembly to the shear sleeve connector, causing the shear sleeve to move upward. When the pull exerted exceeds 400 pounds, the shear pin is broken. The retaining pin, which is attached to the firing pin by a slip-joint coupling, moves upward, compressing the firing pin spring. When the slip-joint coupling of the retaining pin and firing pin reaches the retainer cavity, the firing pin is released from the retaining pin. The compressed firing pin spring drives the firing pin into the primer, initiating the powder train time delay upper ring. The powder train time delay rings burn through the preset time and ignite the ejection-ignition charge. The ejection-ignition charge of the fuze simultaneously ignites the candle and ejects the candle and parachute assemblies from the outer case. Upon clearing the outer case, the split inner case separates, allowing the parachute to deploy.

10-3.4 SAFETY PRECAUTIONS.

a. Since the flare produces an average of 2,000,000 candle power, do not look at an ignited flare without adequate eye shielding.

b. The flare is a base ejection type munition. Do not stand or place any part of the body directly to the rear of an armed flare.

c. The flare presents a fire hazard as well as a missile hazard.

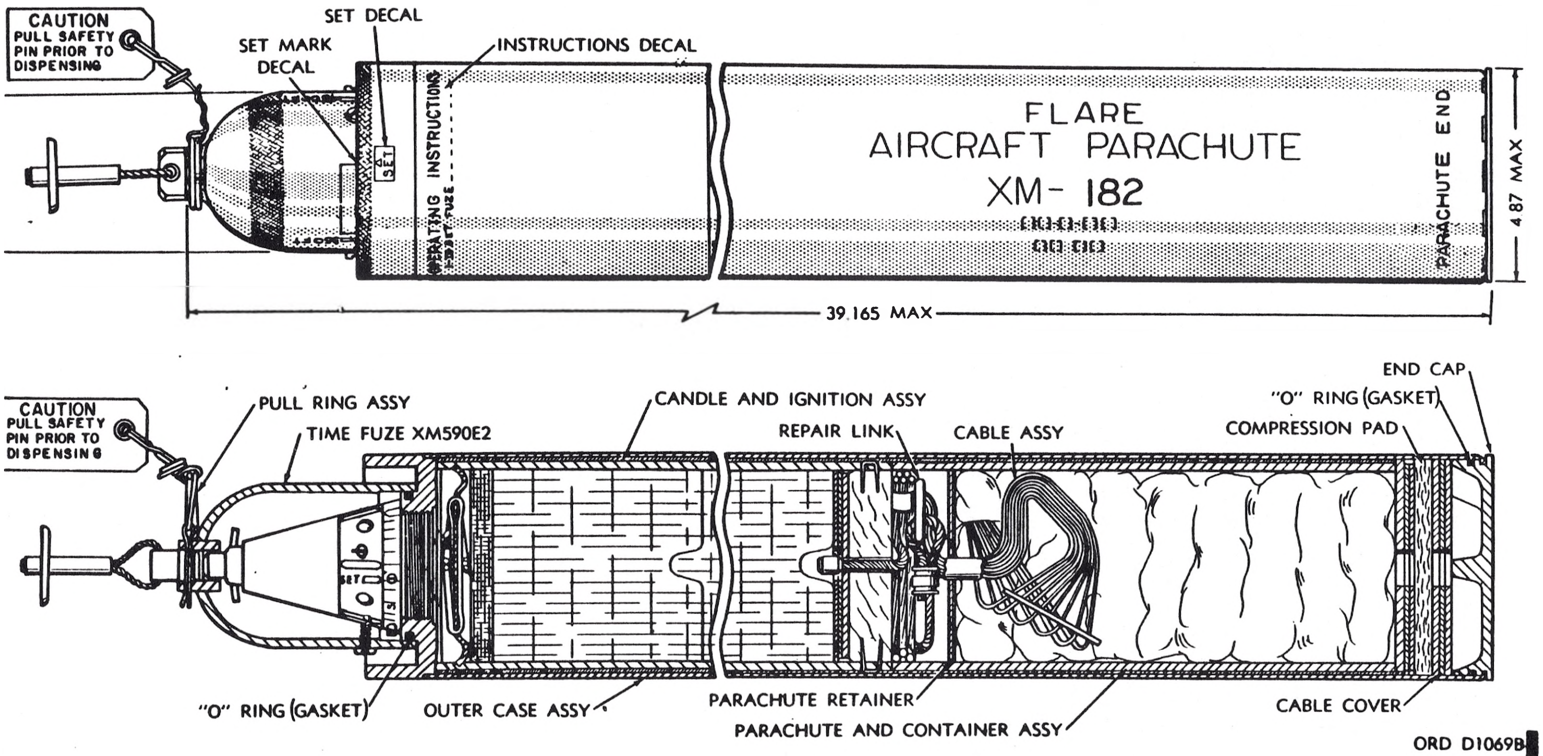

Figure 10–6 Aircraft Parachute Flare XM182

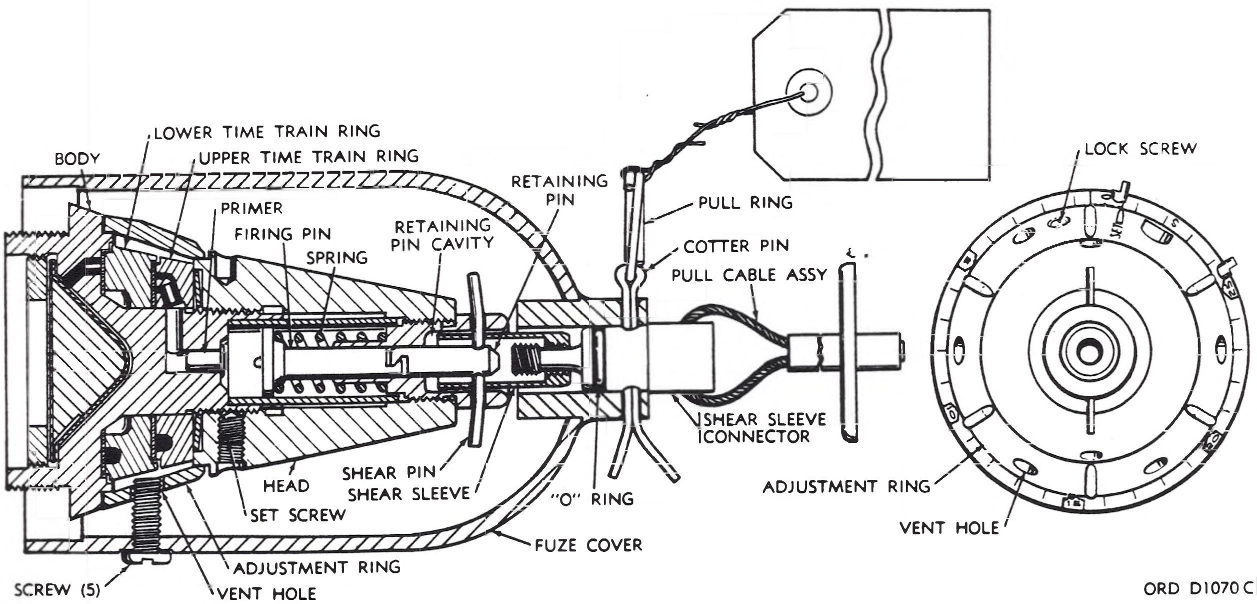

Figure 10–7 Time Fuze XM590E2

10–4. CARTRIDGES, PHOTOFLASH, M112, M112A1, M121, M123A1, M124 and XM185 and XM186.

10–4.1 GENERAL. Photoflash cartridges used as a source of light for aerial photography during reconnaissance missions. They are automatically fired from either a multibarreled ejector (for M112, M112A1, M121, XM185, and XM186 cartridges), or an outer-case type ejector (for M123A, or 124 Cartridges).

WARNING

Photoflash cartridges must never be stored in the ejector, near open flames, or potential fire hazards.

10–4.2 IDENTIFICATION.

10–4.2.1 TYPE

a. M112 Series. These cartridges, when fired, and after a delay time of one, two, or four seconds, produce a flash having an average peak of approximately 100 million candlepower.

b. M121. This cartridge simulates the M112 Series Cartridge and is used as a practice round. It is fired from the same ejector as the M112 Series Cartridge.

c. M123A1. This cartridge, when fired and after a delay time of two, four, or six seconds, produces a flash having an average peak of approximately 260 million candlepower.

d. M124. This cartridge simulates the M123-A1 and is used as a practice round. It is fired from the same ejector as the M123A1 Cartridge.

e. XM185. This cartridge is electrically initiated. When fired after a delay time of two, four, or six seconds, produces a flash of approximately 600 million candlepower.

f. XM186. This cartridge is used as a practice round, designed for pilot training, it does not have an illuminating capability. Externally the XM186 differs from the XM185 in marking only.

10–4.2.2 PAINTING AND MARKING. The aluminum cartridge cases are unpainted. The item name, delay, model number and other pertinent data are marked in black.

10–4.2.3 FITTINGS AND FEATURES.

a. The M112, M112A1 and M121 Cartridges are 1.57 inch in diameter and 7.73 inches long. The M112 and M112A1 Cartridges have an inner photoflash charge case containing 7.0 ounces of photoflash powder, and a powder train delay fuse having a delay time as specified on the cartridge case. The cartridge case has an electric primer and a small propelling charge at the base end. The mouth end of the cartridge is closed with a steel cap. The electric primer is protected from accidental firing during storage, shipment and handling by a shunting clip, which is removed just prior to loading the cartridge into the ejector (figure 10–8).

b. The M121 Cartridge consists of a dummy charge assembled in a cartridge case containing a small propelling charge. No fuse is used. The dummy charge consists of a soft wood filler housing a steel bar to meet the weight requirements of the cartridge. The cartridge has an electric primer which is protected with a shunting clip (figure 10–9).

c. The M123A1 and M124 Cartridges are 2.88 inches in diameter and 8.45 inches long. The M123A1 has an inner photoflash charge case containing 1.75 pounds of photoflash powder, and a powder train delay fuse having a delay time as specified on the cartridge case. The remaining features of the M123A1 Cartridges are similar to the M112 Series Cartridges (figure 10–10).

d. The M124 Cartridge consists of an inert charge contained in an inner charge case which is assembled in a cartridge case containing a small propelling charge. No fuse is used. The inert charge consists of a filler meeting the weight requirements of the cartridge. The cartridge has an electric primer which is protected with a shunting clip (figure 10–11).

e. The XM185 and XM186 cartridges are approximately 11.75 inches long and 3.4 inches in diameter. Both are ejected from the same type of ejector. The XM185 (figure 10–11.1) consists of a cartridge case and an inner charge case. The inner charge case contains a burster, an explosive relay, a delay element, and the photoflash mixture. The cartridge case contains an expelling charge and an electric primer. The XM186 differs from the XM185 in that the inner charge case is inert loaded.

10–4.2.4 WEIGHTS. The M112 Series and M121 Cartridges weigh approximately 16.4 ounces. The M123A1 and M124 Cartridges weigh approxi-

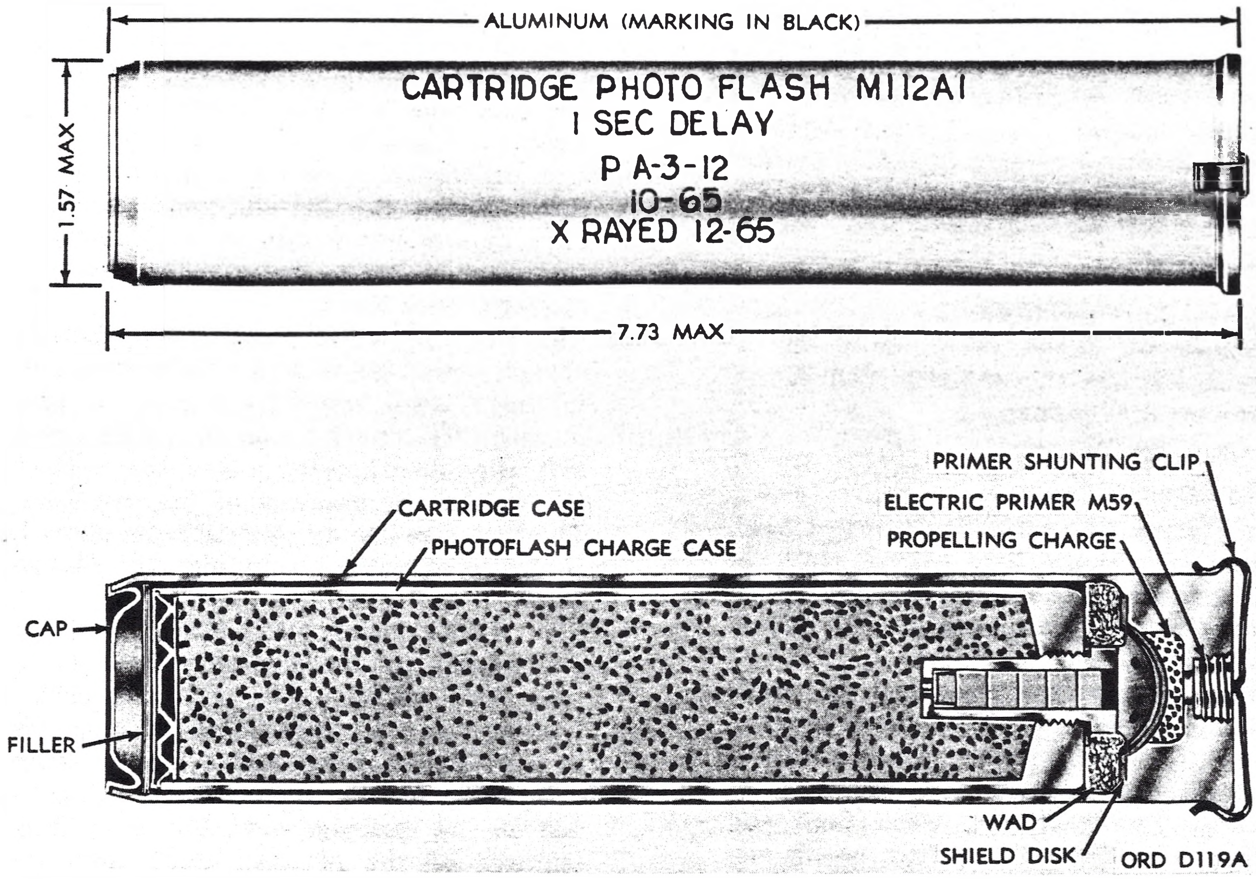

Figure 10–8. Cartridge, Photoflash, M112A1, 1 Sec. Delay.

mately 4.3 pounds. The XM185 cartridge weighs approximately 4 pounds.

10–4.3 HAZARDOUS COMPONENTS. The M-112 Series and M123A1 complete cartridges contain an electric primer (M59), a black powder propelling charge, a delay charge and the photoflash charge. The M123A1 2 Sec. Delay also contains a detonator. The M121 and M124 Cartridge contain only the primer and propelling charge. The XM185 Cartridge contains an electric primer, an expelling charge containing 5.6 grams of black powder, a delay charge, an explosive relay containing lead azide and lead styphnate, a burster containing 1 ounce of boron potassium nitrate and RDX, and a 3.5 pound photoflash mixture composed of magnesium powder, potassium chlorate and barium nitrate. The XM186 Cartridge contains an electric primer and a 5.6 gram expelling charge. The inner charge case is inert.

10–4.4 FUNCTIONING

a. M112 Series. Prior to loading these cartridges in the ejector, the primer shunting clip is removed. Electric current, controlled by an intervalometer in the aircraft, fires the electric primer. This, in turn, ignites the propelling charge which effects the inner charge case containing photoflash power and ignites the delay charge, which is part of the inner charge case. At the end of the delay, the photoflash charge explodes, illuminating the area with sufficient brilliance for night photography.

b. M123A1. This cartridge operates in a manner similar to the M112 Series, differing mainly in the type of fuse used and in its size, shape, and weight.

c. M121. This practice cartridge is fired from the same ejector as the M112 Series Cartridges, but contains no delay fuse or photoflash power.

d. M124. This practice cartridge is fired fror the same ejector as the M123A1 Cartridge, but contains no delay fuse or photoflash power.

10-4.5 SAFETY PRECAUTIONS.

a. Do not look at an ignited cartridge without adequate eye shielding.

b. Do not remove a primer shunting clip except just prior to loading into an ejector.

c. Do not store in the ejector, near open flame, or potential fire hazards.

d. Photoflash cartridges, including the practice rounds, must also be considered as a missile hazard.

e. XM185. Prior to loading the cartridges into a multi-barrel ejector on the aircraft, the primer shunting clip is removed. Aircraft current controlled by an intervalometer initiates the electric primer. The primer ignites the expelling charge which ejects the inner charge case and simultaneously ignites the delay charge. At the end of the delay period (2, 4, or 6 seconds), the explosive relay is initiated, functioning the burster, and photoflash mixture.

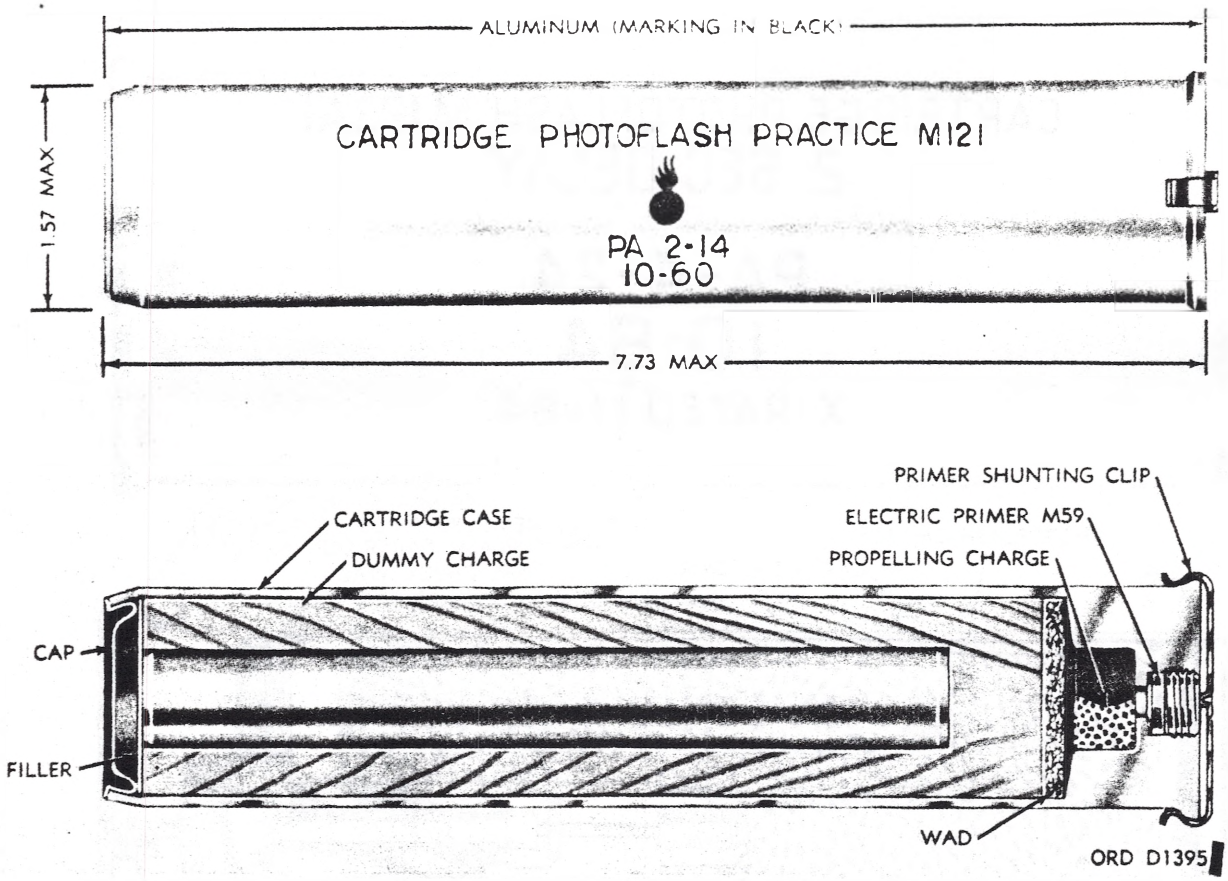

Figure 10–9. Cartridge, Photoflash, Practice, M121

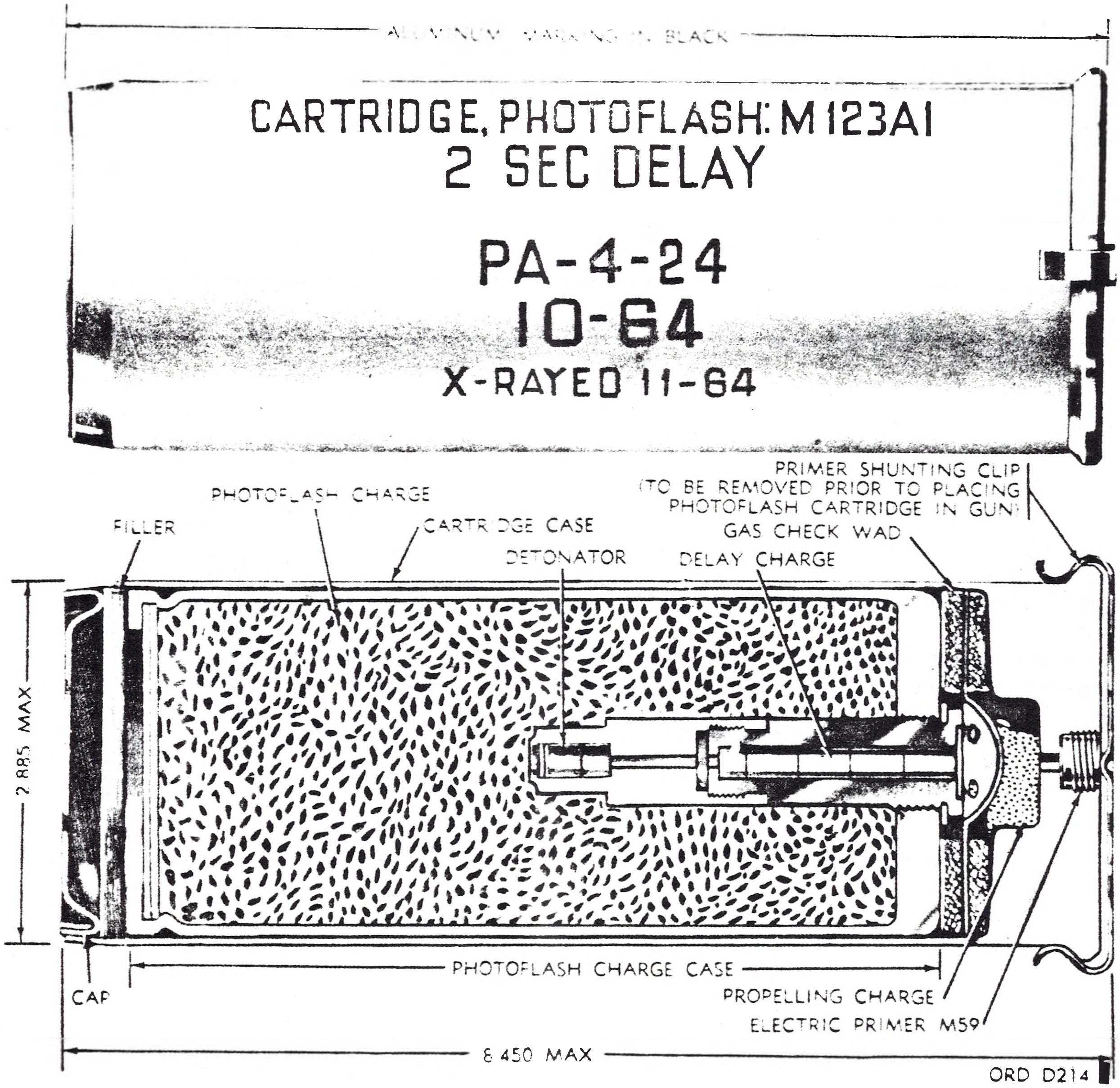

Figure 10–10. Cartridge, Photoflash, M123A1, 2 Sec. Delay

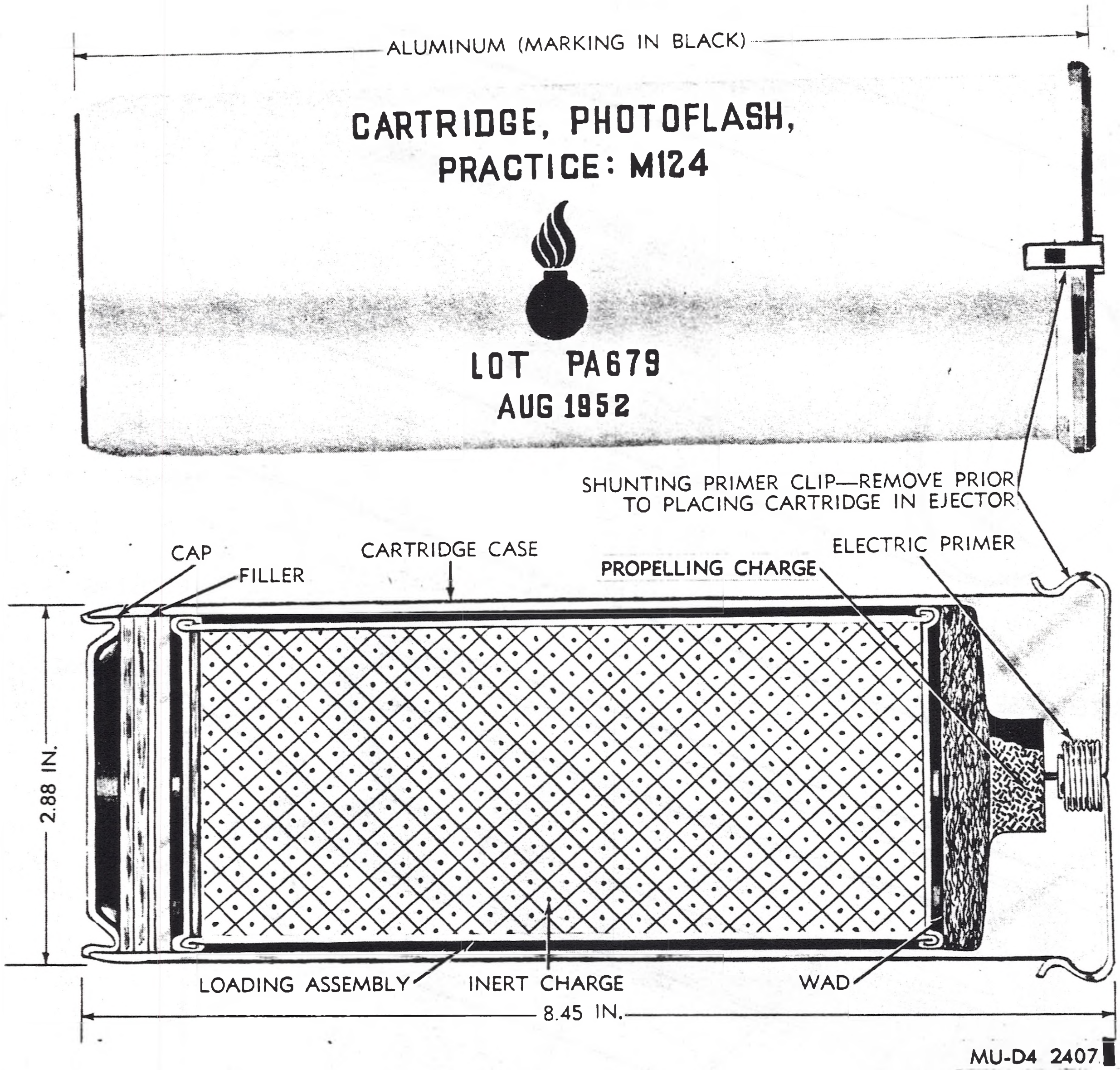

Figure 10–11. Cartridge, Photoflash, Practice, M124.

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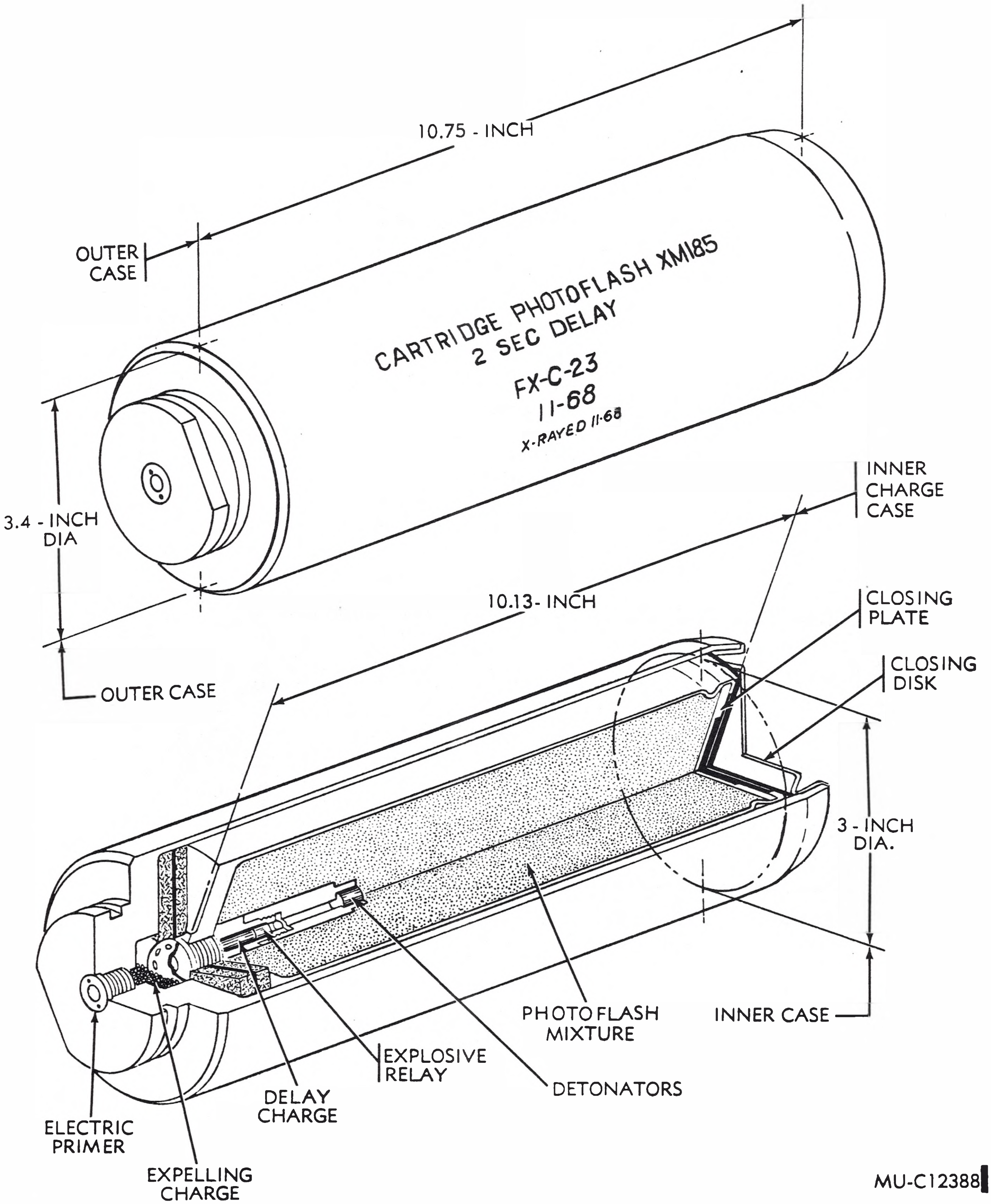

Figure 10–11.1. Cartridge, photoflash: XM185, 2-second delay, cross section.

10-5. PARACHUTE SURFACE FLARES XM183 and XM184.

lier designation of these items included the nenclatures "Battlefield Illumination System" and "Parachute Ground Flare"

10-5.1 IDENTIFICATION.

10-5.1.1 TYPE. Both the XM183 and XM184 are illuminating projectiles preloaded in a molded plastic launcher. Each launcher contains 12 fin-stabilized illuminating projectiles and 12 black powder propelling charges. The projectiles are launched from the ground than descends by parachute, illuminating the surface area. The difference between the two systems is that the XM183 has two fuse trains, each of which will launch six projectiles in sequence, and a "ground" type launching platform whereas the XM184 has twelve fuse trains, which permits launching of each projectile individually, and a "shipboard" type launching platform (figures 10-12 and 10-13).

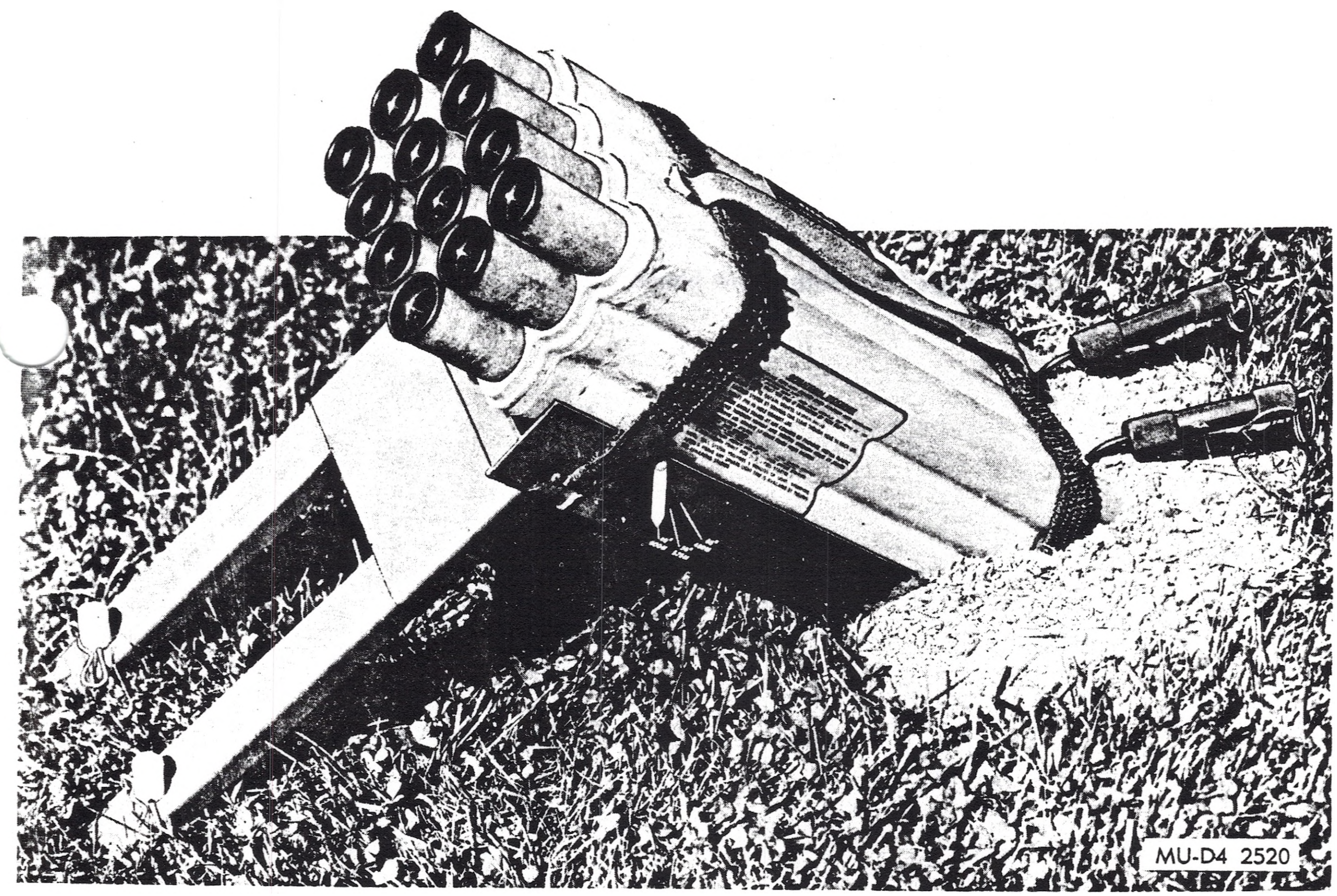

Figure 10-12. Parachute Surface Flare XM183.

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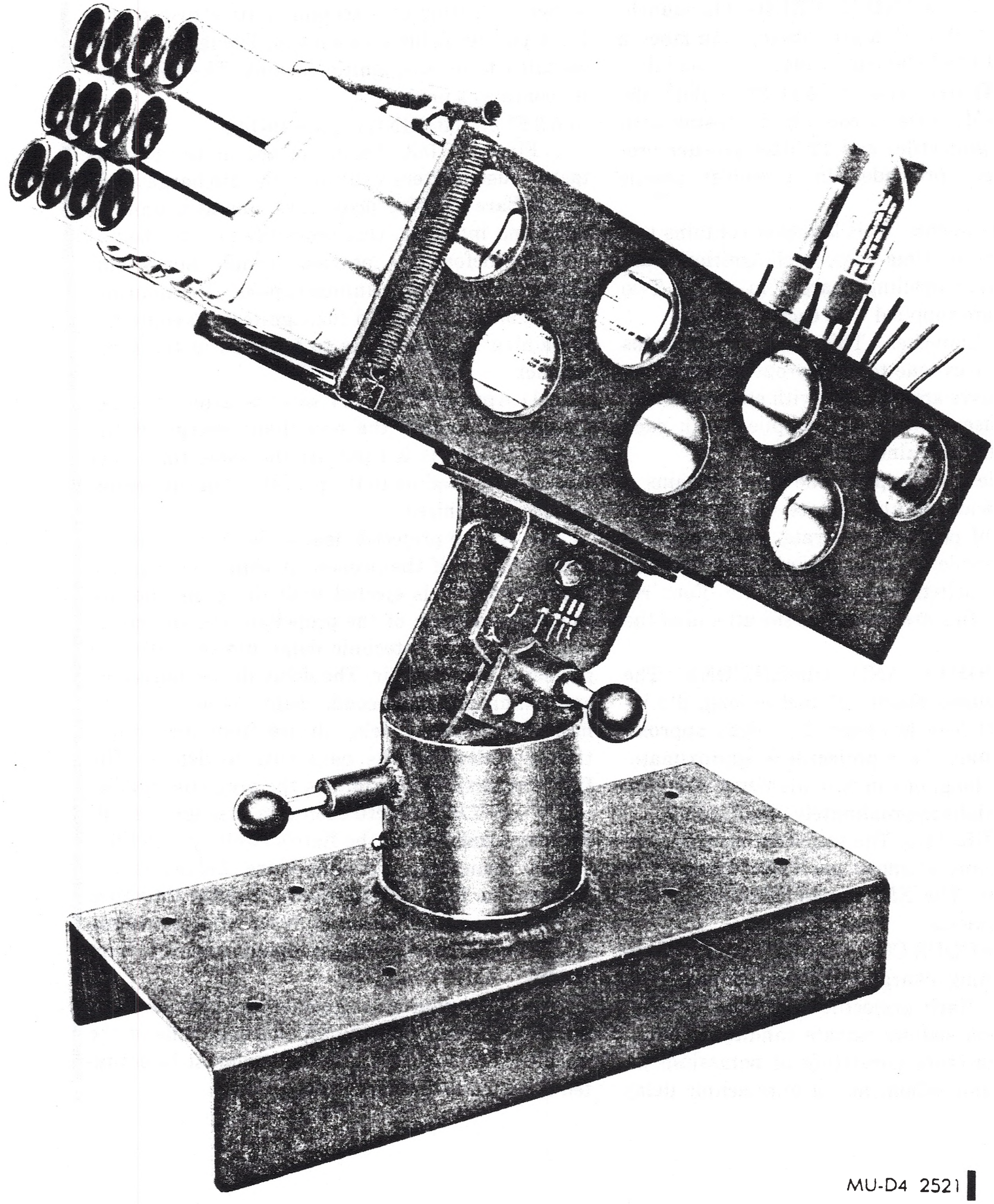

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Figure 10-13 Parachute Surface Flare XM184

10-5.1.2 PAINTING AND MARKING. The launchers are olive drab with a gray instruction label, a gray warning label and a gray identification label.

10-5-1.3 FITTINGS AND FEATURES. Both the XM183 and XM184 flares contain 12 fin-stabilized illuminating projectiles and 12 black powder propelling charges preloaded in a molder plastic launcher.

a. XM183 Launcher. This launcher contains two ignition trains of time fuse, each ignition train connecting six propelling charges in series. Two fuse igniters are supplied with each launcher.

b. XM184 Launcher. This launcher contains twelve time fuses (one to each propelling charge). Two fuse igniters are supplied with each launcher. Additional fuse igniters are supplied with each XM184 shipping container.

c. Projectiles. Each projectile case contains a magnesium and sodium nitrate candle, a first fire mixture of potassium nitrate, boron and teflon, a pyrotechnic delay device of time fuse and black powder pellets, and a parachute. Four retractable steel fins are located at the aft end of the projectile.

10-5.1.4 WEIGHTS AND DIMENSIONS. The launcher is approximately 21 inches long, 6½ inches wide and 5 inches high. It weighs approximately 11 pounds. Each projectile is approximately 11½ inches long, one inch in diameter with fins folded, and weighs approximately a half pound.

10-5.1.5 MATERIALS. The projectile case is composed of a cotton phenolic base. The launcher is molded plastic. The XM183 and XM184 launcher platforms are metal.

10-5.2 HAZARDOUS COMPONENTS. Each of the twelve propelling charges contain 100 grams of black powder. Each projectile contains a 3-ounce magnesium and sodium nitrate candle, 31 grains of first fire mixture consisting of potassium nitrate, boron and teflon, and a pyrotechnic delay device consisting of a section of time fuse with a black powder pellet on each end. The launcher also contains time fuse ignition trains. The fuse igniter contains a primer.

10-5.3 FUNCTIONING (figure 10-14).

a. Flare XM183. Actuating one of the two attached fuse igniters will cause the discharge of six of the flare's twelve projectiles, one at a time, at 30-second intervals. One projectile's candle begins to burn before the previous candle burns out, thereby providing uninterrupted illumination. Actuation of the second fuze igniter will cause the remaining six projectiles to function in the same manner.

(1) Approximately 17 seconds after the fuse igniter is actuated the propellant charge of the first projectile is ignited. At the same time, sections of fuse leading to the propellant of the second projectile is ignited.

(2) As the projectile leaves the launch tube, a small portion of the propellant which has not yet been consumed is ejected with the projectile. As this small portion of the propellant charge burns, it ignites the pyrotechnic delay device while the projectile is in the air. The delay device burns for approximately 10 seconds before the first fire mixture forces the delay device from the projectile case allowing the parachute to deploy. The first fire mixture also ignites the projectile candle.

b. Flare XM184. Actuation of a fuse igniter will discharge only one of the flare's twelve projectiles.

(1) Functioning of the Flare XM184 is the same as the Flare XM183 except that the time fuse is not connected in series from one propelling charge to another propelling charge as in the Flare XM183.

(2) Actuation of a fuse igniter will function the propelling charge of only one projectile of the Flare XM184. Another fuse igniter must be actuated to discharge another projectile.

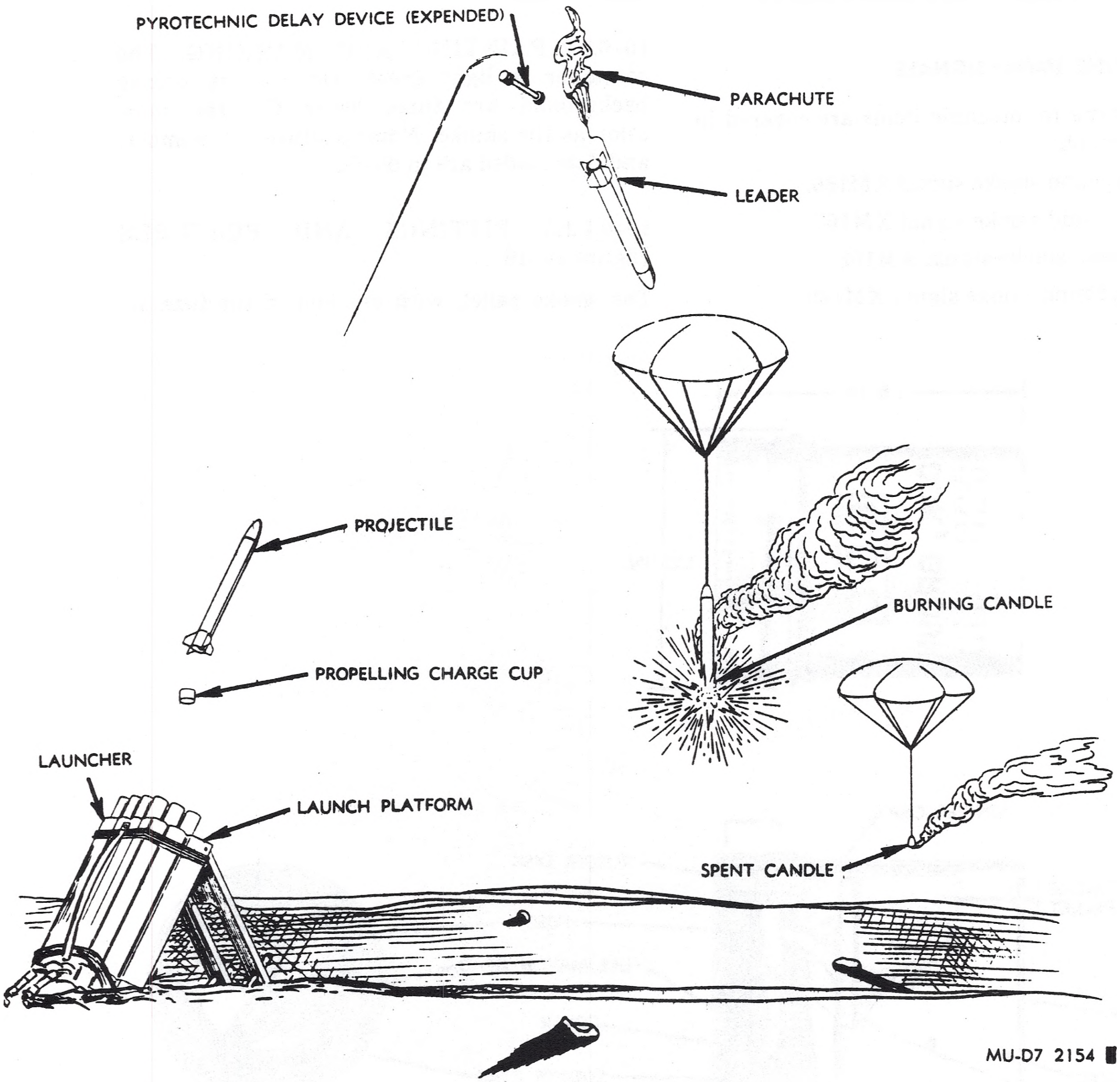


Figure 10–14 Flare XM 183 Sequence of Events

10–5.4 SAFETY PRECAUTIONS.

a. Do not approach a launcher which has been initiated for at least thirty minutes.

b. Flares or projectiles must be considered as a fire hazard and a missile hazard.

10–6 GROUND SMOKE SIGNALS

The following pyrotechnic items are covered in this paragraph:

White ground smoke signal XM166.

Green ground smoke signal XM167.

Red ground smoke signal XM168.

Yellow ground smoke signal XM169.

10–6.1 IDENTIFICATION.

10–6.1.1 TYPE. These signals are small self-contained, fused pyrotechnics (figure 10–15) and are designed to be ignited by hand at the point of use.

10–6.1.2 PAINTING AND MARKING. The container is light green. On a black oblong background are three letter C's the same color as the smoke. Nomenclature, lot number, and date loaded are in black.

10–6.1.1.3 FITTINGS AND FEATURES (figure 10–16).

The smoke pellet, with one end of the fuze at-

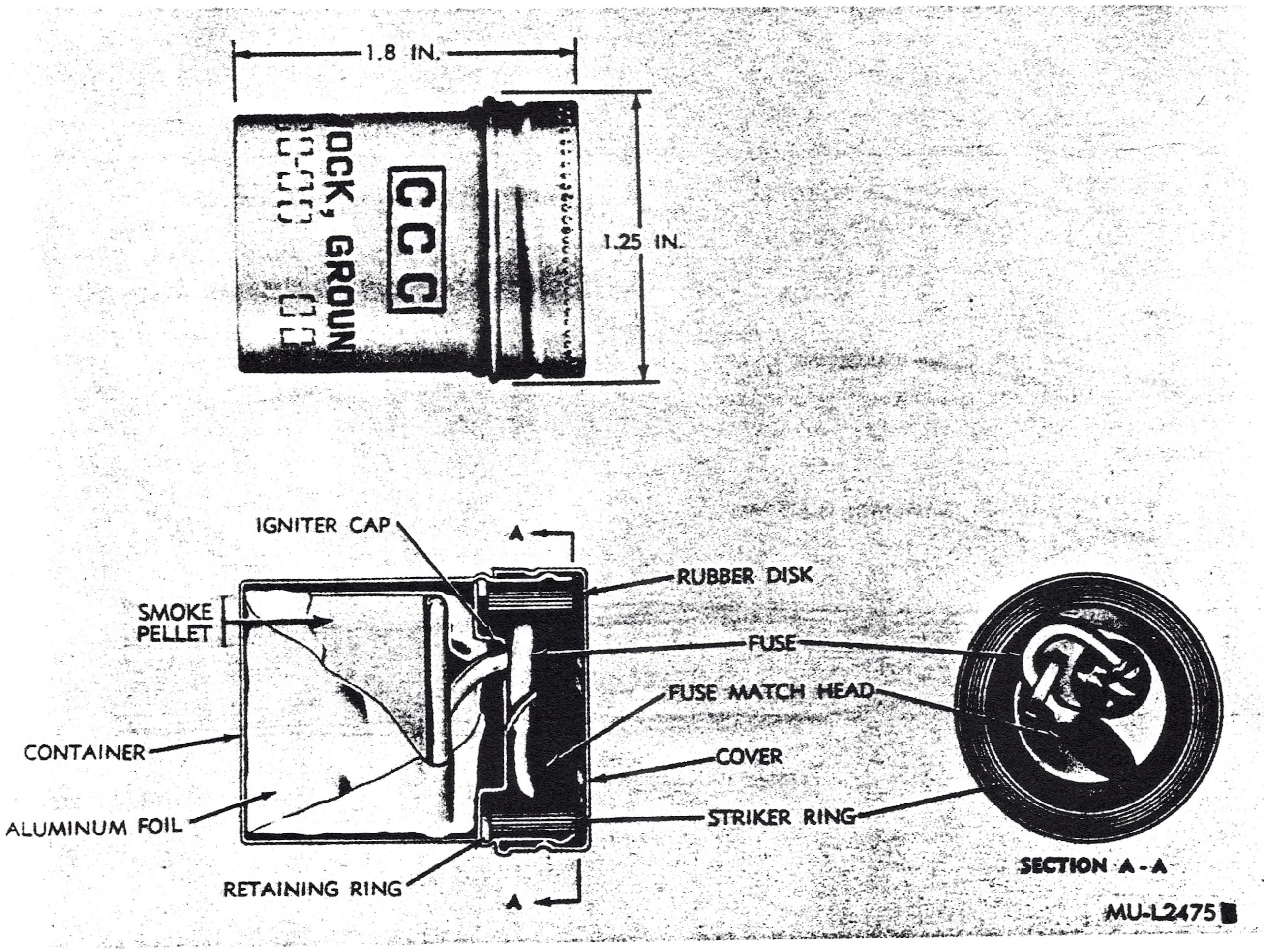


Figure 10–15 Ground Smoke Signal

tached, is wrapped in aluminum foil and is located in the bottom of the container. The other end of the fuse, made into a match head, feeds through the igniter cap. The match head is held in place by the igniter cap. The retaining ring secures these components in place. The striker ring, used to ignite the match head, is stored on top of the retaining ring and is secured by the cover.

10–6.1.1.4 WEIGHTS AND DIMENSIONS.

Container:

Length	1.8 in.
Diameter	1.25 in.
Weight (filled)	3 oz

Length of fuse:

Red and white smoke signals	8.75 in.
Green and yellow smoke signals	6.375 in.

Weight of pellets:

White smoke	30 grams
Green and red smoke	18 grams
Yellow smoke	17 grams

10–6.1.1.5 MATERIALS. The container is made of aluminum.

10–6.2 HAZARDOUS COMPONENTS

The fuse is thermalite-type ignitacord (black

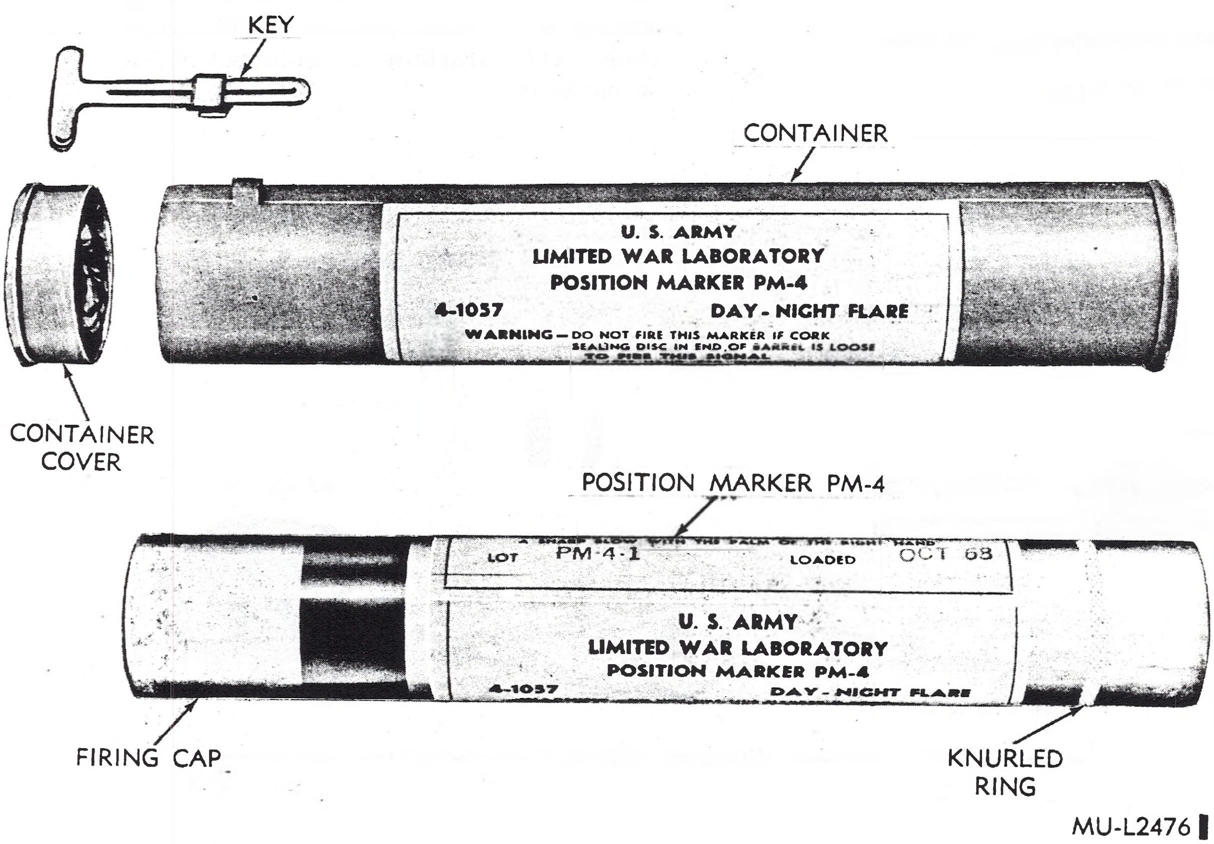


Figure 10–16 Position Marker and Container

powder and nitrocellulose lacquer). The smoke pellet for the white signal consists of dechlorane, zinc oxide, powdered aluminum, ammonium perchlorate, and vinyl alcohol acetate resin. The smoke pellets for the other signals consist of potassuim chlorate, sugar, vinyl alcohol acetate resin, and appropriate dyes.

10–6.3 FUNCTIONING.

The fuse may be ignited by rubbing the fuse match head with the striker ring or by other means. The fuse ignites the smoke pellet within 2 to 8.5 seconds. The smoke pellet emits a smoke cloud for 13 to 30 seconds.

10–6.4 SAFETY PRECAUTIONS.

General safety precautions regarding the handling and disposal of pyrotechnic signals will be observed.

10–7. HAND-HELD POSITION MARKER PM-4.

10–7.1 IDENTIFICATION.

10–7.1.1 TYPE. The hand-held position marker PM-4 is a combined flare and smoke signal for ground use. It is designed to be fired by hand.

10–7.1.2 PAINTING AND MARKING. The position marker is not painted except for the knurled ring at one end which is painted red. The container and position marker each have a white label with black markings as shown in figure 10–16.

10–7.1.3 FITTINGS AND FEATURES (figures 10–16 and 10–17).

a. The firing cap with a firing pin affixed to the inside end, is located on one end of the launch tube. The launch tube contains the signal assembly which consists of the signal body and the payload assembly. A rocket motor assembly with four flexible steel fins is fastened at the rear of the launch tube. The payload assembly, consisting of a signal canister, 9-inch wire leader, and parachute, is contained in the signal body.

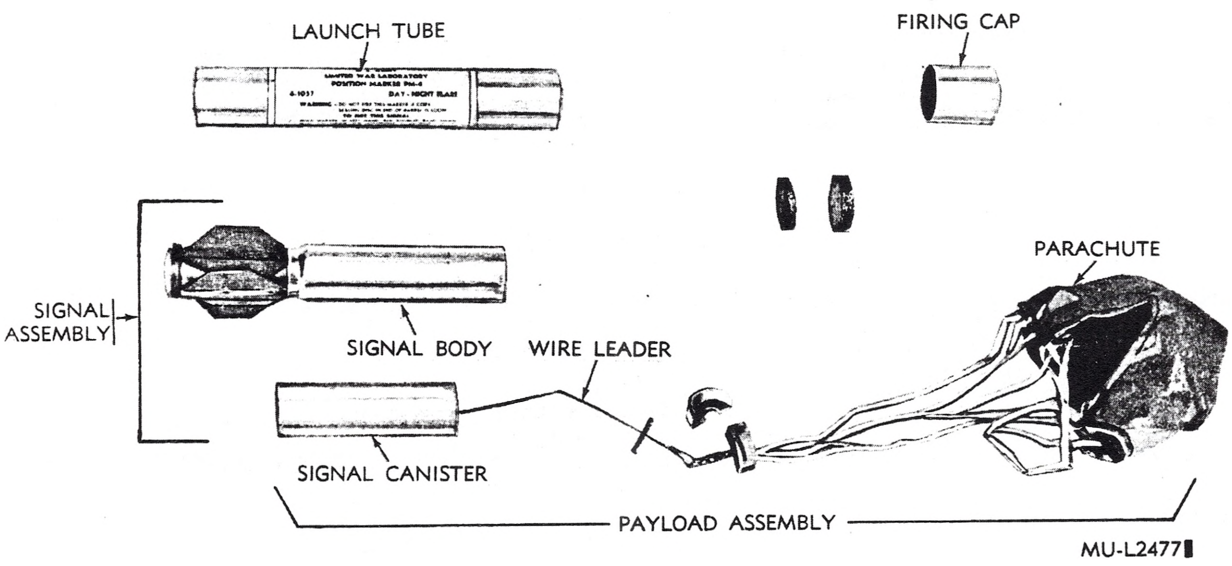


Figure 10–17 Position Marker—Disassembled

10-7.1.4 WEIGHTS AND DIMENSIONS.

Length	10.16 in.
Diameter	1.67 in.
Weight	1 lb

10-7.1.1.5 MATERIALS. The launch tube and firing cap are aluminum. The container is made of metal.

10-7.2 HAZARDOUS COMPONENTS.

Black powder:	
Initiating charge	710 milligrams
Rocket propellant charge	39 grams
Expelling charge	750 milligrams
Sodium nitrate (signal canister	67 grams
Magnesium (signal canister)	60 grams

10-7.3 FUNCTIONING.

The cap is removed from the end of the launch tube and placed on the other end. Holding the launch tube in one hand, cap end down, the cap is struck a sharp blow with the palm of the other hand, which drives the firing pin into the primer. This fires the initiating charge which expels the signal assembly from the launcher permitting the fins to unfold; flame from the initiating charge ignites the rocket motor at a height of about 30 feet. The rocket motor propels the signal assembly upward and ignites the delay charge. Approximately 2 seconds after firing, at an altitude of about 350 feet, the delay charge ignites the expelling charge and the signal canister ignition train. The expelling charge separates the signal body and the payload assembly. As the burning canister falls, the parachute deploys, slowing the descent and suspending the canister above ground by becoming entangled in the trees.

10-7.4 SAFETY PRECAUTIONS.

General safety precautions regarding the handling and disposal of pyrotechnic signals will be observed.

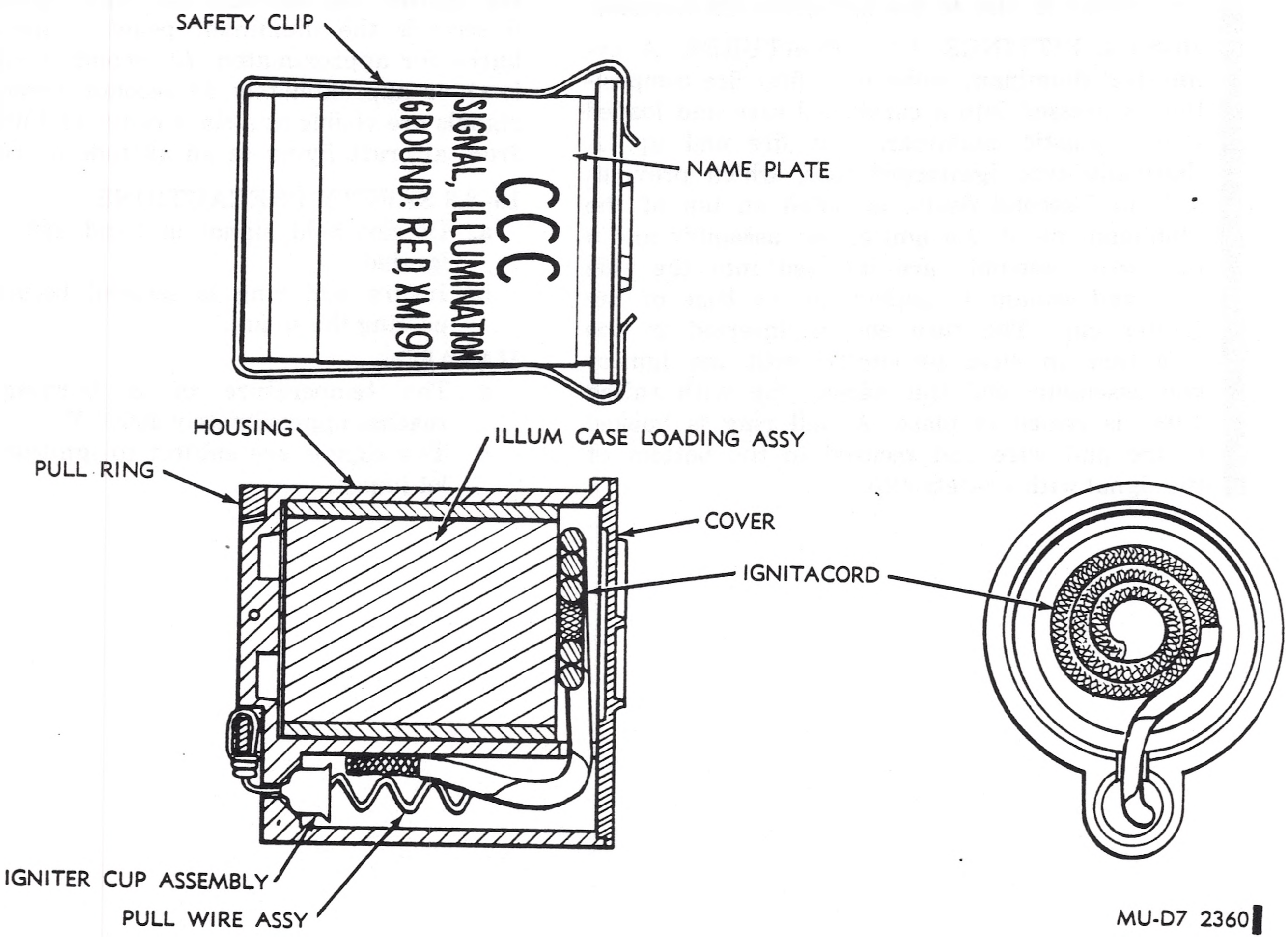


Figure 10-18. XM191 Ground Illumination Signal—Cross Section.

10–8. GROUND ILLUMINATION SIGNALS.

The following pyrotechnic items are covered in this paragraph:

Ground Illumination Signal XM191 (Yellow)

Ground Illumination Signal XM192 (Green)

Ground Illumination Signal XM193 (Red)

A typical signal is shown in figure 10–18.

10–8.1 IDENTIFICATION

10–8.1.1 TYPE. These signals are small, self-contained, fused pyrotectnics. They are designed to be ignited by hand at the point of use.

10–8.1.2 PAINTING AND MARKING. The signals can be identified by their white plastic containers and colored tops with raised letters. The colored top and raised letter indicate the color of the smoke. Immediately below the top are three C's the same color as the illuminant. Also stenciled in black are the nomenclature, the lot number, and the month and year the item was loaded. Except for the markings, the signals are similar in size to the miniature CS Grenade.

10–8.1.3. FITTINGS AND FEATURES. A cylindrical illuminant pellet with first fire composition is pressed into a cardboard case and loaded into a plastic container, first fire end up. A thermalite-type ignitacord fuse, which provides a 3- to 5-second dealy, is coiled on top of the illuminant pellet. An igniter cup assembly and a pull wire assembly are inserted into the side tube and sealant is applied to the base of the igniter cup. The fuse end is inserted in the side tube in close proximity with the igniter cup assembly, and the colored top with raised letter is sealed in place. A pull ring is hooked to the pull wire and secured to the bottom of the signal with a safety clip.

10–8.1.4 WEIGHTS AND DIMENSIONS.

a. Complete Round:

Height	1.80 inches
Diameter	1.30 inches
Weight (approximate)	2 ounces

b. Illuminant Pellet:

Height	1.40 inches
Diameter	1.08 inches
Weight	35–40 grams
Burning Time:	
Red	50–70 seconds
Yellow	50–70 seconds
Green	30–40 seconds

c. Fuse (ignitacord):

Length (approximate)	6.5 inches
Diameter	0.13 inches

10–8.1.5 MATERIAL. The container is made of plastic.

10–8.2 FUNCTIONING.

The safety clip is removed and the pull ring is pulled. This moves the coated wire through the igniter cup igniting the fuse. Within 3 to 5 seconds the illuminant pellet is ignited and burns for approximately 70 seconds (red or yellow) or approximately 40 seconds (green). The signals are visible at a slant range of 1500 meters from aircraft flying at an altitude of 1000 feet.

10–8.3 SAFETY PRECAUTIONS.

a. Do not hold signal in hand after fuse is ignited.

b. Insure pull ring is secured before transporting the signal.

HAZARDS.

a. The temperature of a burning signal reaches approximately 4000° F.

b. The signals are subject to ignition by bullet impact.

SECTION 11

ROCKETS, ROCKET MOTORS, AND ROCKET FUZES

11-1 762-MM ROCKET (HONEST JOHN) XM50 WITH PRACTICE WARHEAD XM38E1, AND M31 SERIES WITH HIGH EXPLOSIVE WARHEADS M57 AND T2021.

The 762-mm rocket M50 with practice warhead M38 is covered in this paragraph. The rocket is commonly referred to as the "Honest John."

11-1.1 IDENTIFICATION.

11-1.1.1 TYPE. The Honest John M50 is an unguided, surface-to-surface, spin and fin stabilized, free-flight solid propellant field artillery rocket, assembled with a practice warhead.

11-1.1.2 PAINTING AND MARKING.

11-1.1.2.1 The warhead shell assembly is stenciled with white letters to identify the type warhead, weight, and other loading information.

11-1.1.2.2 The rocket motor designation and other loading information are stenciled on the side of the rocket motor shell.

11-1.1.2.3 Four white 4-inch squares are painted 90° apart on the outward circumference of the warhead section. The white squares indicate that the warhead section contains pyrotechnic material.

11-1.1.2.4 The remaining exterior surface of the rocket is painted lusterless olive drab.

11-1.1.3 FITTINGS AND FEATURES. The general physical characteristics and location of the major components of the rocket are shown in figure 11-1.

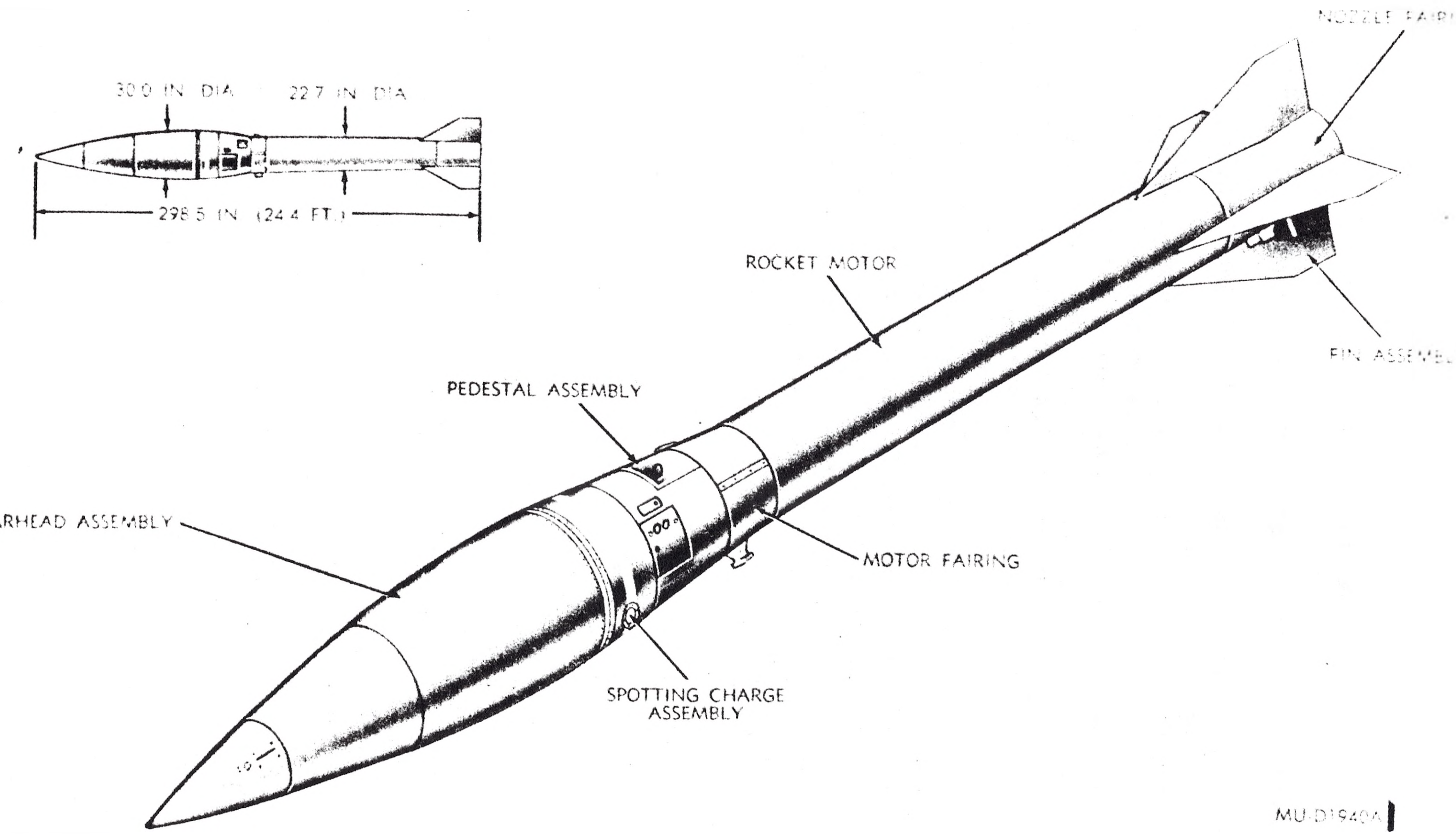


Figure 11–1. General Appearance and Dimensional Characteristics of the 762-mm Rocket M50 (Honest John)

11-1.1.3.1 EXTERNAL FITTINGS.

a. Two pushbutton latches positioned 180° apart secure the nose tip to the warhead shell assembly.

b. Two ring-disc assemblies spaced 180° apart on the warhead base assembly secure the spotting charges in the spotting charge wells.

c. Two 9 x 13 inch hinged doors provide general access into the pedestal assembly interior. These access doors are operated by pushbutton latches.

d. Two hinged doors spaced 180° apart near the rear of the pedestal assembly provide access to the spin-rocket assemblies. Each access door has two spin-rocket exhaust openings.

e. The right hand spin-rocket access door has the breakaway receptacle mounted on it. This receptacle provides the means of connecting the rocket to the external power source for firing the rocket.

f. Each of the four equally spaced warhead attachment bolts are recessed in wells at the forward end of the pedestal assembly. Each well is covered by a cover held in place by a camloc fastener.

g. The forward and aft hoist adapter plates are mounted on the top centerline of the rocket motor.

h. The forward and aft launching shoe adapter plates are mounted on the bottom centerline of the rocket motor. These adapter plates provide means of attaching jettisonable launching shoes.

i. The motor fairing located at the forward end of the rocket motor provides the aerodynamic contour from the pedestal diameter to the rocket motor diameter.

j. The nozzle fairing is mounted over the nozzle assembly at the end of the rocket motor.

k. The spin-rocket ignition switch assembly is mounted to the nozzle fairing slightly left of the bottom centerline.

11-1.1.3.2 FEATURES. The rocket M50 consists of two major assemblies; these are the Practice Warhead Assembly M38 and the Rocket Motor Assembly M66.

a. Practice Warhead Assembly, M38. The M38 warhead is illustrated in figure 11-2. It consists of the following principal components: the nose tip, warhead shell assembly, warhead base assembly, ballast assembly, and the explosive components which comprise the Fuze, MT, M421 the detonating lead assembly, and the two flash-smoke charges.

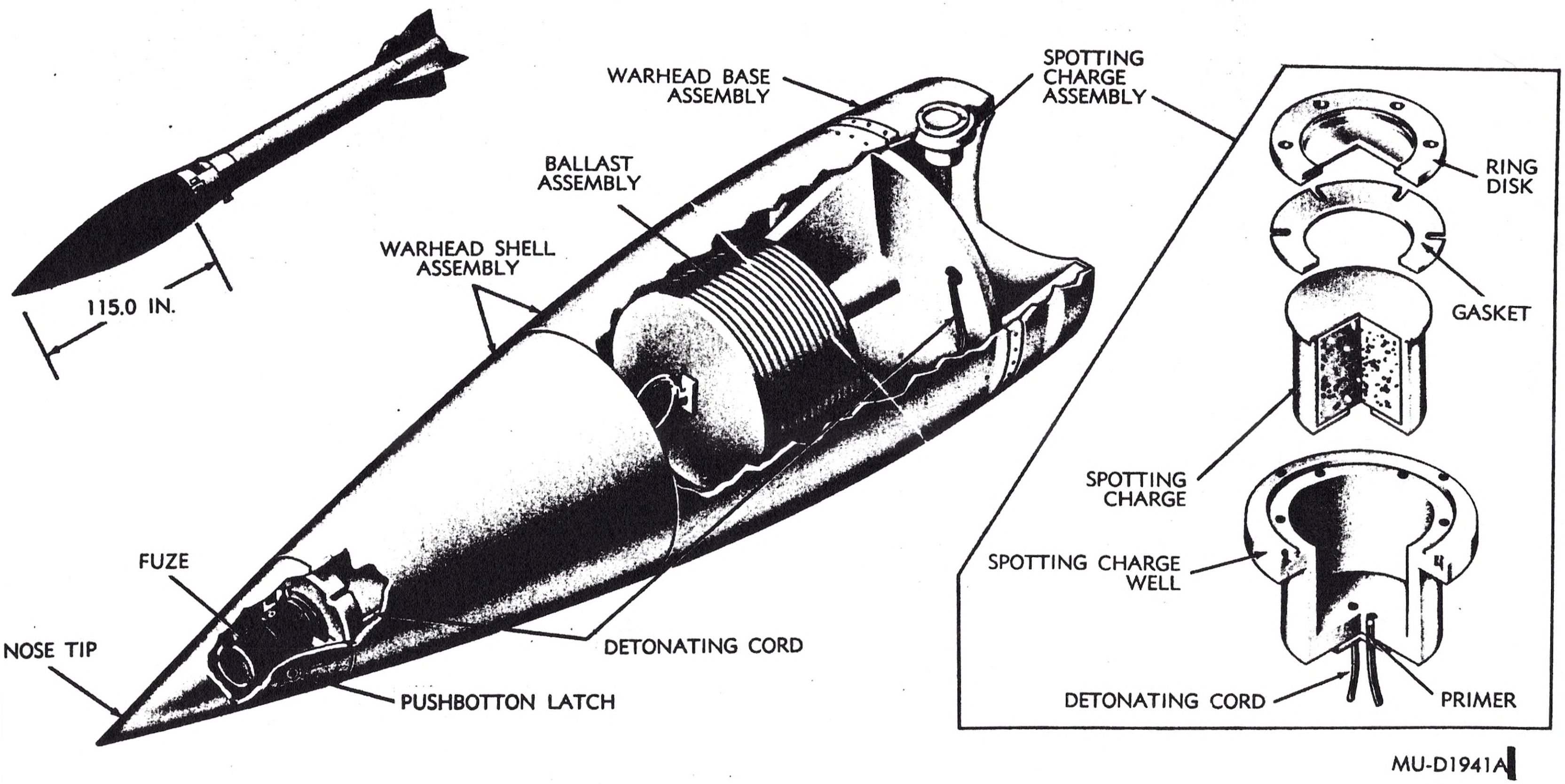


Figure 11–2 Practice Warhead Section. Inset Shows Exploded View of Spotting Charge Assembly.

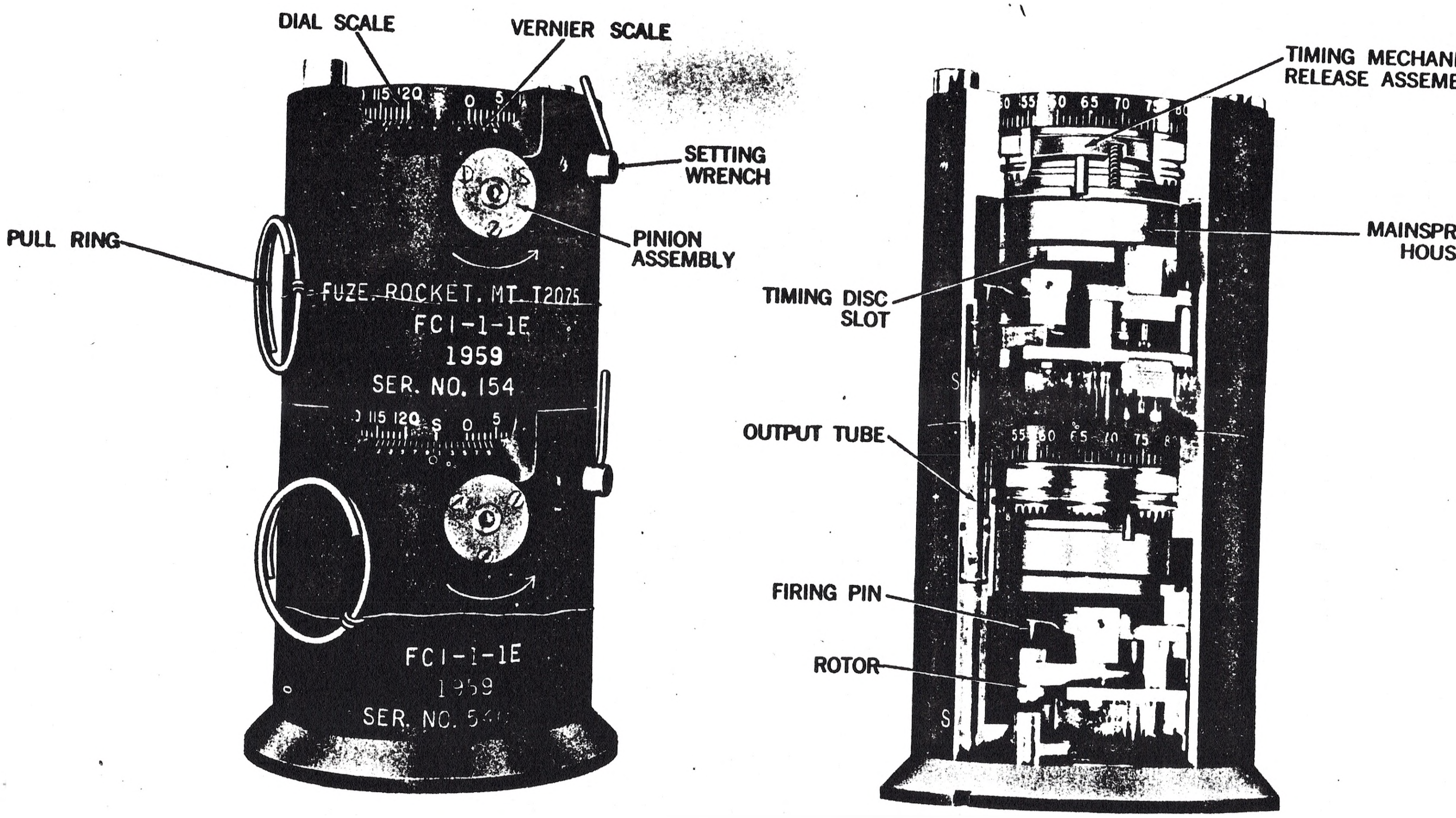
(1) Nose Tip. The nose tip is about 22.5 inches long and is locked to the warhead shell assembly by two pushbutton latches which are 180° apart. When the pushbuttons are depressed, the latches are unlocked making it possible to separate the nose tip from the warhead shell assembly and expose the fuze M421.

(2) Warhead shell assembly. The warhead shell assembly is 77.5 inches long and is attached to the warhead base by flush-head radial screws. The fuze mounting plate forms the forward bulkhead of the warhead shell assembly. The fuze M421 is secured to the fuze mounting plate by a cam operated lock.

(3) Warhead base assembly. The warhead base assembly is 15 inches long and forms the aft end of the warhead assembly. The frame casting at the forward end provides a surface for mounting the ballast assembly. Two spotting charge wells which are internally mounted and spaced 180° apart, house the spotting charges which are inserted externally. Each spotting charge is retained in its case by a ring-disc assembly which is attached to the warhead base assembly by means of screws.

(4) Ballast assembly. The ballast assembly consists of a series of steel plates welded together. It provides the proper weight and center of gravity characteristics for simulation of an HE warhead.

(5) Explosive components. The explosive components of the practice warhead assembly are the flash-smoke charges, the detonating lead assembly, and the fuze assembly M421 the detonating lead assembly consists of a booster and four lengths of detonating cord with end primers. The booster is installed on the fuze mounting plate while the end primers are attached to the detonating cord and secured to the flash-smoke cartridges. The fuze M421 which is illustrated in figure 11-3 is a mechanical time fuze consisting of two identical timer units bolted together but functioning independently of each other. The two timer units are used in parallel for increased reliability. Each timer unit is comprised essentially of a timing mechanism and associated linkages to provide the accuracy of the time interval of fuze functioning. The timing mechanism is a mechanical clockwork utilizing a steel mainspring to provide the driving energy for the mechanism. The running speed of the timing mechanism is controlled by the escapement mechanism. The safety lever release assembly prevents the timing mechanism from functioning until a 13 "g" force acts upon the assembly. The base of each timer unit contains the components and linkages required to aline and fire the detonator. The principal component in the timer unit base is an acceleration sensing device which controls detonator alinement and firing. The pull wire and ring assembly prevents the acceleration sensing device from operating and is removed before firing. Time setting is accomplished by inserting a wrench into the pinion assembly and rotating the wrench counterclockwise until the desired time setting on the dial scale is positioned over the zero mark on the vernier scale.



VIEW A. GENERAL APPEARANCE OF THE FUZE PRIOR TO MOUNTING IN THE ROCKET.

VIEW B. FUZE CUT AWAY TO SHOW INTERNAL COMPONENTS.

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Figure 11–3 MT Fuze M421 (T2075E1).

(a) Spin-rocket assembly. Each spin-rocket assembly consists of solid propellant and a black powder igniter assembled in a steel tubular case. The spin-rockets are mounted in pairs in two supports 180° apart and inter-connected by a manifold system to assure reliable ignition and to balance the applied torque.

(b) Spin-rocket/motor-igniter electrical system. This system provides the circuits for ignition of the spin-rockets and the motor igniter. The principal elements of the system are the thermal batteries, the breakaway receptacle, the spin-rocket ignition switch assembly, and the associated inter-connecting cable assemblies. The two thermal batteries are electrically connected in parallel and are activated by squibs. The breakaway receptacle is mounted in the right hand spin-rocket opening and is connected to the squib terminals of the batteries. The rocket-to-launcher cable is connected to the breakaway receptacle prior to firing the rocket. The spin-rocket ignition switch assembly is installed in cutout in the lower left quadrant of the nozzle fairing at the aft end of the rocket motor. It consists of a pushbutton type switch operated by a handle which protrudes from the switch assembly so that it can be sheared by the launcher rail as the rocket is launched. The switch assembly is connected into the electrical system in the pedestal by a cable which is routed along the outer surface of the rocket motor and enters the pedestal through a hole in the left access door.

(2) Rocket Motor M31. The rocket motor (figure 11-5) consists of 1675 pounds of cast double base propellant grain which has a four pointed star configuration. The grain is forward loaded into the motor shell which is a cylindrical steel (0.164 inch nominal thickness) weldment having provision for attachment of the fin assembly, the hoist adapters, and the launching shoes. The forward end of the shell is pressure sealed by the head closure. A central circular opening in the head closure provides a seat to accommodate the igniter assembly. The nozzel assembly which is welded to the aft end of the shell is covered by the nozzle fairing. Two hoisting adapter plates are attached to the top of the shell, one at the forward end and the other at the rear end. Two jettisonable launching shoe assemblies are attached to adapter plates located on the bottom of the shell. Each assembly consists of a shoe, horizontal ejection spring, vertical ejection spring, and a release pin. The shoe is slotted to engage lugs on the adapter plate. The release pin prevents any movement of the shoe relative to the adapter plate. The release pin in turn, is held in place by a safety pin or, when the rocket is on launcher, by the launcher rail.

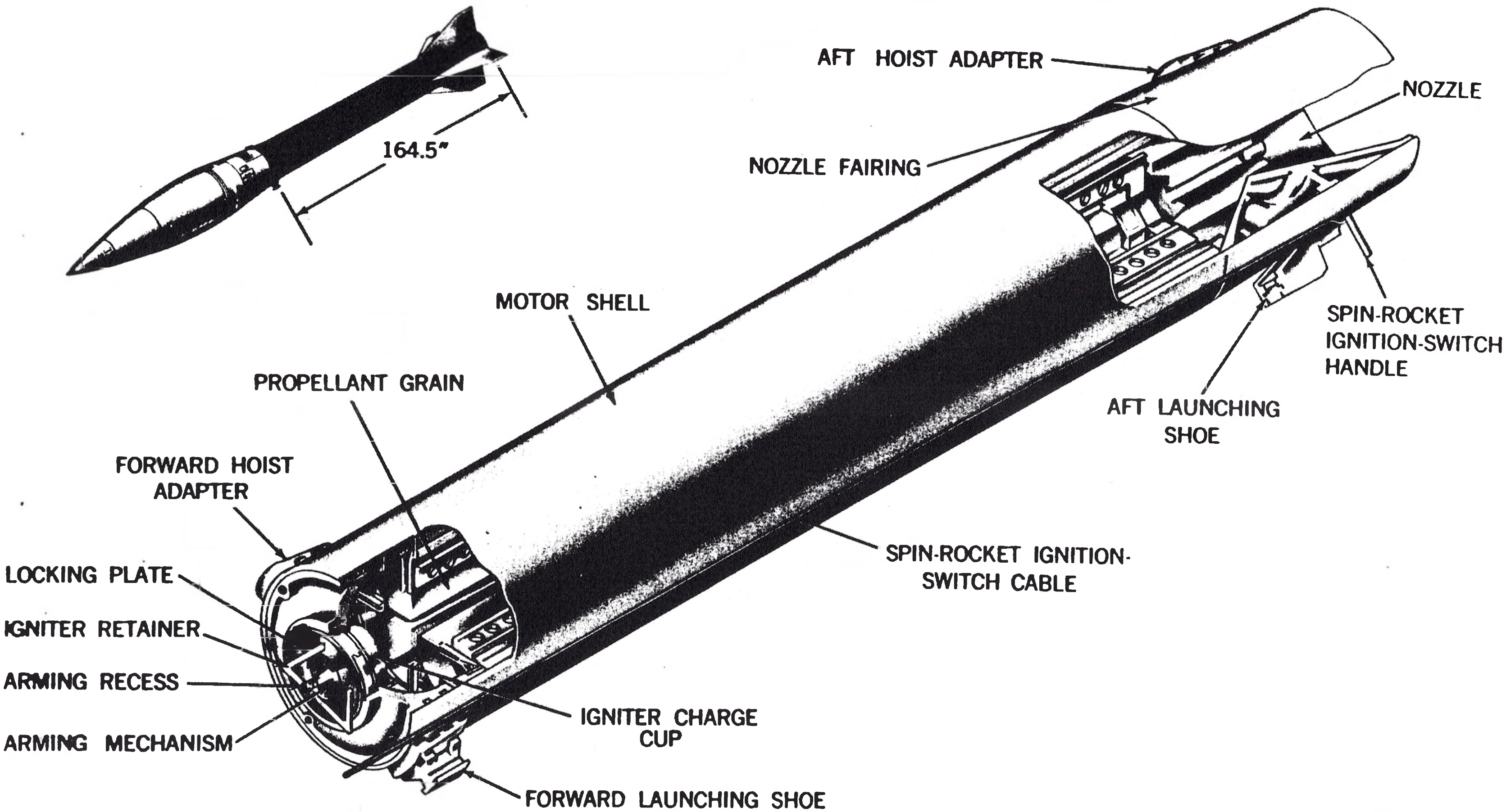

Figure 11–5 Rocket Motor M31.

(3) *Rocket Motor Igniter M58.* The igniter assembly is located on the forward end of the rocket motor. The igniter consists of an igniter charge cup, an ignition element, and an arming mechanism. The hermetically sealed charge cup contains the entire charge which consists of black powder. The ignition element is set in a recess of the igniter charge cup. The arming mechanism is located atop a locking plate in such a position that the drive bar of the arming assembly engages the drive bar slot in the ignition element. The arming mechanism acts as a safety device and renders the unit nonpropulsive in case of accidental ignition when in safe position. The mechanism permits the rocket motor to be shipped with the igniter installed and in the safe (nonpropulsive) position. While in the safe position, the igniter is held in place by a triangular retainer which is fastened to the forward end of the rocket by means of shear screws. If the unit is accidentally fired, the shear screws will fail causing the igniter to be ejected and thus rendering the rocket motor nonpropulsive. The igniter is armed and disarmed by an Allen wrench or a special "T"-wrench. The armed or safe position of the igniter will be attained by turning the igniter wrench to aline mating segments of the words "ARMED" or "SAFE" as desired. In addition, when the igniter is armed a red colored segment on the arming mechanism is alined with a red colored segment on the locking plate. When the igniter is in the safe position, green colored segments are alined.

(4) *Fin Assembly M17.* The fin assembly consists of four fins spaced 90° apart on the nozzle fairing. Each fin is installed so that it is slightly canted. A setscrew secures each fin to the fin mounting block.

11-1.1.4 WEIGHTS. The loaded rocket weighs about 4800 pounds.

11-1.1.5 MATERIALS. The exterior surface of the warhead assembly and the pedestal assembly is aluminum. The rocket motor shell is made of steel and the fin assembly is made of magnesium.

11-1.2 HAZARDOUS COMPONENTS.

a. The fuze M421 consists of two timers each containing a detonator composed of tetryl and an output tube containing an RDX lead.

b. The two flash-smoke charges each contain about 1.5 pounds of spotting composition No. 580 (60–40 blend of barium nitrate and atomized aluminum).

c. The detonating lead assembly consists of a (PETN) booster and four lengths of detonating cord with end primers assembled (figure 11-6).

d. The four spin-rocket assemblies each contain an igniter consisting of 7 grams of black powder and a 2.5 pound charge of double base solid propellant.

e. The rocket motor igniter M58 contains 1.7 pounds of black powder.

f. The rocket motor M31 consists of 1675 pounds of double base solid propellant.

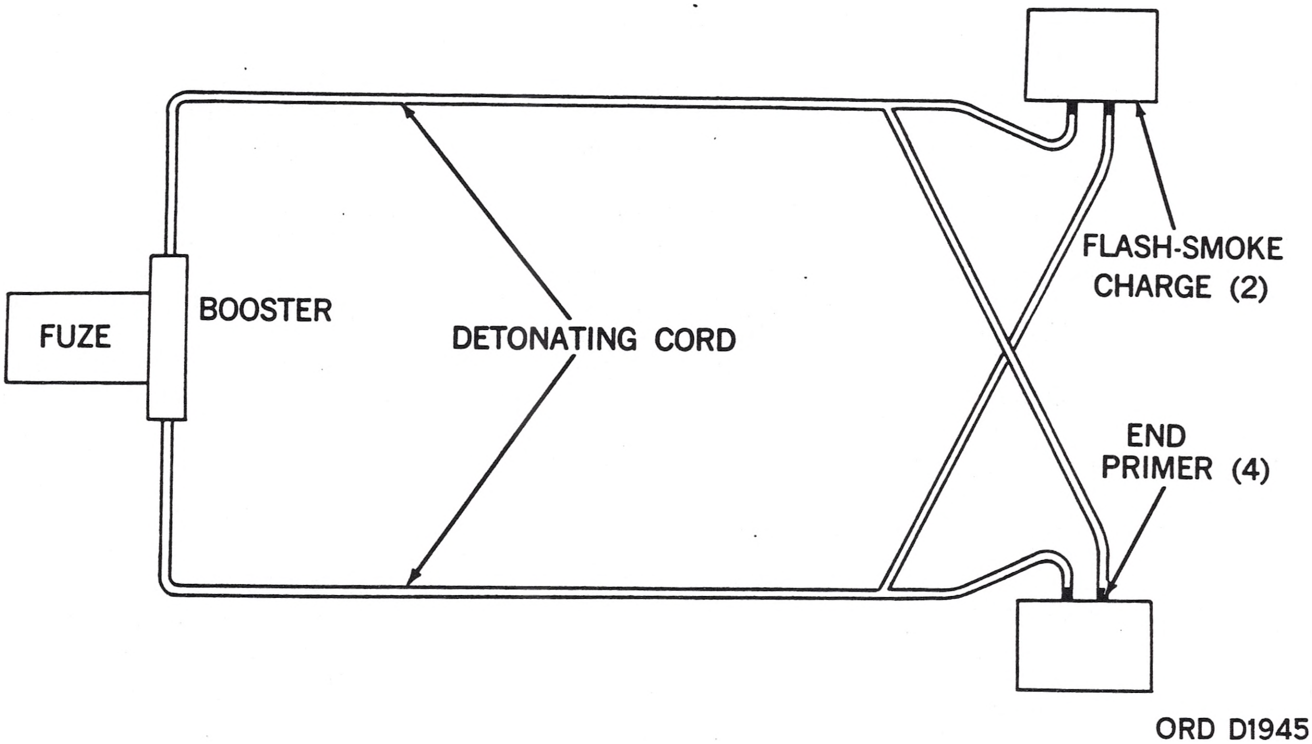

Figure 11-6 Flash-Smoke Warhead Fuzing System.

11-1.3 FUNCTIONING. For the purpose of description, the functioning of the rocket M50 is divided into two basic systems. These are the propulsion system and the fuzing system, whose operations begin essentially at the same time. The propulsion system includes the functioning of the rocket motor M66, while the fuzing system includes the functioning of the warhead assembly M38. Each system is described separately below.

a. *Propulsion system.* Upon the command to fire, the firing circuit is closed causing voltage to be applied to the two squibs in the thermal batteries. The squibs activate the thermal batteries which, in turn, ignite the rocket motor igniter. The burning igniter charge initiates the propellant grain. As the rocket accelerates up the launcher, the handle on the spin-rocket ignition-switch assembly is sheared off. As the handle is sheared off, the spin-rocket ignition-switch closes the circuit between the thermal batteries and the spin-rocket assemblies. The spin-rockets ignite, imparting to the rocket a stabilizing rotation which is maintained by the canted fin assembly for the duration of rocket flight.

b. Fuzing system. As the rocket attains an acceleration of 13 "g's" for a sustained period of 0.6 seconds, the timing mechanism in the fuze begins to operate.

NOTE

The fuze consists of two identical timers operating simultaneously. For the purpose of clarity the operation of only one timer is discussed.

(1) In the clockwork mechanism (figure 11–3) setback causes the release assembly to release the escapement lever, thereby permitting the main-spring to start driving the timing disc at a governed rate through the use of an escapement mechanism.

(2) In the safe and arming device (figure 11–7) the second time cycle uses a "g" mass which, under sustained acceleration, is displaced against an opposing spring at a rate governed by a gear train and escapement mechanism. Following burn out, the mass returns and releases a pair of firing arms against the timing disc. At approximately 1.5 seconds prior to set time, firing arm No. 1 drops into the notch on the timing disc permitting "D" shaft No. 1 to rotate and allows the rotor (containing the detonator) to move into firing position. At the preset time firing arm No. 2 drops into the timing disc notch, rotating "D" shaft No. 2, which releases the firing pin against the detonator. Both units have an RDX lead which transmits the explosion from the detonator to the booster which is attached to the detonating lead assembly. The detonating lead assembly initiates the flash-smoke charges which produce a flash and a white cloud of smoke.

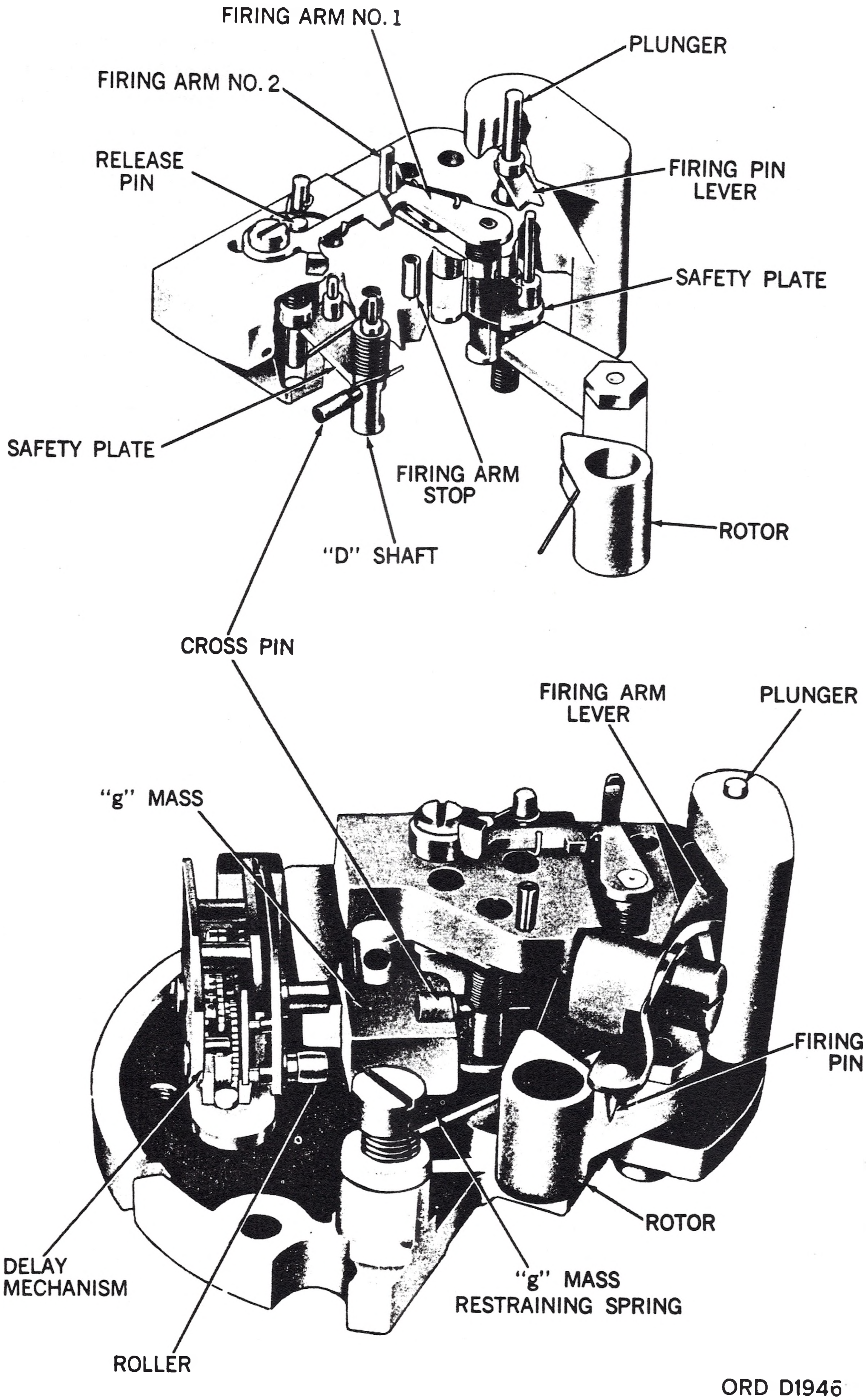

Figure 11-7 Fuze M421 (T2075E1): Lower View, Timer Before Acceleration; Upper View, Arming and Firing Mechanism.

11-1.4 SAFETY PRECAUTIONS.

WARNING

Gound rocket body before attempting any procedures.

11-1.4.1 The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance and propellants must be observed.

11-1.4.2 Use extreme caution when handling these flash-smoke charges. The spotting composition used in the charges is very sensitive to heat, shock, and friction.

11-1.4.3 Do not look in the direction of the disposal area when the charge is being disposed of by burning or detonation. The brilliance of flash produced can be harmful to the eyes even at distances which are safe against fragments.

11-1.4.4 If the spotting composition is spilled, it should be soaked with oil and then picked up with an oil-soaked rag.

11-1.4.5 Positively identify the rocket or rocket component and determine the condition of each component present.

11-1.4.6 Handle the fuse M421 with extreme care because of the spring-wound mechanism and cocked striker which are present. Never attempt to disassemble the fuze M421.

11-1.4.7 Extreme care should be exercised in handling the rocket motor igniter.

11-1.4.8 Avoid any large increase in temperature near the rocket motor never apply any heat directly to the rocket motor.

11-1.4.9 Nonsparking tools (tools with low sparking characteristics) should be used while working around explosive components.

11-1.5 762-MM ROCKET, M31 SERIES WITH HIGH-EXPLOSIVE WARHEADS M57 AND T2021 (HONEST JOHN).

11-1.5.1 IDENTIFICATION.

11-1.5.1.1 TYPE. The M31 Series Honest John rocket is an unguided, surface-to-surface

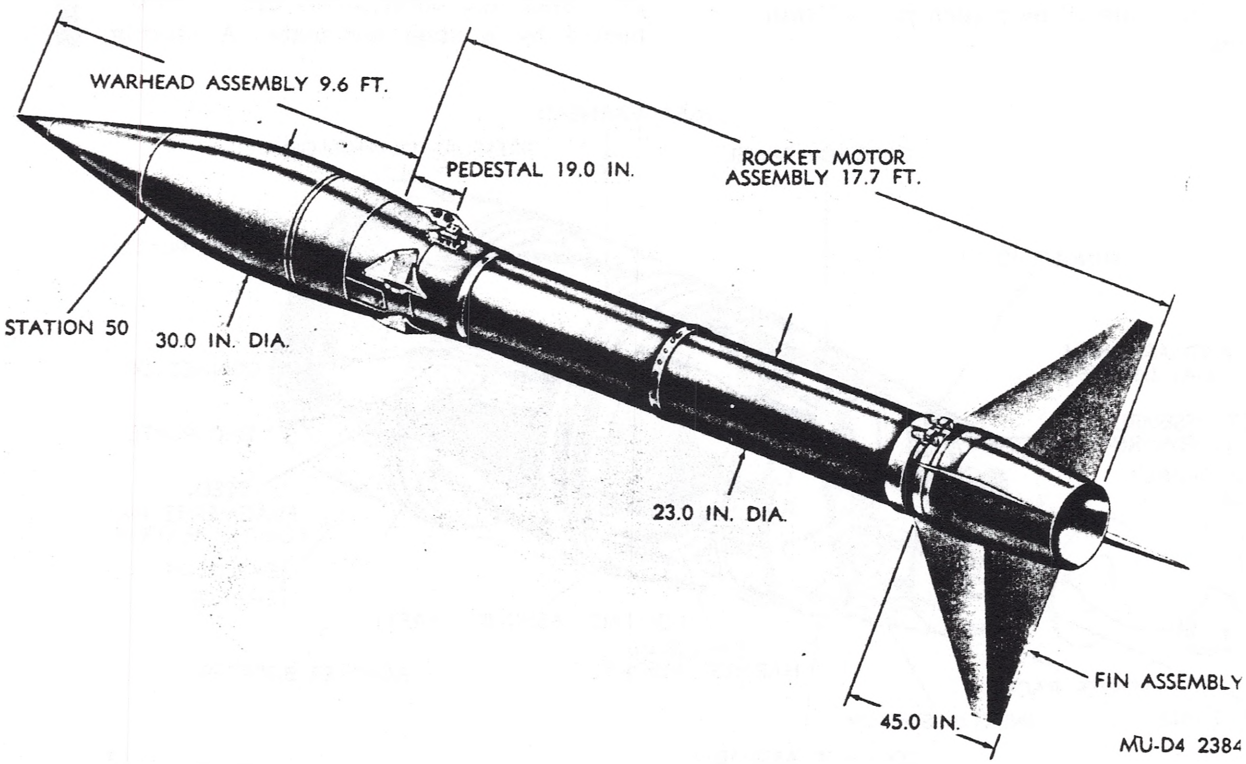

Figure 11-7.1. General Appearance and Dimensional Characteristics of the 762-mm Rocket, M31 Series (Honest John)

spin-and-fin-stabilized, solid-propellant, field artillery rocket. The Honest John may be assembled with the M57 HE Warhead or the T2021 Warhead.

11–1.5.1.2 PAINTING AND MARKING. The rocket is painted olive drab overall. The warhead has a six-inch-wide yellow band around the base of the nose cone. The rocket motor has a six-inch-wide brown band around the skin of the rocket motor assembly.

11–1.5.1.3 FITTINGS AND FEATURES. The general characteristics and location of major components of the rocket are shown in figure 11–7.1.

11–1.5.1.4 EXTERNAL FITTINGS

a. The nose shell assembly is hinged 50 inches from the rocket tip to allow the assembly to swing open.
b. Two hinged access doors, spaced 180° apart, are located on the pedestal.
c. Eight spin rockets are assembled in pairs, spaced 90° apart in the pedestal. A fairing is mounted over each pair of spin rockets.
d. Two forward launching shoe fairings are mounted 180° apart on the aft surface of the pedestal.
e. Two forward launching shoes are mounted 180° apart on the forward end of the motor skin.
f. Two aft launching shoes are mounted 180° apart on the aft end of the motor.
g. Four fin assemblies, located 90° apart, are positioned around the nozzle fairing.
h. A cutout in the nozzle fairing is provided for the spin-rocket actuating switch.

11–1.5.2 FEATURES. The Honest John rocket consists of two major components: the warhead and rocket motor.

a. High Explosive Warhead M57. The M57 warhead (figure 11–7.2) consists of an inner, and an outer shell. The inner shell contains Composition B. Spherical steel fragments are contained in a plastic matrix between the inner and outer shell. The inner and outer shells are interconnected by a steel end-plate. A closing

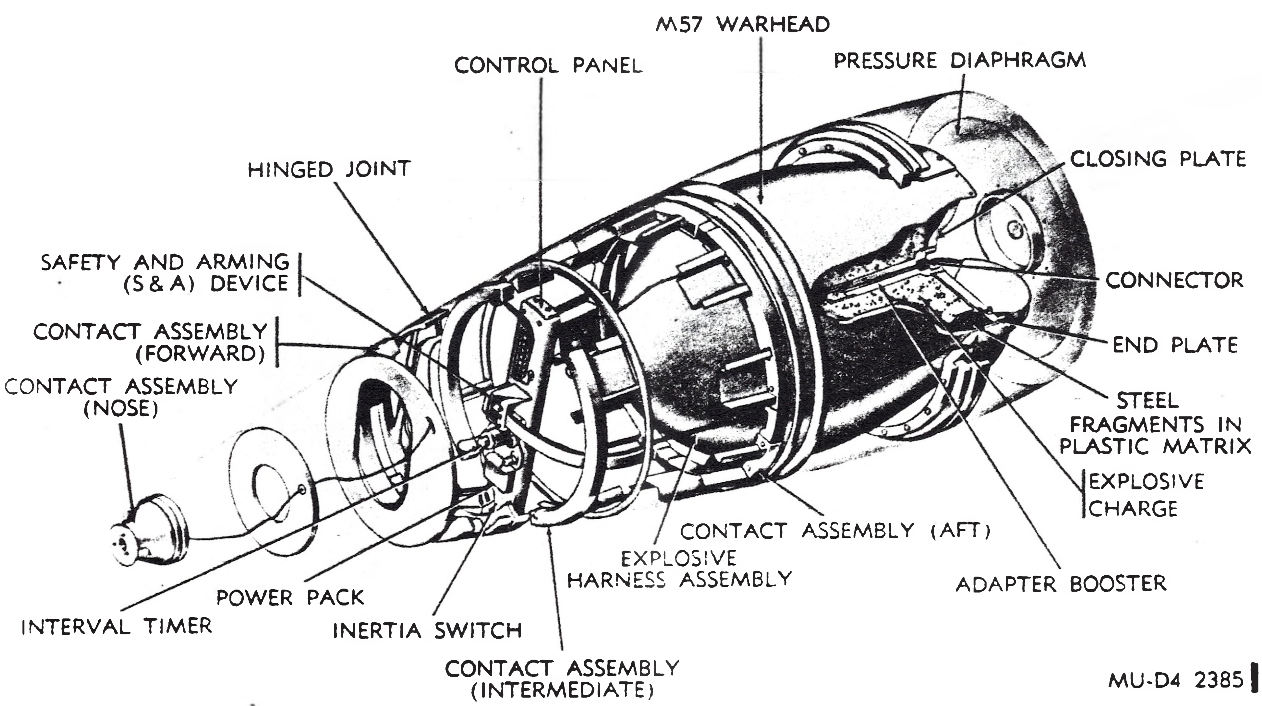

Figure 11–7.2. M1A2 Warhead Assembly with M57 Warhead and Impact Fuzing Installed

plate which fits into the recessed center of the end-plate contains the adapter booster.

b. Fuzing System, XM415. The XM415 is electrically armed and impact initiated. The system (figure 11-7.2) consists of an S and A device, an interval timer, a power pack, four contact assemblies and an explosive harness assembly.

c. High Explosive Warhead T2021. The T2021 warhead (figure 11-7.3) is a cylindrical-shaped warhead which weighs approximately 1500 pounds and contains HBX or tritonal. The base of the warhead contains a booster adapter modified to accept the T1400 series fuze.

d. Fuzing System, T1400 Series. The T1400 series fuzes are electrically armed, impact-inertia, base-detonating fuzes. The system consists of a thermal battery, an arming accelerometer, and a cable assembly.

e. Rocket Motor Assembly, M6 Series. The rocket motor assembly (figures 11-7.4 and 11-7.5) consists of the pedestal, rocket motor, rocket motor igniter, spin rockets and the fin assembly.

(1) The pedestal, located between the rocket motor and the warhead, is bolted to each part. The motor end of the pedestal houses the spin-rocket manifolds, electrical terminals and the spin-rocket batteries.

NOTE

The M2A1 pedestal is similar to the M2, except that cannon-type plug connectors replace terminal boards in the spin-rocket electrical harness, an igniter lead cutter bar is located on the left side access door, and the access doors are secured by quick-opening latches, rather than by screws.

(2) Rocket Motor. The rocket motor (figure 11-7.5) consists of a double-base, multiperforated solid grain pro-

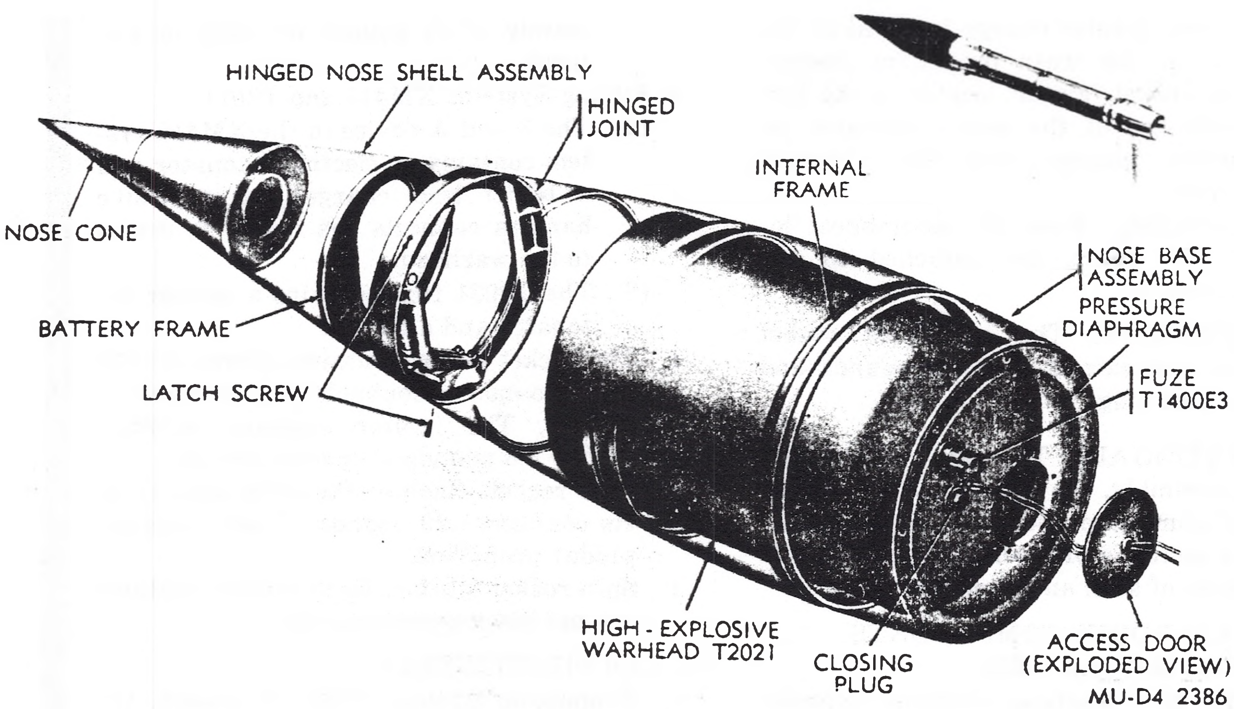

Figure 11-7.3. M1A2 Warhead Assembly with T2021 HE Warhead and Fuzing Components

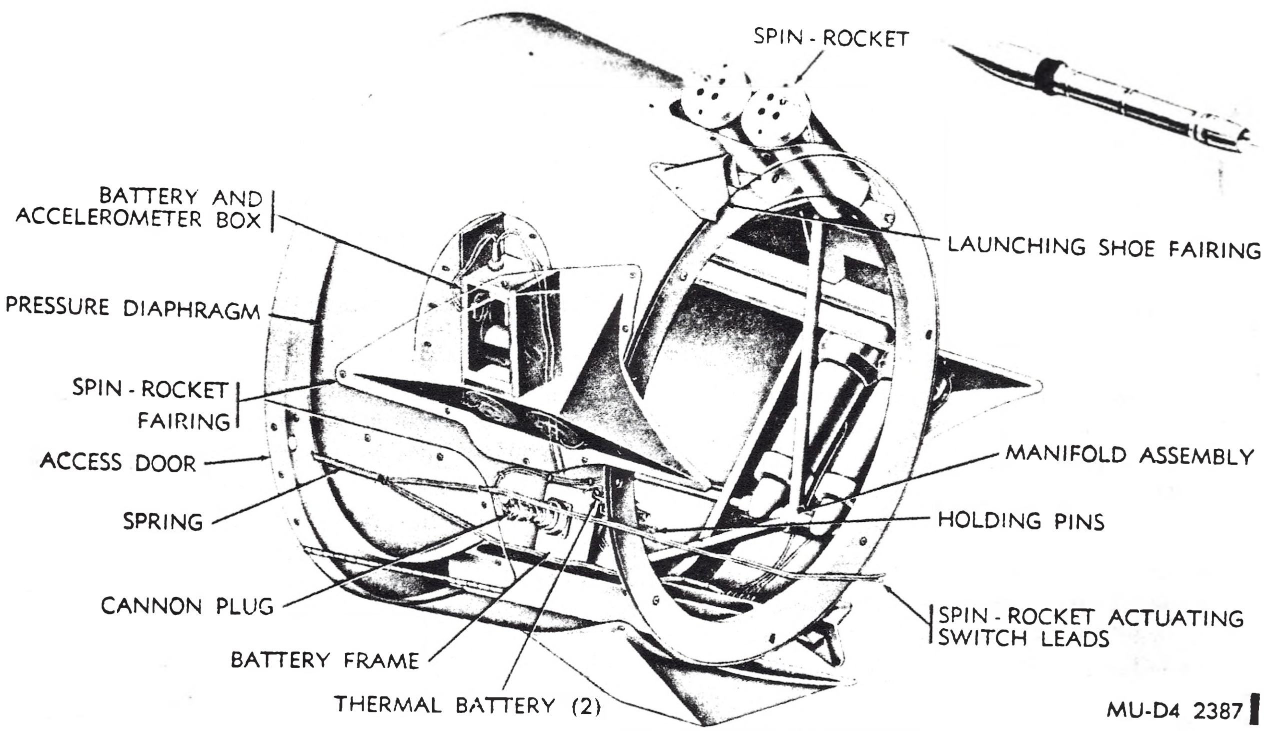

Figure 11-7.4. Pedestal for M6 Rocket Motor

pellant booster charge inserted in the web of the main propellant charge. The rocket igniter, located in the forward end of the motor, contains an igniter charge and four electric squibs.

f. Fin Assembly. Four fin assemblies, located 90° apart, are attached to the rocket nozzle.

11-1.5.3 WEIGHTS. The assembled rocket weighs approximately 5,900 pounds and is 27.3 feet long.

11-1.5.4 MATERIALS. The skin of the warhead assembly, the pedestal, and the fins are of aluminum alloy. The casing of the rocket motor is of steel. The spin rockets are made of steel and aluminum.

11-1.5.5 HAZARDOUS COMPONENTS.

a. Warheads M57 and T2021.

(1) The M57 warhead contains approximately 412 pounds of Composition B.

(2) The T2021 warhead contains approximately 1,215 pounds of HBX or tritonal.

b. Fuzing Systems XM415 and T2021.

(1) The S and A device in the XM415 system contains an electric detonator and a tetryl lead charge. An explosive harness connects the S and A device to the warhead.

(2) The T2021 fuze contains a primer detonator and a booster.

c. The rocket motor contains approximately 2,050 pounds of double-base propellant.

d. Igniter. The igniter contains approximately 3.3 pounds of igniter charge.

e. Spin rocket. Each of the eight spin rockets contains 1.29 pounds of cast (polysulphide) propellant.

f. Spin rocket igniter. Each igniter contains a small black power charge.

11-1.5.6 FUNCTIONING.

a. Propulsion System. Prior to launch, the rocket motor igniter is installed, thermal battery safety pins are removed and final

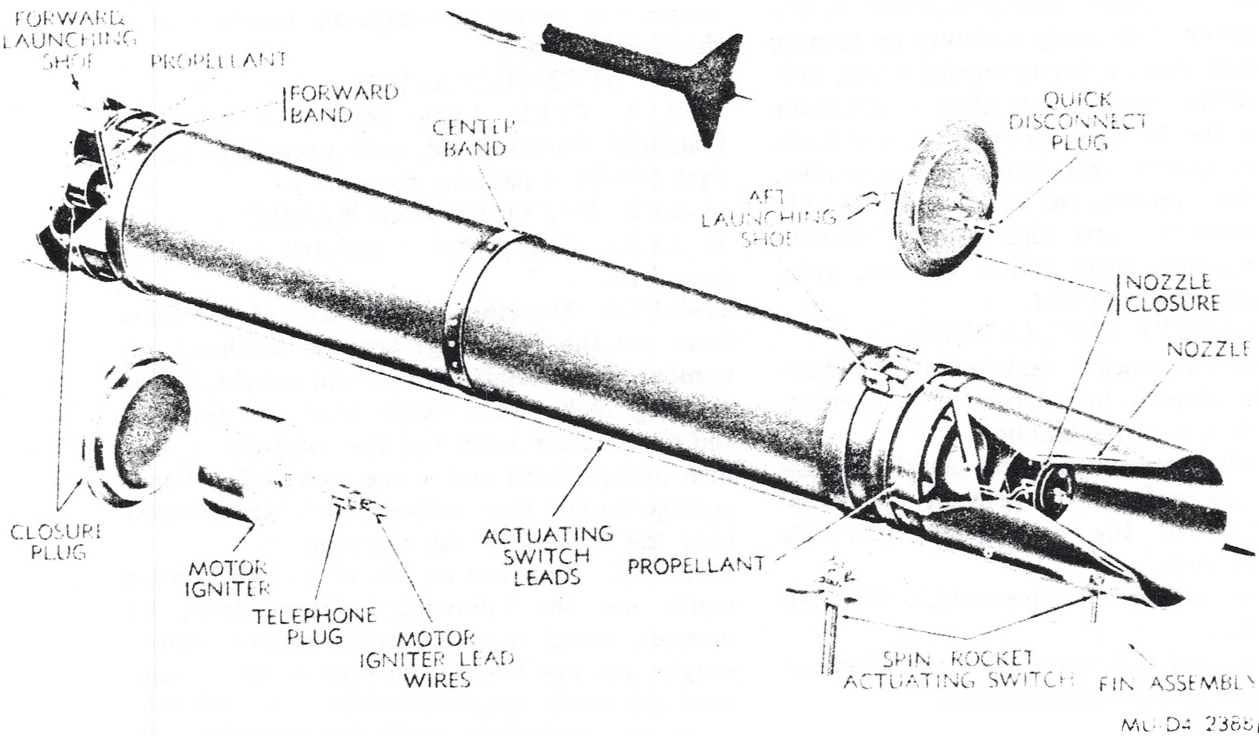

Figure 11–7.5. General Arrangement of the M6 Rocket Motor

connections are made between the rocket motor igniter and the firing panel. Upon command to fire, the electrical squibs in the thermal batteries are initiated. The squibs actuate the thermal batteries which initiate the rocket motor igniter. This, in turn, initiates the propellant grain. As the rocket moves forward, a holding pin is withdrawn from each of the thermal batteries in the pedestal assembly, allowing the batteries to become activated. As the rocket leaves the launcher, the spin ignition switch is closed. This completes a circuit between the spin rockets and the thermal batteries, initiating the spin rockets.

b. Fuzing Systems.

(1) Fuzing systems XM415. Upon setback, the interval timer is actuated and starts the arming sequence of the S and A device. Sustained acceleration causes the S and A device to align the electrical detonator with the lead charge. At a predetermined time, the interval timer completes its cycle and closes a set of contacts. This completes a circuit through the S and A device to the contact rings within the warhead skin. Upon impact, closing of any one of the contact assemblies completes the circuit through the timer to the S and A device, intiating the electrical detonator and functioning the explosive train.

(2) Fuzing system T1400 series. As the rocket is launched, sustained acceleration causes a stop to be removed in the arming accelerometer. This action unlocks a spring-wound clock mechanism, which, in turn, causes displacement of a rotating electrical switch. At the end of the clock cycle, the electrical switch completes the circuit between the battery in the accelerometer box and an electric motor in the fuze. The battery, which was ener-

gized when the spin-rocket actuating switch closed, provides power to the motor. The motor removes an arming stem from a spring-loaded rotor, permitting the rotor to align a detonator in the fuze explosive train and frees an inertia type firing pin assembly. Upon impact, the firing pin assembly moves forward. This initiates the fuze explosive train which, in turn, detonates the warhead.

11–1.5.7 SAFETY PRECAUTIONS

a. If the spin-rocket ignition switch handle is present, do not remove or accidentally break off the handle.

b. Exercise care when using metal tools inside the pedestal to prevent accidental shorting of the spin-rocket actuating switch leads.

c. Do not attempt to disassemble the spin rockets.

d. If pins are still installed in the thermal batteries, secure them in place.

11–2 318-MM ROCKET XM51 WITH FLASH-SMOKE PRACTICE WARHEAD XM8.

The 318-mm rocket XM51 with flash-smoke practice warhead XM8 is covered in this paragraph. The rocket is commonly referred to as the "Little John".

11–2.1 IDENTIFICATION

11–2.1.1 TYPE. Little John is a pre-spun, freeflight, fin-stabilized, solid propellant rocket that follows a ballistic trajectory.

11–2.1.2 PAINTING AND MARKING.

11–2.1.2.1 The rocket is painted a lusterless olive drab.

11–2.1.2.2 Stenciled on the skin of the warhead are the following: type of warhead, lot number, date manufactured, and weight. There is a ½ inch yellow band near the forward end of the after section of the warhead; a one-inch orange band and a one-inch yellow band, approximately four inches apart, are painted near the aft end of the warhead.

11–2.1.2.3 Stenciled on the skin of the rocket motor are the following: nomenclature, lot number, serial number, gross weight, empty weight, storage temperature limits, firing temperature limits, and the words "U.S. ARMY."

11–2.1.3 FITTINGS AND FEATURES. The general physical characteristics and location of the major components of the rocket are shown in figure 11–8.

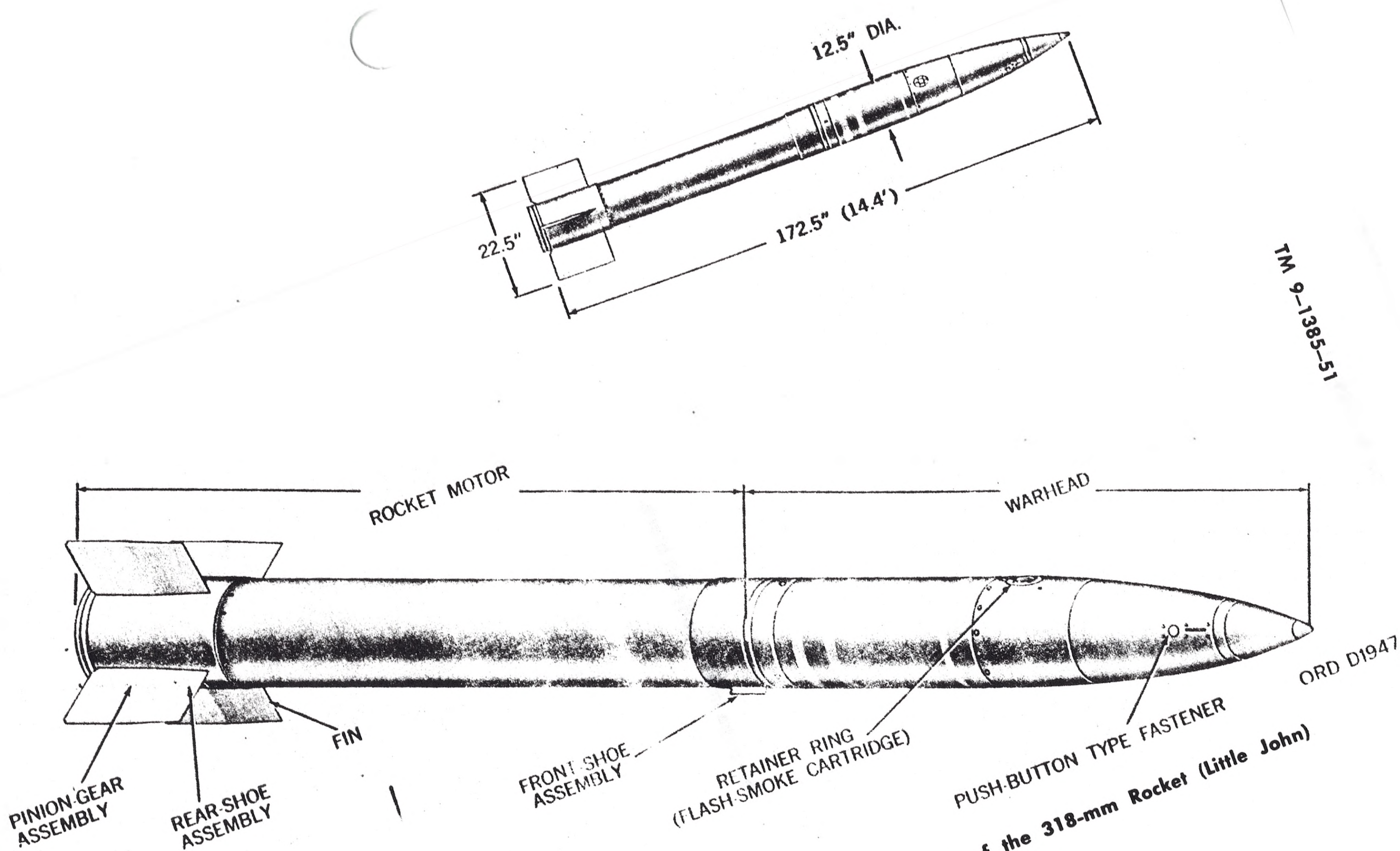

Figure 11–8. General Appearance and Dimensional Characteristics of the 318-mm Rocket (Little John)

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11-2.1.3.1 EXTERNAL FITTINGS.

a. Two push-button type fasteners, 180° apart, are located at the forward end of the warhead midsection. These fasteners secure the nose section of the warhead to the warhead midsection.

b. Two retainer rings, which hold the flash-smoke cartridges in the cartridge well, are located on the midsection of the warhead; these rings are 180° apart.

c. The front-shoe assembly is mounted on the the bottom centerline (as the rocket rests on the launcher) at the forward end of the rocket motor.

d. Four rectangular fins are mounted on the fin-barrel assembly near the after end of the rocket motor; between two of these fins (on the bottom centerline) are the pinion-gear assembly and the rear-shoe assembly.

11-2.1.3.2 ACCESS PROVISIONS.

a. Access to the warhead components may be gained at two points:

(1) Access to the fuze is obtained by pushing the two push-button type fasteners and sliding the nose section forward.

(2) Access to the detonating cord may be gained by removing the midsection of the warhead from the after section by removing the Phillips-head screws.

b. The igniter assembly and the battery and switch assembly and associated wiring are accessible through the nozzle end of the rocket motor.

11-2.1.3.3 FEATURES. Little John consists of Warhead, XM8, and Rocket Motor, XM26E1.

a. *Warhead.* The warhead (see fig. 11-9) consists of a nose section which covers the fuze T2075E1, a midsection which houses the two flash-smoke cartridges and the detonating lead assembly, and an after section which carries the ballast required to give the warhead the necessary weight and center of gravity to match the ballistics of the other warheads used with Little John. The warhead is attached to the rocket motor by a captive-locking ring which threads onto a flange at the forward end of the motor.

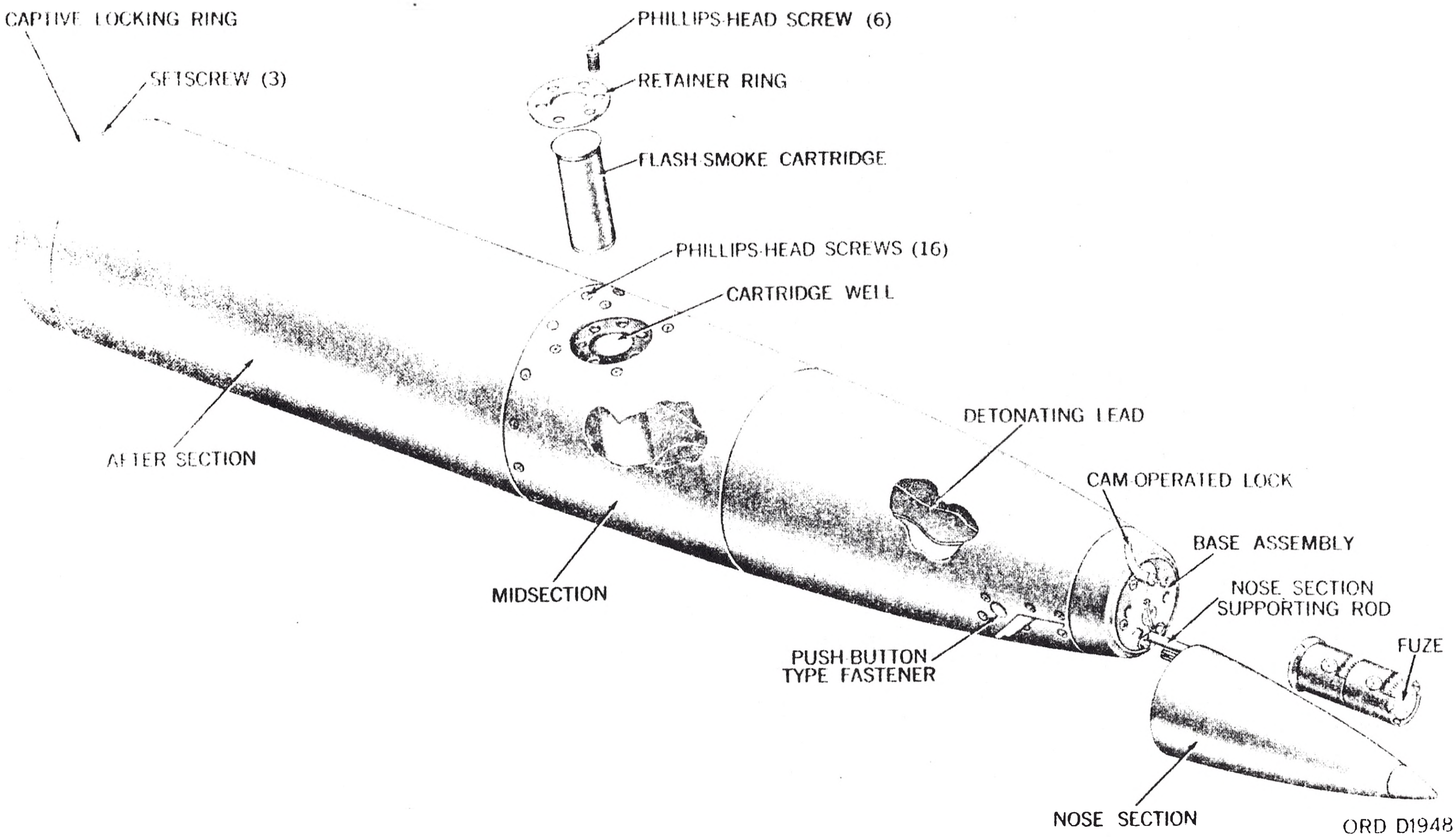

Figure 11-9 Warhead XM8

(1) *Fuze T2075E1*. This fuze is of the mechanical time type. It consists of two separate timers, mounted one upon the other. Each timer consists of a movement assembly and a base assembly. The movement assembly contains the clockwork mechanism and the base assembly contains the detonator, RDX lead, cocked firing pin and associated weights and linkages. The two timers are individually set, and function independently of each other. The movement assemblies have identical dial scales ranging from 0 to 120 seconds. Two pinions are employed to set the desired time. Two pull pins are used to prevent arming of the fuze.

(2) *Detonating lead assembly*. This assembly completes the explosive train between the fuze and the flash-smoke cartridges. The detonating lead assembly consists of a booster assembly, and two lengths of detonating cord with end primers crimped to each length.

(3) *Flash-smoke cartridge*. The flash-smoke cartridge is used to indicate the point of detonation. The warhead contains two such cartridges located 180° apart near the after end of the warhead midsection. Each cartridge is held in the cartridge well by a retainer ring which is secured to the midsection skin by Phillips-head screws.

b. *Rocket Motor*. The rocket motor (figure 11-10) contains the solid-propellant grain that provides thrust for the rocket. The rocket motor employs a front-shoe barrel assembly and a fin-barrel assembly to permit the rocket to spin while it is on the launcher. Components of the battery and switch assembly are mounted on brackets at the rear of the rocket motor nozzle; the igniter assembly is installed in the after end of the propellant grain.

NOTE

The thrust neutralizer is secured to the after end of the rocket motor to disperse thrust in the event of accidental propellant ignition. The thrust neutralizer is removed before the rocket is fired.

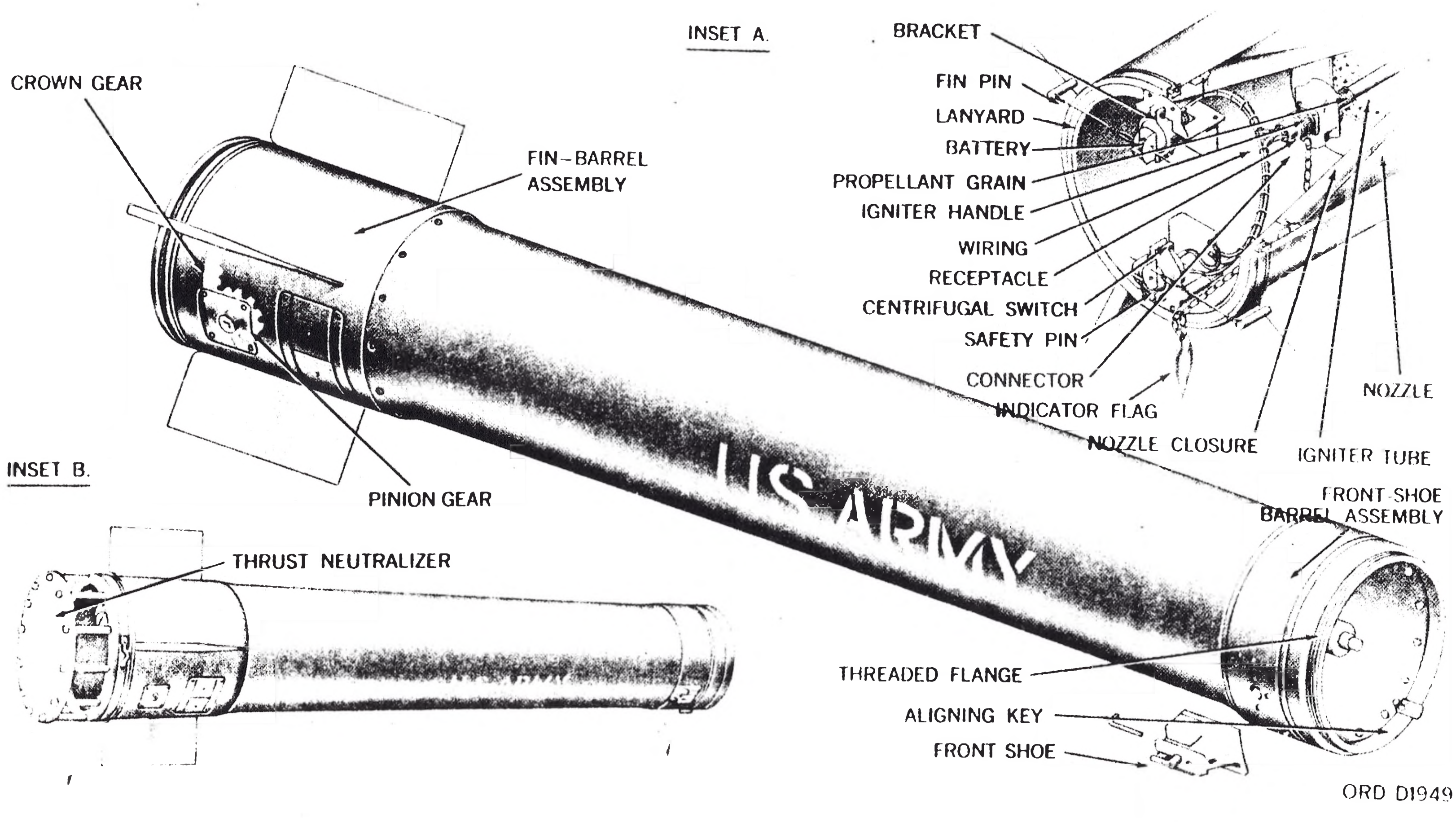

Figure 11-10 Rocket Motor; Inset A-Location of Battery and Switch Assembly and Igniter Assembly. Inset B-Thrust Neutralizer Attached

(1) *Front-shoe barrel assembly.* The assembly contains two thrust bearings that form a junction between the spinning rocket and the stationary front-shoe barrel. The front-shoe engages the launcher rail. When the rocket is fired, the spring-loaded front shoe is ejected from the rocket.

(2) *Fin-barrel assembly.* This assembly permits the rocket to spin while on the launcher. A pinion gear, mounted on the fin barrel, meshes with a crown gear on the rocket motor nozzle and engages a shaft from the spin mechanism. The rear shoe which is mounted on the fin barrel engages the launcher. Four fins are mounted on the fin barrel to provide rocket stability during flight.

(3) *Battery and switch assembly.* This assembly supplies the power to fire the igniter which ignites the propellant grain. It consists of two batteries, two centrifugal switches, two fin-pin assemblies, associated wiring and a connector. The batteries and switches are attached to two brackets on the after end of the rocket motor nozzle. The wiring connects the battery and switch assembly to the connector which plugs into the receptacle on the igniter handle. The fin pins are inserted into the trailing edge of two fins. These fins are used to trigger the batteries.

(4) *Igniter assembly.* This assembly consists of the igniter handle, igniter tube, and receptacle. The igniter tube extends into the propellant grain, and the igniter handle threads into the nozzle closure. The receptacle receives the connector from the battery and switch assembly. An indicator flag is attached to the igniter handle by means of a chain.

11-2.1.4 WEIGHTS. The weight of the rocket, ready for launching, is approximately 779 pounds. The warhead weighs 262 pounds, and the rocket motor weighs 517 pounds.

11-2.1.5 MATERIALS. The exterior surface of the warhead assembly is aluminum. The rocket motor shell is made of steel and the fin assembly is made of magnesium.

11-2.2 HAZARDOUS COMPONENTS.

a. The hazardous components of the warhead are the fuze T2075E1, the detonating lead assembly, and the two flash-smoke cartridges.

(1) The fuze contains two detonators, and two RDX lead assemblies.

(2) The detonating lead assembly consists of a booster assembly, and two lengths of PETN detonating cord with end primers crimped to each length.

(3) Each flash-smoke cartridge contains spotting composition of 1½ pounds of 60 percent barium nitrate and 40 percent atomized aluminum.

b. The hazardous components of the rocket are the propellant charge, its igniter, and two batteries.

(1) The propellant charge consists of approximately 242 pounds of solid propellant.

(2) The igniter is composed mostly of black powder.

(3) The batteries are percussion-initiated thermal batteries.

11-2.3 FUNCTIONING.

a. *Prior to launch.* The rocket is spun prior to launch to obtain maximum accuracy. The drive shaft of the spin mechanism on the launcher engages the pinion gear of the fin-barrel assembly. This gear, in turn, drives a crown gear on the rocket motor nozzle, thus imparting spin to the rocket while it is still on the launcher. At the beginning of spin, the batteries are activated as the battery safety pins are pulled by the lanyards attached to the fin pins in the stationary fins. When rocket spin reaches three revolutions per second, the two centrifugal switches of the battery and switch assembly close, completing the circuit from the batteries to the igniter, and the igniter fires the propellant grain of the rocket motor.

b. *Launch*. As the rocket leaves the launcher, the fin locks with the spinning rocket, and spin is maintained throughout the remainder of flight by the canted fins.

c. *Arming and firing*. Sustained acceleration of the rocket trips a safety lever in the fuze, starting the clock mechanism. Fuze action continues after burnout of the rocket motor propellant, and when the preset time has elapsed, the fuze initiates the detonating lead assembly which, in turn, sets off the flash-smoke cartridges. Each cartridge produces a flash and a white smoke cloud.

NOTE

For fuze functioning refer to paragraph 11-1.

11-2.4 SAFETY PRECAUTIONS.

WARNING

Ground rocket body before attempting any procedures.

11-2.4.1 The general safety precautions regarding the approach, attack and disposal of unexploded ordnance must be observed.

11-2.4.2 Use extreme caution when handling these flash-smoke charges. The spotting composition used in these charges is sensitive to heat, shock, and friction.

11-2.4.3 Do not look in the direction of the disposal area when cartridge is being disposed of by burning or detonation. Brilliance of flash produced can be harmful to the eyes even at distances which are safe against fragments.

11-2.4.4 If the spotting composition is spilled, it should be soaked with oil and then picked up with an oil-soaked rag.

11-2.4.5 If the rocket is found with safety pin(s) inserted in the batteries, secure the pin(s) in place before attempting any procedure which involves reaching into the nozzle of the rocket motor.

11-2.4.6 Extreme care should be taken in handling the rocket motor igniter.

11-2.4.7 Handle the fuze with extreme care because of the spring wound clockwork mechanism and cocked firing pin which are present.

11-2.4.8 Never attempt to disassemble the fuze, for this may result in accidental initiation of the detonators.

11-2.4.9 Avoid any large increase in temperature near the rocket motor and never apply any heat directly to the rocket motor.

11-2.4.10 Keep static-producing devices away from the rocket motor.

11-2.4.11 Nonsparking tools (tools with low sparking characteristics) should be used while working on or near explosive components.

11-3 66-MM HIGH-EXPLOSIVE ANTITANK (HEAT) ROCKET M72 WITH POINT-INITIATING BASE-DETONATING FUZE M412

The 66-MM high-explosive antitank rocket M72 with point-initiating base-detonating fuze M412 is covered in this paragraph. The weapon is commonly referred to as the "LAW."

11-3.1 IDENTIFICATION.

11-3.1.1 TYPE. This weapon is a lightweight, shoulder-fired, fin-stabilized rocket which, as issued, is preloaded in its throw-away launcher. The rocket warhead is of the shaped-charge type, and it includes a point-initiating (piezoelectric crystal) element and a base-detonating fuze. The fuze also contains a graze-sensitive feature.

11-3.1.2 PAINTING AND MARKING. The warhead is painted olive drab or black with markings in yellow. The rocket motor is painted brown.

11-3.1.3 FITTINGS AND FEATURES. The general physical characteristics of the rocket are shown in figure 11-11. External features are as follows:

a. An ogive is attached to the forward end of the rocket warhead body, and a cap on the nose of the ogive covers the point-initiating element of the fuze.

b. The closure houses the base-detonating element of the fuze, and provides a barrier between the rocket motor chamber and the warhead. It is threaded to the forward end of the rocket motor and attached to the rear end of the warhead with a swaged seal.

c. Six folding fins are attached to the exterior of the motor nozzle, and the throat of the nozzle is closed by a molded polyethylene holder for the igniter.

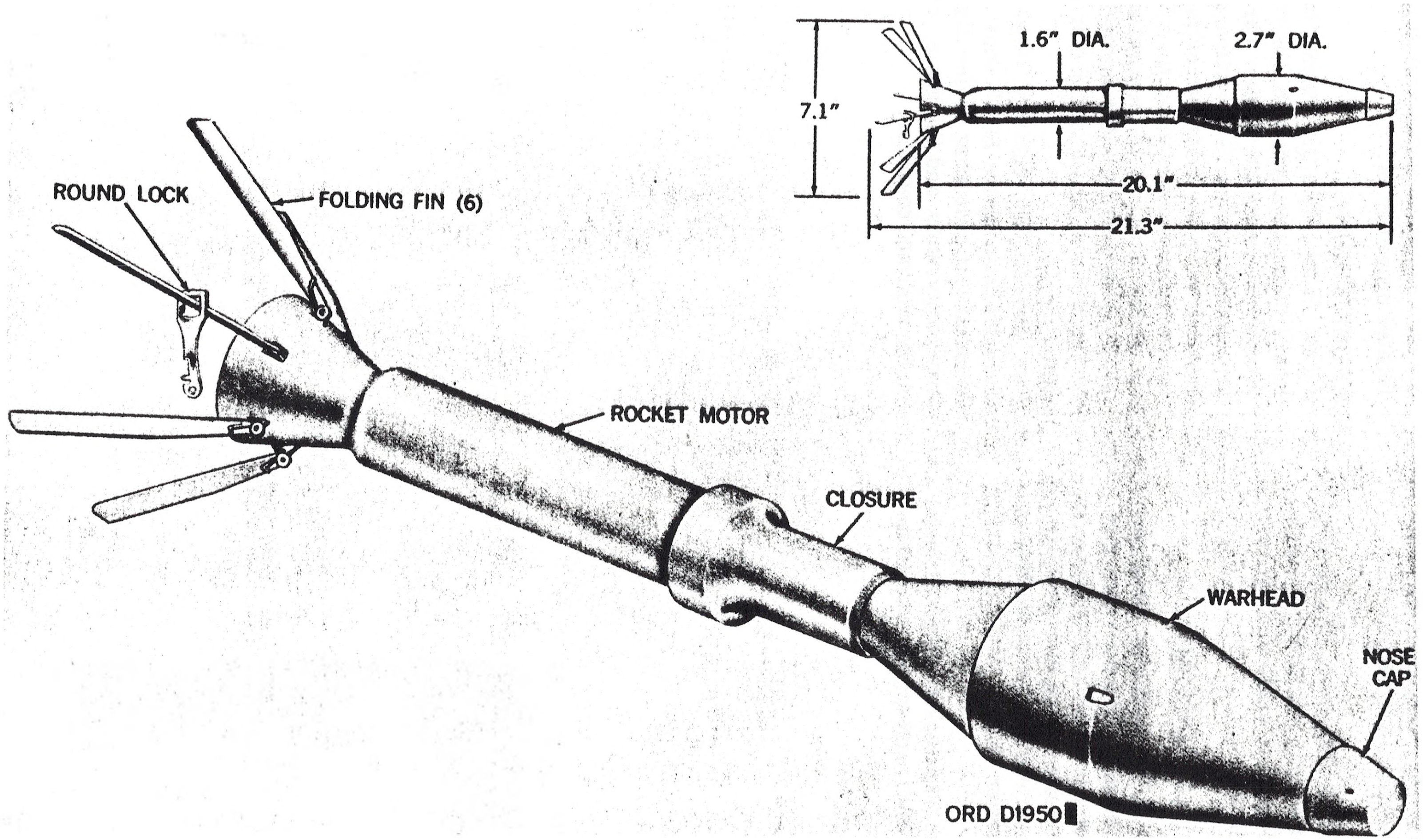

Figure 11–11 66-MM HEAT Rocket M72-External View

11–3.1.4 WEIGHTS. The weight of the complete round, as launched, is 2.2 pounds.

11–3.1.5 MATERIALS. The ogive, the closure, and the rocket motor body are made of aluminum; the warhead body is made of steel, and the fins are magnesium.

11–3.2 HAZARDOUS COMPONENTS

a. Rocket warhead. The rocket warhead contains approximately 0.67 pound of a mixture of 75 percent HMX and 25 percent TNT. The base detonating element of the fuze includes an electric detonater M48, a stab-type primer M106, and a tetryl booster.

b. Rocket motor. The rocket motor consists of Primer M29A1, and igniter, and 19 individual grains of double-base single perforated propellant M7.

11–3.3 FUNCTIONING.

a. Rocket firing. With the rocket launcher locked in the open position, the rocket is fired by squeezing the trigger bar on the top of the launcher. This action releases the tension on the firing pin cable, allowing the spring-loaded firing pin to impact the primer as shown in the inset to figure 11–12. The flash from the primer ignites the igniter and the rocket motor propellant.

b. Fuze arming. The cutaway views of the fuze M412 in figure 11–13 show the sequential leaf unlocking device, the explosive components, and the graze firing pin in the unarmed condition.

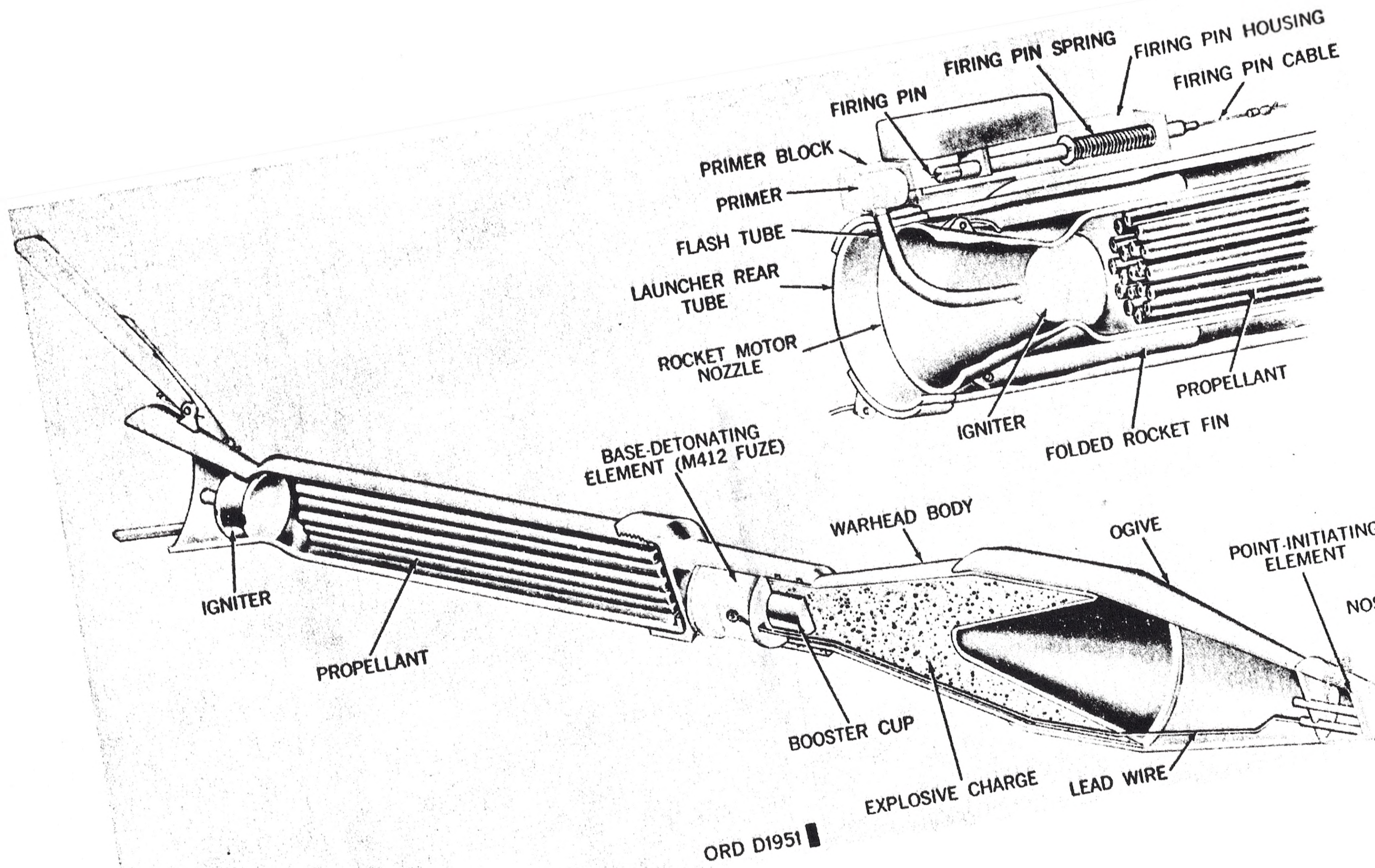

Figure 11–12 66-MM HEAT Rocket M72-Cross Section

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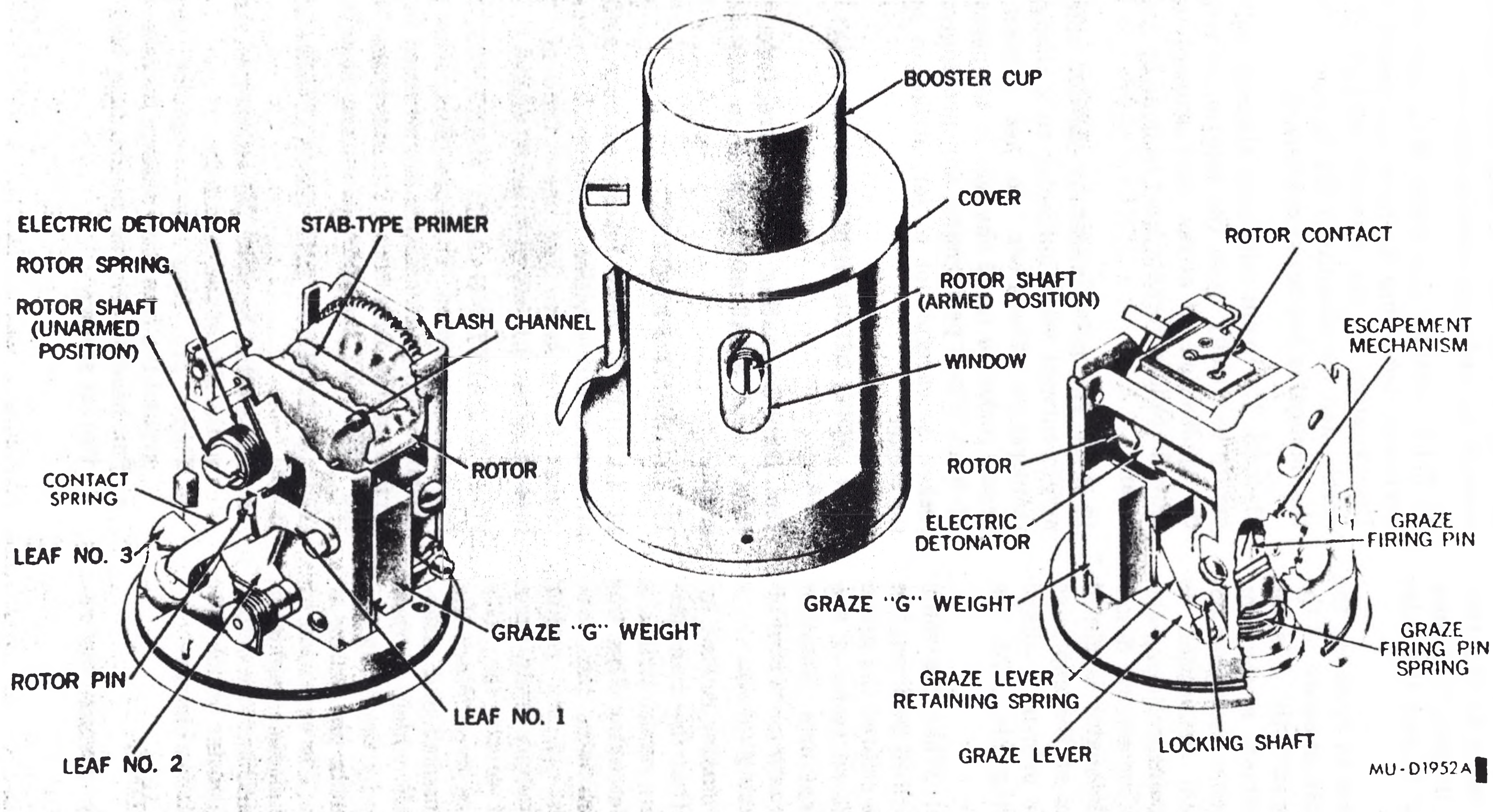

Figure 11–13 Fuze, M412-Sequential Leaf Unlocking Device, Explosive Components, and Graze Firing Pin in Unarmed Condition

(1) Setback, due to acceleration, causes leaf number 3 to move to the rear, thereby unlocking, in turn, leaf number 2, leaf number 1, and the rotor (figure 11–13).

(2) The rotor is now free to rotate to the armed position under pressure of the rotor spring and against the delaying action of the escapement mechanism. When the rotor reaches the armed position, an electrical connection is made between the point-initiating element lead wire and the electric detonator; the electric detonator is alined with the remainder of the explosive train; the stab-type primer is alined with the graze firing pin; and the fuze is armed.

(3) Graze firing system. When the rotor has rotated to its armed position, the slot in the rotor has cleared the graze lever arm, and a cut-out sector of the rotor is opposite that arm. Rotation of the graze lever is now prevented by the graze lever retaining spring.

c. Impact. The electric detonator is fired by an electrical impulse from the point-initiating element when the rocket strikes a target head-on. The detonator fires the booster which then detonates the warhead explosive charge. If the rocket strikes a target at an oblique angle, deceleration due to impact causes the "G"-weight to turn the graze lever. When the graze lever turns, its hooked end disengages the locking shaft which is then cammed out of the way by the firing pin as it is driven by the firing pin spring in to the stab-type primer. The explosion of the primer initiates the electric detonator through the flash channel, and the detonator, in turn, fires the booster which detonates the warhead explosive charge.

11–3.4 SAFETY PRECAUTIONS.

11–3.4.1 The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

11–3.4.2 Consider any rocket M72 that has experienced launching to have an armed fuze. Discoloration of the interior surface of the nozzle, and the absence of the igniter, indicate that launching has been experienced.

11–3.4.3 The point-initiating element will generate electricity upon the release, as well as the application, of stress. Any attempt to remove imbedded rockets must be done by remote means.

11–3.4.4 The point-initiating element will generate current when subjected to a change in temperature. Therefore, do not subject an armed rocket to rapid changes in temperature.

11–3.4.5 When performing any procedures on rocket, be careful not to jar, strike, or move the rocket.

11–4 POINT DETONATING FUZES M4, M4A1, and M4A2

The point-detonating rocket noze fuzes M4, M4A1, and M4A2 are covered in this paragraph.

11–4.1 IDENTIFICATION

11–4.1.1 TYPE. These fuzes are a nose, setback arming, selective action (superquick or delay), impact firing type. The delay time of these fuzes is either 0.1 second or 0.015 second.

11–4.1.2 PAINTING AND MARKING. The fuzes are unpainted. The fuze designation and various loading information are stamped in the surface of the fuze body. The markings "SQ" and "DELAY" are stamped on the fuze body.

11–4.1.3 FITTINGS AND FEATURES (figure 11–14).

a. The slotted head of the selector is visible in the side of the fuze body.
b. There are four slots equally spaced around the fuze body seating surface.
c. The head is secured to the fuze body by two set screws.

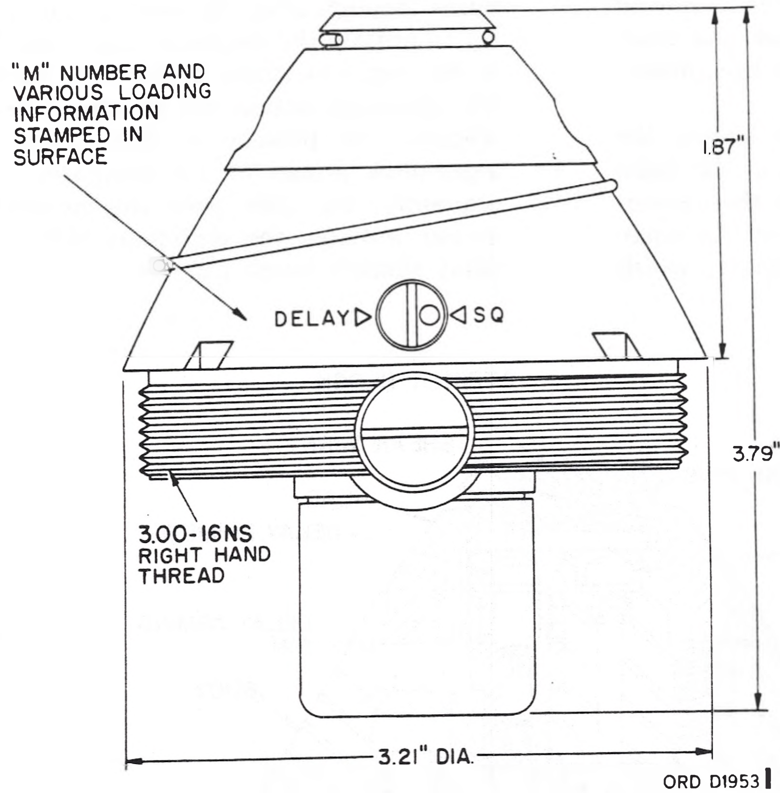

Figure 11-14 Dimensional Characteristics of Fuze M4 Series

11-4.1.4 WEIGHTS. The fuzes weigh approximately 2.06 pounds.

11-4.1.5 MATERIALS. The fuze body is made of steel. The fuze head is made of aluminum.

11-4.2 HAZARDOUS COMPONENTS. The fuze consists of two percussion primers, a black powder delay element, two relays, a detonator (primer mixture, lead azide, and tetryl) and a booster consisting of approximately 0.8 ounce of tetryl.

11-4.3 FUNCTIONING (figures 11-15 and 11-16).

a. The fuzes M4 and M4A1 are similar to the M4A2, except that the selector of those fuzes has two flash holes which are positioned so that when one flash hole alines the superquick explosive train, the other obstructs the delay explosive train and vice versa.

b. When the rocket is prepared for launching, the fuze is set for either superquick or delay action. The action of the fuze is selected by turning the slotted selector until the dot on it registers with the arrow indicating the desired action. In addition, the safety pin is removed to release the setback pin.

c. When the rocket is launched, inertia forces due to acceleration (setback forces) cause the setback pin to move downward against the setback pin spring, thereby compressing it. The downward movement of the setback pin releases the retaining ball, which in turn, releases the delay arming pin. As acceleration of the rocket decreases, the delay arming pin spring forces the delay arming pin upward until the delay arming pin releases the slider. The slider (moved by the slider spring) positions the detonator in proper alinement with the remainder of the explosive train. The spring-loaded detent locks the slider in this position. The fuze is now armed.

d. Upon impact, the striker block is forced inward, breaking the shear wire and causing both firing pins to impinge and initiate their respective primers.

e. If the fuze was set for delay action, the selector obstructs the passage of the flame from the superquick primer to the detonator; consequently, the flash from the delay primer ignites the delay element, which burns through after the predetermined delay to initiate the detonator and remainder of the explosive train. If the fuze was set for superquick action, the selector does not obstruct the passage of flame from the superquick primer to the detonator; consequently, the flash from the superquick primer initiates the detonator before the delay element burns through.

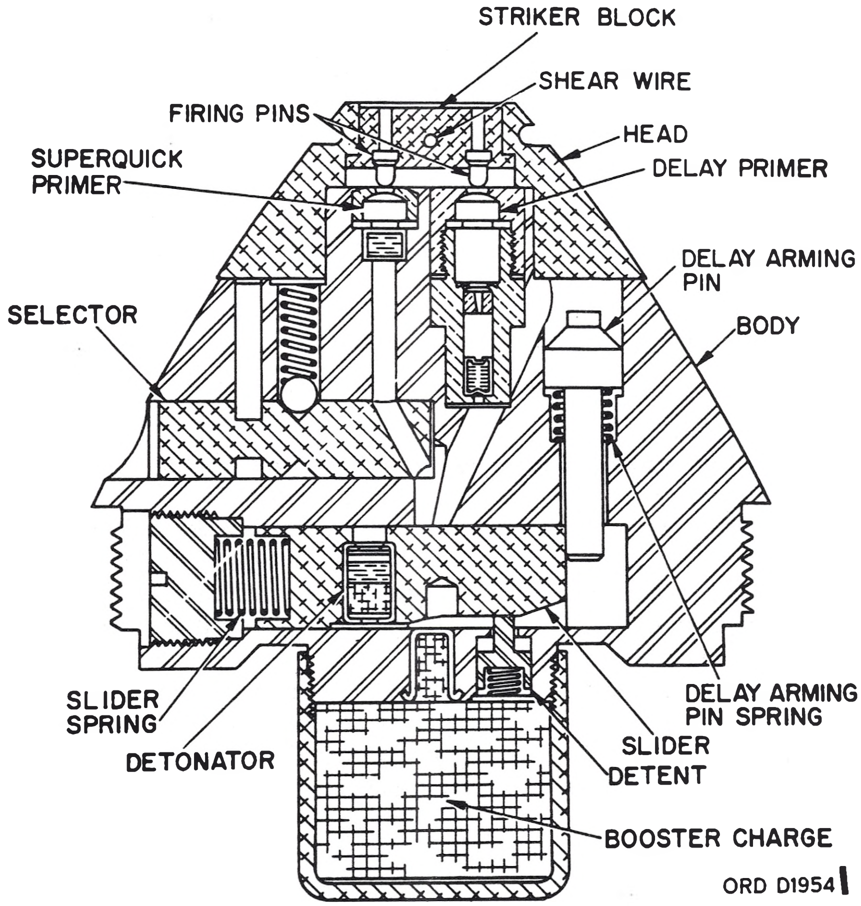

Figure 11-15 Fuze M4A2 in the Unarmed Condition—Cross Section

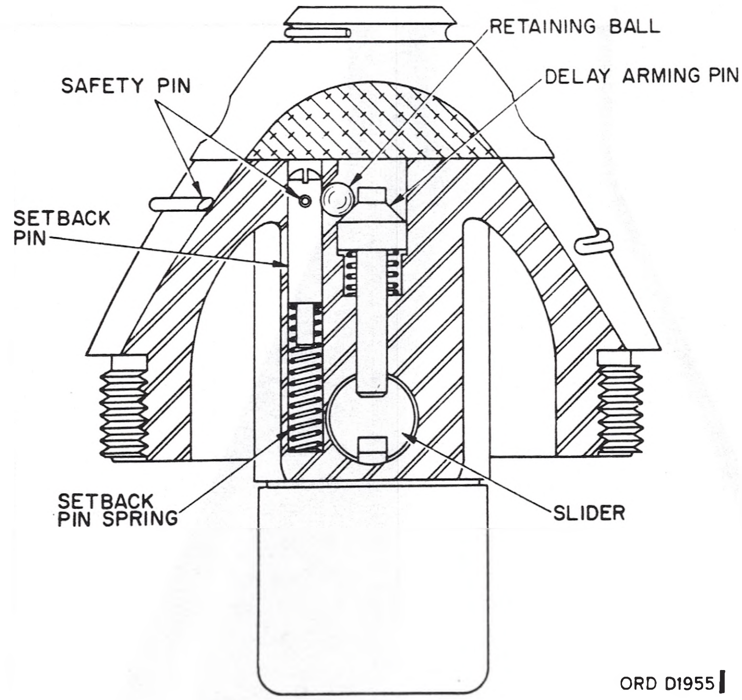

Figure 11-16 Fuze M4A2—Position of Setback Pin, Delay Arming Pin, and Retaining Ball in the Unarmed Condition—Cross Section

11-4.4 SAFETY PRECAUTIONS.

11-4.4.1 The general precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

11-4.4.2 Positively identify the rocket and fuze present, and determine the condition of the fuze.

11-4.4.3 Do not drop or jar the fuze or rocket. Always protect the striker block against any blows which would cause its movement.

11-4.4.4 If the warhead is imbedded in the ground, initial movement will be done remotely.

11-4.4.5 If the striker block is separated from the fuze by a dearmer, protect the exposed primers by plugging up the cavity with soft material such as cloth or tape.

11-4.4.6 An auxiliary booster (0.8 pound of TNT and 0.2 pound of tetryl) is used with these fuzes in deep cavity rocket heads. The auxiliary booster is not secured to either the rocket head or fuze and may fall out when the fuze is removed. In the event the auxiliary booster remains in the rocket head after the fuze is removed, secure it against movement in the rocket head.

11-5 POINT INITIATING FUSES M406 AND MK181

The point initiating fuzes M406 and MK18 are covered in this paragraph.

11-5.1 IDENTIFICATION.

11-5.1.1 TYPE. These fuzes are of the accelera tion-delayed arming, impact firing, point initiat ing, instantaneous action type.

11-5.1.2 PAINTING AND MARKING. Th fuzes are unpainted. The designation and loadin information are stamped in the conical surfac of the fuze body.

11-5.1.3 FITTINGS AND FEATURES (figur 11-17).

a. The fuze does not contain a firing pin. primer, housed in the fuze body, is initiate directly on impact.
b. Two wrench flats, 180° apart, are machine in the windshield.
c. The tip of the conically shaped windshiel forms a solid cylinder.

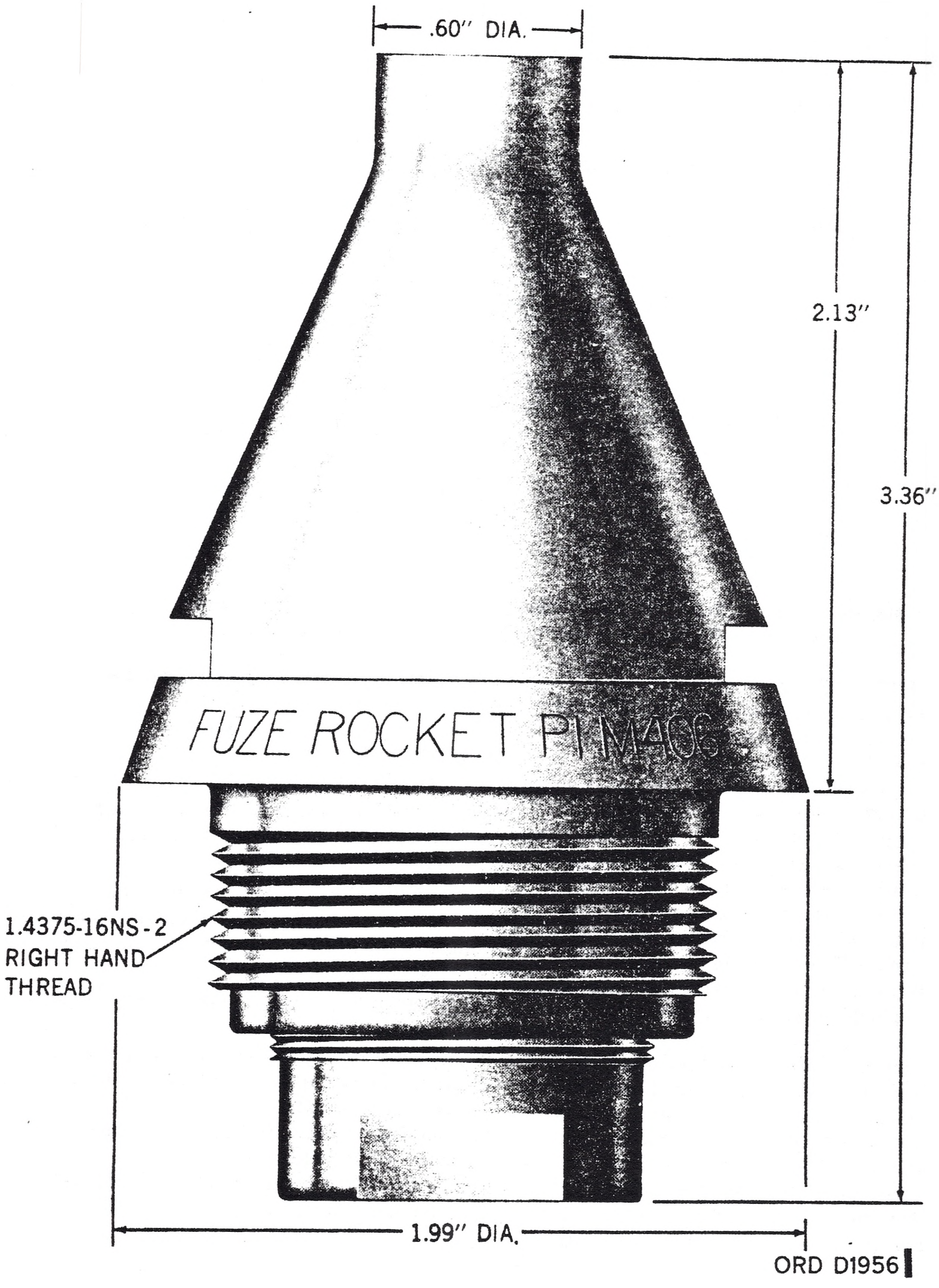

Figure 11-17 Dimensional Characteristics of Fuze M406

11-5.1.4 WEIGHTS. The fuze weight is approximately 0.83 pound.

11-5.1.5 MATERIALS. The body and the windshield of the fuzes are made of steel.

11-5.2 HAZARDOUS COMPONENTS. The explosive train of the fuzes consists of the following components: primer, detonator, rotor lead charge, auxiliary lead charge, and auxiliary booster which contains a shaped charge.

11-5.3 FUNCTIONING. The fuze M406 and the fuze Mk 181 are identical in construction, in arrangement of their components, and in operation. Therefore, the description of the functioning of the fuze as presented below, as well as the sectional view of the fuze and details of its rotor mechanism as shown in figures 11-18 and 11-19 respectively, apply to both fuzes.

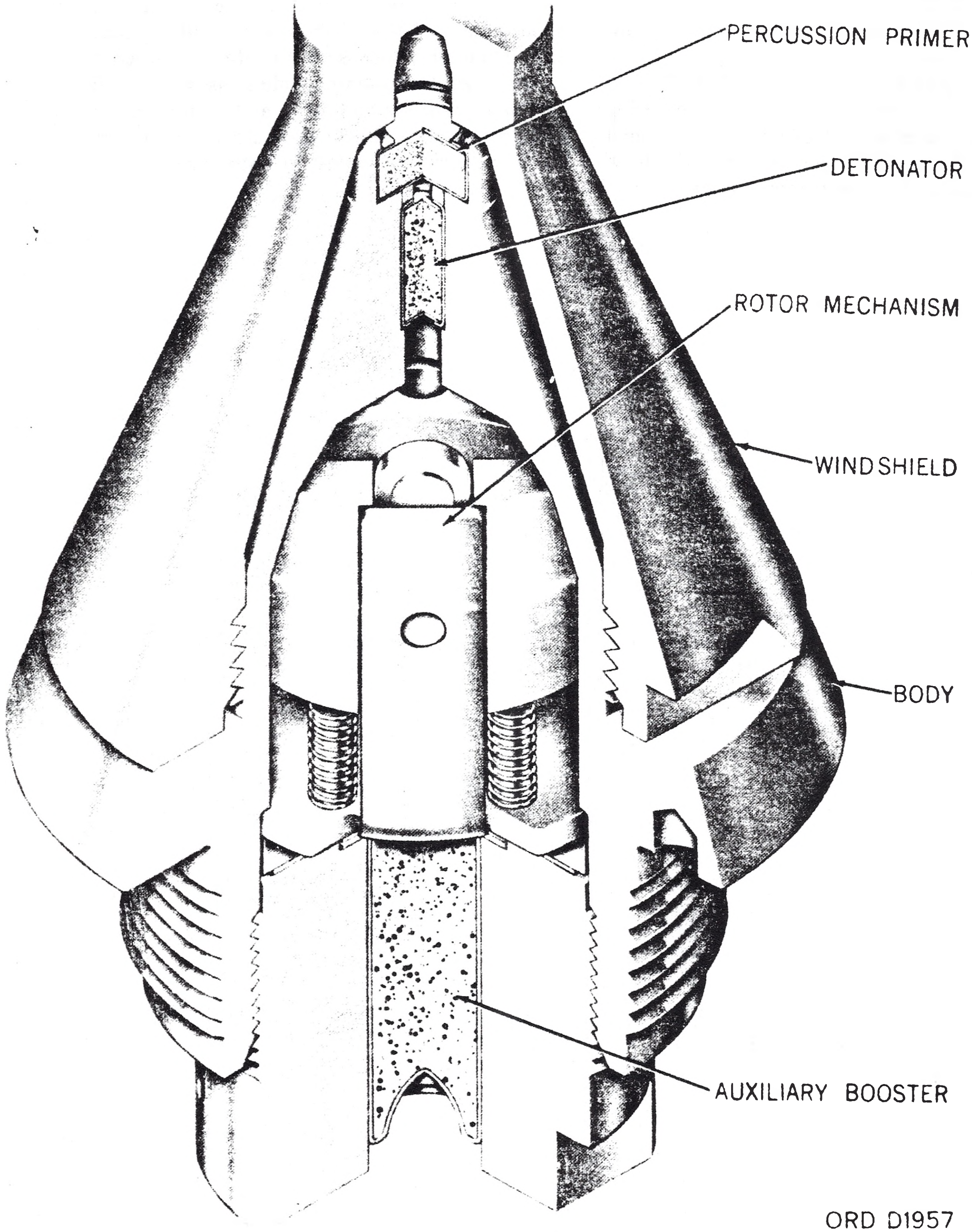

Figure 11-18 Fuze M406 or Mk 181 - in the Unarmed Condition - cut away view

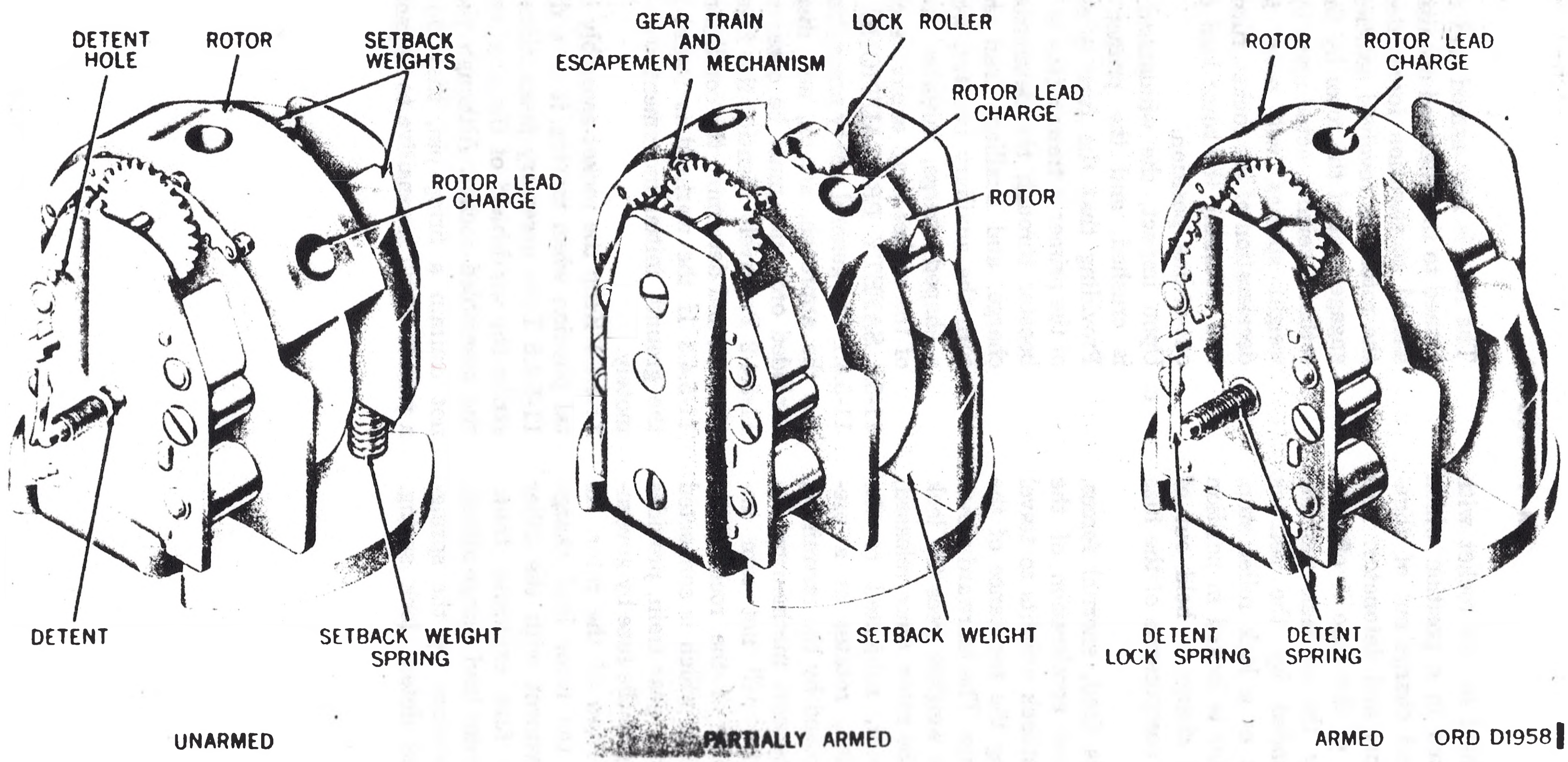

Figure 11-19 Rotor Mechanism-In the Unarmed, Partially Armed, and Armed Conditions

a. The fuze is assembled to the rocket with the fuze rotor locked in a position which places the rotor lead charge out of alinement with the primer and detonator. This unarmed condition of the fuze is effected and maintained by the setback weights, which, when extended by the setback weight springs, act as a lock roller stop. As a result, the rotor is locked in position and the rotor lead charge is held out of line with the other components of the fuze explosive train.

b. When the rocket is fired, enertial forces, due to the sustained acceleration of the rocket, cause the setback weights to travel rearward overcoming the resistance of the setback weight springs. The rearward movement of the setback weights frees the lock roller and releases the rotor. Once released, the unbalanced rotor, subjected to the forces of acceleration, rotates at a predetermined rate imposed by the restraining action of the escapement mechanism. To insure that the fuze will not arm immediately upon firing of the rocket, the escapement mechanism which is connected to the rotor through a gear train, provides a delay in the arming of the fuze by governing the rate of rotation of the rotor. As the rotor revolves, the rotor lead charge is brought into alinement with the other components of the fuze explosive train, and the rotor, with rotor lead charge alined, is locked in this position by the spring-actuated detent and detent lock spring. The fuze is now armed and cannot be returned to the unarmed condition. However, should acceleration forces decrease before the rotor has revolved sufficiently to allow engagement of the rotor by the detent, the setback weights, acted upon by the setback weight springs, will move forward with deceleration of the rocket, turning the rotor and returning the rotor lead charge to the out-of-line position.

c. Upon impact, the windshield of the fuze is crushed, and the primer is initiated. Providing that the fuze is armed, action of the primer is transmitted to the auxiliary booster through the detonator, rotor lead charge, and auxiliary lead charge. In its turn the auxiliary booster, which contains a shaped charge, initiates the detonation of the rocket head explosive charge.

11-5.4 SAFETY PRECAUTIONS.

11-5.4.1 The general safety precautions regarding ing the approach, attack, and disposal of unexploded ordnance must be observed.

11-5.4.2 Positively identify the fuze and rocket present, and determine the condition of the fuze.

11-5.4.3 If the warhead is found imbedded in the ground, initial movement will be done remotely.

11-5.4.4 Keep the rocket assembly in a horizontal position when moving it to a disposal area.

11-5.4.5 Take necessary precautions and do not strike the windshield of the fuze, or drop or jar the assembled rocket. Although these fuzes do not contain a firing pin, they do incorporate a primer which is sensitive to impact.

11-6 PROXIMITY FUZE, ROCKET, XM429.

The fuze covered in this paragraph may be assembled with either Warhead, 2.75 inch Rocket, HE, M151, or Warhead, 2.75 inch Rocket, HE, XM229.

11-6.1 IDENTIFICATION.

11-6.1.1 TYPE.

a. Warheads. The M151 Warhead is approximately 16 inches long overall and it contains approximately 2.3 pounds of Composition B4 explosive filler. The XM229 Warhead is approximately 26 inches long overall and it contains approximately 5 pounds of Composition B4 explosive filler.

b. Fuze. The XM429 is a proximity fuze backed up by an impact sensing element. The fuze contains a safety and arming device which is activated by setback force, and retarded by a delay gear train.

11-6.1.2 PAINTING AND MARKING. The fuze is unpainted, and fuze designation and loading information are stamped on the aluminum housing (adapter) of the fuze.

11-6.1.3 FITTINGS AND FEATURES. The visible parts of the fuze are shown in figure 11-20 and an exploded view is shown in figure 11-21.

11-6.1.4 WEIGHT. The fuze weighs approximately 14 ounces.

11-6.1.5 MATERIALS.

a. The electronic head assembly consists of electronic components contained in plastic material, mounted on a stamped can.

b. The adapter is made of aluminum alloy.

c. The booster cup and closing disk are steel.

11-6.2 HAZARDOUS COMPONENTS.

11-6.2.1 The M84 electric detonator contains 130 mg of explosive.

11-6.2.2 The XM113 stab primer contains 14 mg NOL 130 primer mix.

11-6.2.3 The booster contains 9 grams of tetryl.

11-6.2.4 The lead-in explosive contains 0.125 gram of tetryl.

11-6.3 FUNCTIONING.

a. General. The major functional components of the fuze are the electronic head, the power supply (thermal battery), and the safety and arming device (figure 11-22). The electronic

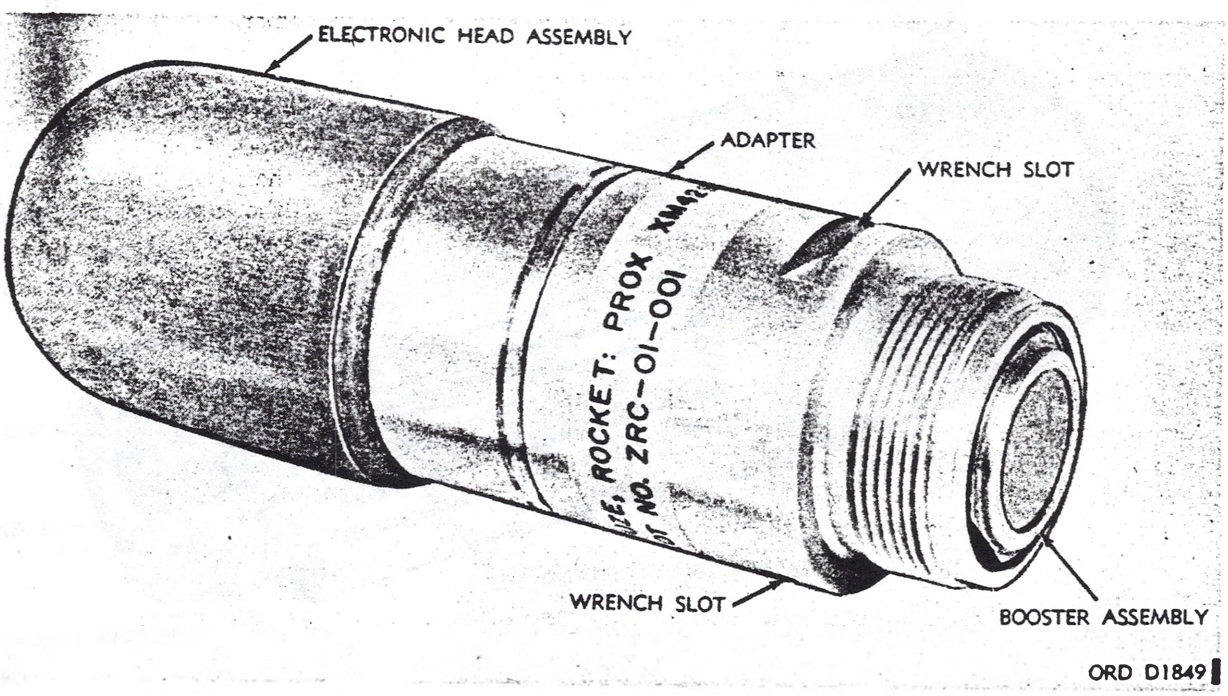

Figure 11-20 XM429 Proximity Rocket Fuze

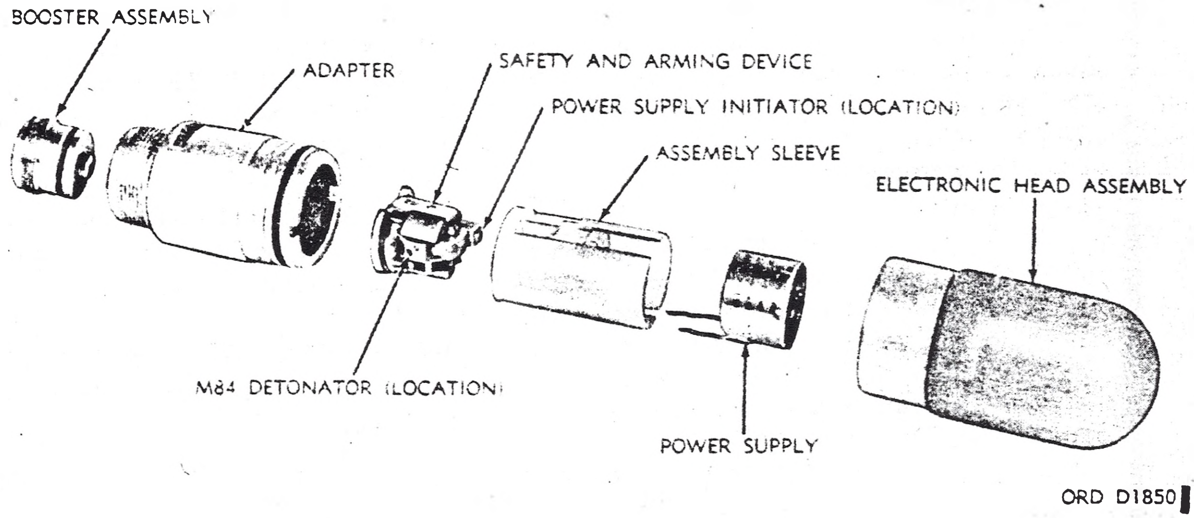

Figure 11-21 Exploded View of XM429 Fuze

head contains the components that transmit and receive the signals that trigger the firing upon proximity to the target. The head also contains an impact sensing element for backup in the event of proximity failure. The power supply (thermal battery) is the power source for all electronic components of the fuze. The safety and arming device contains an unbalanced rotor engaged to a delay gear train. The gear train maintains the detonator out of alinement with the booster until the round is fired.

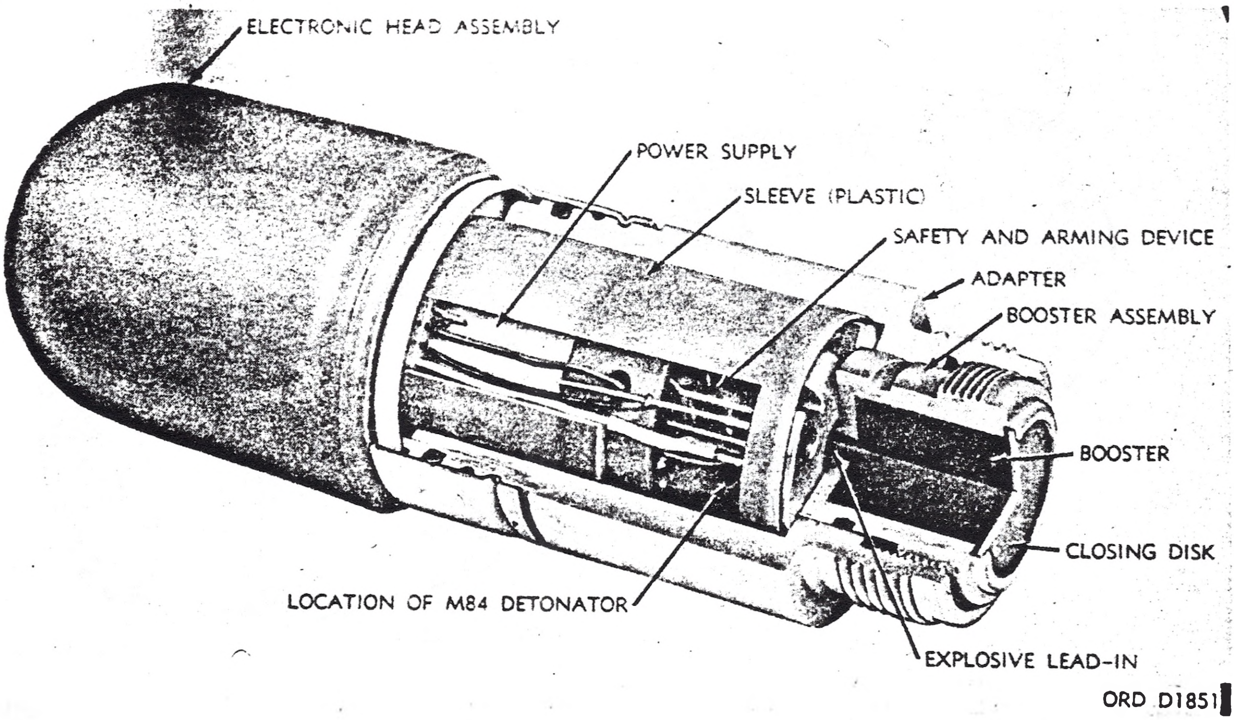

Figure 11-22 Cutaway View of XM429 Fuze

b. Operation.

1. Upon firing, acceleration forces cause the spring-loaded weight in the safety and arming device to move rearward. When the weight has moved to the set-back position, the rotor is released.
2. The acceleration forces acting on the unbalanced rotor cause it to rotate. The movement of the rotor is retarded by its engagement with a delay gear train. After approximately .25 second, the rotor releases a firing pin to initiate the XM113 stab primer. This, in turn, initiates activation of the thermal power supply. The power supply provides electric power to the electronic head. With sustained acceleration, the rotor moves to, and locks, in the armed condition (figures 11–22 and 11–23). This aligns the M84 electric detonator with the lead-in explosive. In this position, the M84 electric detonator is connected, through switch contacts, to the firing circuits in the electronic head. The fuze is then armed.
3. When the fuze properly senses the target, it discharges a firing capacitor into the M84 electric detonator. This, in turn, initiates the lead-in explosive, the booster and the warhead.

NOTE

If acceleration above 12g's is not sustained for a minimum period of .25 second, the safety and arming device will reset to the fully unarmed condition (figure 11–24).

4. If a proper signal is not received by the electronic head, the fuze functions

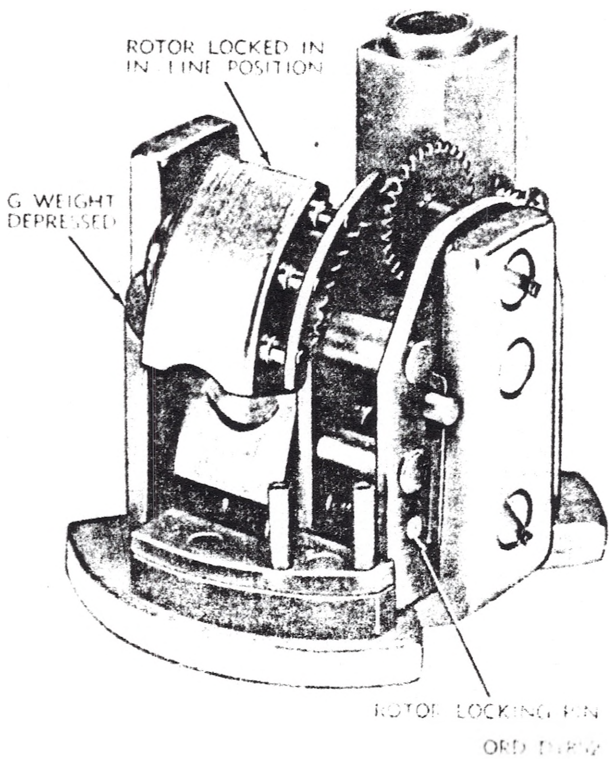

Figure 11–23 Safety and Arming Device—Armed Position

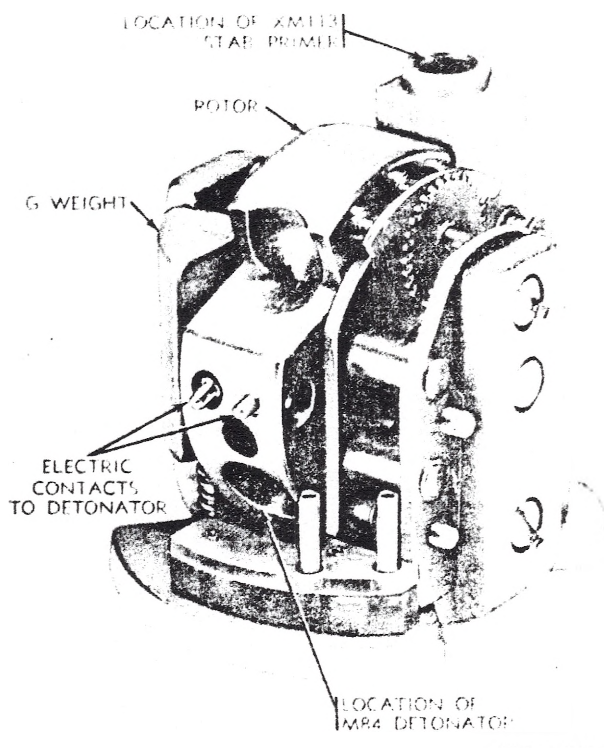

Figure 11–24 Safety and Arming Device—Unarmed Position

on impact when the impact switch closes. This discharges the firing capacitor into the M84 electric detonator.

11–6.4 SAFETY PRECAUTIONS. General proximity (VT) fuze safety precautions regarding the approach, attack and disposal of this item must be observed.

11-7 PROXIMITY FUZE, ROCKET, M414 (FOR ZUNI). The fuze covered in this paragraph is used with the ZUNI (5-inch) rocket system, and may be assembled to either the Mk24 Mod O general purpose rocket head, or the Mk32 Mod O antitank, antipersonnel rocket head.

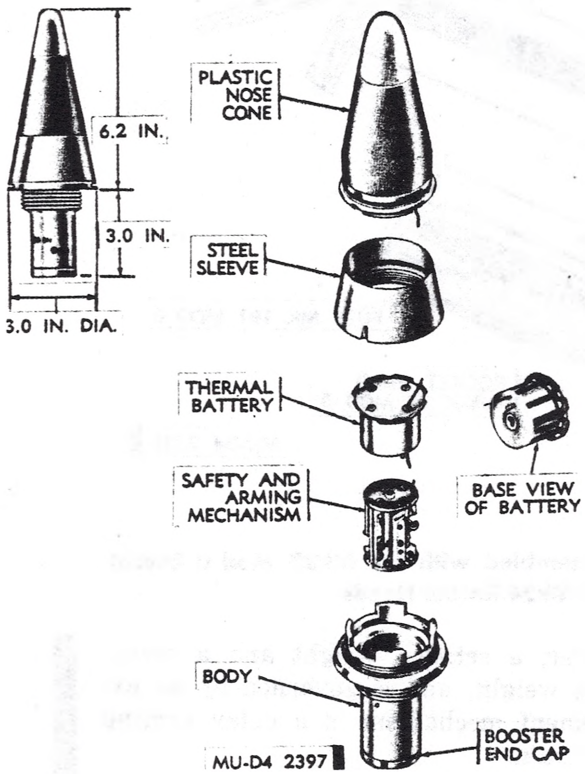

Figure 11-25. M414 Proximity Rocket Fuze and Major Components

11-7.1 IDENTIFICATION.

11-7.1.1 TYPE.

a. Rocket heads. The ZUNI rocket heads are made of steel. The Mk24 Mod O rocket head, fitted with the M414 proximity fuze and the Mk191 Mod O base detonating fuze, weights approximately 48.0 pounds. When this rocket head is a component of a ZUNI rocket assembly, the motor of which has been fired, the total weight of the rocket assembly is approximately 72.5 pounds. The Mk32 Mod O rocket head, fitted with the M414 proximity fuze, weights approximately 44.0 pounds. When this rocket head is a component of a ZUNI rocket assembly, the motor of which has been fired, the total weight of the rocket assembly is approximately 68.5 pounds. The ZUNI is a 5-inch solid propellant rocket, fired from aircraft. The external dimensions of the rocket assembly and the rocket heads are shown in figure 11-26.

b. Fuze. The M414 is a proximity fuze backed up by a self-destruct element which is a mechanically operated cocked-striker device. The fuze contains a safety and arming device which is activated by setback force, and governed by a delay train. The visible parts are a two-piece plastic nose cone, a steel sleeve and the fuze body seating surface, which has two wrench slots.

c. Motor. The rocket motor is a cylindrical aluminum tube approximately 62.7 inches long, with a steel contact band at the forward end and four aluminum folding fins attached to a steel nozzle assembly at the rear of the motor.

11-7.1.2 PAINTING AND MARKING. The fuze is unpainted, and the fuze designation is stamped on the steel sleeve. The rocket designation and loading information are stenciled on the rocket head.

11-7.1.3 FITTING AND FEATURES. The visible parts of the fuze and the rocket assembly are shown in figures 11-25 and 11-26.

11-7.1.4 WEIGHT. The fuze weighs approximately 2.64 pounds.

11-7.1.5 MATERIALS.

a. The fuze head assembly consists of electronic components contained in a two-piece plastic nose cone.

b. The fuze sleeve is made of steel.

c. The fuze body is made of aluminum.

11-7.2 HAZARDOUS COMPONENTS.

11-7.2.1 The fuze contains a T97 percussion primer, which activates the thermal battery, a T108 percussion primer in the self-destruct mechanism, an electric detonator, a tetryl lead (0.082 gram) and a tetryl booster charge (13.4 grams).

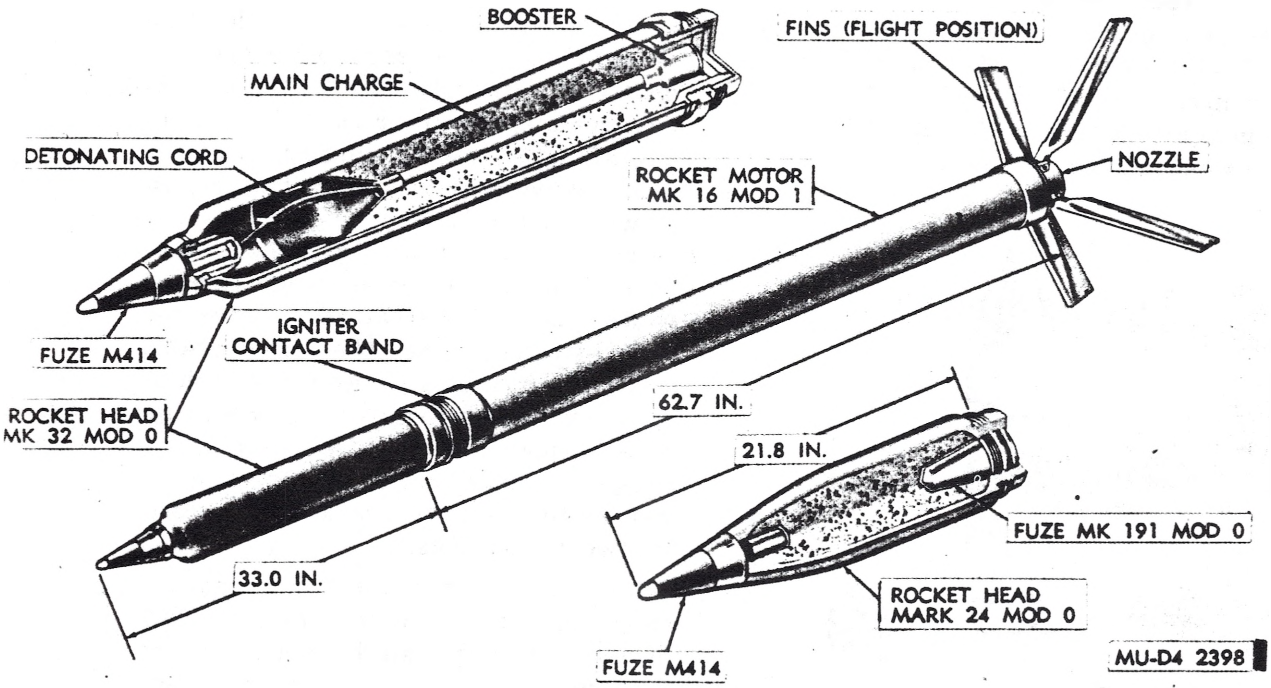

Figure 11–26. External Configuration of the ZUNI Rocket Assembled with the Mk32 Mod 0 Rocket Head, and Cutaway Views of the Mk32 and Mk24 Rocket Heads

11–7.2.2 The Mk24 Mod 0 rocket head contains 10 pounds of Composition B explosive charge.

11–7.2.3 The Mk32 Mod 0 rocket head contains 15 pounds of Composition B explosive charge.

11.7.2.4 An unfired Mk16 Mod 1 rocket motor contains an electric squib, an igniter (blackpowder with flaked magnesium) and 35.5 pounds of double-base, solid propellant.

11–7.3 FUNCTIONING.

a. General. The major functional components of the M414 proximity fuze are the electronic head, the power supply (thermal battery), and the safety and arming device. The electronic head contains the components that transmit and receive the signals that trigger the firing upon proximity to the target. The power supply is the power source for all electronic components of the fuze. The safety and arming device contains an unbalanced rotor barrier, a setback weight and a sector drive weight, and is governed by an escapement mechanism in a delay arming gear train.

b. Operation.

(1) Upon firing, acceleration forces cause the setback weight to overcome the setback spring, and move rearward. When the setback weight is fully depressed, the sector drive weight is released, and rotates under the influence of the setback force. The rate at which the sector drive weight rotates is governed by an escapement mechanism in the delay arming gear train.

(2) When acceleration of the rocket is sustained for a sufficient period, a rotating cammed shaft releases a spring-loaded firing pin which detonates the T97 primer. This, in turn, initiates activation of the thermal power supply. The power supply

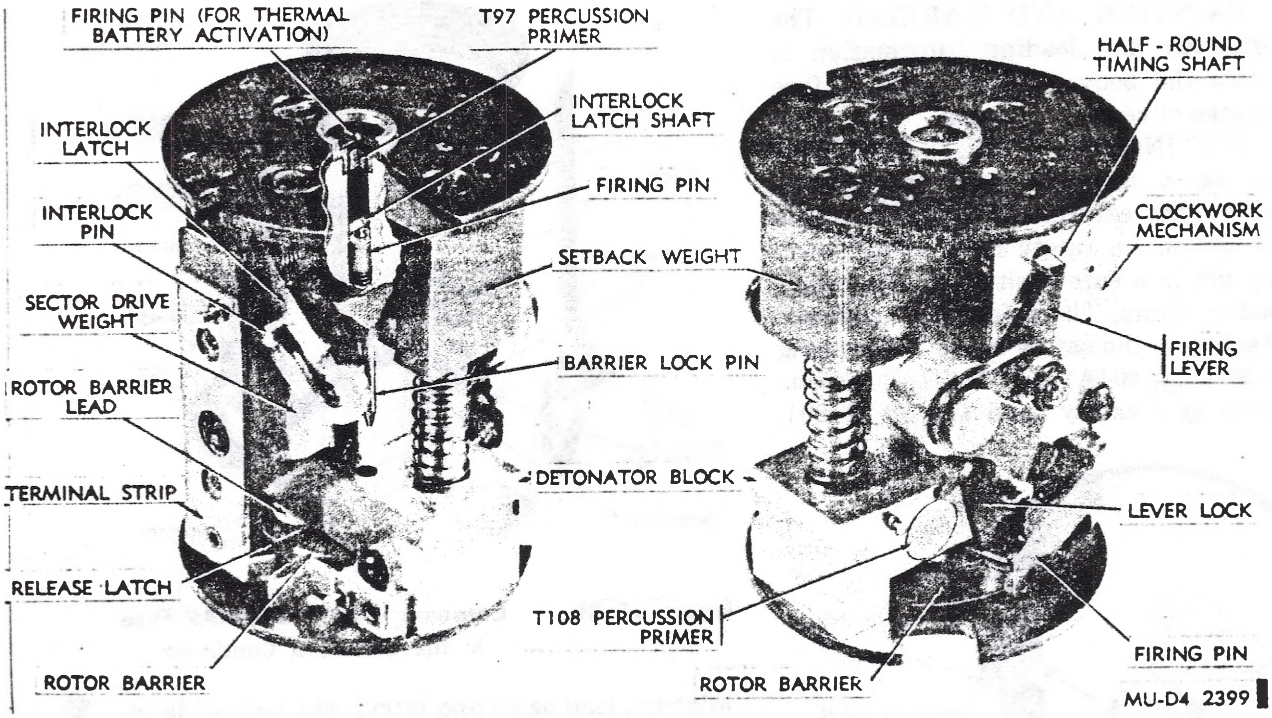

Figure 11-27. Two Views of Safety and Arming Device for M414 Fuze

provides electric power to the electronic head.

NOTE

If the rocket fails to maintain an acceleration of 19 g's for at least 400 feet of travel, the fuze will neither arm nor recycle.

(3) When proper acceleration is maintained for a distance of 400 feet, a switch operates, allowing the firing capacitor to charge. The fuze is then fully armed.

(4) When the fuze properly senses the target, it discharges the firing capacitor through the electric detonator, initiating the explosive train.

c. Self-Destruct Feature. A self-destruct element of the fuze begins to function as soon as the rotor barrier turns to the armed position. The self-destruct element will initiate the fuze explosive train after 6 to 10 seconds of the rocket flight.

NOTE

Before the fuze is inserted in the rocket head, the self-destruct element may be made inoperable by turning a small slotted pin in the side of the fuze body to the S.D. OFF position.

11-7.4 SAFETY PRECAUTIONS. General proximity (VT) fuze safety precautions regarding the approach, attack and disposal of this item must be observed.

11-8 BASE DETONATING FUZES M400, M401, M404, M404A1, M404A2 and M405.

11-8.1 IDENTIFICATION.

11-8.1.1 TYPE. The M400, M401, M404, M404A1, M404A2 fuzes are of the base-detonating (BD), direct-arming (arming pin), impact-fired (inertia plunger), nondelay type. The M405 is a dummy fuze similar in appearance to the M404A2 fuze. It simulates handling and arming pin ejection of the M404A2 fuze. The M400 and M401 are used in 2.36-inch rockets. The M404, M404A1, M404A2 and M405 are used in 3.5-inch rockets.

11–8.1.2 PAINTING AND MARKING. The fuze designation and loading information is stamped into the body of the fuze. The fuze body is painted olive drab or black.

11–8.1.3 FITTINGS AND FEATURES. The M400 fuze has a safety pin and arming pin, which are visible externally. The M401 fuze (figure 11–28) has a safety band which holds the arming pin in a safe position and acts as a waterproofing clamp. The safety pin is permanently attached to the safety band. The arming pin of the M404, M404A1, and M404A2 fuzes is held in place by a safety band (figure 11–29).

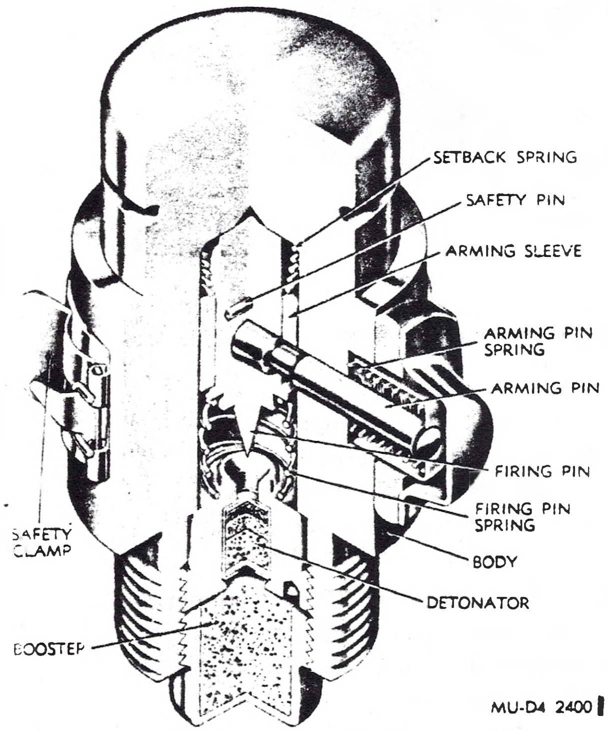

Figure 11–28. Cutaway View of M401 Fuze in the Unarmed Condition

11–8.1.4 MATERIALS. The M400 and M401 fuzes have steel bodies. The M404, M404A1, M404A2, and M405 fuzes have aluminum bodies.

11–8.2 HAZARDOUS COMPONENTS. These fuzes, except the M405, contain a detonator and a booster. The detonator consists of primer

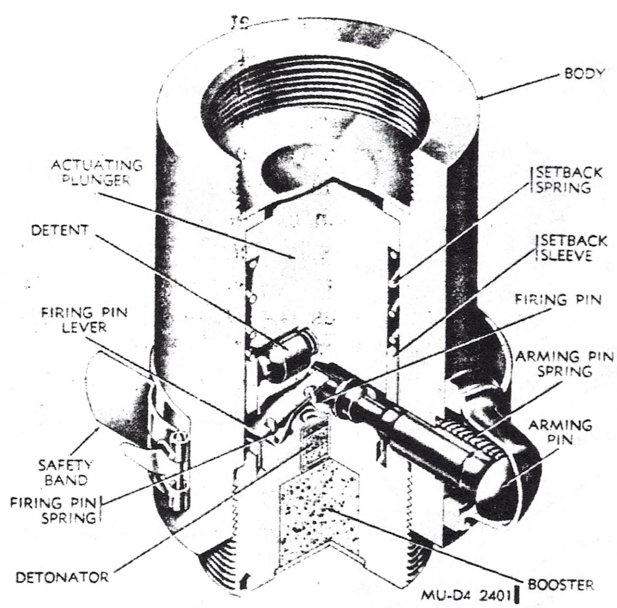

Figure 11–29. Cutaway View of M404A2 Fuze in the Unarmed Condition

mixture, lead azide and tetryl; the booster is tetryl. The M405 fuze is inert.

11–8.3 FUNCTIONING.

a. M400 and M401 FUZES. Prior to launch, the safty pin is removed from the M400 fuze or the safety band is removed from the M401 fuze. The arming pin, which is held in position by the arming sleeve to prevent its ejection, keeps the firing pin from moving. When the rocket is launched, the arming sleeve compresses the setback spring and disengages itself from the arming pin. The arming pin spring forces the arming pin outward until it strikes the inner wall of the launcher. When the rocket leaves the launcher, the arming pin is ejected from the rocket by the arming pin spring, which arms the fuze. The firing pin spring prevents the firing pin from striking the detonator until impact. Upon impact, the firing pin overcomes the firing pin spring and pierces the detonator. This initiates the explosive train.

b. M404, M404A1, and M404A2 FUZES. Prior to launch, the safety band is removed from the rocket. This allows the spring-loaded arming pin to come in contact with the bore of the launcher. When the rocket is fired, inertia forces cause the setback sleeve to move rearward, compressing the setback spring and clearing the path of the arming pin. The setback sleeve is locked in the rearward position by a spring-loaded detent. When the rocket leaves the launcher, the arming pin is thrown clear of the fuze by the arming pin spring, thus arming the fuze. Upon impact, the actuating plunger moves forward, striking the firing pin lever. This drives the firing pin into the detonator, which initiates the explosive train. These fuzes are rapid in action and sensitive to low-angle graze impacts. Fuzes M404, M404A1 and M404A2 contain a graze sensitive feature.

11-8.4 SAFETY PRECAUTIONS

11-8.4.1 Observe all safety precautions regarding graze-sensitive fuzes.

11-8.4.2 Observe shaped charge precautions when disposing of warheads.

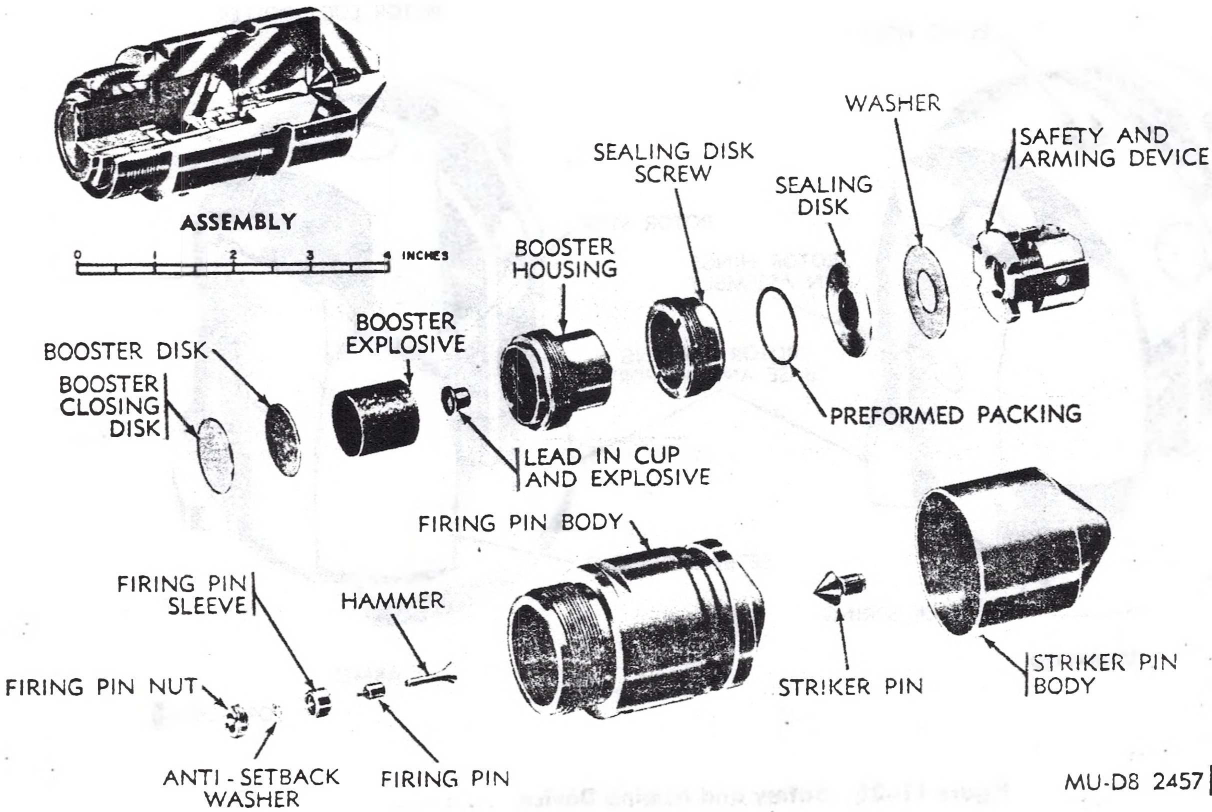

Figure 11–30 Cutaway and Exploded Views of Fuzes M423 and M427

11–9 FUZES, ROCKET, PD, M423 AND M427.

The fuzes covered in this paragraph may be used with the following 2.75 Inch Rocket Warheads: HE, M151 or XM229; Target Marker (HE) XM152, XM153, XM157 or XM158; or Smoke, WP, M156.

11–9.1 IDENTIFICATION.

11–9.1.1 TYPE. These fuzes are of the acceleration-delayed arming, impact-firing, point-initiating, instantaneous-action type.

11–9.1.2 PAINTING AND MARKING. The fuzes are painted olive drab and the fuze designation and loading data are stenciled in yellow.

11–9.1.3 FITTINGS AND FEATURES. The general physical characteristics and exploded view are shown in figure 11–30. The fuzes are cylindrical with a flat-point conical ogive, and have wrench slots for fitting to the warhead. The fuzes have four major components: an aluminum striker pin body; an aluminum firing pin body; a safety and arming device assembly, and a steel booster housing which contains the lead-in cup explosive charge and the booster charge.

11–9.1.4 WEIGHTS. Each fuze weighs approximately one pound.

11–9.2 HAZARDOUS COMPONENTS.

11–9.2.1 The primer contains lead azide and primer mix tetryl; the detonator contains lead azide, the lead-in cup and the booster contain tetryl.

11–9.3 FUNCTIONING.

a. Fuze M423 has a short arming time for

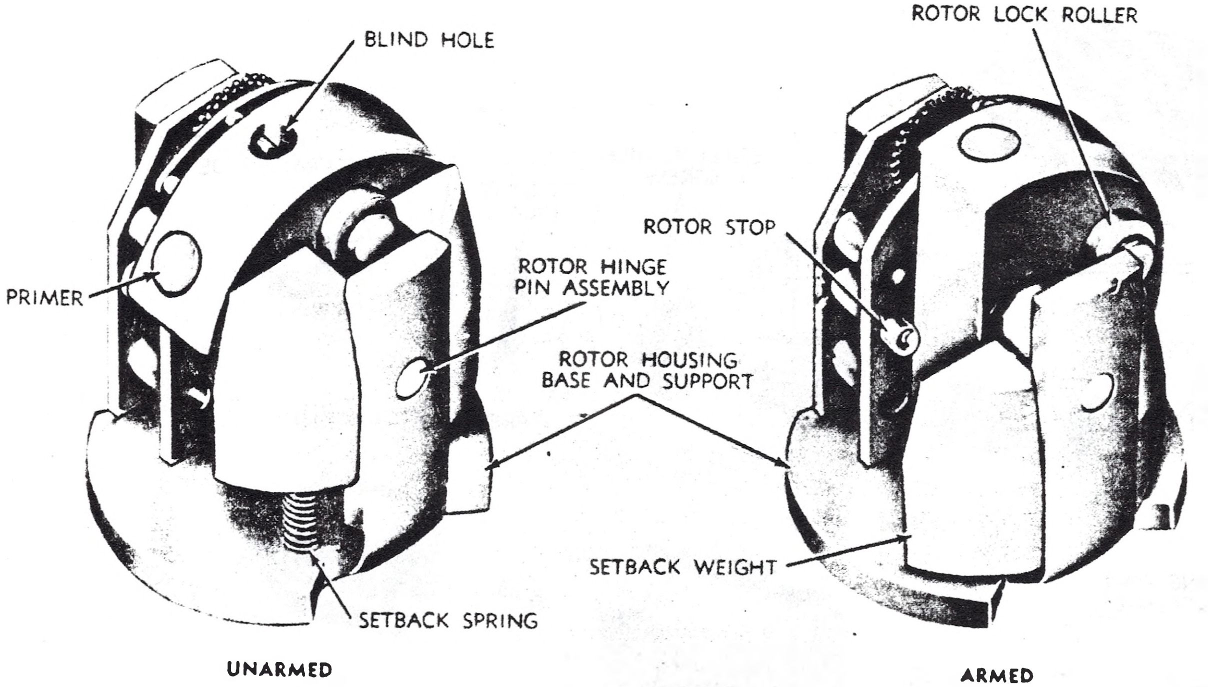

Figure 11–31 Safety and Arming Device

use by low performance aircraft. The M427 differs only in arming time, and is used by high-performance aircraft.

b. When the rocket is fired, inertia forces cause the setback weight of the safety and arming device (fig. 11–31) to move rearward, compressing the setback spring. This releases the unbalanced rotor to rotate and lock in place in the armed position. When the fuze strikes the target, the cone of the striker pin body is driven rearward, forcing the striker pin to drive the hammer into the firing pin. The firing pin is thus driven through the antisetback washer into the primer. This initiates the explosive train which, in turn, detonates the warhead explosive.

11–9.4 SAFETY PRECAUTIONS.

a. Positive identification of the rocket warhead and fuze must be made.

b. Initial movement of an imbedded rocket warhead should be done from a remote position.

c. Do not drop or jar the rocket warhead and take care not to strike the fuze.

11-10 66-MM INCENDIARY (TPA) ROCKET XM74 WITH BASE DETONATING FUZE M412 MODIFIED (XM434).

11-10.1 IDENTIFICATION.

11-10.1.1 TYPE. The XM74 (figure 11-32) is a fin stabilized incendiary rocket which may be mounted as a four-round rocket clip (figure 11-33) and fired, one at a time, from a hand held XM202 rocket launcher. The warhead is fitted to a rocket motor similar in appearance to the M72 (LAW) rocket motor.

11-10.1.2 PAINTING AND MARKING. The four-round clip hardware is painted olive drab. The rocket motor is brown, the adapter is yellow and the warhead is light red. All markings are in black and the words "Warhead XM235" are in black on the warhead of the XM74 incendiary rocket.

11-10.1.3 FITTINGS AND FEATURES. Components of the incendiary rocket XM74 are shown in figure 11-32. The warhead contains a primacord burster, an incendiary filler and a base detonating nondelay action type fuze. This is a modified M412 fuze, the modification consisting of removing the electric initiating feature and the booster charge. The fuze M412 Modified (XM434) will function by graze action as well as direct impact. Characteristics of the rocket XM74 four-round clip are shown in figure 11-33.

11-10.1.4 WEIGHTS AND DIMENSIONS. Each rocket XM74 weighs three pounds, is approximately 21 inches long and three inches in diameter at the warhead. The loaded rocket XM74 four-round clip weighs approximately 15 pounds and is 22 inches long, six inches wide and six inches high.

11-10.1.5 MATERIALS. The rocket and the four-round clip metal parts are of aluminum. The aluminum fins have steel springs. The fuze is of aluminum and steel.

11-10.2 HAZARDOUS COMPONENTS.

a. The warhead contains approximately one and one-half pounds polyisobutylene thickened triethylaluminum filler. The primacord burster weighs approximately two grams. The fuze M412 Modified (XM434) contains a stab primer M106 and a modified (nonelectric) detonator M48. The primer M106 contains lead azide and NOL 130 mix and the modified detonator M48 contains lead azide and PETN.

b. The rocket motor contains approximately 57 grams propellant M7; the igniter M56 contains black powder and the percussion

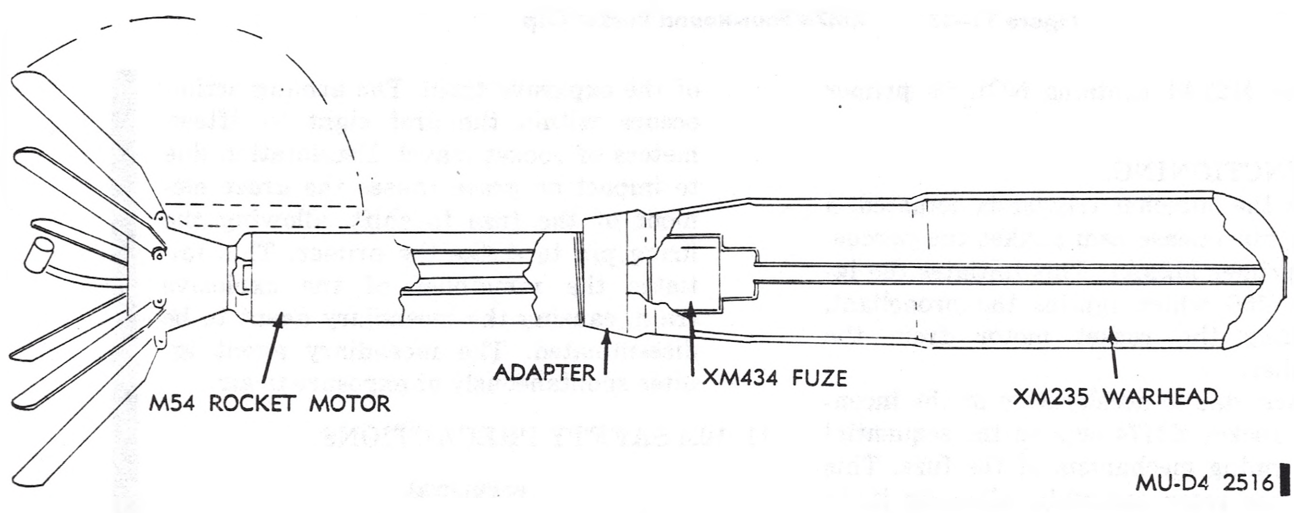

Figure 11-32 66MM Incendiary (TPA) rocket XM74

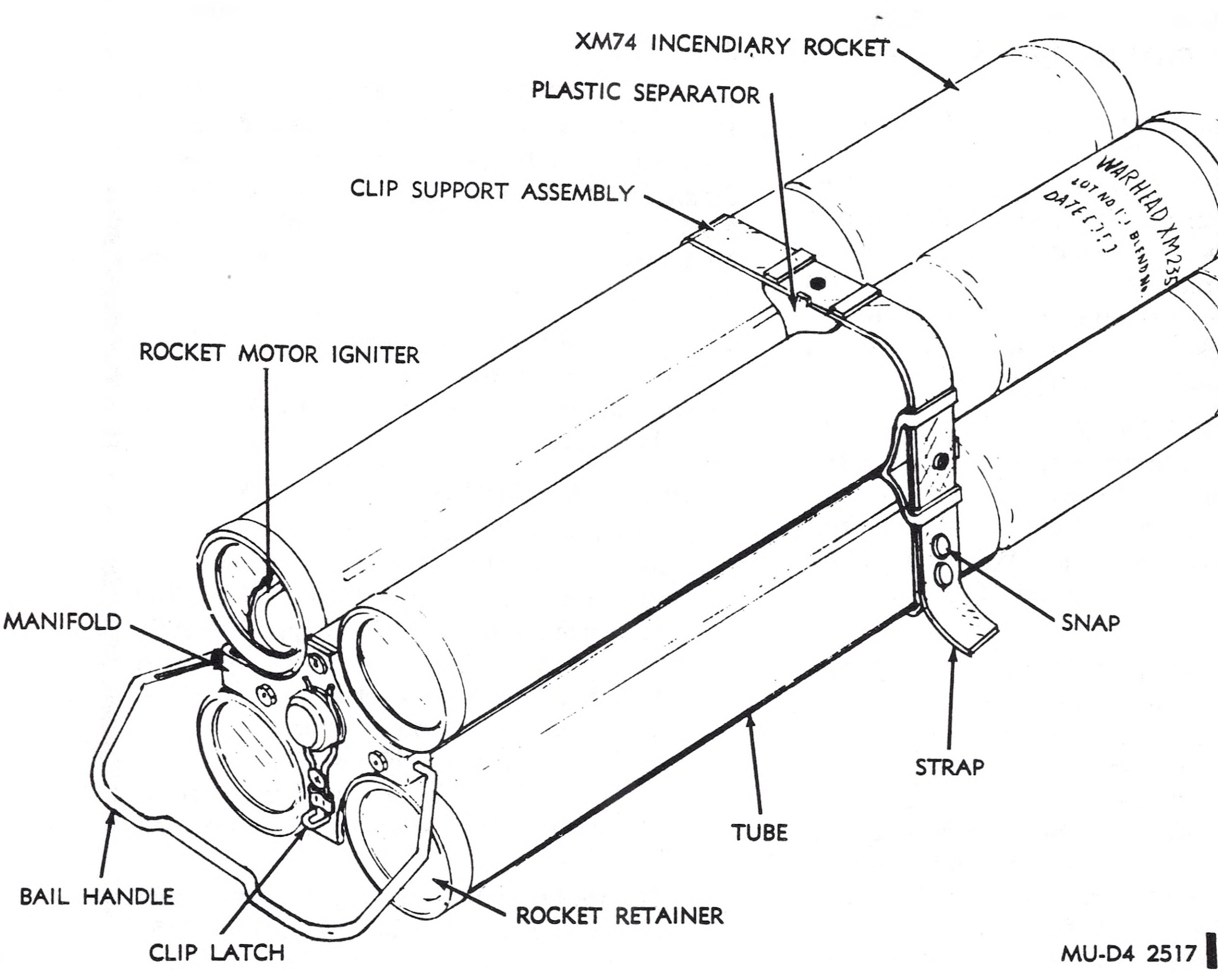

Figure 11–33 XM74 Four-Round Rocket Clip

primer M29A1 contains NOL 60 primer mix.

11–10.3 FUNCTIONING.

a. When the launcher trigger is actuated, a firing pin release cam strikes the percussion primer M29A1. This initiates the igniter M56 which ignites the propellant, expelling the rocket motor from the launcher.

b. Setback, due to acceleration of the incendiary rocket XM74 acts on the sequential leaf arming mechanism of the fuze. This frees the rotor assembly, allowing it, in turn, to rotate to the armed position, alining the detonator with the remainder of the explosive train. The arming action occurs within the first eight to fifteen meters of rocket travel. Deceleration due to impact or graze causes the graze element of the fuze to shift, allowing the firing pin to strike the primer. This initiates the remainder of the explosive train, causing the incendiary agent to be disseminated. The incendiary agent ignites spontaneously or exposure to air.

11–10.4 SAFETY PRECAUTIONS.

WARNING

The rocket contains a fuze with a cocked striker. Do not strike or jar the rocket. If rocket is found embedded, initial movement must be made remotely.

a. Observe all safety precautions regarding graze sensitive fuzes.

b. Always work from the sides, not the ends of rockets or rocket clips.

c. Take normal safety precautions for incendiary explosives when working on these items.

d. Personnel not involved in EOD operations should remain a minimum distance of 600 feet away, under cover, from the operations site. The minimum exposed distance is 900 feet.

11–10.5 HAZARDS.

a. The incendiary agent ignites spontaneously on exposure to air.

b. The incendiary agent will continue to burn even if immersed in water.

c. Small amounts of water react violently with the incendiary agent, causing splatter and fire. Large amounts of water can be used as a first aid measure to wash or flush off the incendiary agent.

d. The incendiary agent is extremely destructive to body tissue.

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SECTION 12

VARIOUS EXPLOSIVE ITEMS

12-1. Aircraft Personnel Catapults M1A1, M3, M4, and M5.

12-1.1 IDENTIFICATION.

12-1.1.1 TYPE

a. M1A1. This catapult is a mechanically actuated, gas-operated, three-tube telescoping, cartridge-actuated device for upward ejection of personnel from high-speed aircraft.

b. M3, M4, and M5. These catapults are pressure-actuated, gas-operated, three-tube telescoping, cartridge-actuated devices for ejection of personnel from high-speed aircraft. The catapults M3 and M5 are utilized for upward ejection and the catapult M4 is utilized for downward ejection.

12-1.1.2 PAINTING AND MARKING

a. The model designation and various loading information are stenciled on the cylindrical surface of the outside tube of the catapult. In addition, the model designation may be stamped on the top surface of the block assembly.

b. The model designation and various loading information concerning the cartridge assembly which is assembled in the catapult are stenciled on the cylindrical surface of the outside tube of the catapult.

12-1.1.3 FITTINGS AND FEATURES (figures 12-1 through 12-4). The catapults are located at the rear of the ejection seat backrest. In addition, the following fittings and features apply as noted:

12-1.1.3.1 M1A1.

a. Fittings.

(1) The sear is L-shaped and passes through the trunnion, block, and a notch in the firing pin. The arm of the sear has an eye in it for cable attachment.

(2) The sear locking pin passes diagonally through the block and firing pin at 90° to the sear.

(3) The ground safety pin and shipping cotter pin are attached to each other. The ground safety pin is identified by a red streamer which is attached to it.

(4) The block, which may either have a cylindrical or a flat neck, has a female fitting at its upper extremity for catapult attachment to the receptacle on the ejection seat.

(5) The trunnion has two male fittings which attach the catapult to the aircraft structure.

(6) The effective stroke of this catapult is approximately 66 inches.

b. Features.

(1) The catapult M1A1 is a mechanically actuated, gas-operated, three-tube telescope ejector, consisting of an outside tube, a telescoping tube, and an inside tube. The block, which is secured to the upper end of the inside tube, attaches to a receptacle on the backrest of the ejection seat. The trunnion, which is secured to the upper end of the outside tube, attaches to the aircraft structure. After the catapult assembly is installed in the aircraft, the safety wire, which secures the sear locking pin to the block, is removed. The sear locking pin is attached by cable to the manual control or canopy control of the aircraft ejection system, thereby providing a

means whereby the sear locking pin is withdrawn upon actuation of the ejection system by the pilot. In addition, the sear is attached by cable to the ejection seat hand grip trigger. The shipping cotter pin, which prevents downward movement of the firing pin, is replaced with the ground safety pin. The ground safety pin is removed prior to flight of the aircraft (and replaced after flight). The catapult assembly is now ready for actuation.

(2) The sear locking pin, which passes through the block and firing pin, prevents the sear from rotating. The sear passes through the block and a notch in the firing pin in such a way as to cock the spring-loaded firing pin and prevents it from striking the cartridge primer when the sear arm is in the "UP" position. In addition when the sear arm is in the "UP" position, the sear locks the block and inside tube assembly to the trunnion and outside tube assembly. Otherwise, the aircraft and pilot would fall free of the aircraft when the aircraft is flown in the up-side-down position.

12-1.1.3.2 M3, M4 and M5.

a. Fittings.

(1) The pressure inlet port is located in the block. A flexible or steel tube is connected to the block at the pressure inlet port after the catapult is installed in the aircraft. A pipe plug is threaded into the pressure inlet port for catapult shipment and storage purposes.

(2) These catapults have no external safety pins or fittings since they have a pressure actuated firing mechanism.

(3) The block has a female fitting at its upper extremity for catapult attachment to the receptacle on the ejection seat.

(4) The trunnion of the catapults M3 and M5 has two lugs which attach the catapult to the aircraft structure.

(5) The catapult M4 is attached to the aircraft structure by a female fitting located on the cap which closes the bottom end of the outside tube.

(6) The effective stroke of the catapult M3 is approximately 88 inches; of the M4, approximately 45 inches; the M5, approximately 66 inches.

b. Features.

(1) These catapults are pressure-actuated, gas-operated, three-tube telescope ejectors, consisting of an outside tube, a telescoping tube and an inside tube, The block, which is secured to the upper end of the inside tube, attaches to a receptacle on the ejection seat. The trunnion, which is secured to the upper end of the outside tube, attaches to the aircraft structure. The catapult M4, which has no trunnion, is attached to the aircraft structure by a lug-type cap at the base of the outside tube. After the catapult assembly is installed in the aircraft, the pipe plug is unthreaded from the pressure inlet port in the block and a flexible or steel tube is connected to the pressure inlet port. The flexible or steel tube, which leads from an initiator, connects the catapult to the ejection system in the aircraft. The block and inside tube assembly is free swiveling to facilitate connection of the flexible or steel tube. The catapult assembly is now ready for actuation.

(2) The firing pin is not spring-loaded, but is held in place by the shear pin. The latches lock the block and inside tube assembly to the trunnion and outside tube assembly. This is necessary to hold the seat and crewman in the aircraft when the aircraft is flown in the up-side-down position.

12-1.1.4 WEIGHTS.

a. M1A1. The total weight of the catapult is approximately 8.2 pounds.

b. M3. The total weight of the catapult is approximately 25 pounds.

c. M4. The total weight of the catapult is approximately 6.7 pounds.

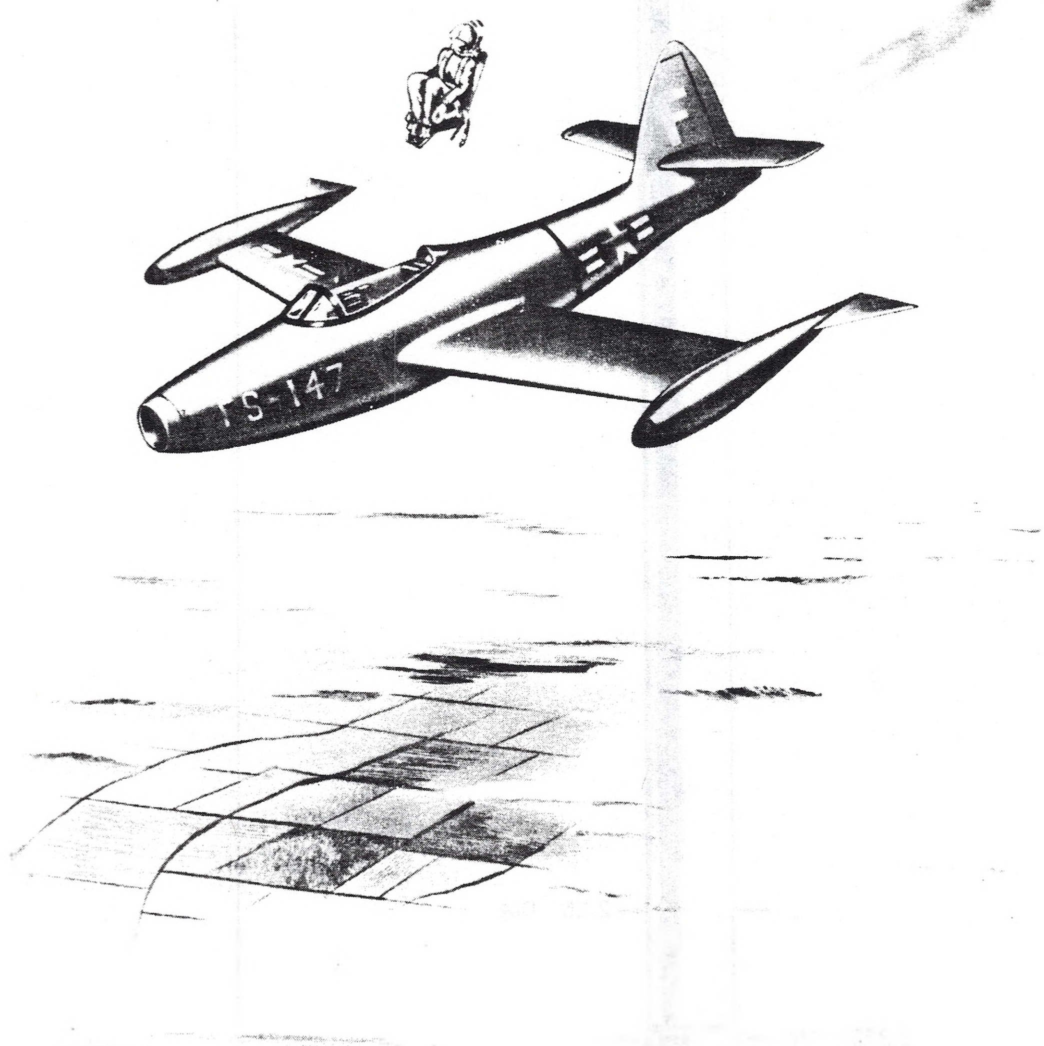

Figure 12–1. A typical aircraft emergency escape system in Operation.

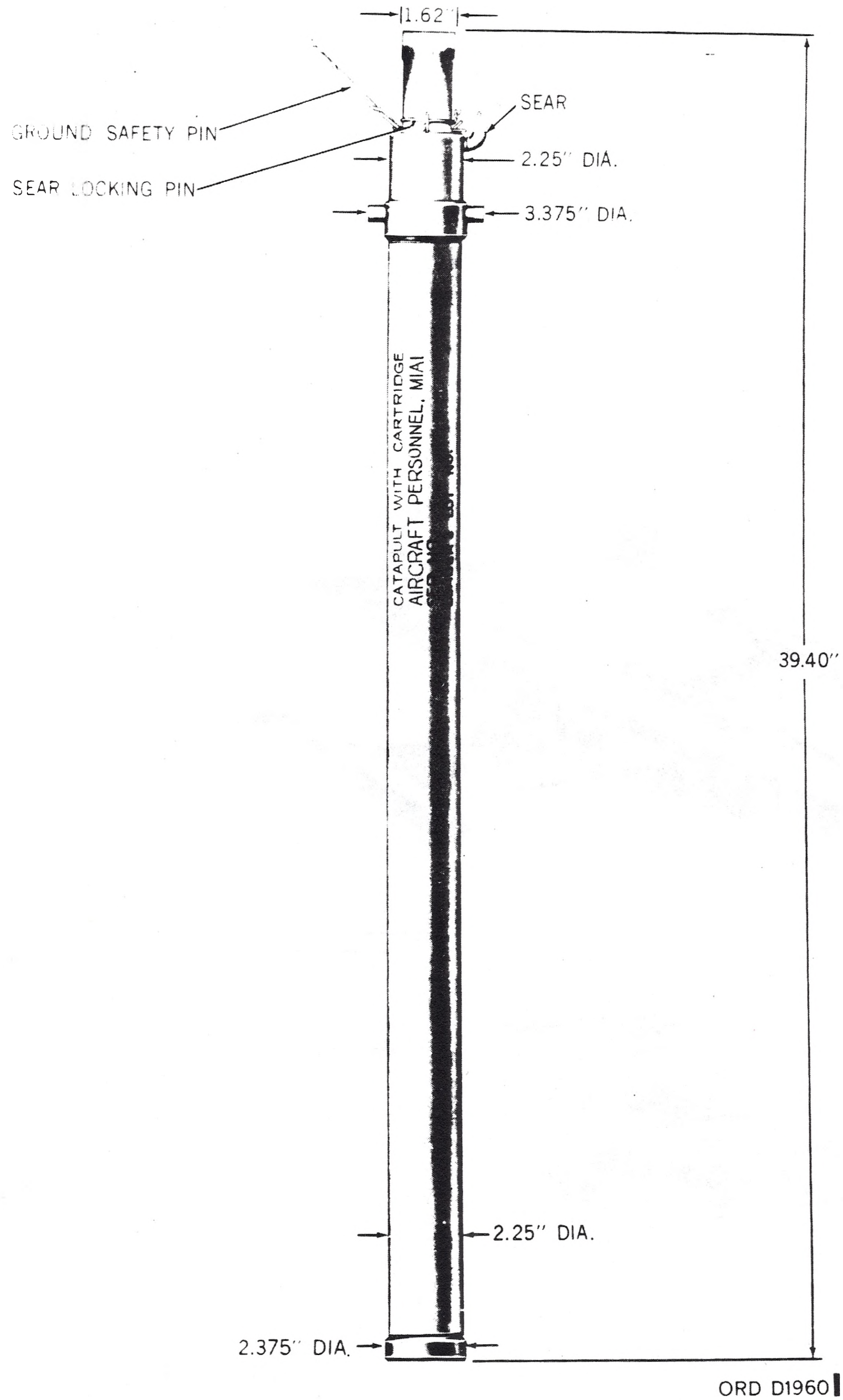

Figure 12-2. Dimensional Characteristics of the Catapult M1A1

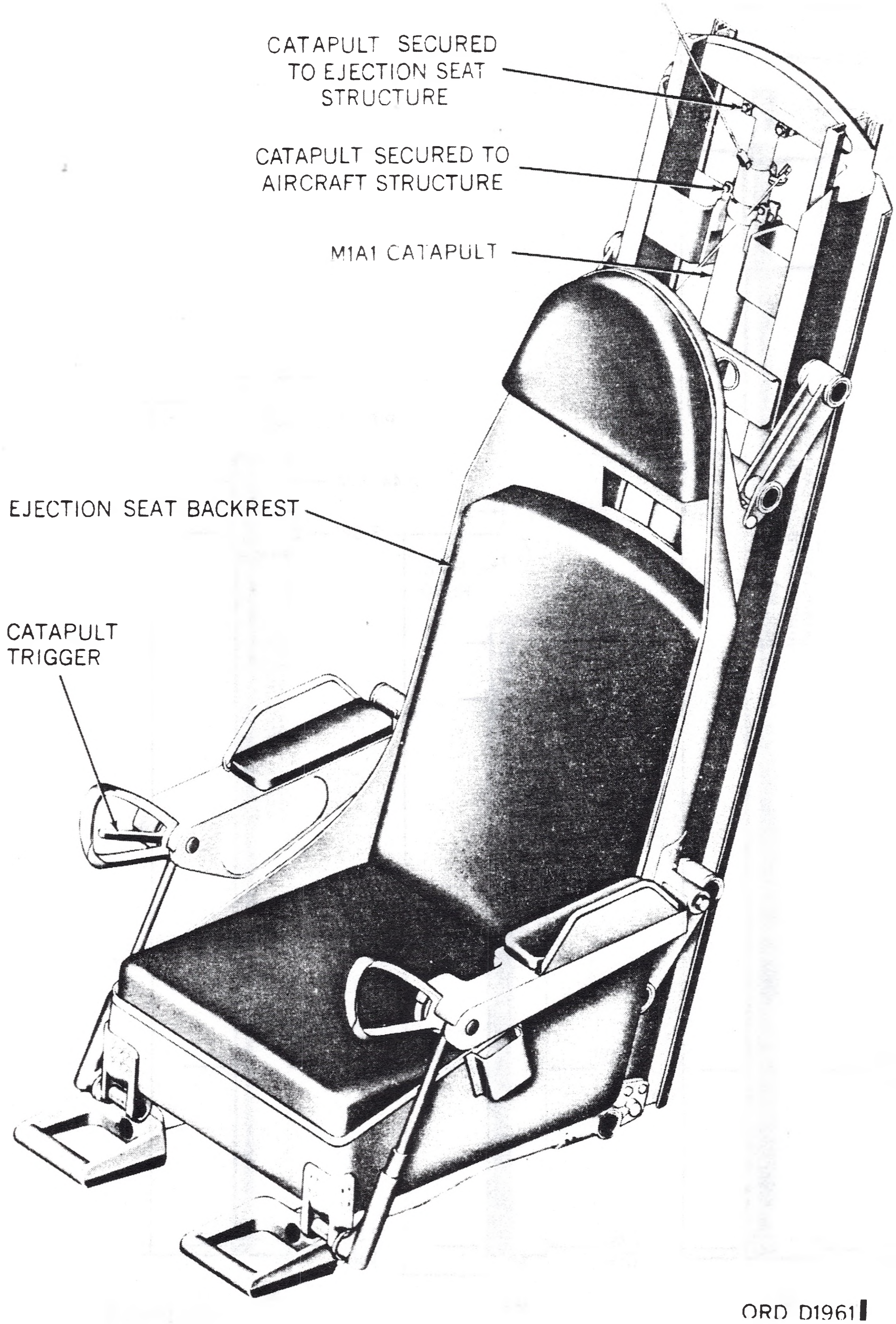

Figure 12-3. Approximate Location of a Typical Catapult on an Ejection Seat

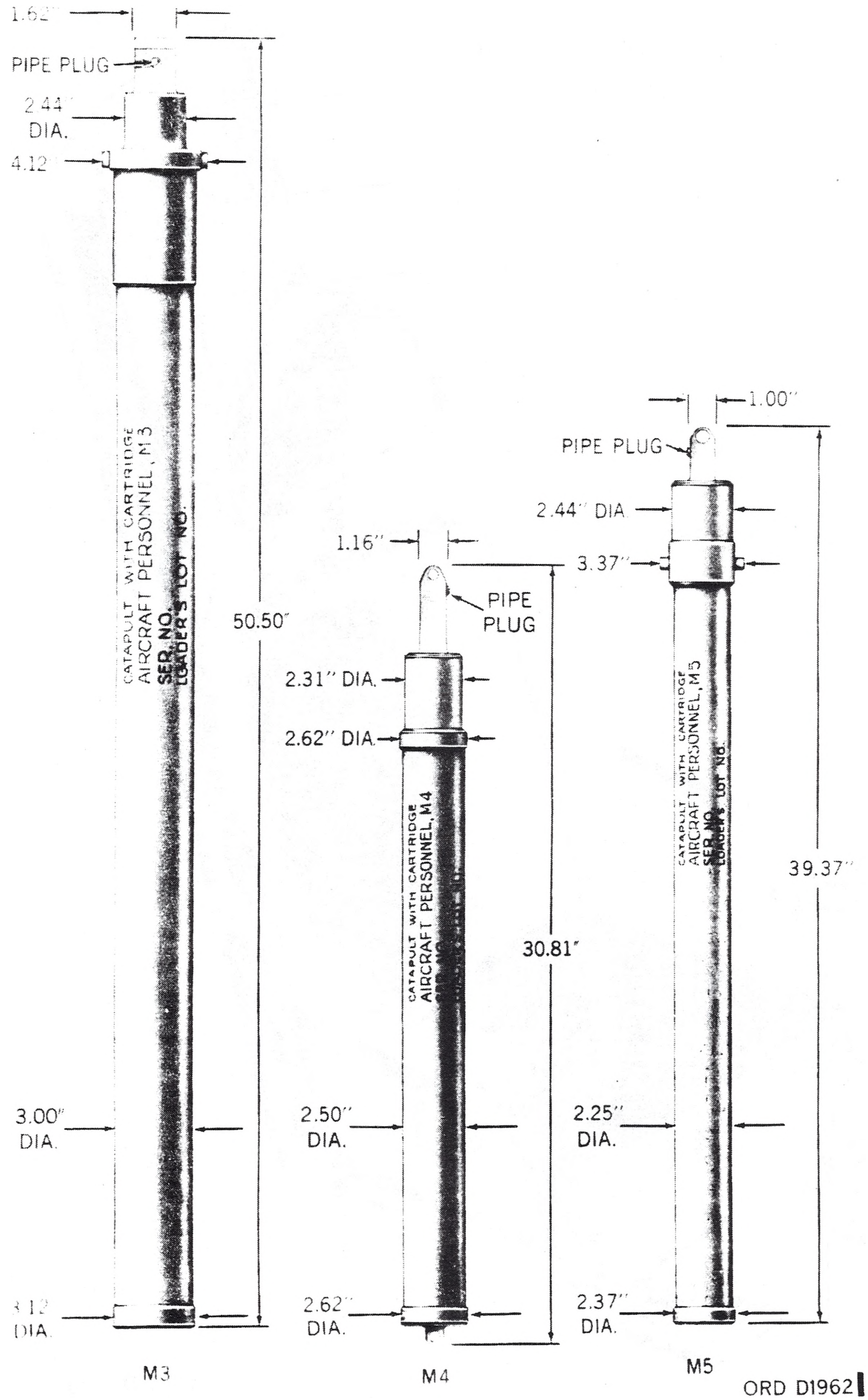

Figure 12-4. Dimensional Characteristics of Catapults M3, M4, and M5

d. M5. The total weight of the catapult is approximately 8.2 pounds.

12-1.1.5 MATERIALS. Catapults M1A1, M3, M4, and M5 are made of Aluminum.

12-1.2 HAZARDOUS COMPONENTS. The catapults covered herein utilize catapult cartridges which consist of a primer, igniter, and propellant as follows:

a. Catapults M1A1 and M5 contain catapult cartridge M28A1. The primer is a percussion type, the igniter consists of approximately 0.15 ounce of black powder, and the propellant consists of approximately 2.97 ounces of smokeless (solid) solvent type propellant M6.

b. Catapult M3 contains catapult cartridge M36. The primer is a percussion type, the igniter consists of approximately 0.15 ounce of black powder, and the propellant consists of approximately 7.06 ounces of smokeless (solid) solvent type propellant H8.

c. Catapult M4 contains catapult cartridge M37. The primer is a percussion type, the igniter consists of approximately 0.11 ounce of black powder, and the propellant consists of approximately 1.93 ounces of smokeless (solid) solvent type propellant H8.

12-1.3 FUNCTIONING.

a. M1A1 (figure 12-5).

(1) When the pilot pulls the trigger on the right arm rest of the ejection seat, the canopy remover mechanism fires and the canopy is jettisoned. As the canopy is jettisoned, it withdraws the sear locking pin from the catapult assembly which permits the sear to be rotated. The catapult is now armed.

(2) Simultaneously as the pilot pulls the trigger on the right arm rest of the ejection seat, the sear arm is rotated to the "DOWN" position through a pulley system. As the sear is rotated, its flat portion aligns with the notch in the trunnion, thereby unlocking the block and inside tube assembly from the trunnion and outside tube assembly. In addition, the flat portion of the sear presents itself to the notch in the firing pin and the firing pin is released. The firing pin spring drives the firing pin down against the cartridge primer which is initiated.

(3) Flame from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. The catapult assembly is provided with gas seals insuring a sufficient gas pressure build-up to thrust the telescoping and inside tubes upward, thereby ejecting the seat clear of the aircraft. The inside tube of the catapult assembly is ejected with the seat. The outside and telescoping tubes with trunnion remain in the aircraft.

b. M3 (figure 12-6), M4, and M5.

(1) When the pilot triggers the ejection system, the initiator to which the catapult is connected by the flexible or steel tube is fired. The resulting gas pressure passes through the flexible or steel tube to the pressure inlet port in the block and exerts a force on the top of the firing pin. The firing pin is forced downward, shearing the shear pin and camming the latches inward. As the latches are cammed inward clear of the stop ring, the block and inside tube assembly is unlocked from the trunnion and outside tube assembly. The firing pin, still acted upon by gas pressure, continues downward until it strikes and initiates the primer in the cartridge.

(2) The flash from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. Sufficient gas pressure is formed from the burning propellant and maintained by the gas seals to thrust the telescoping and inside tubes upward (the catapult M4 downward), thereby ejecting the seat clear of the aircraft. The block and inside tube assembly is ejected with the seat. The outside and telescoping tubes with trunnion remain in the aircraft.

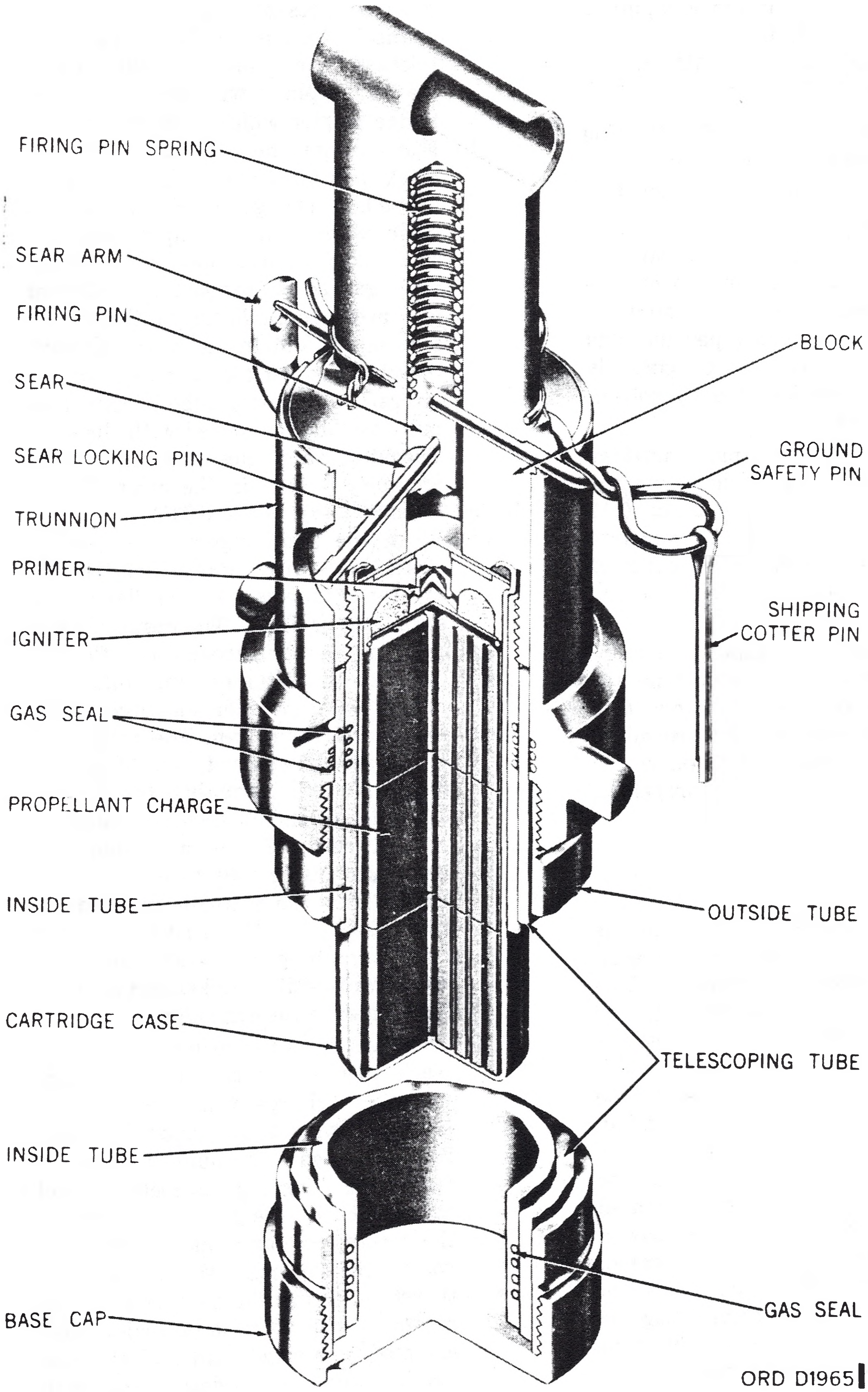

Figure 12-5. Catapult M1A1 in the Unarmed Condition—Cutaway View

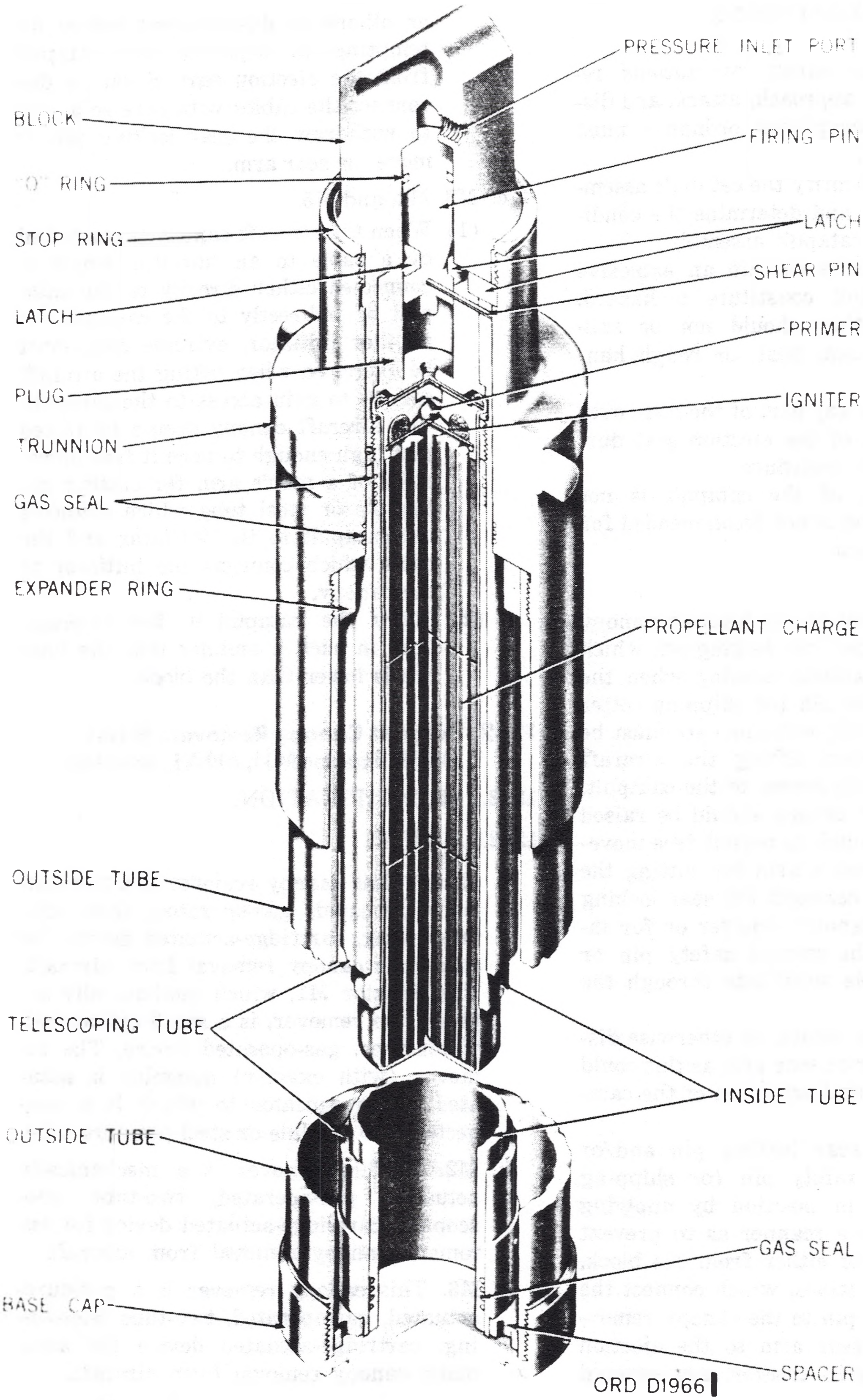

Figure 12-6. Catapult M3, in the Unarmed Condition—Cutaway View.

12-1.4 SAFETY PRECAUTIONS.

a. All Catapults.

(1) The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

(2) Positively identify the catapult assembly present, and determine the condition of the catapult assembly.

(3) These catapults contain an explosive cartridge and constitute a hazard. Therefore, they should not be subjected to shock, heat, or rough handling.

(4) Do not place any part of the body over any portion of the ejection seat during the EOD procedure.

(5) Disassembly of the catapult is not necessary and is not recommended for EOD purposes.

b. M1A1.

(1) Since removal of the aircraft canopy withdraws the sear locking pin which results in catapult arming when the ground safety pin (or shipping cotter pin) is missing, extreme care must be exercised when lifting the aircraft canopy to gain access to the catapult. The aircraft canopy should be raised just high enough to permit free movement of a man's arm for cutting the cable which connects the sear locking pin to the canopy remover or for insertion of the ground safety pin or other suitable substitute through the block.

(2) Do not move, rotate, or otherwise disturb the sear or sear arm as this could cause accidental actuation of the catapult.

(3) Secure the sear locking pin and/or the ground safety pin (or shipping cotter pin) in position by applying tape in such a manner as to prevent withdrawal of either from the block.

(4) Be sure the cables, which connect the sear locking pin to the canopy remover and the sear arm to the ejection seat hand grip trigger, are severed or otherwise disconnected before attempting to separate the catapult from the ejection seat. Sever or disconnect the cables with care so as not to withdraw the sear locking pin or move the sear arm.

c. M3, M4, and M5.

(1) When the aircraft canopy is connected by a cable to an initiator which is connected either directly to the catapult or indirectly to the catapult via another initiator, extreme care must be exercised when lifting the aircraft canopy to gain access to the catapult. The aircraft canopy should be raised just high enough to permit free movement of a man's arm for cutting the flexible or steel tube which connects the catapult to the initiator and the cable which connects the initiator to the canopy.

(2) Carry the catapult to the disposal area in such a manner that the base cap is lower than the block.

12-2. Aircraft Canopy Removers M1A1 (With Exactor M1), M2A1, and M3.

12-2.1 IDENTIFICATION.

12-2.1.1 TYPE.

a. M1A1. This canopy remover is a mechanically actuated, gas-operated, three-tube telescoping, cartridge-actuated device for automatic canopy removal from aircraft. The Exactor M1, which mechanically actuates the remover, is a small cylindrical, piston-type, gas-operated device. The remover (with exactor) assembly is actuated by an initiator to which it is connected by a flexible or steel pressure tube.

b. M2A1. This remover is a mechanically actuated, gas-operated, two-tube telescoping, cartridge-actuated device for automatic canopy removal from aircraft.

c. M3. This canopy remover is a pressure-actuated, gas-operated, two-tube telescoping, cartridge-actuated device for automatic canopy removal from aircraft.

12-2.1.2 PAINTING AND MARKING.

a. The model designation and various loading information are stenciled on the cylindrical surface of the outside tube of the remover.

b. The model designation and various loading information concerning the cartridge assembly which is assembled in the remover are stenciled on the cylindrical surface of the outside tube of the remover.

12-2.1.3 FITTINGS AND FEATURES (figure 12-7).

12-2.1.3.1 FITTINGS

a. M1A1 (figure 12-8).

(1) The exactor, which is mounted to the telescoping tube stop on the remover by two screws, contains a pressure inlet port. A flexible or steel tube leading from an initiator is connected to the pressure inlet port after the remover is installed in the aircraft. A pipe plug is threaded into the pressure inlet port for exactor shipment and storage purposes.

(2) The flanged base cap contains four holes for attachment of the remover to the aircraft.

(3) Four small holes (pressure relief outlets) sealed with pressure sensitive tape are located in the flat end of the exactor cylinder.

(4) The ground safety pin and shipping cotter pin are attached to each other. When either one is installed in the remover, it passes through the base of the firing head neck.

(5) The effective stroke of this remover is approximately 23.3 inches.

b. M2A1 (figure 12-9).

(1) The sear is L-shaped and passes through the bearing tube, block, and a notch in the firing pin. The arm of the sear has an eye in it for cable attachment.

(2) The sear locking pin passes diagonally through the block and firing pin at 90° to the sear.

(3) The ground safety pin and shipping cotter pin are attached to each other. When either one is installed on the remover, it passes through the block and firing pin.

(4) The block, which has a flat neck, has a female fitting at its upper extremity for remover attachment to the canopy.

(5) The base cap, which is screwed to the base of the outside tube, contains a female fitting for attachment of the remover to the aircraft structure.

(6) The effective stroke of this remover is approximately 28.2 inches.

c. M3 (figure 12-10).

(1) The pressure inlet port is located in the block. A flexible or steel tube is connected to the block at the pressure inlet port after the remover is installed in the aircraft. A pipe plug is threaded into the pressure inlet port for remover shipment and storage purposes.

(2) This remover has no external safety pins or fittings since it has a pressure firing mechanism.

(3) The block has a female fitting at its upper extremity for remover attachment to the canopy.

(4) The base cap, which is screwed to the base of the outside tube, contains a female fitting for attachment of the remover to the aircraft structure.

(5) The effective stroke of this remover is approximately 26.0 inches.

12-2.1.3.2 FEATURES.

a. M1A1. The remover M1A1 is a mechanically actuated, gas-operated, three-tube telescope ejector, consisting of an outside tube, a telescoping tube, and an inside tube. The exactor M1 is a piston-type, gas-operated mechanism which functions to release the firing pin of the remover. The exactor is mounted to the telescoping tube stop on the remover by two screws after the shipping wire is removed. The operating rod of the exactor passes through the stop, firing head, and firing pin of the remover in place of the shipping wire. The remover and exactor assembly

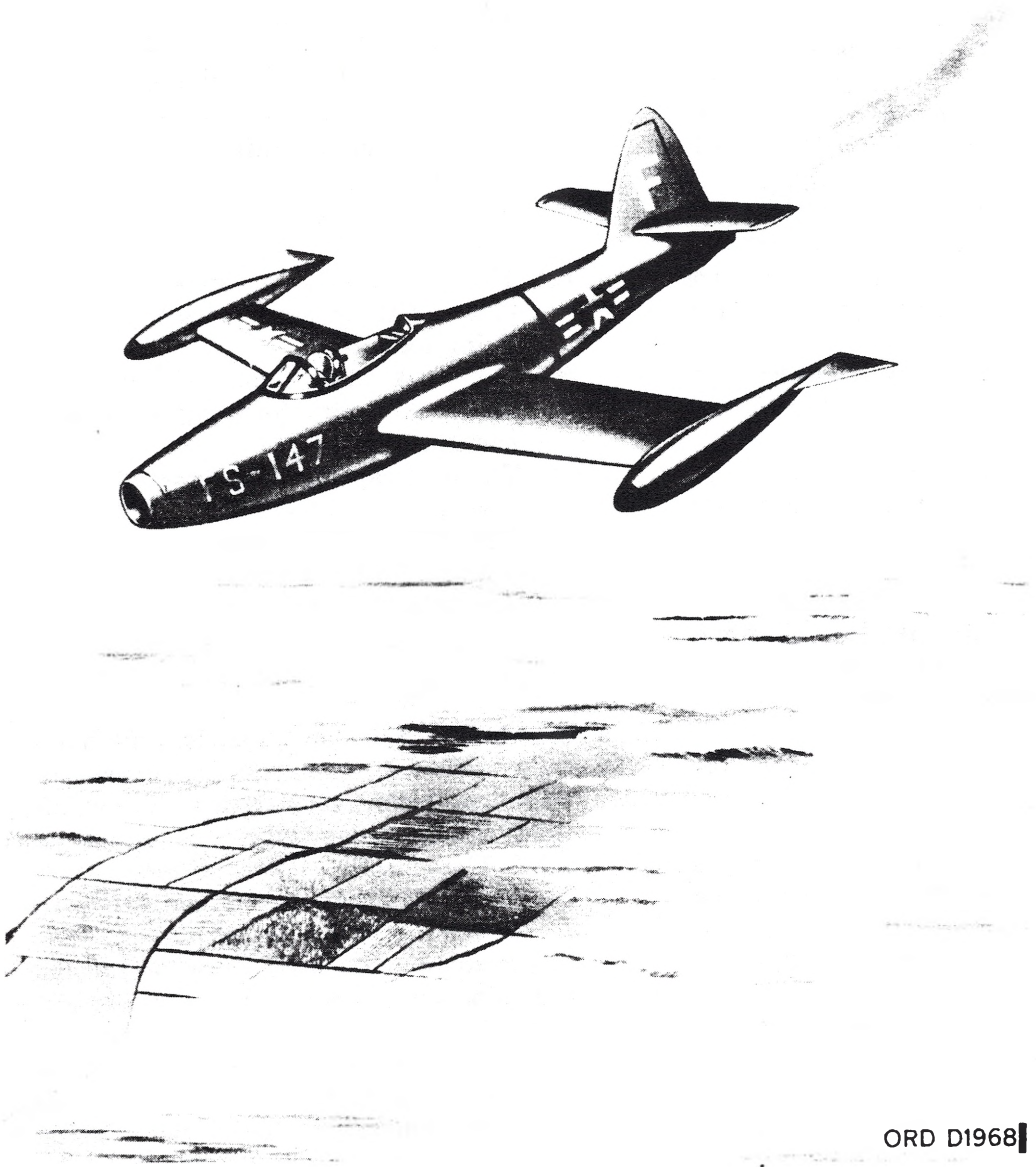

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Figure 12-7. A Typical Aircraft Canopy Jettisoned Clear of an Aircraft by a Canopy Remover

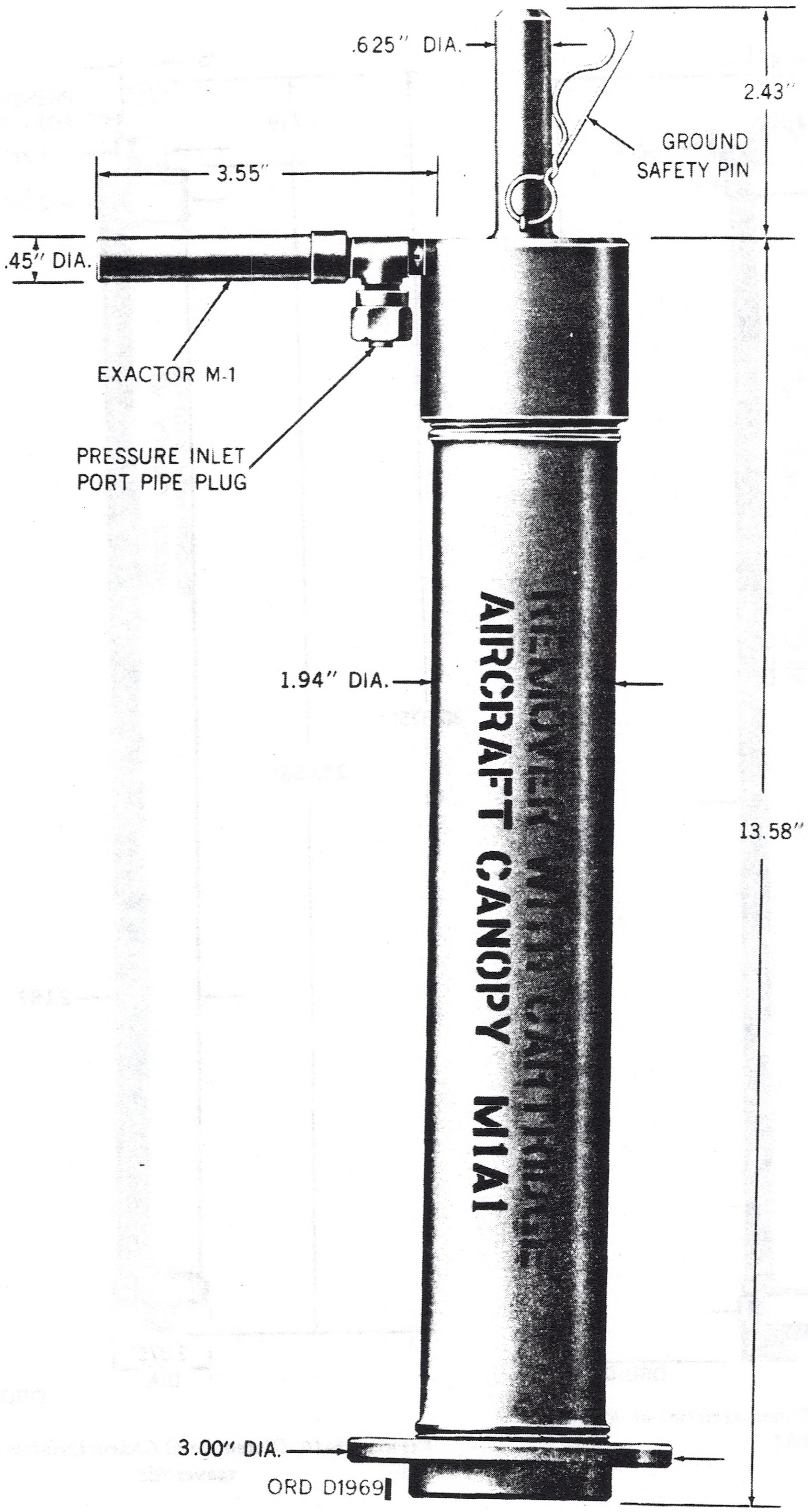


Figure 12–8. Dimensional Characteristics of Remover M1A1 Assemblied with Exactor M1

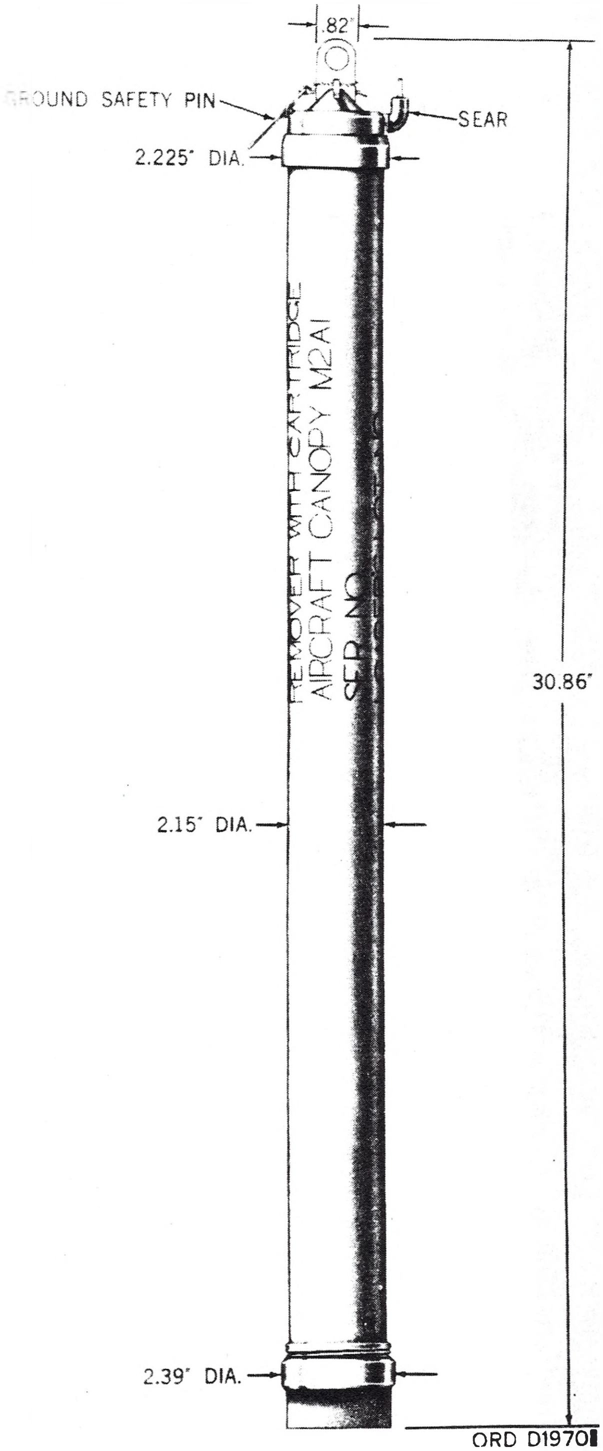


Figure 12-9. Dimensional Characteristics of Remover M2A1

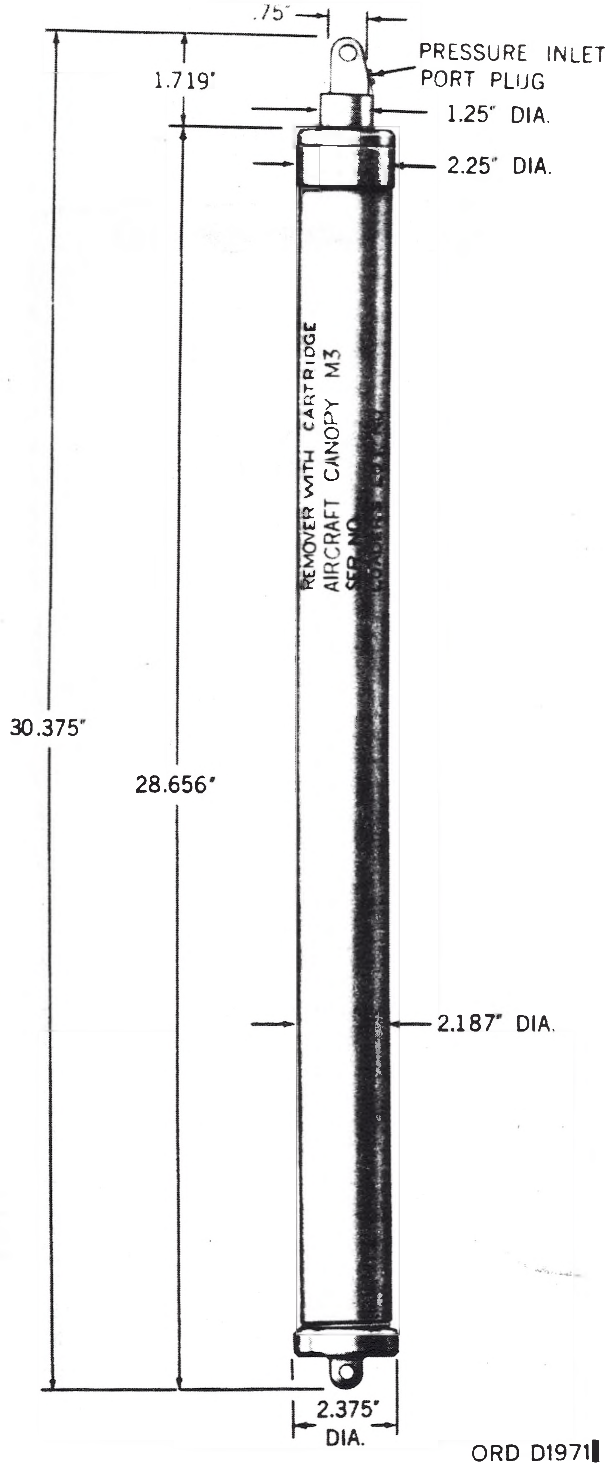


Figure 12-10. Dimensional Characteristics of Remover M3

is installed in the aircraft by securing the base cap of the remover to the aircraft structure. A flexible tube, which leads from an initiator, is attached to the pressure inlet port on the exactor and connects the remover and exactor assembly to the ejection system in the aircraft. The shipping cotter pin is replaced with the ground safety pin which is removed from the firing head of the remover prior to flight of the aircraft (and replaced after flight).

b. M2A1.

(1) The remover M2A1 is a mechanically actuated, gas-operated, two-tube telescope ejector, consisting of an outside tube and an inside tube. The block which is secured to the upper end of the inside tube, attaches to the canopy. The base cap, which is screwed to the base of the outside tube, attaches to the aircraft structure. After the remover is installed in the aircraft, the safety wire, which secures the sear locking pin to the block, is removed. The sear locking pin and sear are attached by cables and a mechanical linkage to the manual control of the aircraft ejection system, thereby providing a means whereby the sear locking pin is withdrawn and the sear is rotated upon actuation of the ejection system by the pilot. The shipping cotter pin, which prevents downward movement of the firing pin, is replaced with the ground safety pin. The ground safety pin is removed prior to flight of the aircraft (and replaced after flight).

(2) The sear locking pin, which passes through the block and firing pin, prevents the sear from rotating. The sear passes through the bearing tube, block, and a notch in the firing pin in such a way as to cock the spring-loaded firing pin and prevent it from striking the cartridge primer when the sear arm is in the "UP" position. In addition, the sear locks the block and inside tube assembly to the bearing tube and outside tube assembly when the sear arm is in the "UP" position.

c. M3.

(1) The remover M3 is a pressure-actuated, gas-operated, two-tube telescope ejector, consisting of an outside tube and an inside tube. The block, which is secured to the upper end of the inside tube, attaches to the canopy. The base cap, which is secured to the base of the outside tube, attaches to the aircraft structure. After the remover assembly is installed in the aircraft, the pipe plug is unthreaded from the pressure inlet port in the block and a flexible or steel tube which leads from an initiator, connects the remover to the emergency escape system of the aircraft. The block and inside tube assembly is free swiveling to facilitate connection of the flexible or steel tube.

(2) The firing pin is not spring-loaded, but is held in place by the shear pin. The latches lock the block and inside-tube assembly to the bearing tube and outside tube assembly.

12-2.1.4 WEIGHTS.

a. M1A1. The total weight of the remover without the exactor is approximately 2.1 pounds.

b. M2A1 or M3. The remover assembly is mover is approximately 4.4 pounds.

12-2.1.5 MATERIALS.

a. M1A1. The remover and exactor assembly is made of a hard, aluminum alloy.

b. M2A1 or M3. The remover assembly is made of a hard, aluminum alloy.

12-2.2 HAZARDOUS COMPONENTS. The removers covered herein utilize explosive cartridge assemblies which consist of a primer, igniter, and propellant as follows:

a. Remover M1A1 contains cartridge M29A2. The primer is a percussion type, the igniter consists of approximately 0.06 ounce of black powder, and the propellant consists of approximately 0.27 ounce of solvent-type smokeless propellant M2. The exactor M1 does not contain any explosive.

b. Remover A2A1 or M3 contains cartridge M31A1 or M31A2. The primer is a percussion type, the igniter consists of approximately 0.06 ounce of black powder, and the propellant consists of approximately 0.8 ounce of solvent-type, smokeless, propellant M2.

12–2.3 FUNCTIONING.

a. M1A1 (figure 12–11).

(1) When the pilot operates the canopy release trigger on the arm rest of the ejection seat, a mechanical linkage to the initiation causes the initiator to fire. The resulting gas pressure passes through the flexible tube to the pressure inlet port in the exactor. As gas pressure enters the pressure inlet port, it forces the unlocking piston towards the remover, compressing the unlocking piston spring and allowing the three steel balls to move radially outward from their seat in a groove on the operating rod. This action releases the operating piston from its locked position. The gas pressure now causes the operating piston and operating rod to move rearward away from the remover, thereby withdrawing the operating rod from the remover and releasing the firing pin. The spring-loaded firing pin moves downward and strikes the cartridge primer which is initiated.

(2) Flame from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. The remover assembly is provided with gas seals insuring a sufficient gas pressure build-up to thrust the telescoping and inside tubes upward, thereby lifting the canopy sufficiently to allow aerodynamic removal of the canopy from the aircraft. The inside tube of the remover assembly is ejected with the canopy. The outside and telescoping tubes remain in the aircraft.

b. M2A1 (figure 12–12).

(1) When the pilot triggers the manual control on the right arm rest of the ejection seat, a mechanical linkage pulls the sear locking pin from the remover, thereby arming the remover. The sear is then rotated so that the sear arm is in the "DOWN" position. As the sear is rotated, two flat portions on the sear align with notches in the bearing tube, thereby unlocking the block and inside tube assembly from the bearing tube and outside tube assembly. In addition, a third flat portion on the sear presents itself to the notch in the firing pin and the firing pin is released. The firing pin spring drives the firing pin down against the cartridge primer which is initiated.

(2) Flame from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. The remover assembly is provided with gas seals insuring a sufficient gas pressure build-up to thrust the inside tube upward, thereby forcibly removing the canopy. Aerodynamic action carries the canopy away from the aircraft.

c. M3 (figure 12–13).

(1) When the pilot triggers the ejection system, the initiator to which the remover is connected by the flexible or steel tube is fired. The resulting gas pressure passes through the flexible or steel tube to the pressure inlet port in the block and exerts a force on the top of the firing pin. The firing pin is forced downward, shearing the shear pin and camming the latches inward. As the latches are cammed inward clear of the stop ring, the block and inside tube assembly is unlocked from the bearing tube and outside tube assembly. The firing pin,

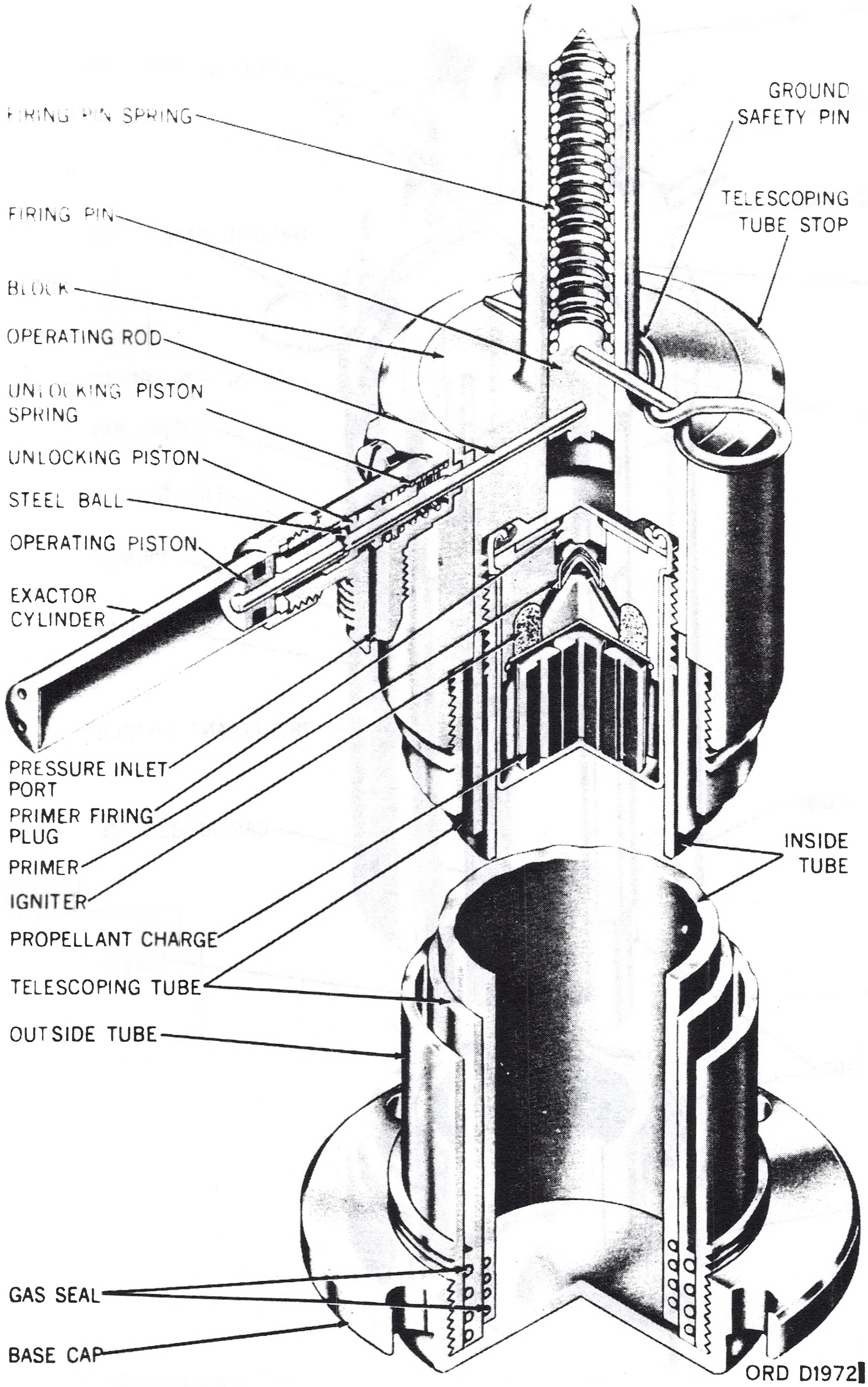


Figure 12-11. Remover M1A1 Assembled with Exactor M1—Unarmed Condition—Cutaway View.

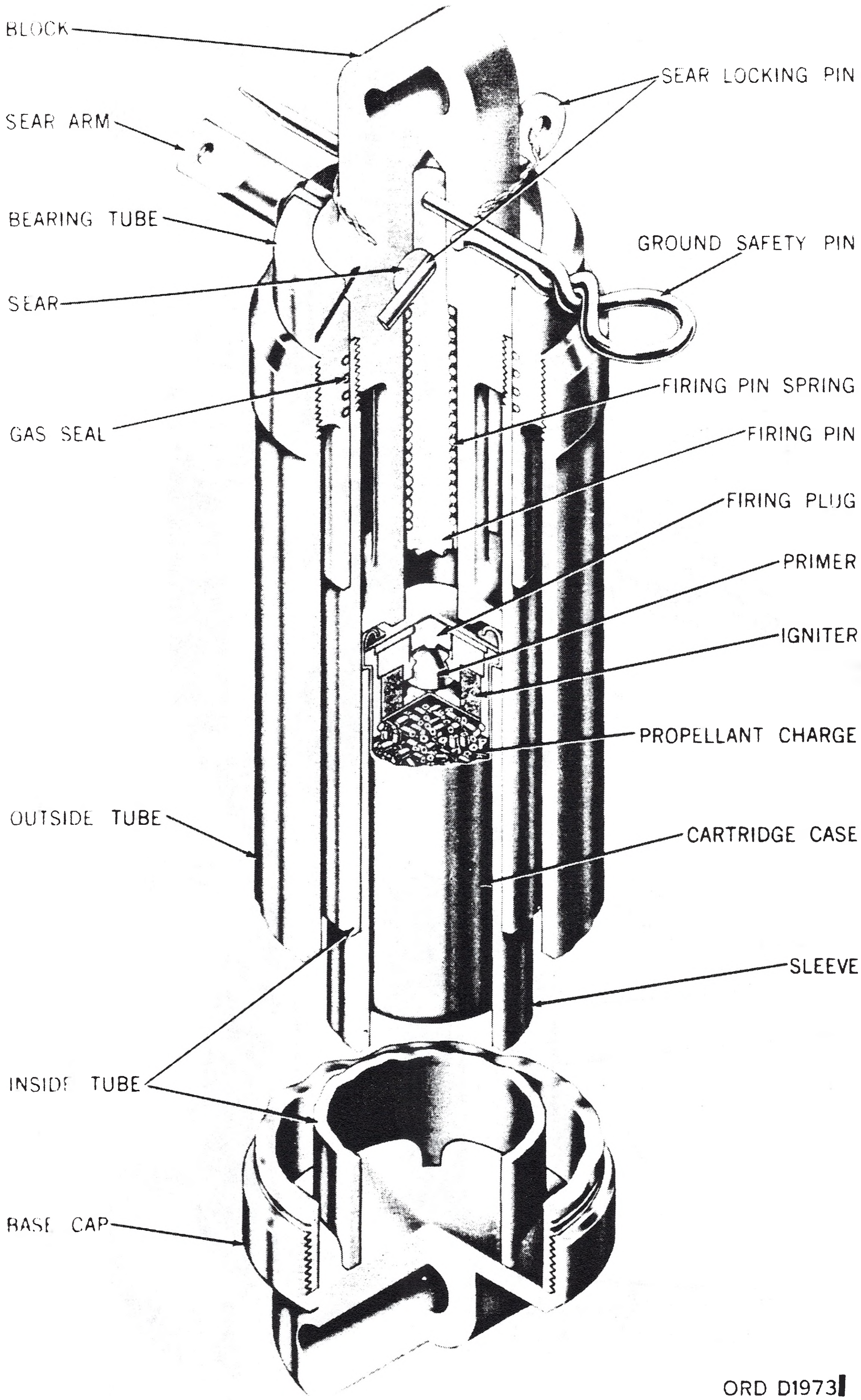


Figure 12-12. Remover M2A1 in the Unarmed Condition—Cutaway View

still acted upon by gas pressure continues downward until it strikes and initiates the primer in the cartridge.

(2) The flash from the primer ignites the black powder igniter and smokeless (solid) propellant charge which produces a large volume of gas upon burning. Sufficient gas pressure is formed from the burning propellant and maintained by the gas seals to thrust the inside tube upward, thereby lifting the canopy sufficiently to allow aerodynamic removal of the canopy from the aircraft. The inside tube and block of the remover assembly is ejected with the canopy. The outside tube and bearing tube remain in the aircraft.

12-2.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

b. The canopy remover should be rendered safe after the seat catapult has been rendered safe. Instructions on the rendering safe procedure of seat catapults are provided in paragraphs 19-1 and 19-2.

c. Positively identifying the remover present, and determine the condition of the remover.

d. The remover contains an explosive cartridge and constitutes a hazard. Therefore, it should not be subjected to shock, heat, or rough handling.

e. Do not place any part of the body over any portion of the remover.

f. Carry the remover to a disposal area in such a manner that the base cap is lower than the block.

g. Disassembly of the remover is not necessary and is not recommended for rendering safe or disposal purposes.

h. When the remover is in the armed condition, fully insert the ground safety pin or a suitable substitute in the neck of the firing head and secure it in place with tape.

12-3. Catapult or Canopy Remover Initiator M3 and Delay Initiator M4.

12-3.1 IDENTIFICATION.

12-3.1.1 TYPE. These initiators are mechanically actuated firing devices designed to function, by gas pressure, another pressure-actuated device such as a catapult, remover, thruster, initiator, or lap belt release, to which it is connected by a length of flexible or steel tube.

12-3.1.2 PAINTING AND MARKING.

a. The model designation and various loading information are stenciled on the initiator chamber.

b. The model designation and various loading information of the explosive cartridge assembly which is assembled in the initiator are stenciled on the initiator chamber.

12-3.1.3 FITTINGS AND FEATURES (figure 12-14).

12-3.1.3.1 FITTINGS

a. The cap, which is screwed on the chamber and is either staked in place or secured by two set screws, has an integral mounting flange with two bolts holes for attaching the initiator to the deck adjacent to the seat or to the rear or underside of the seat.

b. The chamber has an integral standard pressure fitting at its base end which serves as a pressure outlet port.

c. A flexible or steel tube, which is connected to the pressure outlet port when the initiator is installed in the aircraft, connects the initiator to another pressure-initiated, cartridge-actuated device or a piston-type device.

d. A shipping cap seals the pressure outlet port prior to initiator installation in the aircraft.

e. The initiator pin protrudes from the top of the initiator and has an eye in it for attachment of a pull cable.

f. The safety pin passes through the cap and a slot in the neck of the initiator pin. It prevents withdrawal of the initiator pin.

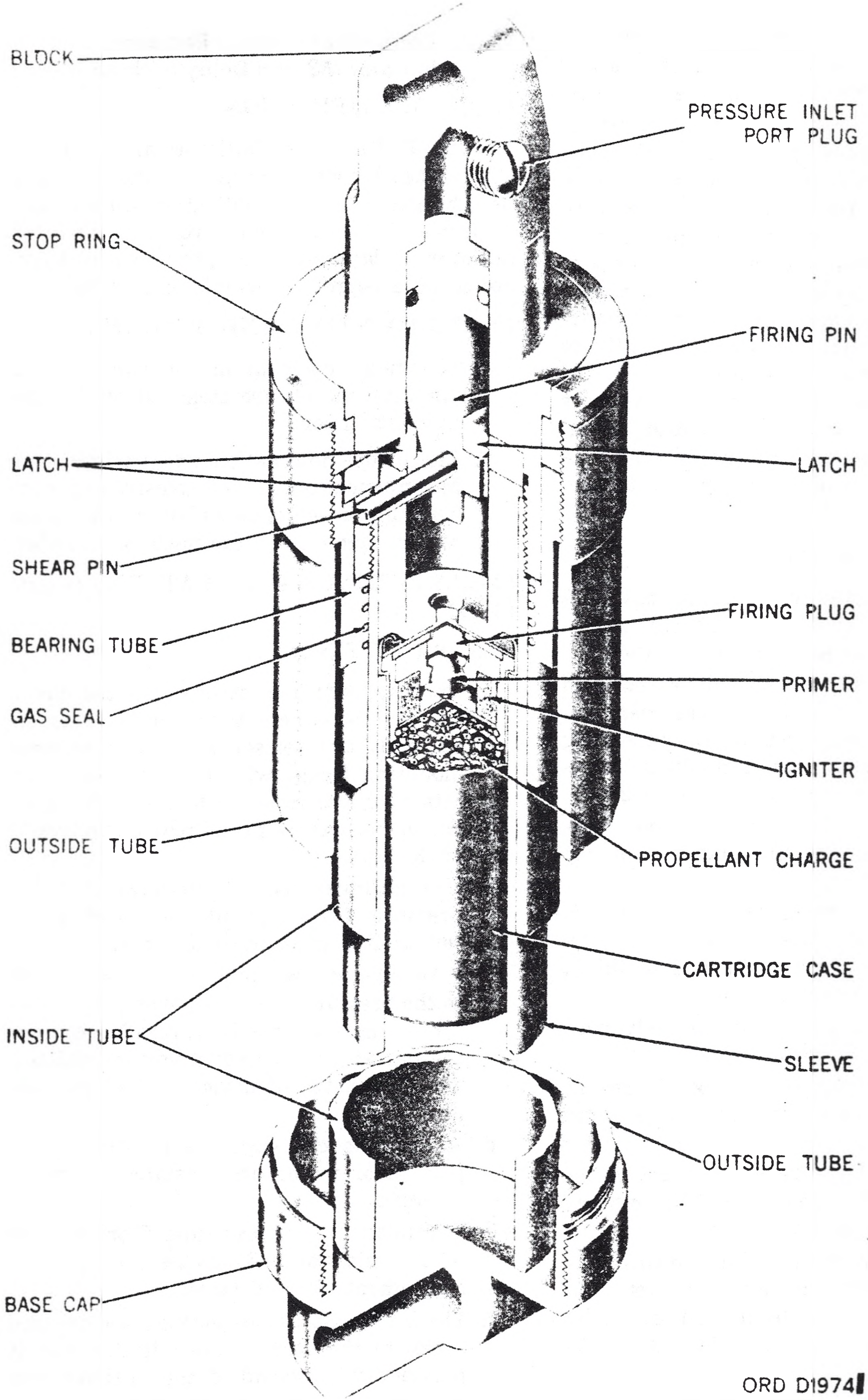


Figure 12-13. Remover M3 in the Unarmed Condition—Cutaway View

g. The minimum pull force required to withdraw the initiator pin sufficiently to fire the initiator is 20 to 30 pounds.

h. The initiator pin is designed so that it pulls completely free from the initiator when the initiator is fired.

i. The gas pressure delivered at the pressure outlet port when the initiator fires is approximately 5,200 pounds per square inch for initiator M3 and 4,100 pounds per square inch for delay initiator M4.

12-3.1.3.2 FEATURES. These initiators are mechanically actuated devices which consist of a small cylindrical chamber incorporating a pressure outlet port, an explosive cartridge, and a firing mechanism. The firing mechanism consists of an initiator pin, initiator spring, firing pin, and three retaining balls which lock the initiator pin to the firing pin in the unarmed condition. A flexible or steel tube is connected to the pressure outlet port, thereby connecting the initiator to another cartridge-actuated or piston-type device which requires gas pressure for actuation. The initiator pin is connected at its eye by a cable to the escape system controls. The safety pin is removed from the initiator prior to aircraft flight and replaced in the initiator after aircraft flight.

12-3.1.4. WEIGHTS. The initiator M3 weighs approximately 0.9 pound and the delay initiator M4 weighs approximately 1.0 pound.

12-3.1.5 MATERIALS. The initiators are made of a hard aluminum alloy.

12-3.2 HAZARDOUS COMPONENTS. These initiators utilize explosive cartridges as follows:

a. Initiator M3. This initiator uses initiator cartridge M38. This cartridge consists of a percussion-type primer, an igniter consisting of approximately 0.035 ounce black powder, and propellant consisting of approximately 0.098 ounce of solvent-type, smokeless (solid), propellant M2.

b. Delay Initiator M4. This initiator uses delay initiator cartridge M46. This cartridge consists of a percussion-type primer, a delay element M5 (T3) which consists of approximately 0.037 ounce of delay mixture, an igniter consisting of approximately 0.035 ounce of black powder, and propellant consisting of approximately 0.056 ounce of solvent-type, smokeless (solid), propellant M2.

12-3.3 FUNCTIONING (figure 12-15).

Note. The delay initiator M4 is basically similar in construction and functioning to the initiatior M3, except that it contains an explosive cartridge which incorporates a 2-second delay element.

a. When the emeregency escape system is triggered, the initiator pin is withdrawn from the initiator after a minimum pull force of 20 to 30 pounds is exerted on the initiator pin. As the initiator pin is being withdrawn, it pulls the firing pin with it, thereby compressing the initiator spring in the firing pin housing and cocking the firing pin. When the initiator pin has been withdrawn 3/8 of an inch, the three retaining balls fall into a decess in the firing pin housing, thereby unlocking the firing pin from the initiator pin which is then pulled completely free of the initiator. The compressed initiator spring then drives the firing pin into the cartridge primer which is initiated.

b. In the case of the initiator M3, flame from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. The initiator is gas sealed with an O-ring so that gas pressure of approximately 5,200 pounds per square inch is delivered to the pressure outlet port. The gas under pressure flows through the flexible or steel tube to the cartridge actuated device connected at the other end of the tube and actuates the device (canopy remover or seat catapult).

c. In the case of the delay initiator M4, flame from the primer ignites the delay element which burns for a calculated delay time of 2 seconds. After the delay ele-

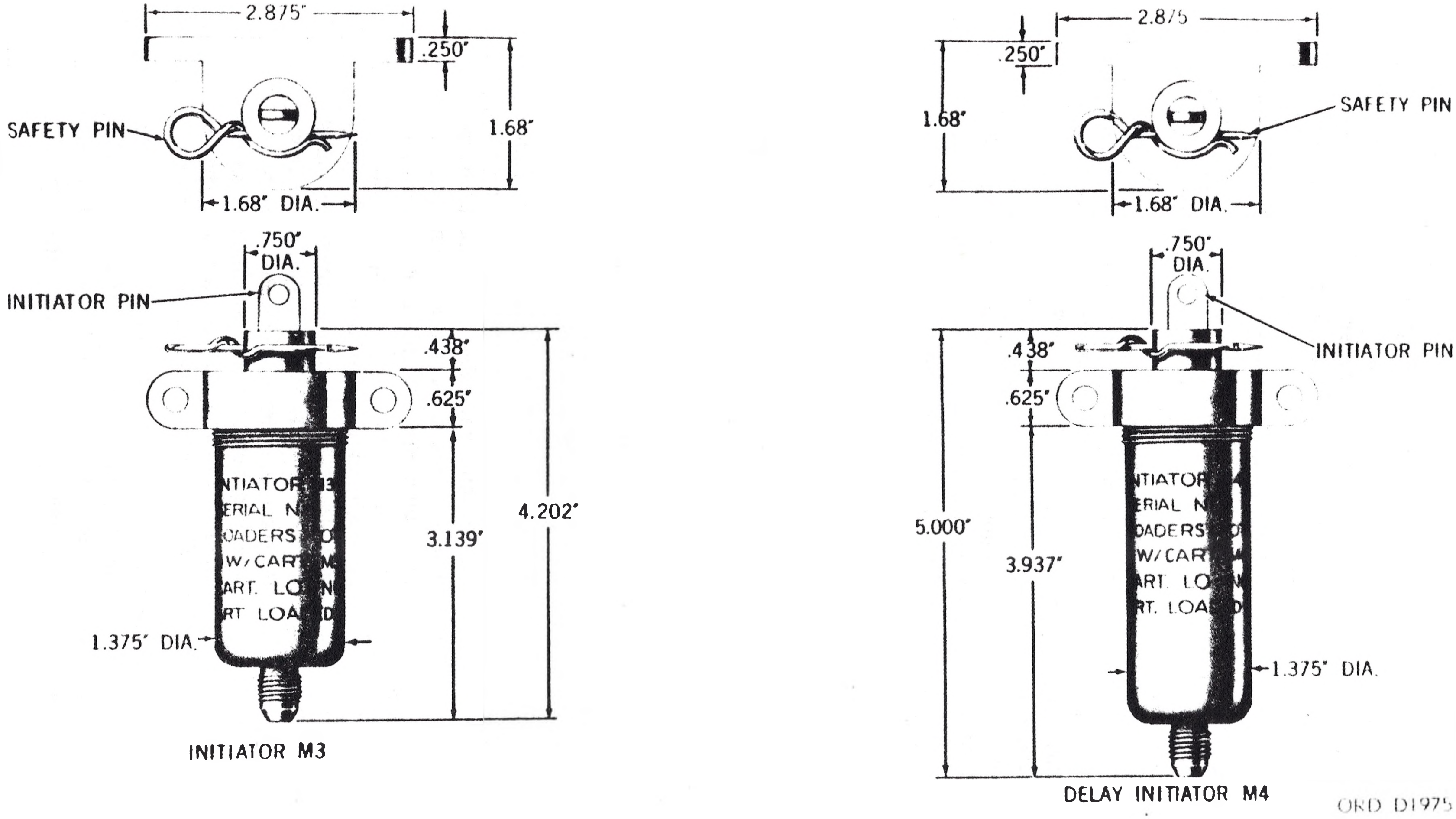


Figure 12–14. Dimensional characteristics of initiator and delay initiator M4

ment burns through, the flame ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. Gas pressure of approximately 4,100 pounds per square inch is delivered to the pressure outlet port. The gas under pressure flows through the flexible or steel tube to the piston-type device which automatically releases the lap belt.

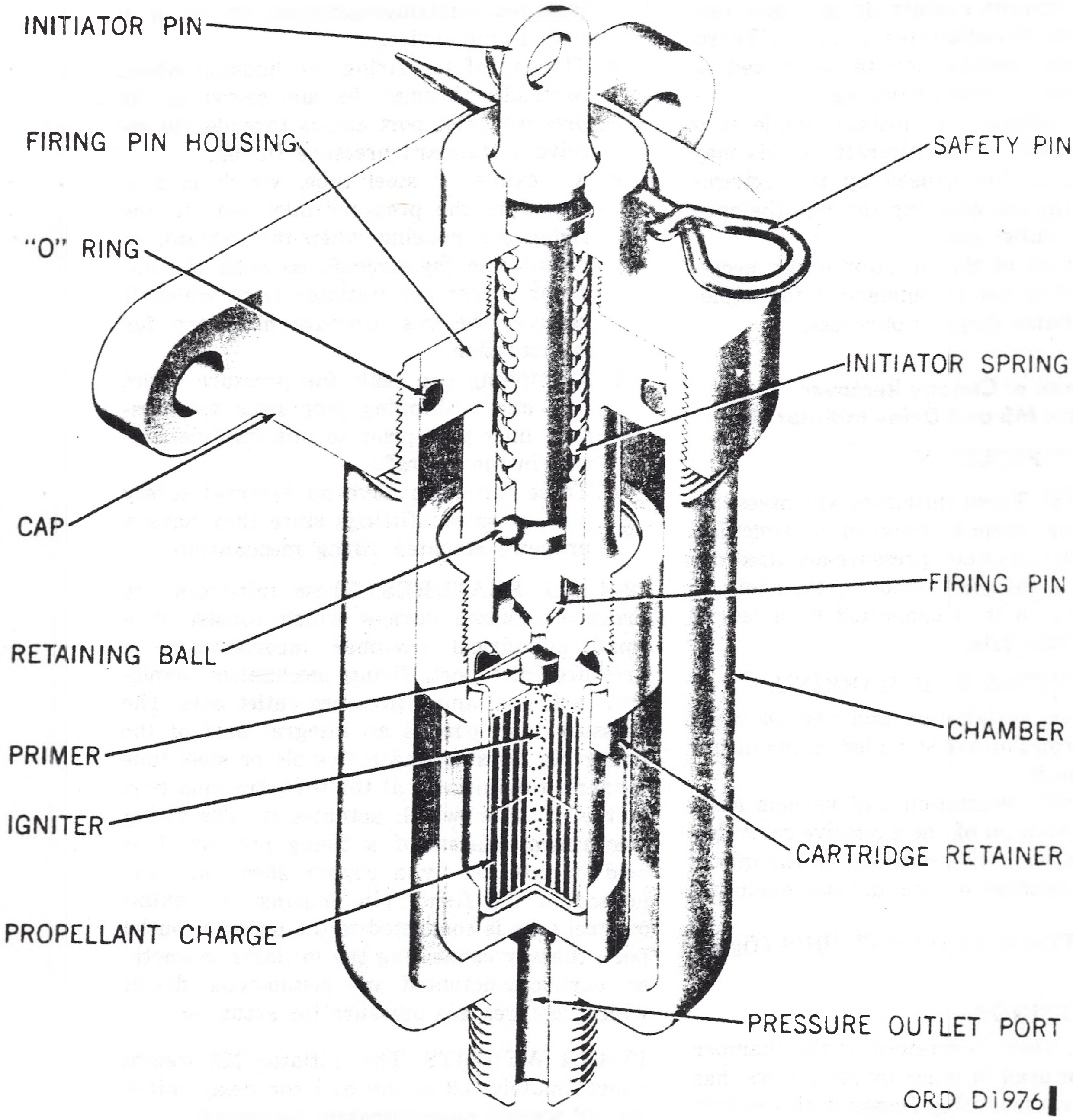


Figure 12-15. Initiator M3 in the Unarmed Condition—Cutaway View

12-3.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

b. Positively identify the initiator present, and determine the condition of the initiator.

c. These initiators contain an explosive cartridge which constitutes a hazard. Therefore, they should not be subjected to shock, heat or rough handling.

d. Do not actuate the initiator while it is still installed in the aircraft as this may result in a fire caused by the extreme heat of the gas escaping through the open pressure outlet port.

e. Disassembly of the initiator is not necessary and is not recommended for explosive ordnance disposal purposes.

12-4. Catapult or Canopy Remover Initiator M5 and Delay Initiator M6.

12-4.1 IDENTIFICATION.

12-4.1.1 TYPE. These initiators are pressure-actuated firing devices designed to function, by gas pressure, another pressure-actuated device such as a catapult remover, thruster, or initiator to which it is connected by a length of flexible or steel tube.

12-4.1.2 PAINTING AND MARKING.

a. The model designation and various loading information are stenciled on the initiator chamber.

b. The model designation and various loading information of the explosive cartridge assembly which is assembled in the initiator are stenciled on the initiator chamber.

12-4.1.3 FITTINGS AND FEATURES (figure 12-16).

12-4.1.3.1 FITTINGS.

a. The cap, which is screwed on the chamber and is secured in place by set screws, has an integral mounting flange with two bolt holes for attaching the initiator to the deck adjacent to the seat, or to the rear or underside of the seat.

b. The chamber has an integral standard pressure fitting at its base end which serves as a pressure outlet port.

c. A flexible or steel tube which is connected to the pressure outlet port when the initiator is installed in the aircraft, connects the initiator to another pressure-initiated, cartridge-actuated device or a piston-type device.

d. The top of the firing pin housing which protrudes through the cap, serves as the pressure inlet port and is threaded to receive a standard pressure fitting.

e. A flexible or steel tube, which is connected to the pressure inlet port in the firing pin housing when the initiator is installed in the aircraft, connects the initiator to another initiator from which it receives the gas pressure necessary for its actuation.

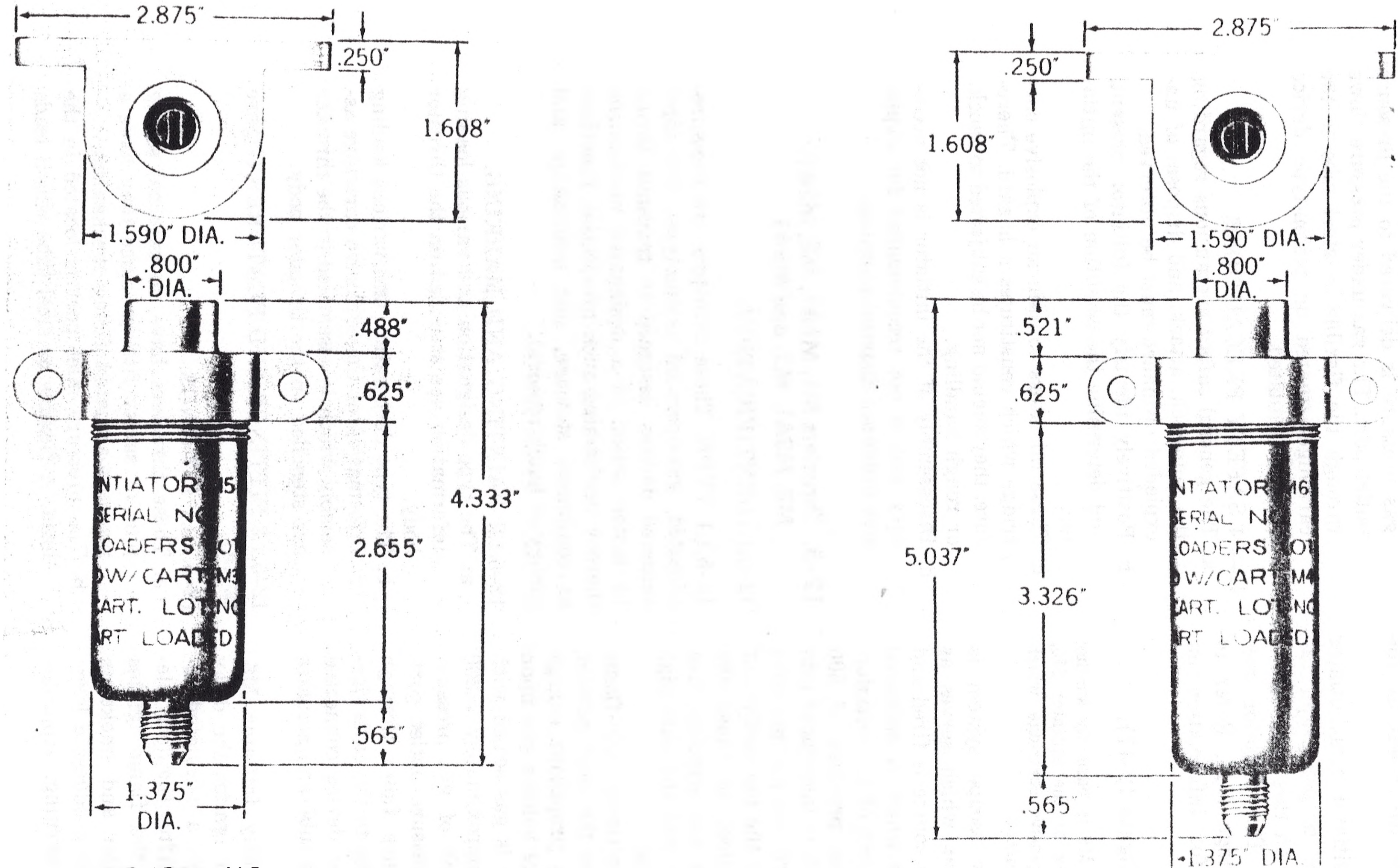
f. A shipping cap seals the pressure outlet port and a shipping plug seals the pressure inlet port prior to initiator installation in the aircraft.

g. These initiators have no external safety pins or safety fittings since they have a pressure actuated firing mechanism.

12-4.1.3.2 FEATURES. These initiators are pressure-actuated devices which consist of a small cylindrical chamber incorporating a pressure inlet port, firing mechanism, explosive cartridge, and a pressure outlet port. The pressure inlet port is an integral part of the firing pin housing and a flexible or steel tube connects the initiator at the pressure inlet port to the initiator which actuates it. The firing mechanism consists of a firing pin, which is held in position by a copper shear pin and housed in the firing pin housing. A flexible or steel tube is connected to the pressure outlet port, thereby connecting the initiator to another cartridge-actuated or piston-type device which requires gas pressure for actuation.

12-4.1.4 WEIGHTS. The initiator M5 weighs approximately 0.9 pound and the delay initiator M6 weighs approximately 1.0 pound.

12-4.1.5 MATERIALS. The initiators are made of a hard aluminum alloy.



INITIATOR M5

DELAY INITIATOR M6

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Figure 12-16. Dimensional Characteristics of Initiator M5 and Delay Initiator M6

12–4.2. HAZARDOUS COMPONENTS. The initiators utilize explosive cartridges as follows:

a. Initiator M5. This initiator uses initiator cartridge M38. Refer to paragraph 12–3.2a for information on this cartridge.
b. Delay Initiator M6. This initiator uses delay initiator cartridge M46. Refer to paragraph 12–3.2b for information on this cartridge.

12–4.3 FUNCTIONING (figure 12–17).

Note. The delay initiator M6 is basically similar in construction and functioning to the initiator M5, except that it contains an explosive cartridge which incorporates a 2-second delay element.

a. When the emergency escape system is triggered, the initiator which serves as an actuating pressure source is fired and develops gas pressure which is delivered to the pressure inlet port of the initiator. When a minimum gas pressure of 500 pounds per square inch is introduced into the pressure inlet port, the gas pressure exerts a force against the top surface of the firing pin sufficient to cause the shear pin to fail. The gas pressure then drives the firing pin into the cartridge primer which is initiated.
b. In the case of the initiator M5, flame from the primer ignites the black powder igniter and smokeless propellant charge which produces a large volume gas upon burning. The initiator is gas sealed with an O-ring so that approximately 5,200 pounds per square inch of gas pressure is delivered to the pressure outlet port. The gas under pressure flows through the flexible or steel tube to the cartridge-actuated or piston-type device connected at the other end of the tube and actuates the device.
c. In the case of the delay initiator M6, flame from the primer ignites the delay element which burns for a calculated delay time of 2 seconds. After the delay element burns through, the flame ignites the black powder igniter and smokeless propellant charge which produces a large volume of gas upon burning. Approximately 4,100 pounds per square inch of gas pressure is delivered to the pressure outlet port. The gas under pressure flows through the flexible or steel tube to the cartridge-actuated or piston-type device which is actuated.

12–4.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.
b. Positively identify the initiator present, and determine the condition of the initiator.
c. These initiators contain an explosive cartridge which constitutes a hazard. Therefore, they should not be subjected to shock, or rough handling.
d. Disassembly of the initiator is not necessary and is not recommended for explosive ordnance disposal purposes.

12–5. Thrusters M1, M1A1, M2, M2A1, M3, M3A1, M5, and M5A1

12–5.1 IDENTIFICATION.

12–5.1.1 TYPE. These thrusters are pressure-actuated, gas-operated piston-type, cartridge-actuated devices designed to transmit thrust by piston action to a designated mechanism, thereby performing such preejection functions as equipment stowage, seat positioning, and canopy or hatch removal.

12–5.1.2 PAINTING AND MARKING.

a. The type designation and various loading information are stenciled on the thruster body.
b. The type designation and various loading information of the explosive cartridge assembly which is assembled in the thruster are stenciled on the thruster body.

12–5.1.3 FITTINGS AND FEATURES (figure 12–18).

12–5.1.3.1 FITTINGS.

a. These thrusters have no external safety pins or safety fittings since they have a pressure-actuated firing mechanism.
b. The pressure inlet port is located in the head. A flexible or steel tube which leads

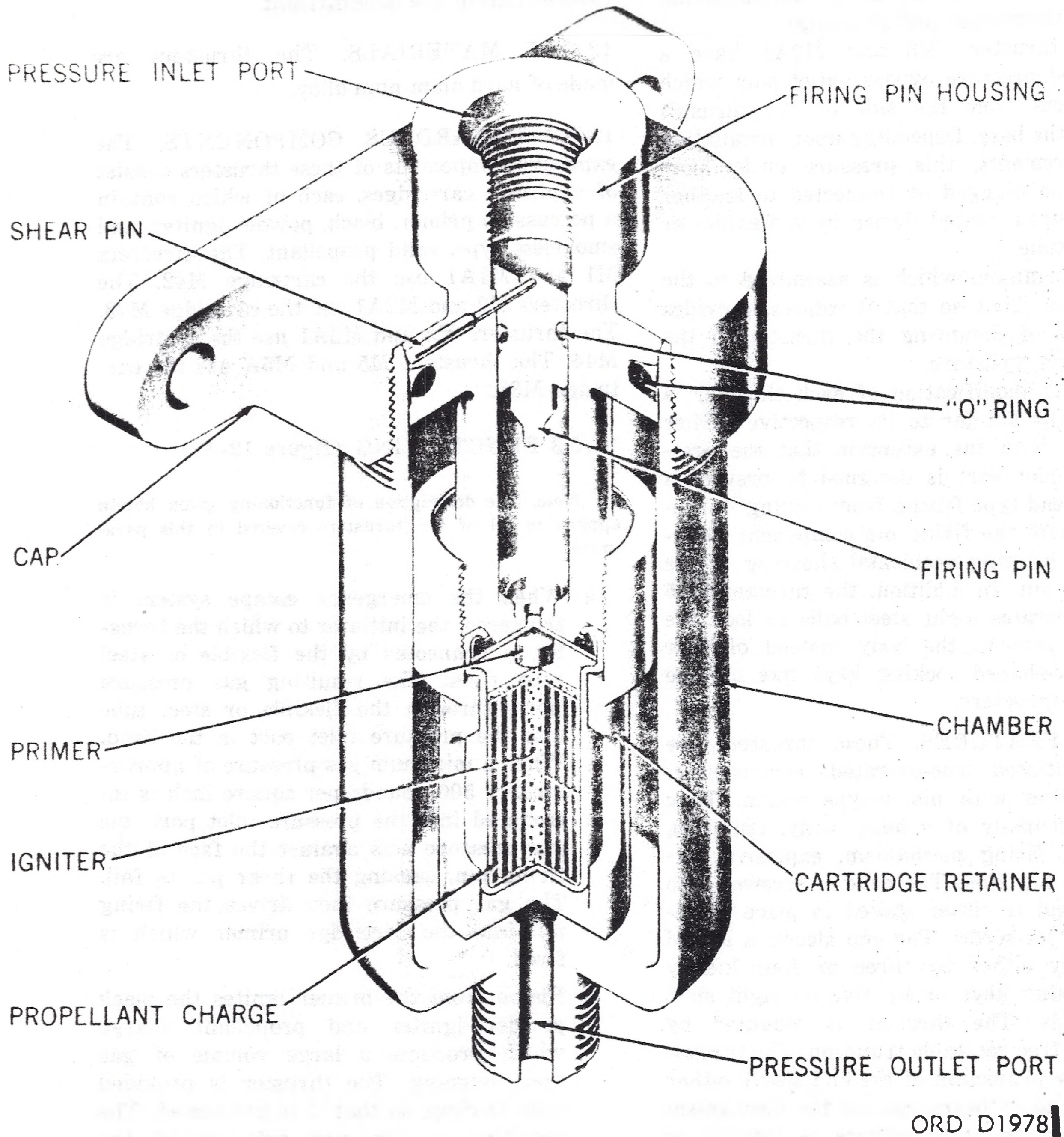


Figure 12-17. Initiator M5 in the Unarmed Condition—Cutaway View

from an initiator is connected to the head at the pressure inlet port after the thruster is installed in the aircraft. A shipping plug is threaded into the pressure inlet port for thruster shipment and storage purposes.

c. The end sleeve at the base end of the thruster body has a threaded, stud-like projection between 7/8 to 1 inch in length, with a curved face, so that the mechanism to be actuated may be threaded to this stud, or bear against it as the installation may require. A cap is threaded over the stud for thread protection during thruster storage and shipping.

d. The thrusters M3 and M3A1 have a tapped pressure bypass outlet port which projects from the side of the thruster near the base. Depending upon installation requirements, this pressure outlet port may be plugged or connected to another pressure-actuated device by a flexible or steel tube.

e. The trunnion, which is assembled to the thruster body so that it rotates, provides means of mounting the thruster to the aircraft structure.

f. The A1 modification of each thruster is basically similar to its respective earlier model with the exception that the pressure inlet port is designed to prevent a bulkhead type fitting from coming in contact with the firing pin component thereby preventing accidental shearing of the shear pin. In addition, the thrusters M5 incorporates eight steel balls to lock the end sleeve to the body instead of four kidney-shaped locking keys like all the other thrusters.

12-5.1.3.2 FEATURES. These thrusters are pressure-initiated, gas-operated, cartridge-actuated devices with piston-type action. They consist principally of a head, body, trunnion, and sleeve, firing mechanism, explosive cartridge, and a piston. The head is screwed into the body and is either staked in place or secured by a set screw. The end sleeve is locked to the body either by three or four kidney shaped locking keys or by five or eight steel locking balls. The thruster is mounted by means of a free rotatable trunnion. The threaded, stud-like projection of the end sleeve either is threaded to or bears against the mechanism that the thruster is to actuate. A flexible or steel tube which leads from the initiator that actuates the thruster, is connected to the pressure inlet port in the head. The thrusters M3 and M3A1 also have a pressure by-pass outlet port which, depending upon installation requirements, may be plugged or connected by a flexible or steel tube to another cartridge-actuated device which it actuates.

12-5.1.4 WEIGHTS. The weights of the items covered herein are insignificant.

12-5.1.5 MATERIALS. The thrusters are made of hard aluminum alloy.

12-5.2 HAZARDOUS COMPONENTS. The explosive components of these thrusters consist of explosive cartridges, each of which contain a percussion primer, black, powder igniter, and smokeless type, solid propellant. The thrusters M1 and M1A1 use the cartridge M42. The thrusters M2 and M2A1 use the cartridge M43. The thrusters M3 and M3A1 use the cartridge M44. The thrusters M5 and M5A use the cartridge M38.

12-5.3 FUNCTIONING (figure 12-19).

Note. The description of functioning given herein applies to all of the thrusters covered in this paragraph.

a. When the emergency escape system is triggered, the initiator to which the thruster is connected by the flexible or steel tube fires. The resulting gas pressure flows through the flexible or steel tube into the pressure inlet port in the head. When a minimum gas pressure of approximately 500 pounds per square inch is introduced into the pressure inlet port, the gas pressure acts against the face of the firing pin, causing the shear pin to fail. The gas pressure then drives the firing pin into the cartridge primer which is fired.

b. Flame from the primer ignites the black powder igniter and propellant charge which produces a large volume of gas upon burning. The thruster is provided with O-rings so that it is gas sealed. The resulting gas pressure acts against the face of the piston, causing the piston to move forward. The forward movement of the piston compresses the piston locking spring until the locking keys (or steel locking balls) fall into the unlocking groove in the piston. The end sleeve and piston then thrust forward as a unit accomplishing the intended action.

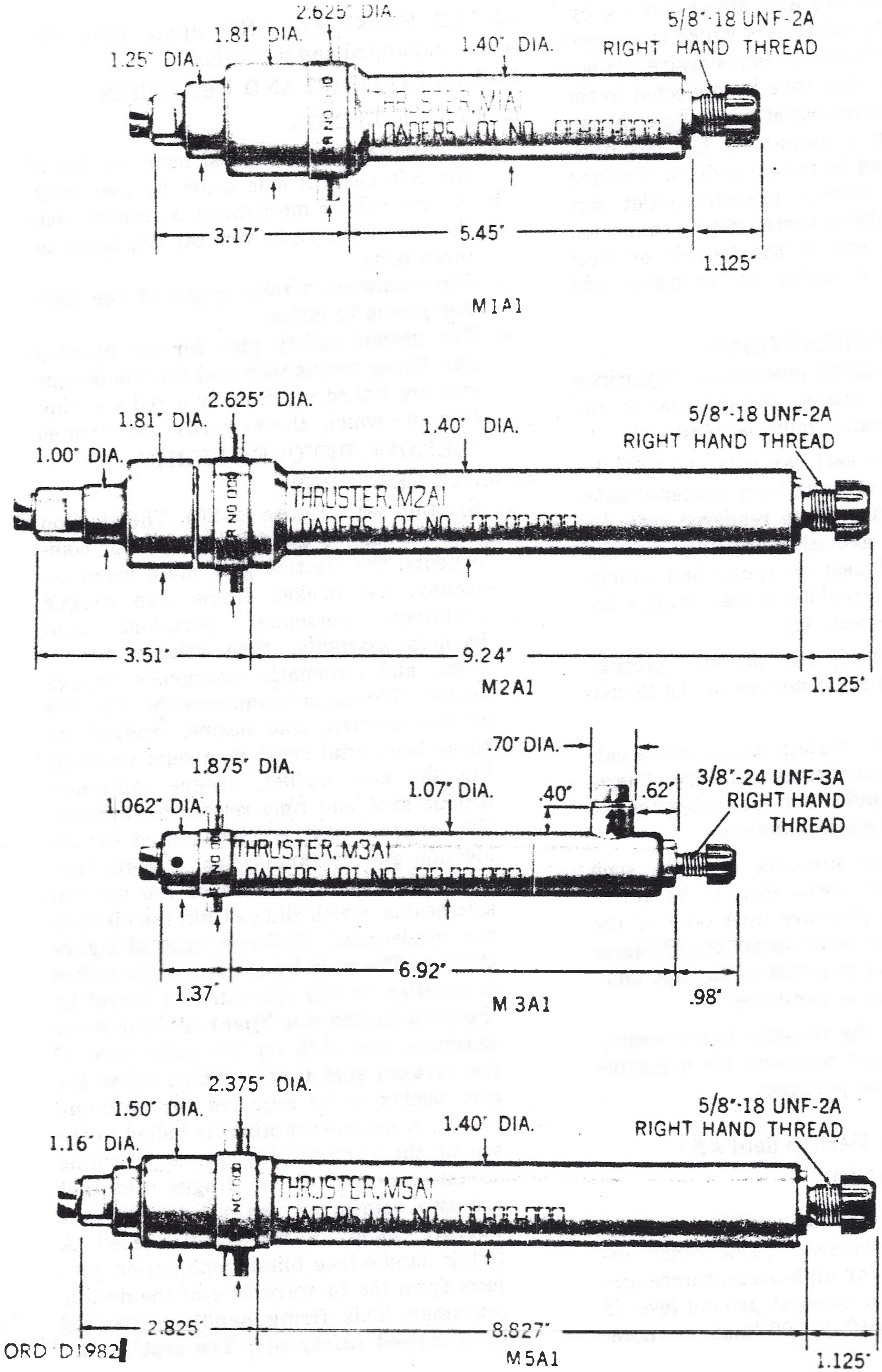


Figure 12-18. Dimensional Characteristics of Thrusters M1A1, M2A1, M3A1, and M5A1

c. The thrusters M3 and M3A1 have a by-pass pressure outlet port which is plugged when piston thrust action is desired. When a flexible or steel tube is connected to the by-pass pressure outlet port, these thrusters are used as initiators. The gas pressure developed by the cartridge is diverted through the by-pass pressure outlet port to the cartridge-actuated device connected at the other end of the flexible or steel tube instead of acting on the piston and end sleeve.

12–5.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

b. After (1) the seat catapult and (2) the canopy remover have been rendered safe, the thruster should be rendered safe. Instructions on explosive ordnance disposal procedures of seat catapults and canopy removers are provided in paragraphs 12–1 and 12–2 respectively.

c. Positively identify the thruster present, and determine the condition of the thruster.

d. These thrusters contain an explosive cartridge which constitutes a hazard. Therefore, they should not be subjected to shock, heat, or rough handling.

e. Never cause air pressure or tools, such as screwdrivers, awls, etc., to be introduced into the pressure inlet port of the thruster as this could cause the thruster to fire, resulting in property damage and/or serious injury to personnel.

f. Disassembly of the thruster is not recommended and is not necessary for explosive ordnance disposal purposes.

12–6. Martin-Baker Ejection Seat A5

12–6.1 IDENTIFICATION.

12–6.1.1 TYPE. The ejection seat A5 is a fully automatic, cartridge-operated, emergency escape device designed for high-performance aircraft. It allows safe ejection at ground level if the speed of the aircraft is 100 knots or more.

12–6.1.2 PAINTING AND MARKING. The seat is unpainted and unmarked.

12–6.1.3 FITTINGS AND FEATURES.

12–6.1.3.1 FITTINGS.

a. A drogue gun is secured near the top of the left vertical side beam by two bolts.

b. A time release mechanism is secured near the top of the right vertical side beam by three bolts.

c. The maximum stroke length of the ejection gun is 72 inches.

d. The ground safety pins for the ejection gun firing mechanism and for the drogue gun are linked together by a red warning flag on which these words are printed "REMOVE BEFORE FLIGHT".

12–6.1.3.2 FEATURES.

a. Ejection seat (figure 12–20). The ejection seat consists of the following major components: the ejection gun, main beam assembly, seat bucket, drogue gun, drogue container, personnel parachute and harness assembly, time release mechanism, and automatic emergency oxygen system. The main beam assembly consists of two verticle side beams, bridged by three horizontal cross members, supporting the seat bucket, drogue container, drogue gun, and time release mechanism. The ejection seat is railmounted on the ejection gun by three pairs of metal slippers, fitted to the inside of the vertical side beams, which slide within the ejection gun guide rails. (Refer to inset of figure 12–21.) The main beam assembly is locked in position on the ejection gun barrel by the latch mechanism. There are four guide channels, two each on the outer face of the vertical side beams, which allow the seat bucket to be adjusted for optimum height. A drogue container is bolted to the top of the vertical side beams. Forming an integral part of the drogue container are two reinforced peaks by which the aircraft canopy is broken, if needed. A firing handle-face blind combination projects from the forward face of the drogue container. This firing handle is secured by a tagged safety pin. The seat bucket

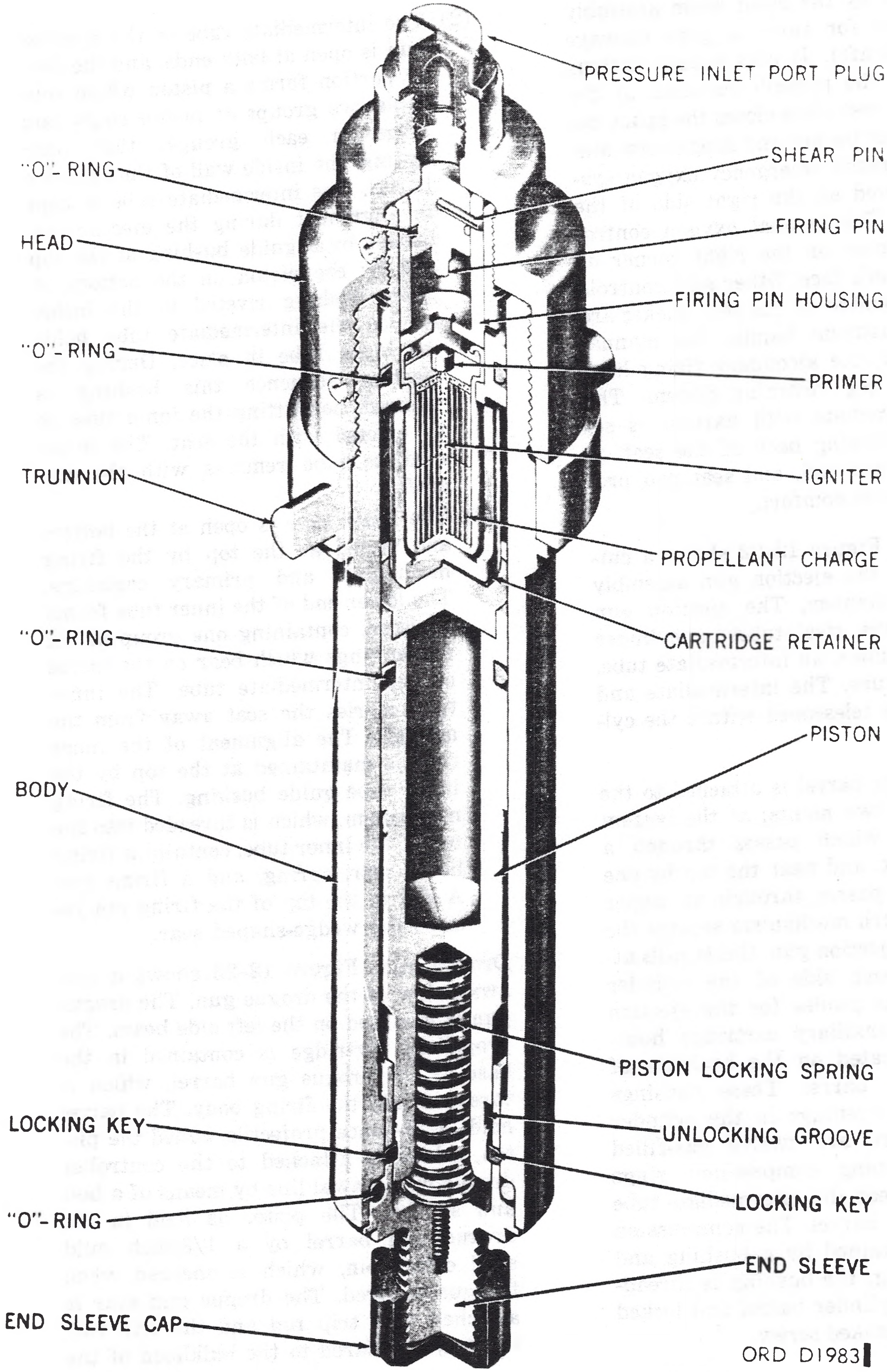


Figure 12–19. Thruster M1A1 in the Unarmed Condition—Cutaway View

is supported by the main beam assembly and provides for survival gear stowage (PK–2 Pararaft). It also houses various controls for the proper operation of the seat. A back rest plate closes the space between the seat bucket and drogue container. The automatic emergency oxygen system is mounted on the right side of the seat bucket. The manual oxygen control knob is mounted on the right corner of the seat bucket's face. Other seat controls which are mounted on the seat bucket are the seat adjustment handle, the manual override lever, the secondary firing handle, and the leg restraint system. The personnel parachute with harness is secured to the sloping back of the seat. A back pad, kidney pad, and seat pad provide the occupant comfort.

b. Ejection gun. Figure 12–22 shows a cutaway view of the ejection gun assembly and latch mechanism. The ejection gun consists of three steel tubes: a cylinder barrel (outer tube), an intermediate tube, and an inner tube. The intermediate and inner tubes are telescoped within the cylinder barrel.

(1) The cylinder barrel is attached to the aircraft at two points; at the bottom by a bolt which passes through a swivel block, and near the top by one bolt which passes through an upper clamp. A latch mechanism secures the seat to the ejection gun. Guide rails attached to each side of the cylinder barrel act as guides for the ejection seat. Two auxiliary cartridge housings are located on the backside of the cylinder barrel. These housings cover small openings in the cylinder barrel. There are twelve gas-filled shock absorbing compression rings located between the intermediate tube and cylinder barrel. The compression rings are retained by a bushing and a carrier ring; the bushing is threaded into the cylinder barrel and locked by a special staked screw.

(2) The intermediate tube of the ejection gun is open at both ends, and the lower portion forms a piston which contains two groups of piston rings (six rings in each group), that bear against the inside wall of the cylinder barrel. The intermediate tube is kept in alignment during the ejection sequence by a guide bushing at the top and by the piston on the bottom. A guide bushing riveted to the inside top of the intermediate tube holds the inner tube in place. During the ejection sequence this bushing is sheared, permitting the inner tube to be ejected with the seat. The intermediate tube remains with the aircraft.

(3) The inner tube is open at the bottom and closed at the top by the firing mechanism and primary cartridge. The lower end of the inner tube forms a piston, containing one group of six piston rings which bear on the inside of the intermediate tube. The inner tube carries the seat away from the aircraft. The alignment of the inner tube is maintained at the top by the inner tube guide bushing. The firing mechanism, which is threaded into the top of the inner tube, contains a firing body, sear, spring, and a firing pin. A slot in the top of the firing pin retains the wedge-shaped sear.

c. Drogue gun. Figure 12–23 shows a cutaway view of the drogue gun. The drogue gun is mounted on the left side beam. The propellant cartridge is contained in the base of the drogue gun barrel, which is threaded into the firing body. The barrel holds a 15-ounce projectile, called the piston, which is attached to the controller drogue withdrawal line by means of a bolt and shackle. The piston is held in the drogue gun barrel by a 1/8-inch mild steel cotter pin, which is sheared when the gun is fired. The drogue gun sear is attached to a trip rod and the trip rod, in turn, is secured to the bulkhead of the

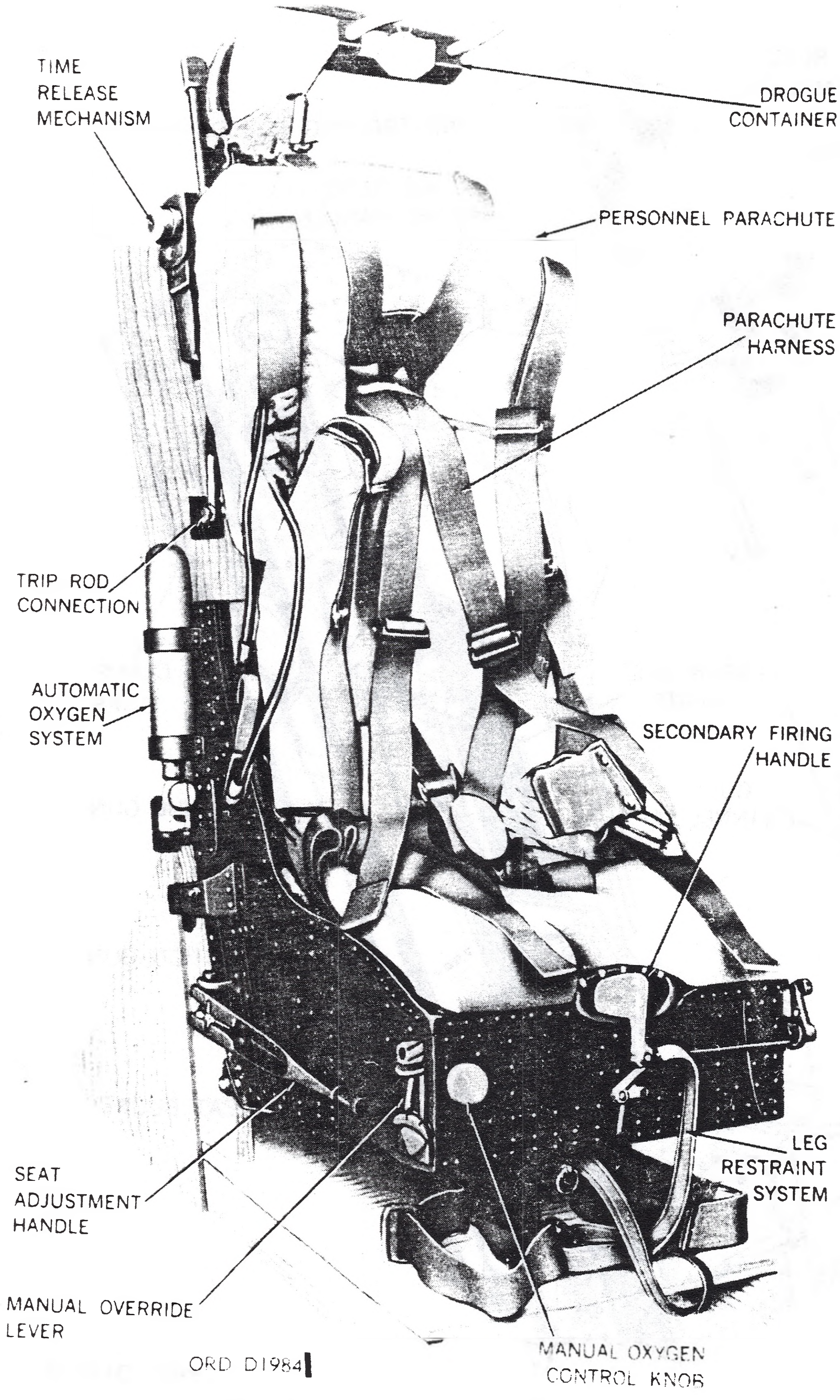


Figure 12-20. Martin-Baker Ejection Seat A5

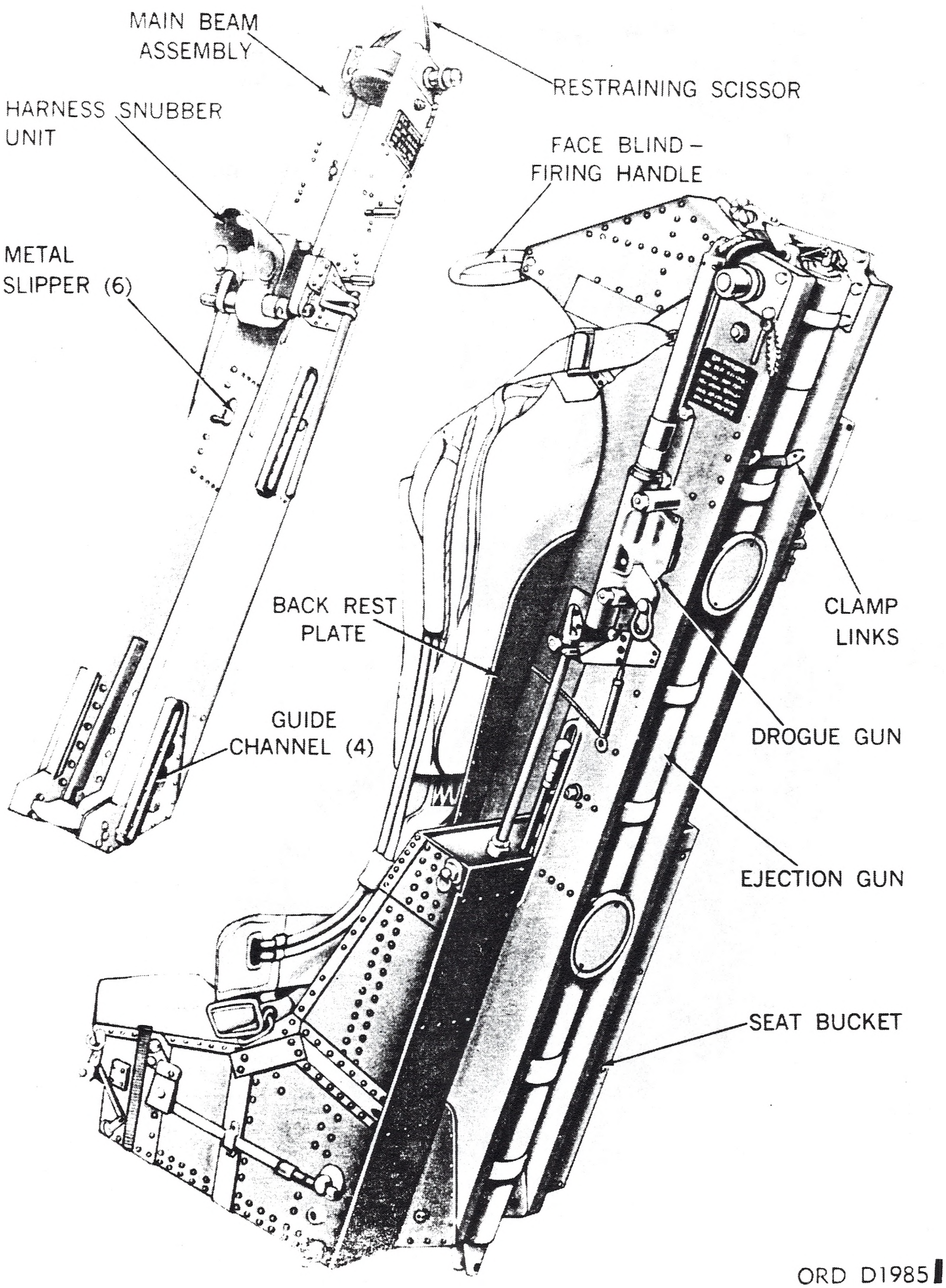


Figure 12-21. Some of the Major Components of Ejection Seat A5

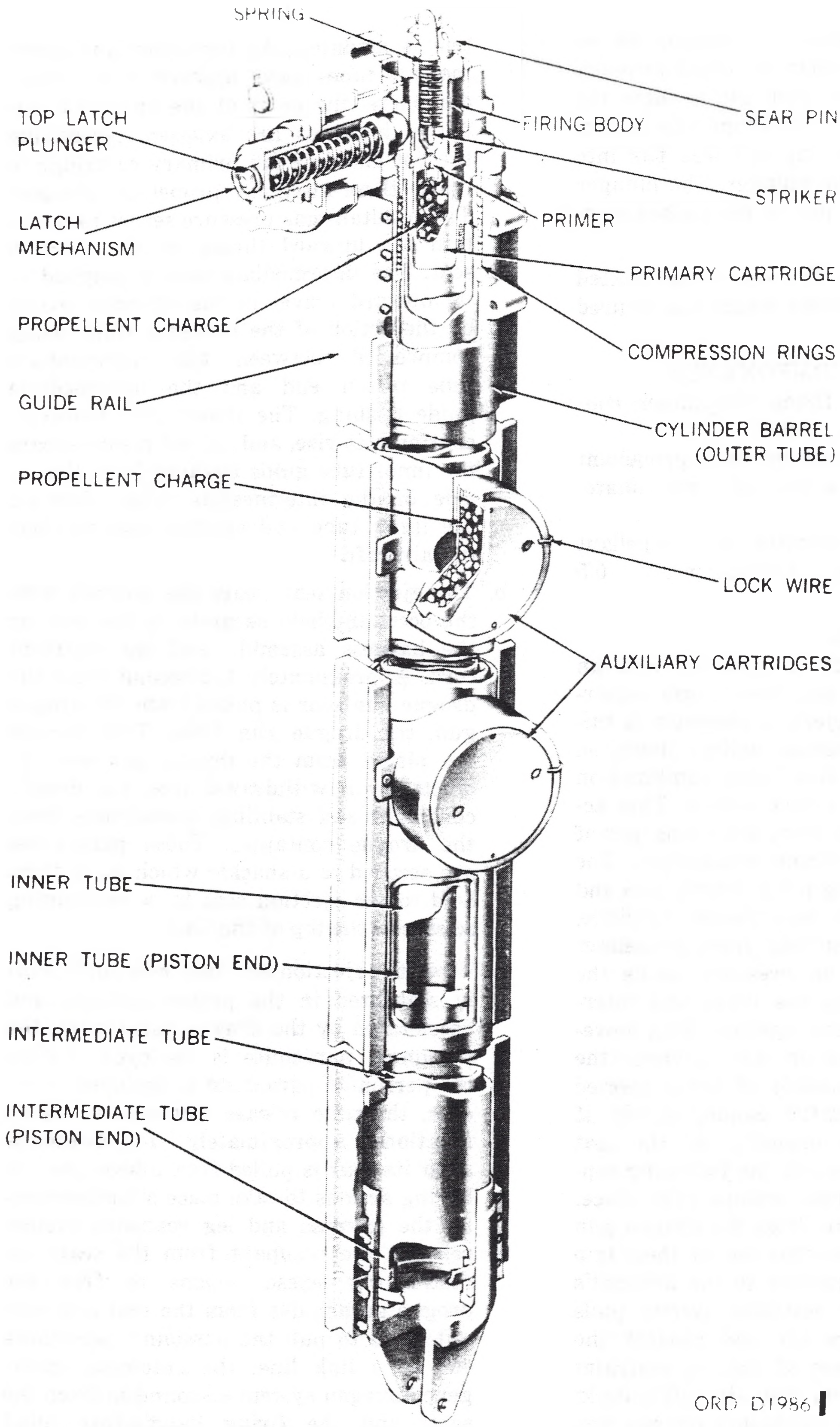


Figure 12-22. Ejection Gun Assembly and Latch Mechanism—Cutaway View.

aircraft. The drogue gun contains an escapement delay mechanism which provides a 1/2-second delay from the moment the sear is pulled until the firing pin strikes the cartridge. The trip rod sear fits into a slot in the locking plunger. The plunger retains the firing pin in the cocked position.

12–6.1.4 MATERIALS. The seat is fabricated from aluminum alloy sheets which are secured by rivets.

12–6.2 HAZARDOUS COMPONENTS.

a. The ejection gun firing mechanism contains a percussion primer.
b. The ejection gun contains three propellant charges weighing a total of approximately 9 ounces.
c. The drogue gun contains one propellant charge weighing approximately 0.5 ounces.

12–6.3 FUNCTIONING.

a. When the aircraft is airborne and an emergency escape situation occurs requiring ejection, the ejection sequence is initiated by the occupant pulling down on the firing handle-face blind combination or the secondary firing handle. This action frees the sear from the firing pin of the ejection gun firing mechanism. The spring-loaded firing pin is driven into and fires the primer in the primary cartridge. The hot gases resulting from propellant combustion build up pressure inside the inner tube, causing the inner and intermediate tubes to rise together. This movement lifts the ejection seat upward (the ejection seat is capable of being ejected through the aircraft's canopy safely if canopy cannot be opened). As the seat initially moves upward, the following separate and concurrent actions take place: the sears are pulled from the drogue gun and time release mechanism by their trip rods which are attached to the aircraft's bulkhead: the leg restraint system pulls the occupants legs aft and against the seat bucket; a rivet of the leg restraint system shears from the aircraft's deck; and the automatic emergency oxygen system is actuated. As the inner and intermediate tubes move upward in the cylinder barrel the ports of the auxiliary cartridge housings are exposed, permitting the hot gases of the primary cartridge to ignite these auxiliary propellant charges. The resultant gas pressure serves to maintain the upward thrust on the ejection seat. The intermediate tube is stopped in its upward travel in the cylinder barrel by the action of the pressure rings being compressed between the intermediate tube piston end and the intermediate guide bushing. The inner tube, however, continues to rise, and its end piston shears the inner tube guide bushing from the inside of the intermediate tube, allowing the inner tube and ejection seat to clear the aircraft.
b. The ejection seat clears the aircraft with the occupant held securely in the seat by the harness assembly and leg restraint cord. Approximately 1/2-second after the drogue gun sear is pulled from the drogue gun, the drogue gun fires. This propels the piston from the drogue gun and extracts, by a withdrawal line, the drogue controller and stabilizer parachutes from the drogue container. These parachutes are secured to a shackle which is, in turn, held to the ejection seat by a restraining scissor at the top of the seat.
c. When the ejection seat has been sufficiently stabilized in the proper attitude and decelerated by the drogue parachutes, the personnel parachute is deployed. Before the personnel parachute is deployed, however, the time release mechanism, which functions approximately 1–1/4-seconds after its sear is pulled free, allows the following actions to take place simultaneously: the harness and leg restraint system releases the occupant from the seat; the restraining scissor opens to free the drogue parachutes from the seat and permit them to pull the personnel parachute out by a link line; the automatic emergency oxygen system disconnects from the seat; and the firing handle-face blind

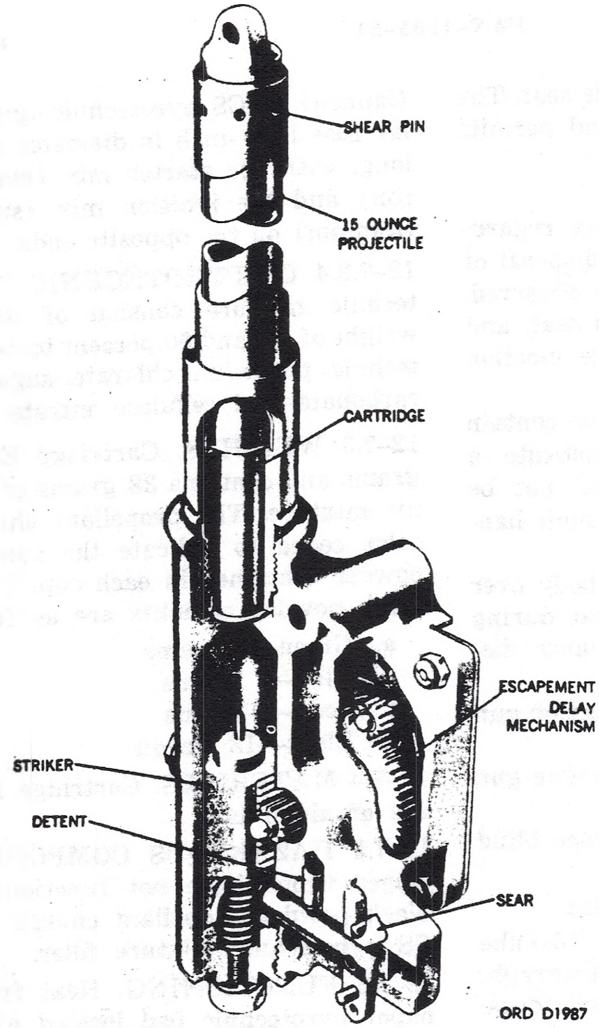


Figure 12–23 Drogue Gun—Cutaway View

combination separates from the seat. The occupant's parachute opens and permits a safe descent.

12-6.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding the approach, attack, and disposal of unexploded ordnance must be observed.

b. Positively identify the ejection seat, and determine the condition of the ejection gun and drogue gun.

c. The ejection and drogue guns contain propellant charges which constitute a hazard. Therefore, they should not be subjected to shock, heat, or rough handling.

d. Do not place any part of the body over any portion of the ejection seat during performance of explosive ordnance disposal procedures.

e. Do not disturb or remove the ejection gun sear.

f. Do not place a strain on the drogue gun trip rod.

g. Do not remove or handle the face blind or the secondary firing handle.

12-7 35MM TACTICAL CS CARTRIDGE E23

Cartridge E23, which is fired from 16-Tube Launcher E8, is covered in this paragraph. Each launcher tube contains four cartridges.

12-7.1 IDENTIFICATION.

12-7.1.1 TYPE. Cartridge E23 (figure 12-24) contains a propellant charge, a CS pyrotechnic mixture and a delay fuse train.

12-7.1.2 PAINTING AND MARKING. Cartridge E23 bears no markings.

12-7.2 FITTINGS AND FEATURES. The internal and external characteristics of Cartridge E23 are shown in figure 12-24.

12-7.2.1 CARTRIDGE E23 FUSE TRAIN. The cartridge fuse train consists of a pyrotechnic disc and an outside zirconium-barium chromate heat paper fuse strip covered with leadfoil tape.

12-7.2.2 PROPELLANT CHARGE. The propellant charge in Cartridge E23 is black powder and may be 3, 7, 10, or 13 grams, depending on its position in the tube.

12-7.2.3 CARTRIDGE E23 TIME DELAY FUSE. The time delay provides a 5- to 6-second delay from propellant ignition (launch) to CS pyrotechnic ignition. This delay fuse is ¼-inch in diameter and 2¾ inches long, with the starter mix (black powder-boron) and the ignition mix (silicon-red lead-titanium) on the opposite ends.

12-7.2.4 CS PYROTECHNIC. The CS pyrotechnic mixture consists of 40 percent by weight of CS and 60 percent by weight of pyrotechnic, potassium chlorate, sugar, magnesium carbonate and cellulose nitrate.

12-7.3 WEIGHTS. Cartridge E23 weighs 70 grams and contains 38 grams of CS pyrotechnic mixture. The propellant charge cups are color coded to indicate the amount of black powder contained in each cup. The colors and black powder amounts are as follows:

a. Green—3 grams

b. Blue—7 grams

c. Red—10 grams

d. Clear—13 grams

12-7.4 MATERIALS. Cartridge E23 canisters are of aluminum.

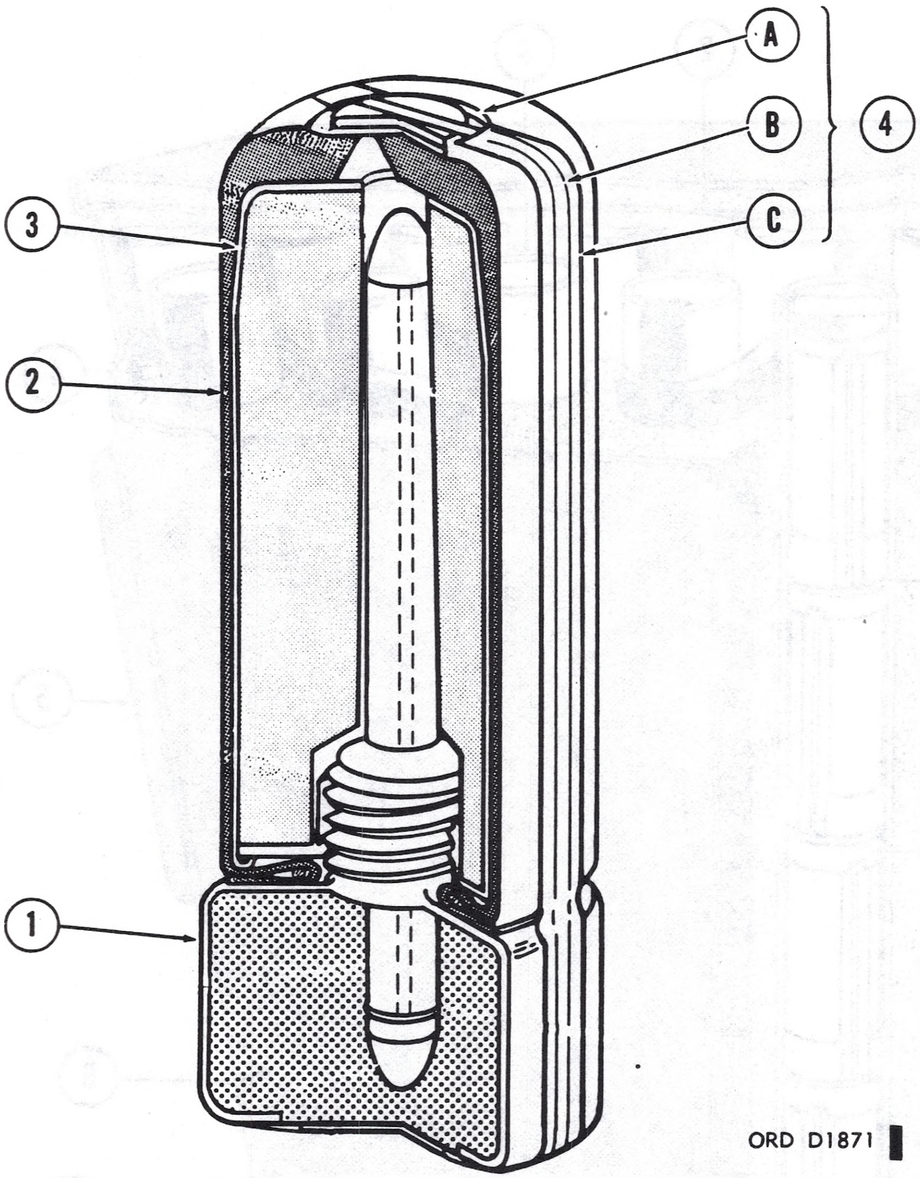
12-7.5 HAZARDOUS COMPONENTS. Cartridges which have not functioned contain a black powder propellant charge as well as a CS pyrotechnic mixture filler.

12-7.6 FUNCTIONING. Heat from the heat paper pyrotechnic pad located at the bottom of the cartridge burns through the lacquered diaphragm and ignites the black powder. When the black powder ignites, the gas produced expels the cartridge from the launcher. At the same time, the fuse in the cup is ignited and, in turn, ignites the 5- to 6-second time delay fuse inside the cartridge. At the end of the delay time, the delay fuse ignites the igniter coating which, in turn, ignites the CS pyrotechnic mixture. The mixture burns for 10 to 15 seconds, causing CS agent release through the top of the elastomeric diaphragm.

12-7.7 SAFETY PRECAUTIONS.

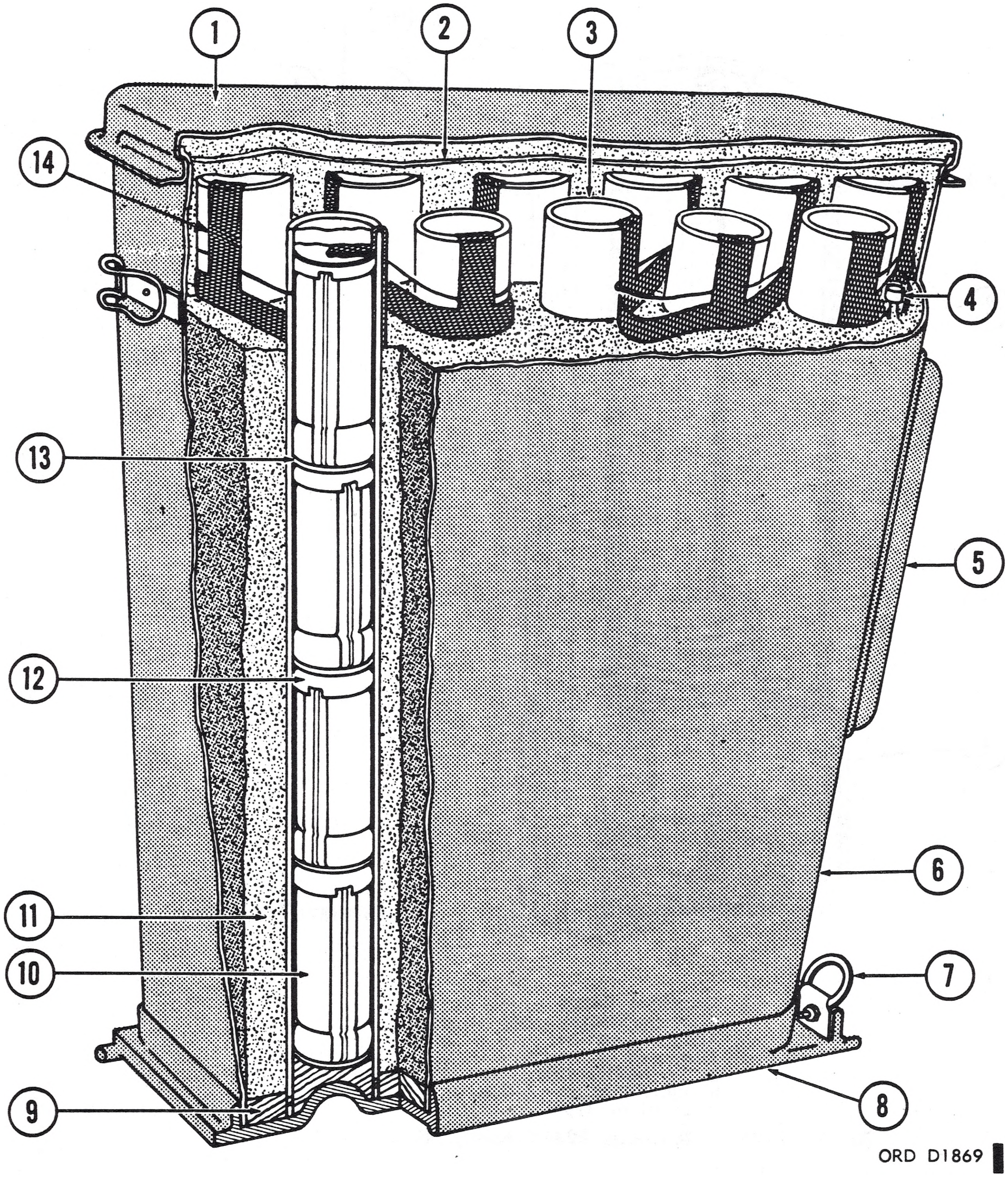
a. Have a protective field mask available and remain upwind when disposing of CS Cartridges E23.

b. Place a heavy wire mesh screen or other suitable barrier over the burning pit when disposing of CS Cartridges E23 that have the propellant charge attached.



1 Propellant charge
2 Elastomeric diaphragm
3 Aluminum canister
4 Fuze train
  a Pyrotechnic disc
  b Pyrotechnic fuse strips
  c Lead—foil type

Figure 12-24 Cartridge E23—Cutaway View



1 Top cover
2 Foil vapor barrier
3 Paper tube
4 M2 electrical squib
5 Firing well cover
6 Plastic case
7 Carrying harness attachments ring
8 Baseplate
9 Epoxy resin
10 E23 cartridge
11 Polyurethane foam
12 Plastic separator cap
13 Cardboard separator disc
14 Main fuse and igniter cord

Figure 12–25 Launcher Module—Cutaway View

12-8. LAUNCHER E8.

Launcher E8 is used to dispense 35-mm Tactical CS Cartridge E23.

12-8.1 IDENTIFICATION.

12-8.1.1 TYPE. Launcher E8 (figure 12-25) is a 16-tube, man-portable, expendable type launcher containing sixty-four CS Cartridges E23.

12-8.1.1.1 PAINTING AND MARKING. The launcher is painted olive drab overall, with one red band and one brown band. In addition, a 4-inch by 6-inch gray decal is affixed to the module body. The decal has one red bar and one brown bar. All other data markings are in red.

12-8.2 FITTINGS AND FEATURES. Figure 12-25 shows the internal and external components of Launcher E8 Module.

12-8.3 WEIGHT. The complete launcher with sixty-four Cartridges E23 weighs 33.5 pounds.

12-8.4 MATERIALS. Module E8, lid and firing platform are plastic.

12-8.5 HAZARDOUS COMPONENTS. The sixty-four Cartridges E23 within Launcher E8 contain 5.5 pounds of CS pyrotechnic mixture and 492 grams of black powder.

12-8.6 FUNCTIONING. The launcher is emplaced for firing by extending the collapsible trails and adjusting the positioning panel to obtain the desired quadrant elevation. Launcher E8 can be fired electrically or manually.

a. *Electrical.* Initiation of the electrical squibs ignites the main fuse train which, in turn, ignites the sixteen-branch fuse train (one fuse branch to each launcher tube). The branch fuse ignites the pyrotechnic disc on each of the uppermost cartridges. The flame is transferred to the propellant charge launching the projectile.

b. *Manual.* Release of the striker arm initiates the primer which, in turn, ignites a delay element. After a 5-second delay, the main fuse train is ignited. The remainder of the firing cycle is identical to the electrically initiated system.

12-8.7 SAFETY PRECAUTIONS.

a. Remain upwind and have a protective field mask available when disposing of Launcher E8 that contains Cartridges E23.

b. Place a heavy wire mesh screen or other suitable barrier over the burning pit when disposing of Launchers E8 that contain Cartridges E23.

12-9. 40-MM RIOT CONTROL CS CARTRIDGE XM674 (E24) AND 40-MM RED SMOKE, RS, CARTRIDGE XM675 (E25).

40-mm, CS; Riot Control Cartridge XM674 (E24) and 40-mm, Red Smoke (RS) Cartridge XM675 (E25) are covered in this paragraph.

12-9.1 IDENTIFICATION.

12-9.1.1 TYPE.

a. 40-mm CS Cartridge XM674 is a burning type munition, designed to be fired from Launcher M79, using the special plastic adapter, or it may be hand fired by using the cartridge firing cap assembly.

b. 40-mm, RS Cartridge XM675 is a burning type red smoke munition designed to be fired in the same manner as Cartridge XM674.

12-9.1.2 PAINTING AND MARKING. Body assemblies of Cartridges XM674 and XM675 bear no markings.

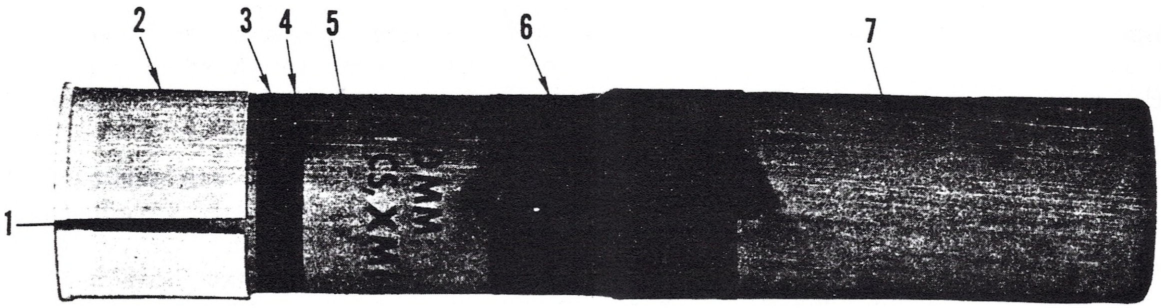
a. XM674 CS Cartridge (figure 12-26). The cartridge barrel and firing cap assembly are painted gray, with one red band and one brown band around the barrel body. All data markings are in red. The body assembly (figure 12-27) outer covering is black synthetic rubber.

b. XM675 RS Cartridge (figure 12-28). The cartridge barrel and firing cap assembly are painted light green with one brown band around the barrel body. All data markings are in white. The body assembly is identical in outward appearance as the XM674.

12-9.2 FITTINGS AND FEATURES.

a. XM674 CS Cartridge—XM675 RS Cartridge. Cartridges XM674 and XM675 are similar in external appearance. The outward difference in the two cartridges is in the painting and marking.

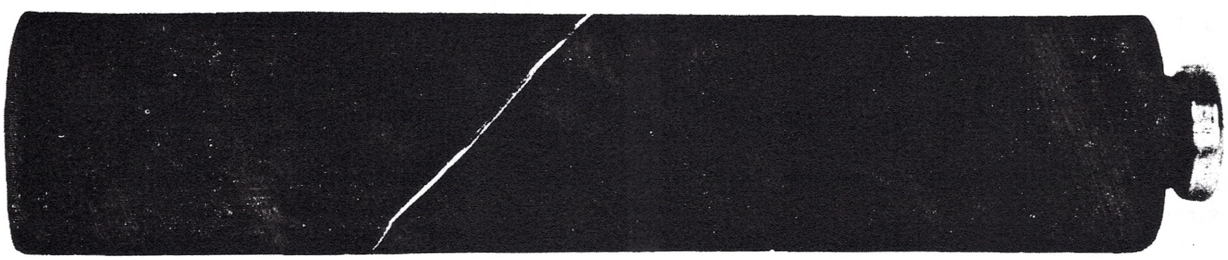
b. XM674 CS Cartridge—XM675 RS Cart-



MU-D4 2173

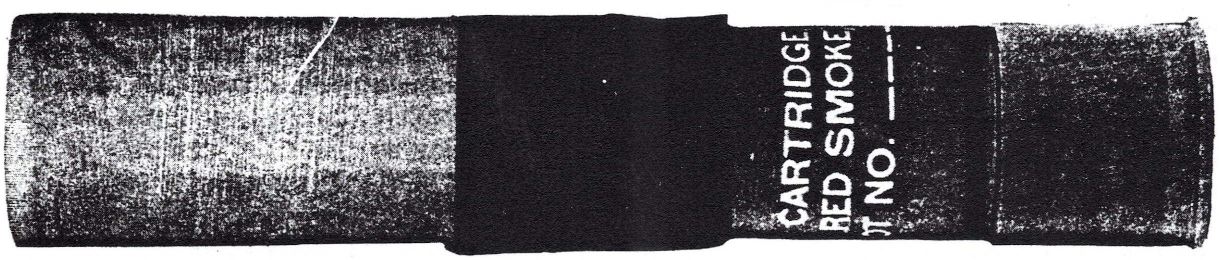
1 Barrel
2 Launcher adapter
3 Red band
4 Brown band
5 Decal
6 Pressure sensitive tape
7 Firing cap assembly

Figure 12–26 Cartridge XM674



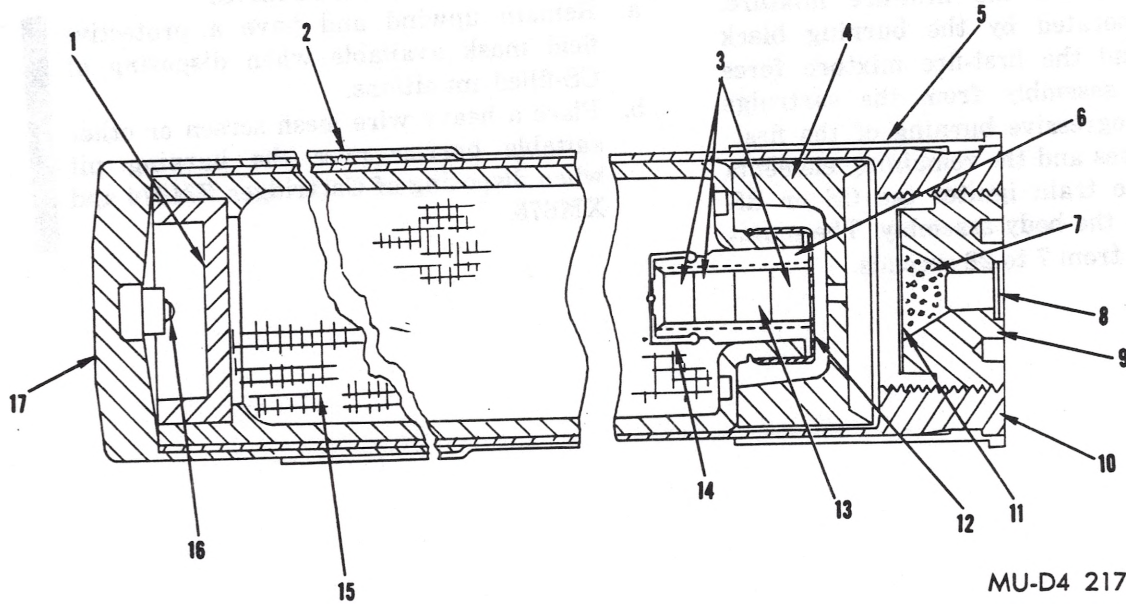
MU-D4 2174

Figure 12–27 Body Assembly



MU-D4 2175

Figure 12–28 Cartridge XM675



1 Rubber body assembly
2 Pressure sensitive tape
3 First fire mixture
4 Spacer
5 Launcher adapter
6 Aluminum alloy sleeve
7 Black powder
8 Primer
9 Primer holder
10 Cartridge barrel
11 Pressure sensitive tape
12 Closure cap
13 Pelletized delay mixture
14 Plastic seal cup
15 CS pyrotechnic mixture
16 Steel firing pin
17 Firing cap assembly

Figure 12–29 Cartridge XM674—Cutaway View

ridge. Cartridges XM674 and XM675 are similar internally, the difference being that the XM674 contains three first-fire mixtures, one delay charge and a CS pyrotechnic mixture. Cartridge XM675 contains two first-fire mixtures, two delay charges and a red smoke pyrotechnic mixture. All other internal items are the same. Figure 12–29 shows the internal components of CS Cartridge XM674.

12–9.3 WEIGHTS AND DIMENSIONS. Cartridges XM674 and XM675 are approximately 9 inches long and 1.5 inches in diameter. Each weighs 0.75 pound. The body assembly is approximately 7 inches long, 1.5 inches in diameter and weighs 200 grams. The primer contains 0.77 grain of lead styphnate. The propellant charge contains 0.50 grain of black powder. The XM674 contains 45 grams of CS pyrotechnic mixture. The XM675 contains approximately 0.951 gram of red smoke pyrotechnic mixture.

12–9.4 MATERIALS. The firing cap assembly and cartridge barrel are aluminum, the launcher adapter is plastic and the body assembly is synthetic rubber.

12–9.5 HAZARDOUS COMPONENTS. Cartridge XM674 contains a CS pyrotechnic mixture and constitutes a fire hazard and a CS exposure hazard. Cartridge XM675 contains red smoke (RS) and constitutes a fire hazard.

12–9.6 FUNCTIONING.

a. General. Cartridges XM674 and XM675 may be fired by hand or fired from Grenade Launcher M79. When fired from Launcher M79, the firing cap assembly is discarded. When fired by hand, the plastic launcher adapter is discarded.

b. CS Cartridge XM674 and RS Cartridge XM675. Primer initiation ignites the black powder propelling charge which, in turn, ignites the first-fire mixture. Gases generated by the burning black powder and the first-fire mixture force the body assembly from the cartridge barrel. Progressive burning of the first-fire mixtures and the remaining elements of the fuse train ignites the CS or RS mixture in the body assembly. The munition burns from 7 to 28 seconds.

12–9.7 SAFETY PRECAUTIONS.

a. Remain upwind and have a protective field mask available when disposing of CS-filled munitions.

b. Place a heavy wire mesh screen or other suitable barrier over the burning pit when disposing of Cartridges XM674 and XM675.

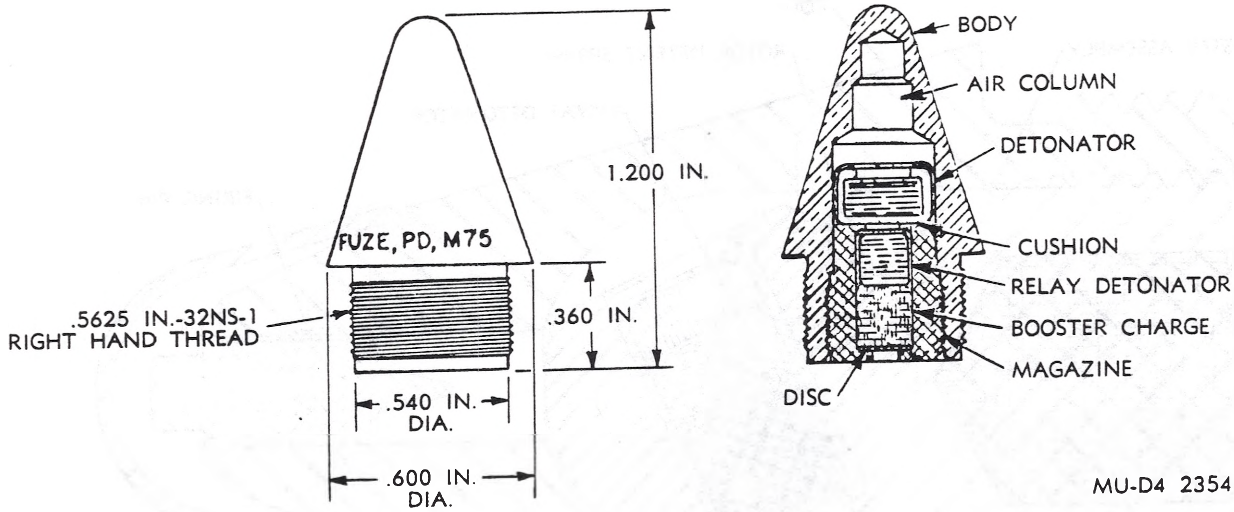


Figure 12–30 Fuze, Projectile, 20-mm, PD, M75

12–10. FUZE, PROJECTILE, 20-MM, PD, M75.

12–10.1 IDENTIFICATION.

12–10.1.1 TYPE. The fuze M75 (figure 12–30) is a point-detonating, impact, nondelay, always-armed type, and is used with 20-mm HE, HEI, and HET rounds.

12–10.1.2 MARKING. The body of the fuze is stamped with identifying marking.

12–10.1.3 WEIGHT. The fuze weighs approximately 0.80 ounce.

12–10.1.4 MATERIAL. The body of the fuze is made of brass.

12–10.2 HAZARDOUS COMPONENTS. The fuze M75 contains a detonator, a relay detonator, and a booster charge.

12–10.3 FUNCTIONING.

12–10.3.1 The fuze M75 is always armed, has no moving parts, and needs no preparation for firing.

12–10.3.2 Upon impact, the nose of the fuze is crushed. Pieces of the fuze body, driven into the detonator by the impact, cause the detonator to function. In addition, the air cushion in front of the detonator, being compressed by crushing the fuze body, produces heat and pressure, which will function the detonator. Functioning of the detonator fires the explosive train to the main charge of the projectile.

12–10.4 SAFETY PRECAUTIONS. The general safety precautions regarding unexploded ordnance must be observed.

12–11 FUZE, PROJECTILE, PD, M505A3 (20-MM).

12–11.1 IDENTIFICATION.

12–11.1.1 TYPE. The fuze M505A3 (figure 12–31) is a point-detonating, nondelay, centrifugal-armed fuze. The fuze is used with the high-explosive incendiary projectile (figure 12–32). The projectile also contains a tracer and self-destruct feature.

12–11.1.2 MARKING. The fuze is unpainted and unmarked. The projectile body is yellow with markings in black or metal stamping on the rotating band.

12–11.1.3 WEIGHTS AND DIMENSIONS. The fuze with projectile is approximately 3

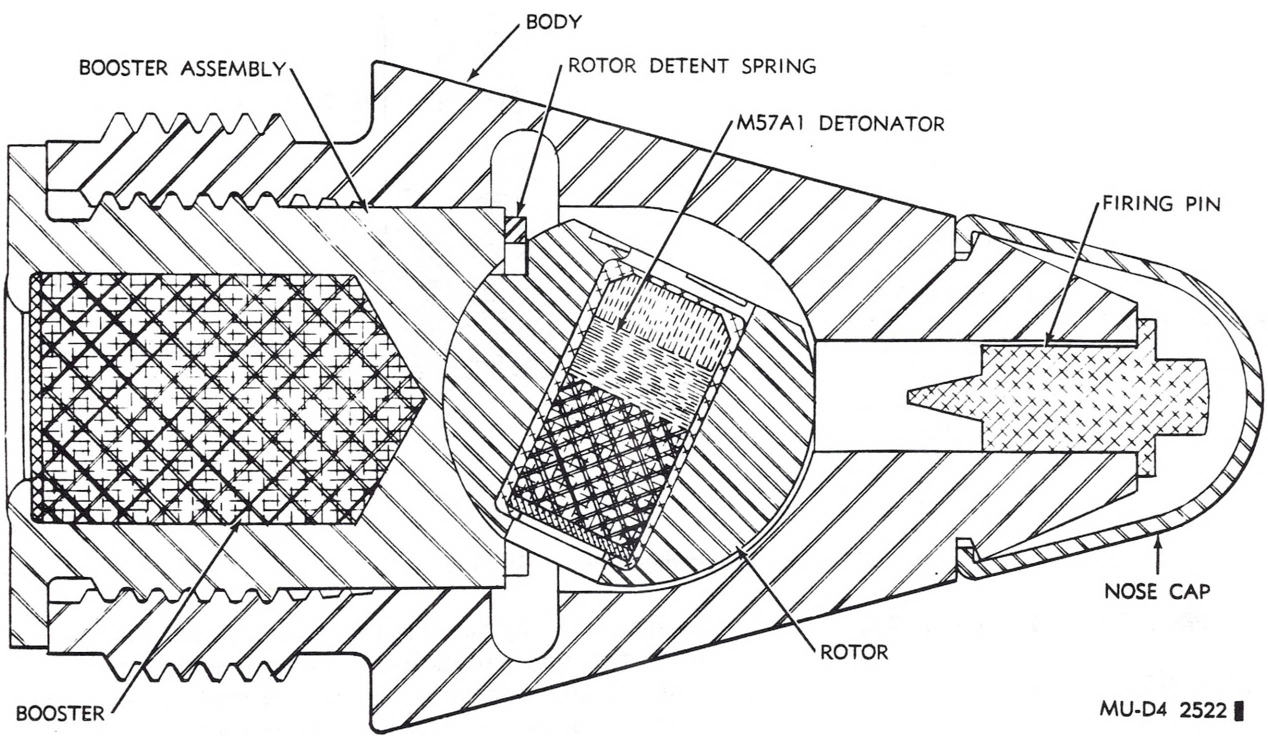


Figure 12–31 Point-Detonating Fuze M505A3—Cutaway View

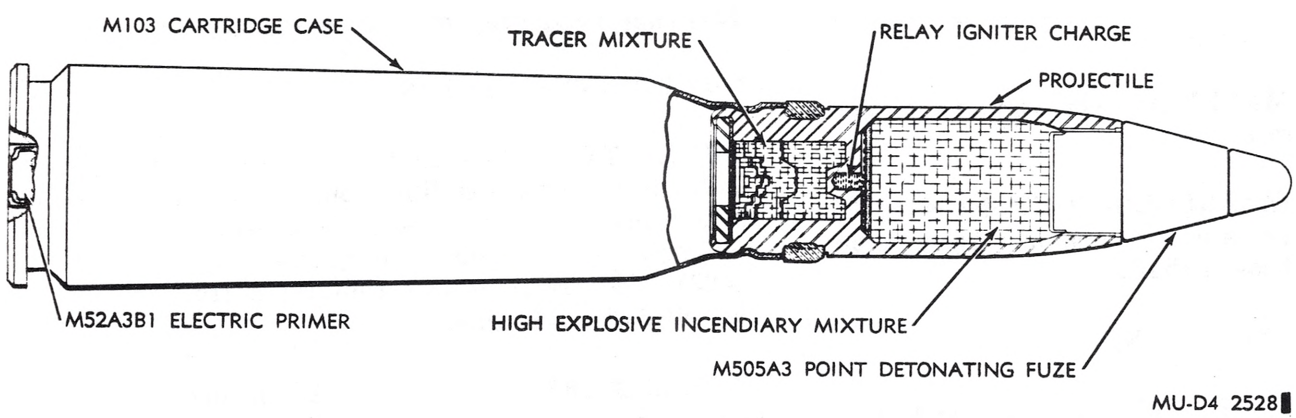


Figure 12–32 HEIT-SD 20-mm Cartridge XM246E3—Cutaway View

inches long and weighs approximately 3.6 ounces.

12-11.1.4 MATERIAL. The fuze and projectile body are steel.

12-11.2 HAZARDOUS COMPONENTS.

a. The fuze M505A3 contains a detonator M57A1 and an HMX booster.

b. The projectile contains a high-explosive incendiary mixture, a relay igniter charge, and a tracer mixture.

12-11.3 FUNCTIONING.

a. Centrifugal forces cause the rotor detent spring to move outward, removing a block from the unbalanced rotor detonator. Continued centrifugal forces cause the detonator rotor to turn to the in-line position, alining the detonator, explosive train, and firing pin, arming the fuze.

b. Upon impact, the firing pin is driven into the detonator, initiating the explosive train, detonating the projectile. If the projectile does not impact within 3 to 7 seconds, it will self-destruct. Self-destruction is accomplished when the tracer mixture burns for a period of 3 to 7 seconds, at which time the relay cup becomes sufficiently heated to ignite the relay charge, causing the projectile filler to detonate.

12-11.4 SAFETY PRECAUTIONS.

a. The general safety precautions regarding unexploded ordnance must be observed.

b. The cartridge case contains an electric primer.

12-12. FUZE, PROJECTILE, 20-MM, PDSD, M594.

12-12.1 IDENTIFICATION.

12-12.1.1 TYPE. The fuze M594 is a point detonating, centrifugally armed and has a self-destruct mechanism of the cocked striker type (figure 12-32.1) The fuze is used with the high explosive,. incendiary, tracer projectile of cartridge, 20-MM: M599.

12-12.1.2 MARKING. The fuze is unpainted, and unmarked. The projectile body is painted yellow with red stenciled T's on the bourellet. Other markings such as nomenclature are in black. The cartridge case has identification markings stamped on the base.

12-12.1.3 WEIGHTS AND DIMENSIONS. The fuze with projectile is approximately 3 1/2 inches long and weighs approximately four ounces.

12-12.1.4 MATERIAL. The projectile and cartridge case are made of steel and the fuze is aluminum and steel.

12.12.2 HAZARDOUS COMPONENTS.

a. The M594 fuze contains an M1231 detonator and an HMX booster weighing approximately a half gram.

b. The projectile contains a high explosive incendiary mixture, an igniter charge, and a tracer mixture.

12-12.3 FUNCTIONING.

a. Upon leaving the bore, centrifugal forces cause the following to occur simultaneously:

(1) The rotor detent spring moves outward, freeing the unbalanced rotor which turns, alining the detonator with the explosive train.

(2) The arming coil spring loosens, allowing the arming coil to unwind and the serrated core to expand which moves it out of the path of the firing pin.

(3) The self-destruct mechanisms's spring loaded locking lever tends to pivot away from the axis of the fuze in opposition to the force exerted by the spring of the release lever. This action allows the leaf safety spring to swing out, unlocking the system.

b. If impact occurs prior to spin decay, the striker is forced against the firing pin, causing it to be driven into the detonator, initiating the explosive train and detonating the projectile.

c. If impact does not occur prior to spin decay, the self-destruct mechanism will function. As the spin decays, the spring overcomes the centrifugal force on the spring loaded lever which pivots towards the axis of the fuze. When the lever moves sufficiently to unlock the release lever, the diminishing centrifugal force and spring loaded plunger move the release lever outward. This allows the plunger to force the firing pin into the detonator, initiating the explosive train and detonating the projectile. The self-destruct mechanism functions within 4 to 7 seconds after the projectile leaves the bore.

12-12.4 SAFETY PRECAUTIONS.

a. Projectiles found lying in the field must be presumed to be armed.

b. Protect the fuze from impact or shock.

c. The self-destruct mechanism contains a cocked striker.

d. Armed projectile may function if moved or jarred.

12–13. CARTRIDGE, XM688.

12–13.1 IDENTIFICATION.

12–13.1.1 TYPE. The Cartridge, XM688 (figure 12–33) is an unfuzed round designed to propel a grapnel hook using the M79 Launcher.

12–13.1.2 MARKING. The XM688 Cartridge is unpainted metal. All markings are in black.

12–13.1.3 FITTINGS AND FEATURES. The cartridge consists of the XM195 Cartridge Case which is secured to the forward portion of the round by a crimp ring. The forward portion of the cartridge is composed of the propellant grain cup, propellant and an exhaust nozzle.

12–13.1.4 WEIGHT. The cartridge weighs approximately 0.5 pound. The grapnel hook (excluding steel cable assembly) weighs 5 pounds.

12–13.1.5 MATERIALS. The grapnel hook and cable assembly are made of steel. The rope is nylon.

12–13.2 HAZARDOUS COMPONENTS. The cartridge contains 100 grams of black powder.

12–13.3 FUNCTIONING. Prior to launching, the grapnel hook assembly (figure 12–33.1) is muzzle loaded onto the M79 Launcher. When the cartridge is loaded, the propellant grain cup fits into the rocket motor shroad of the grapnel hook assembly. Upon firing the propellant grain cup together with the grapnel is expelled from the launcher by the expulsion charge. At the same time the expulsion charge ignites the propellant grain. The burning propellant grain causes the grapnel assembly to be propelled to the target.

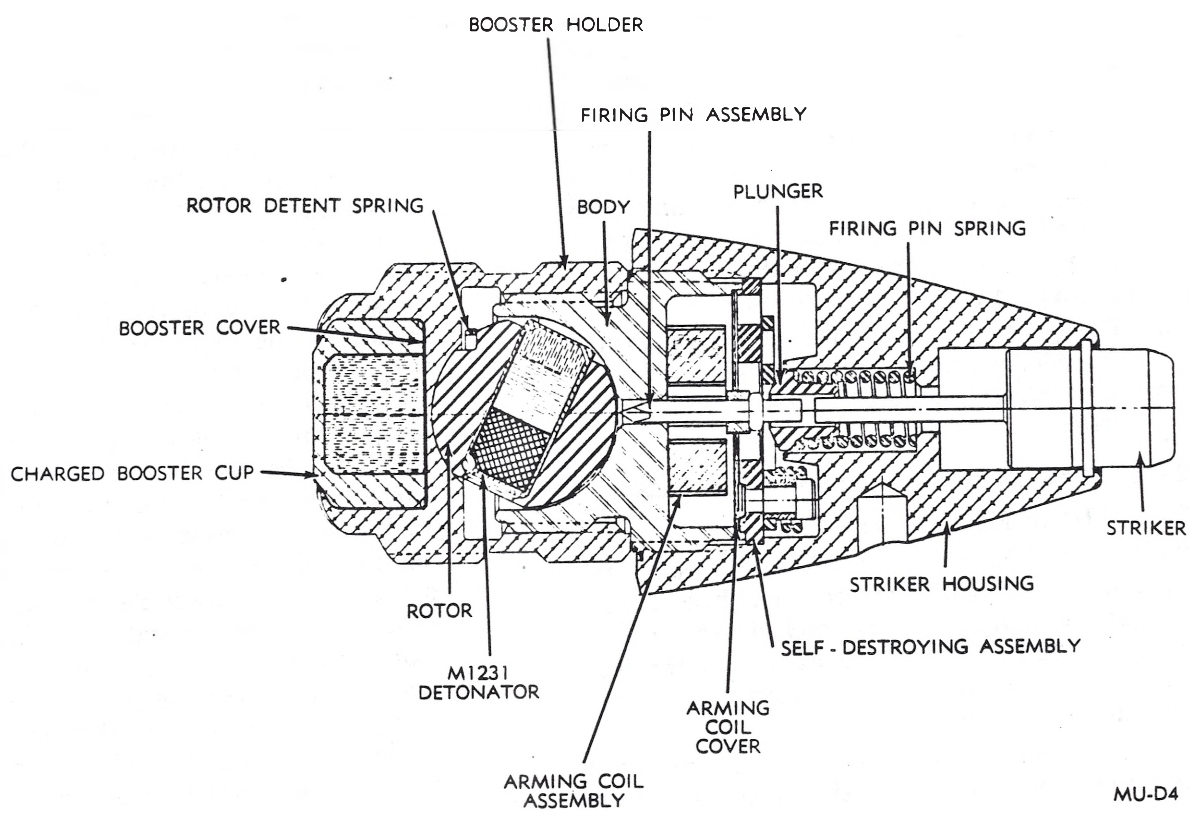


Figure 12–32.1. M594 Point Detonating Self-Destruct Fuze.

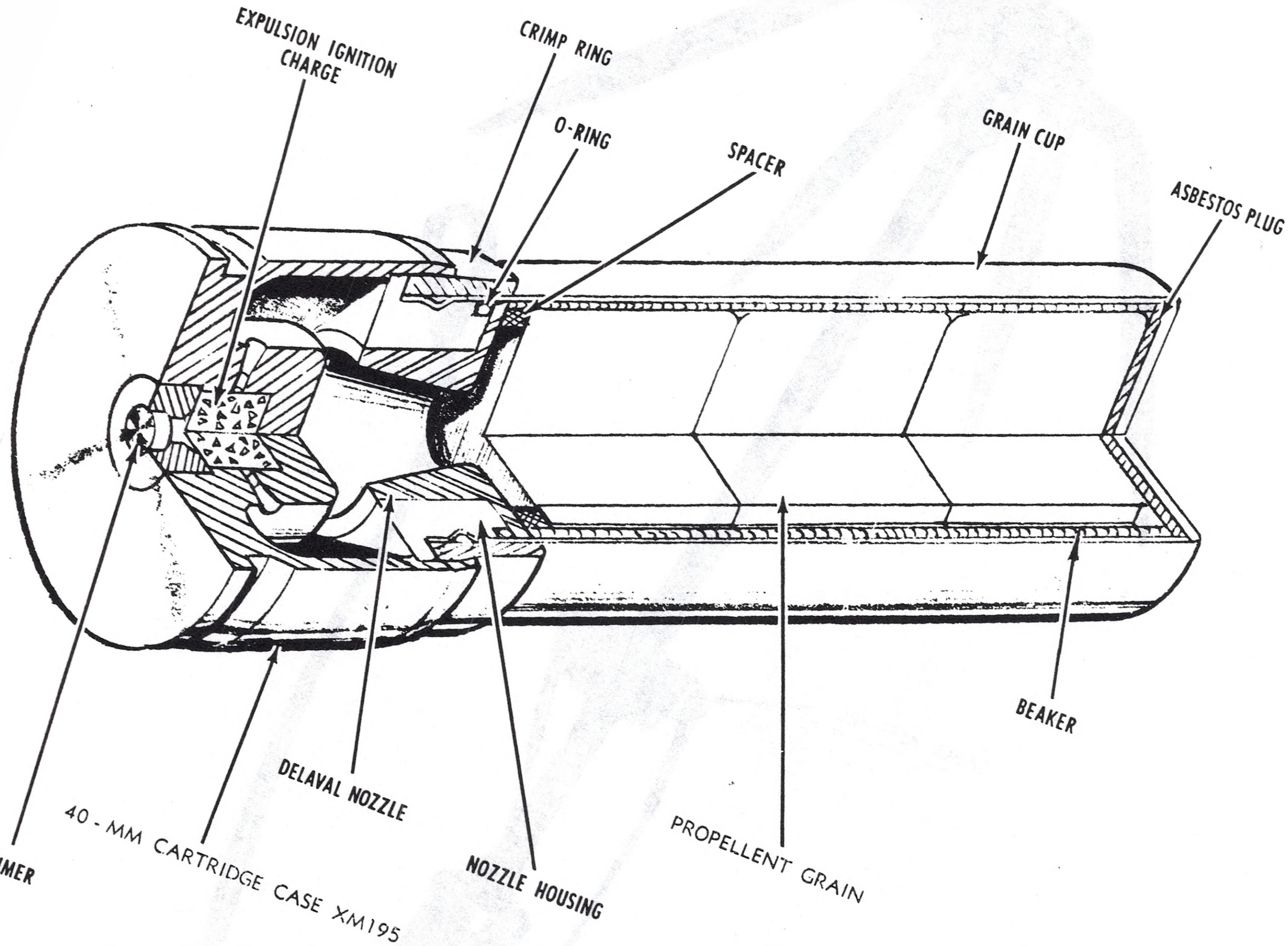


Figure 12-33. Cartridge, XM688—Cutaway View.

MU-D 2494

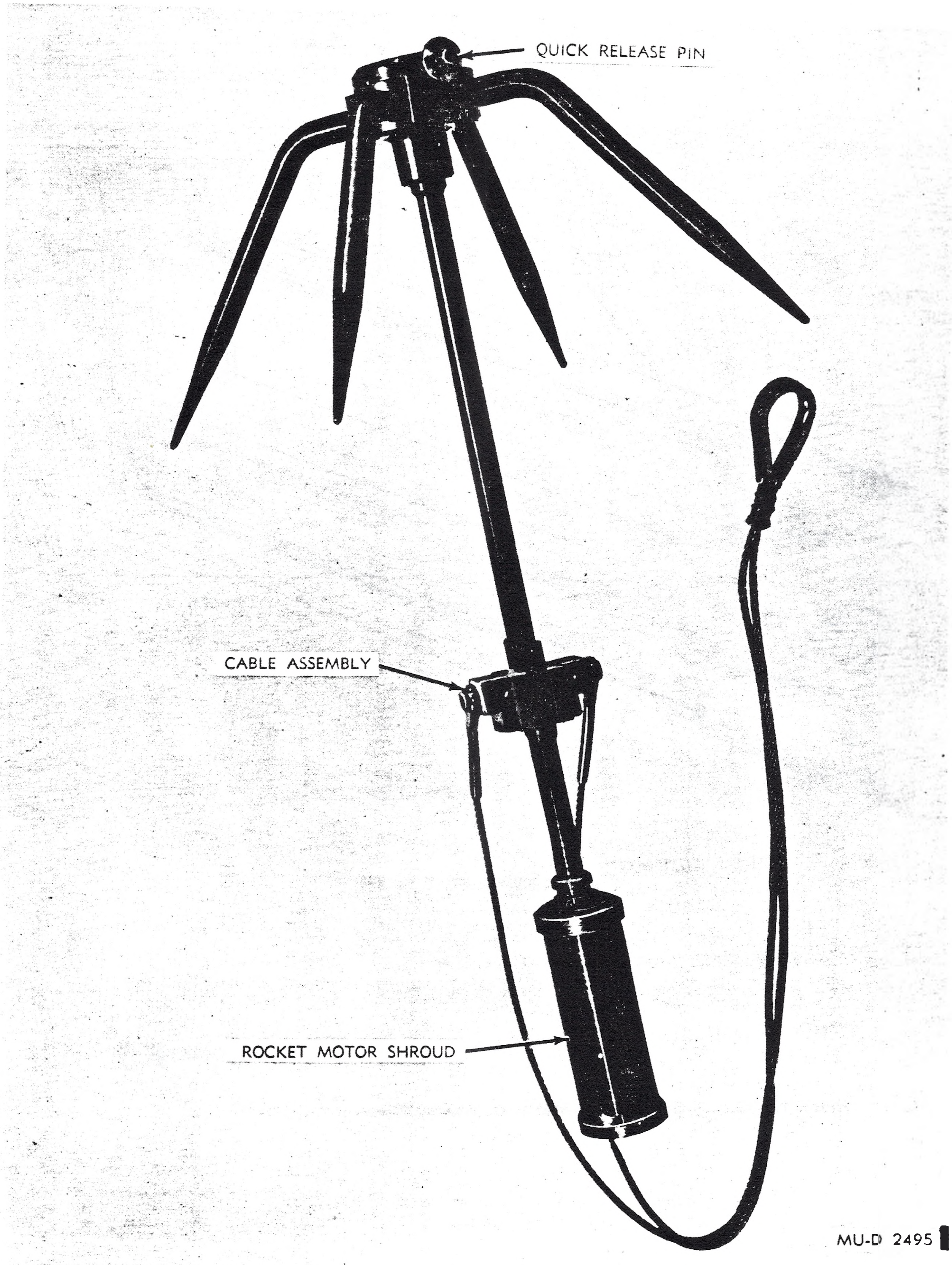


Figure 12-33.1. Grapnel Hook—Assembled.

SECTION 13

DISPENSED AND CLUSTERED MUNITIONS

13-1 SMOKE BOMB BLU-17/B WITH FUZE M206A2E2

Smoke bomb BLU-17/B with fuze M206-A2E2 is covered in this paragraph.

13-1.1 IDENTIFICATION.

13-1.1.1 TYPE. The bomb BLU-17/B (figure 13-1) is a white phosphorus (WP) filled bursting type grenade designed to be dispensed from aircraft bomb dispensers SUU-14/A, SUU-14A/A, SUU-7B/A, and SUU-7C/A.

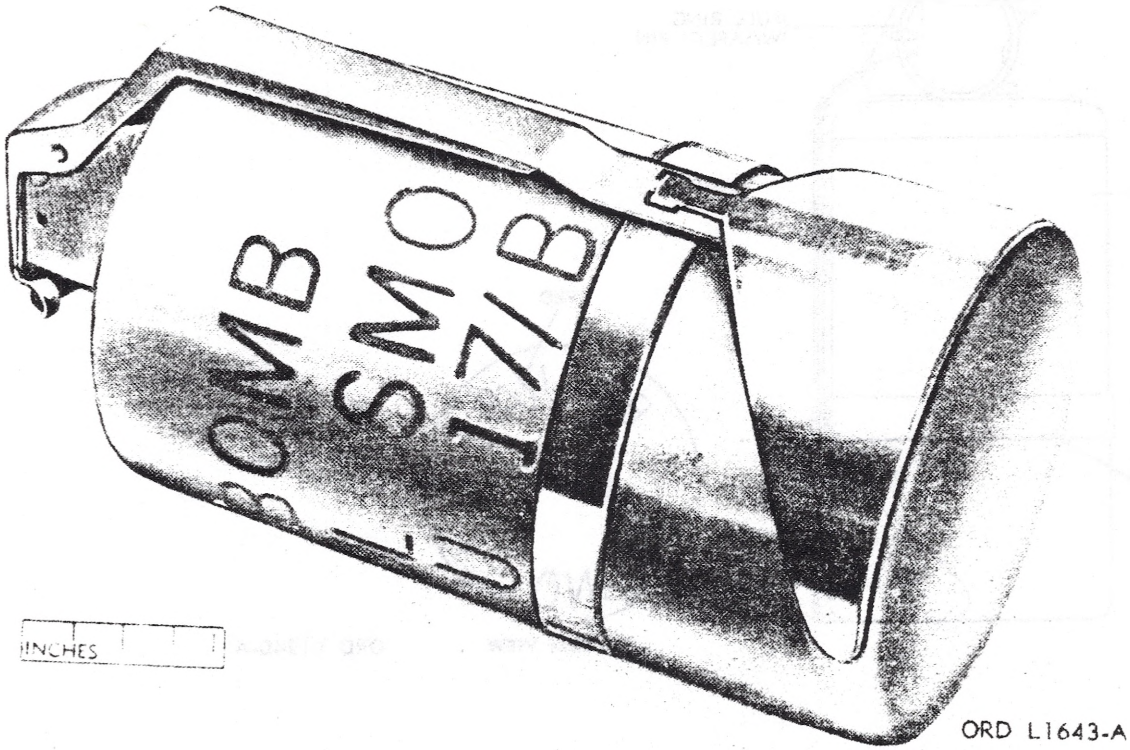


Figure 13-1 Bomb BLU-17/B

13-1.1.2 PAINTING AND MARKING. The bomb body is painted light green with markings in red (figure 13-2).

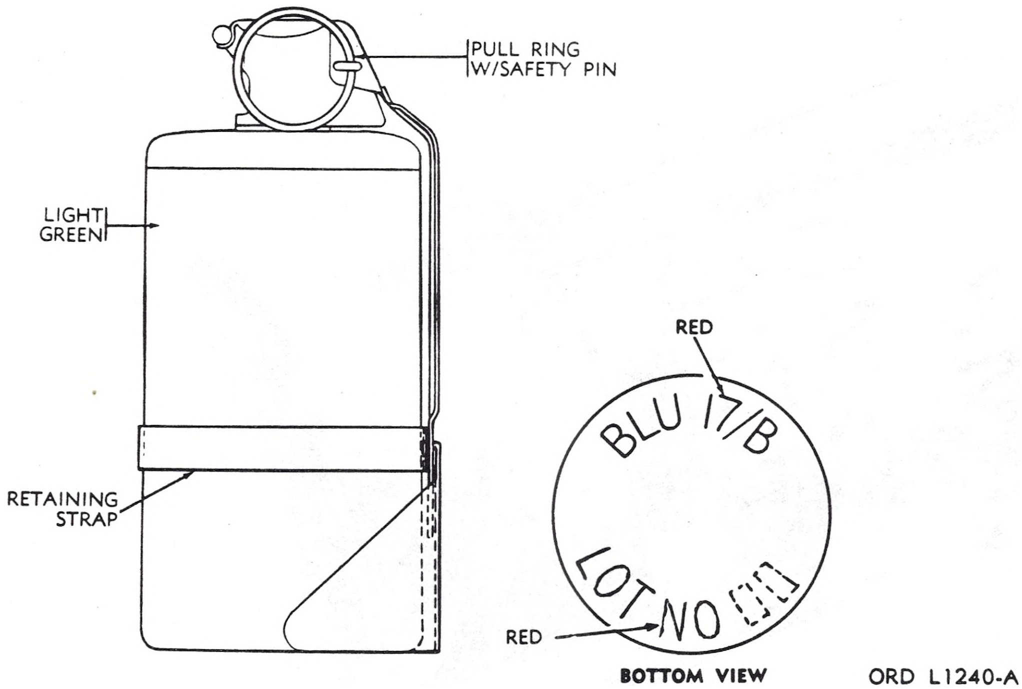


Figure 13-2 Bomb BLU-17/B

13-1.1.3 FITTINGS AND FEATURES.

a. The general characteristics of the fuze assembly and bomb are shown in figure 13-3.

b. The fuze assembly M206A2E2 is a modified version of the 4-5 second delay detonating fuze assembly M206A2. The fuze assembly lever has been lengthened and

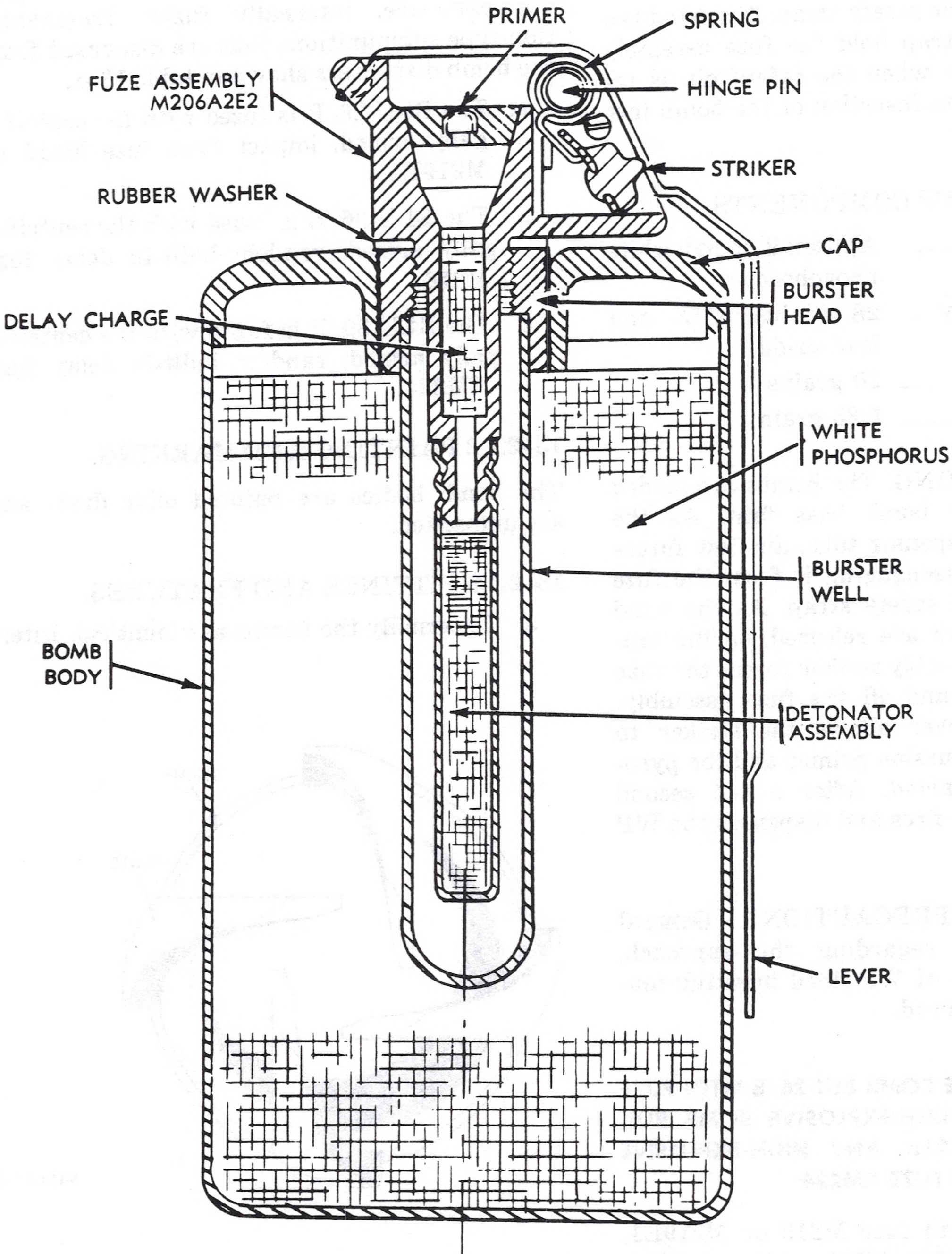


Figure 13.3 WP Smoke Bomb BLU-17/B-Cross-Sectional View

has two slots cut into the lower portion. A safety strap, which also has a slot in each end, fits around the bomb body and under the fuze assembly lever. Two projections on the wind tab fit through the slots of the fuze assembly lever and into each of the slots of the safety strap. The wind tab and safety strap hold the fuze assembly lever in place when the safety pin is removed prior to insertion of the bomb into the dispenser.

13-1.2 HAZARDOUS COMPONENTS.

Filler	Approx 2 pound white phosphorous
Detonator assembly	28 grains RDX and lead azide
Delay charge	20 grains
Primer M42	0.35 grain

13-1.3 FUNCTIONING. The bombs are loaded into the dispenser bomb base first. As the bombs leave the dispenser tube, air flow forces the wind tab up, disengaging it from the fuze assembly lever and safety strap. As the wind tab and safety strap are released, spring tension of the fuze assembly striker forces the fuze assembly lever up and off the fuze assembly. Removal of the lever allows the striker to impinge on the percussion primer and the pyrotechnic delay is started. After a 4-5 second delay, the detonator fires and dispenses the WP filler.

13-1.4 SAFETY PRECAUTIONS. General safety precautions regarding the approach, attack, and disposal of WP filled bursting munitions must be observed.

13-2 HIGH-EXPLOSIVE BOMB BLU-26/B WITH FUZE M219 OR M219E1, HIGH-EXPLOSIVE BOMB BLU-36/B WITH FUZE M218, AND HIGH-EXPLOSIVE BOMB BLU-59/B WITH FUZE XM224

Bomb BLU-26/B with fuze M219 or M219E1, bomb Blu-36/B with fuze M218, and bomb BLU-59/B with fuze XM224 are covered in this paragraph.

13-2.1 IDENTIFICATION.

13-2.1.1 TYPE.

The bombs BLU-26/B, BLU-36/B, and BLU-59/B (figure 13-4) are small, spherical shaped, high-explosive, internally fuzed, fragmentation-type submunitions that are dispensed from the bomb dispensers shown in table 13-1.

a. The BLU-26/B is fuzed with the centrifugally armed, impact fired fuze M219 or M219E1.

b. The BLU-36/B is fuzed with the centrifugally armed, random built-in delay fuze M218.

c. The BLU-59/B is fuzed with the centrifugally armed, random built-in delay fuze XM224.

13-2.1.2 PAINTING AND MARKING.

The bomb bodies are painted olive drab, and are unmarked.

13-2.1.3 FITTINGS AND FEATURES.

a. Externally the bombs are identical. Inter-

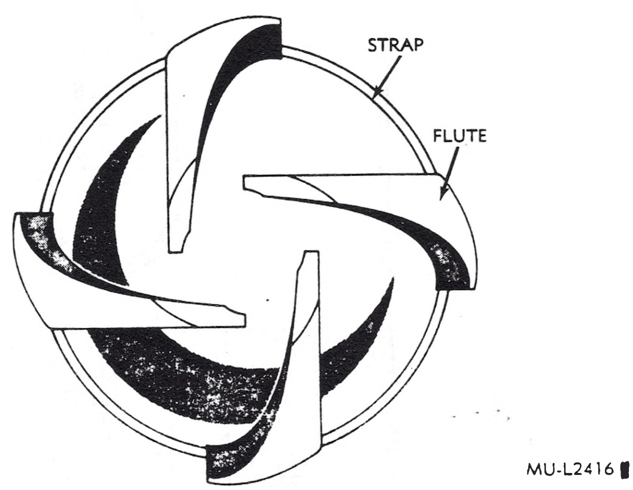


Figure 13-4 Bomb BLU-26/B, BLU-36/B, or BLU-59/B—External View

Table 13–1. Dispensing Systems for Bombs BLU–26/B, BLU–36/B, and BLU–59/B

System	Dispenser designation	Payload	
		Designation	Quantity
CBU–24/B	SUU–30/B	BLU–26/B	670
CBU–24/B (Mod)	SUU–30/B (Mod)	BLU–26/B	670
CBU–24A/B	SUU–30A/B	BLU–26/B	670
CBU–24B/B	SUU–30B/B	BLU–26/B	670
CBU–24C/B	SUU–30C/B	BLU–26/B	640
CBU–49/B (Mod)	SUU–30/B (Mod)	BLU–59/B	670
CBU–49A/B	SUU–30A/B	BLU–59/B	670
CBU–49B/B	SUU–30B/B	BLU–59/B	670
CBU–49C/B	SUU–30C/B	BLU–59/B	640
CBU–29/B (Mod)	SUU–30/B (Mod)	BLU–36/B	670
CBU–29A/B	SUU–30A/B	BLU–36/B	670
CBU–29B/B	SUU–30B/B	BLU–36/B	670
CBU–29C/B	SUU–30C/B	BLU–36/B	640
ADU–272A/B ----------	----------------------	BLU–26/B	177*
ADU–272B/B ----------	----------------------	BLU–26/B	177*
ADU–285A/B ----------	----------------------	BLU–36/B	177*
ADU–285B/B ----------	----------------------	BLU–36/B	177*

* Each bomb cluster.

nally they differ in their fuzing. Each bomb (figures 13–5 and 13–6) is a fluted sphere, 2¾ inches at the flute, and 0.92 pound in weight. A clamp ring encircles the sphere and holds the two hemispheres together.

b. The bomb fuzes are mounted internally and are contained in a stepped cylindrical case. Externally the fuzes are similar in appearance. The fuze M219 has a dimple in the center of the case; the fuze M219E1 has a pimple in the center of the case; and the M218 and XM224 fuze cases are smooth. The configuration and general arrangement of fuzes M219 and M219E1 are shown in figures 13–6.1 and 13–6.2. A general arrangement and cross-section of fuzes M218 and XM224 are shown in figures 13–6.3 and 13–6.4.

c. No external features are provided to indicate if the bombs are armed or unarmed when found outside of their dispenser.

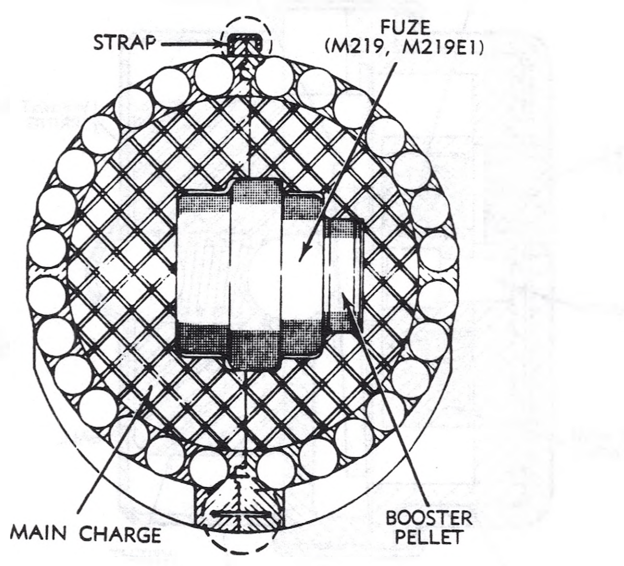


Figure 13–5 Bomb BLU–26/B—Cross Section

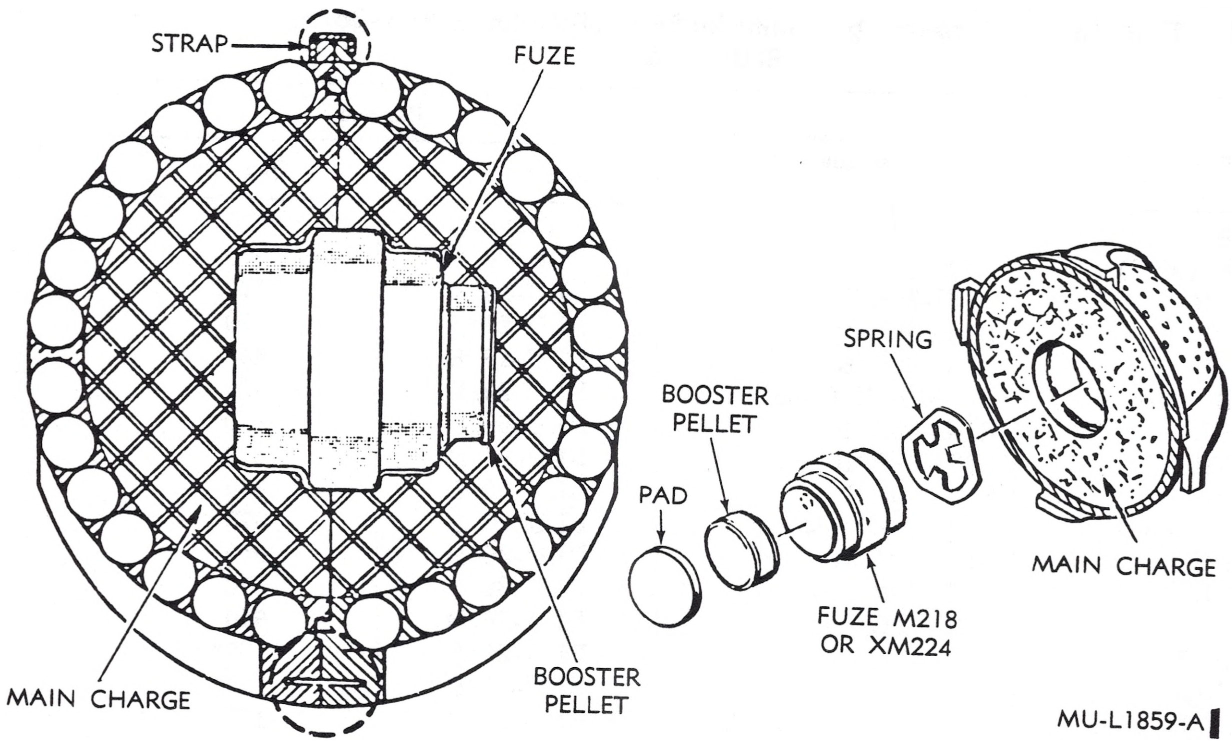


Figure 13-6 Bomb BLU-36/B or BLU-59/B—Cross Section

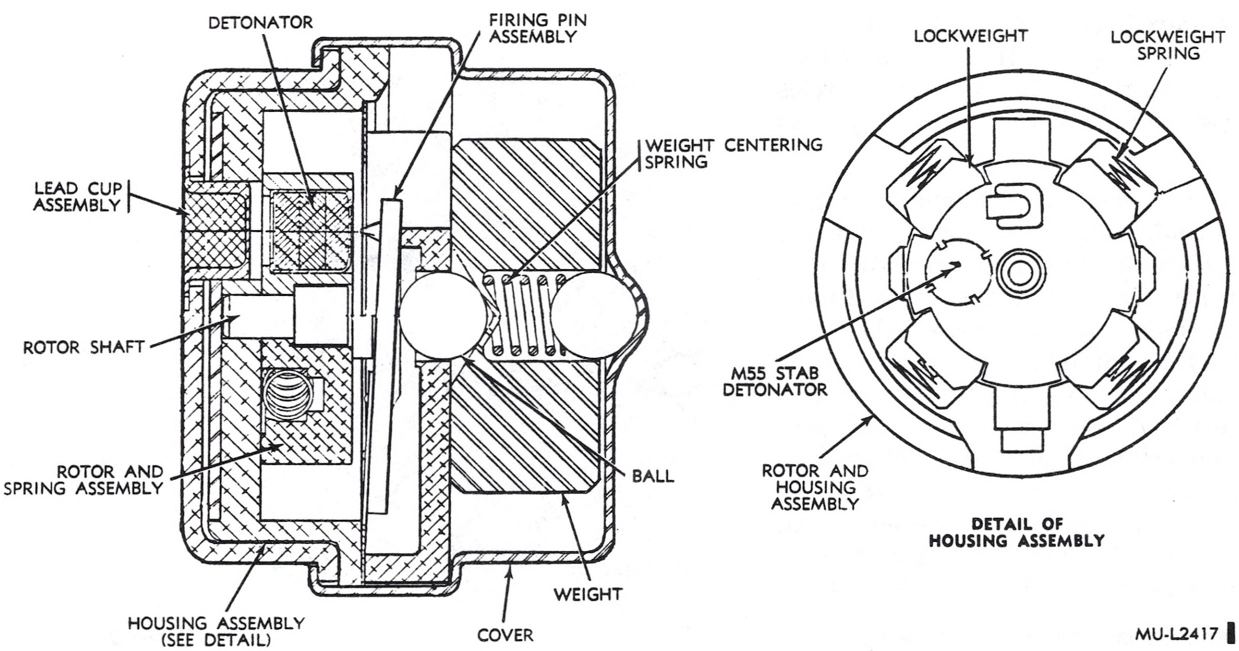


Figure 13-6.1 Fuze M219E1—Cross Section

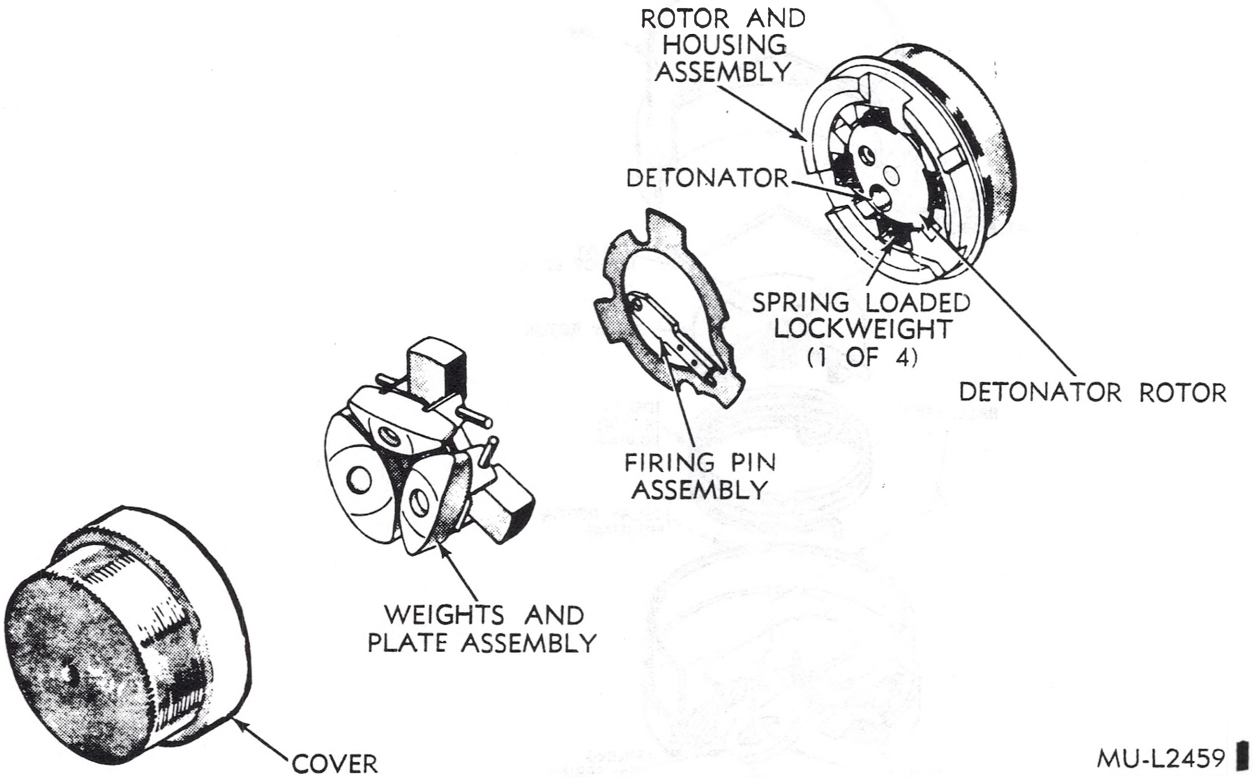


Figure 13–6.2 Fuze M219—Exploded View

d. Fuze safety in the bombs BLU-26/B, BLU-36/B, and BLU-59/B is accomplished by an out-of-line detonator rotor which is held by four spring-loaded lockweights.

13–2.1.4 WEIGHTS. The bombs weigh approximately 1 pound.

13–2.1.5 MATERIALS.

a. The bomb body is made of die-cast aluminum. Steel balls, embedded in the body, provide fragmentation.

b. The stepped cylindrical fuze housing is made of steel and aluminum.

13–2.2 HAZARDOUS COMPONENTS.

The bombs BLU-26/B, BLU-36/B, and BLU-59/B contain approximately 0.186 pound of explosives. Each consists of approximately 81 grams of cyclotol or composition B (main hemispherical charge) and a booster containing approximately 1.4 grams of RDX or PBX.

13–2.3 FUNCTIONING.

a. Bomb BLU-26/B.

(1) Fuze M219.

(a) Prior to arming, the detonator rotor is held in the out-of-line position by four spring-loaded lockweights which fit into slots of the detonator rotor. In addition, the firing pin extends into the lock safe hole of the detonator rotor and is held in that position by three hammerweights which force the firing hammer against the leaf spring of the firing pin.

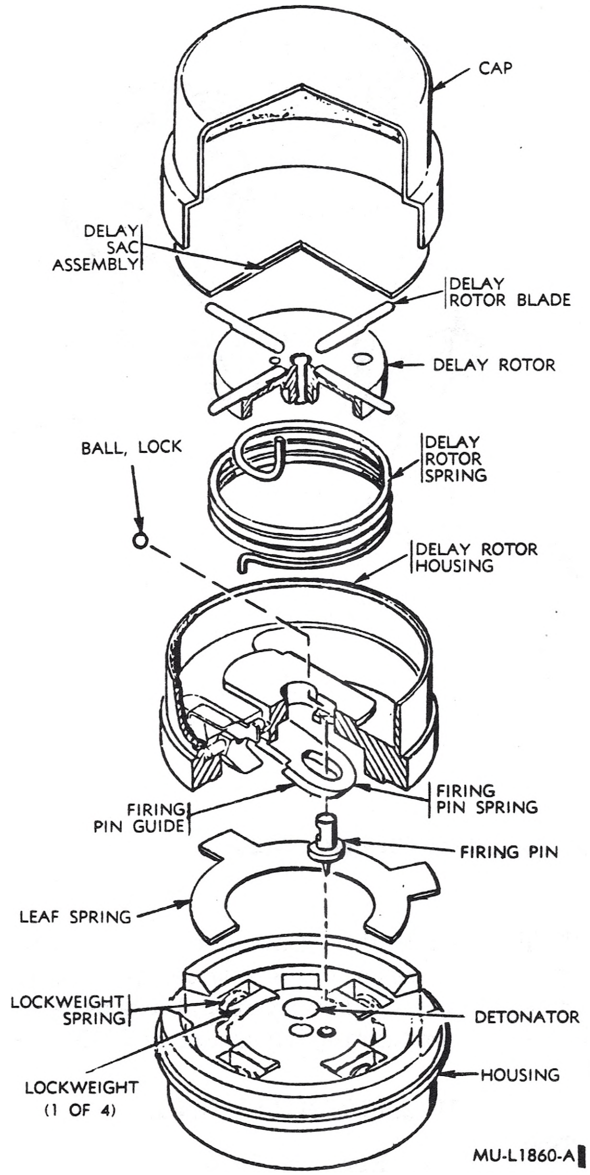


Figure 13-6.3 General Arrangement of Fuze M218 or XM224

(b) When the bomb is released into the airstream, the bomb flutes cause the bomb to spin at a high rate of speed. When the bomb reaches the required rate of spin, centrifugal force causes the hammerweights to move outward and the firing pin is withdrawn from the lock safe hole in the detonator rotor. At the same time, the four lockweights are withdrawn from the slots of the detonator rotor. The detonator rotor is now free to move and is rotated to the in-line (armed) position by the rotor spring. Impact at any angle causes the hammerweights to drive

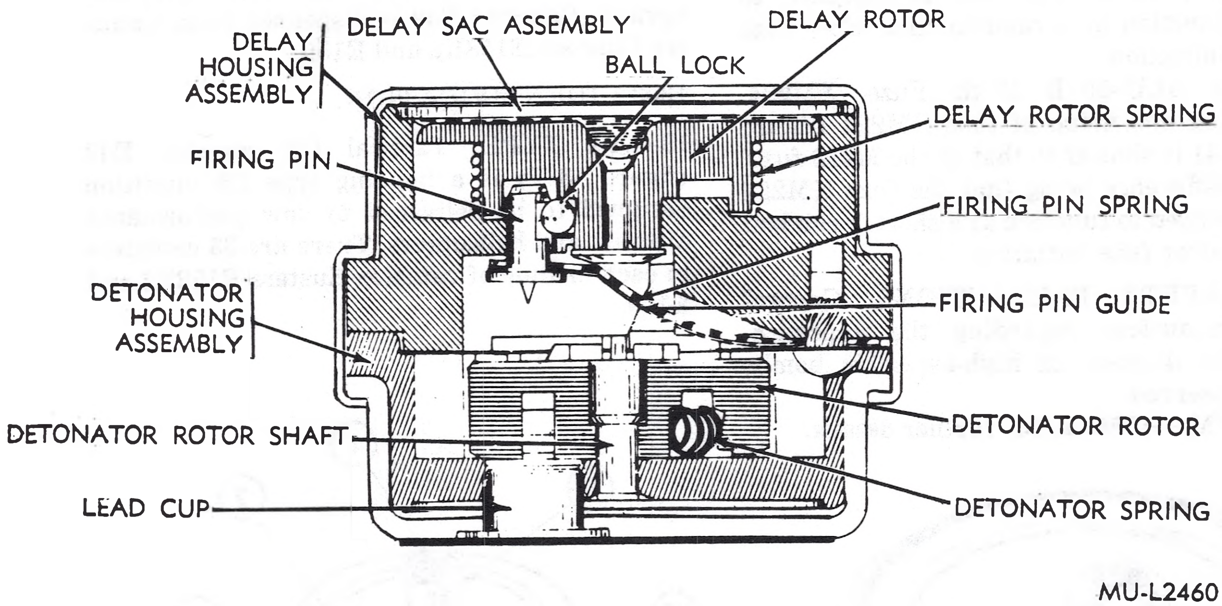


Figure 13–6.4 Fuze M218 or XM224—Cross Section

the firing hammer into the firing pin, forcing the firing pin into the detonator, initiating the explosive train.

(2) Fuze M219E1. This fuze is a modification of the fuze M219.

(a) Prior to arming, the detonator rotor is held in the out-of-line position by four spring-loaded lockweights only.

(b) When the bomb reaches the required rate of spin, centrifugal force causes the lockweights to be withdrawn from the detonator rotor. The rotor drive spring causes the rotor to turn to the in-line (armed) position. Upon impact of the bomb at any angle, inertia causes the weight to move, camming the push ball against the firing pin assembly. The firing pin is driven into the detonator, initiating the firing train.

b. Bomb BLU-36/B With Fuze M218.

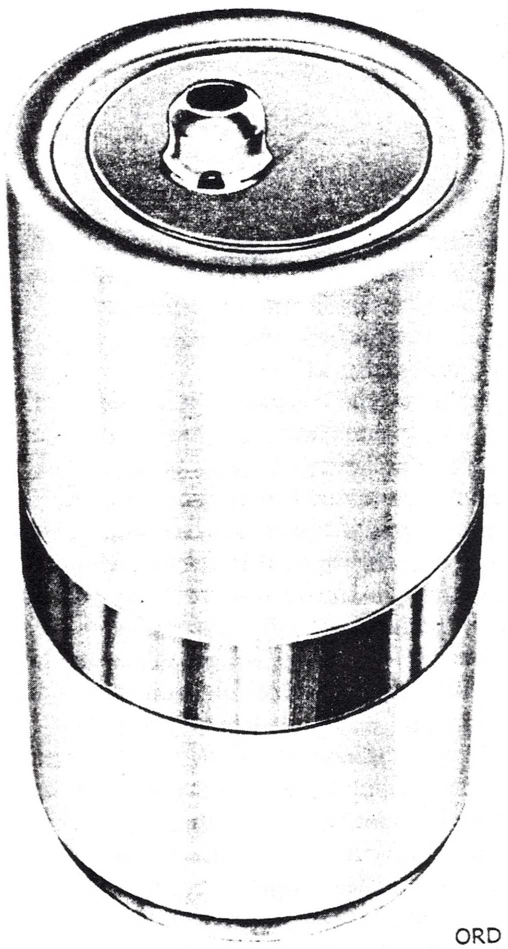
(1) Prior to arming, the detonator rotor (figure 13–6.4) is held in the out-of-line position by four spring-loaded lockweights. The firing pin is locked in the up position by a firing pin lock ball which is engaged in a groove in the firing pin shaft.

(2) When the bomb is released into the airstream and reaches the required rate of spin, centrifugal force causes the lockweights to be retracted from the detonator rotor. Retraction of the lockweights allows the rotor spring to turn the rotor to the in-line (armed) position. Arming of the detonator rotor releases the delay rotor lever, allowing the spring-driven rotor to turn. Rotation of the delay rotor causes the rotor blades to wipe across the viscous fluid delay sac. In so doing, the blades deform the sac and force the viscous fluid ahead of the delay rotor blades. After approximately 330° of rotation, a recess in the delay rotor shaft is alined with the firing pin lock ball, allowing the lock ball to move out, freeing the firing pin. The

firing pin spring drives the firing pin into the detonator, initating the explosive train. The fuze is designed to function at a random time after fuze initiation.

c. Bomb BLU–59/B With Fuze XM224. Arming and firing of fuze XM224 (figure 13–6.4) is similar to that of the M218 fuze. The difference being that the fuze XM224 is designed to function at a shorter random time after fuze initiation.

13–2.4 SAFETY PRECAUTIONS. General safety precautions regarding the approach, attack, and disposal of high-explosive bombs must be observed.
Refer to TM 9–1385–50 for further details.



ORD C9359

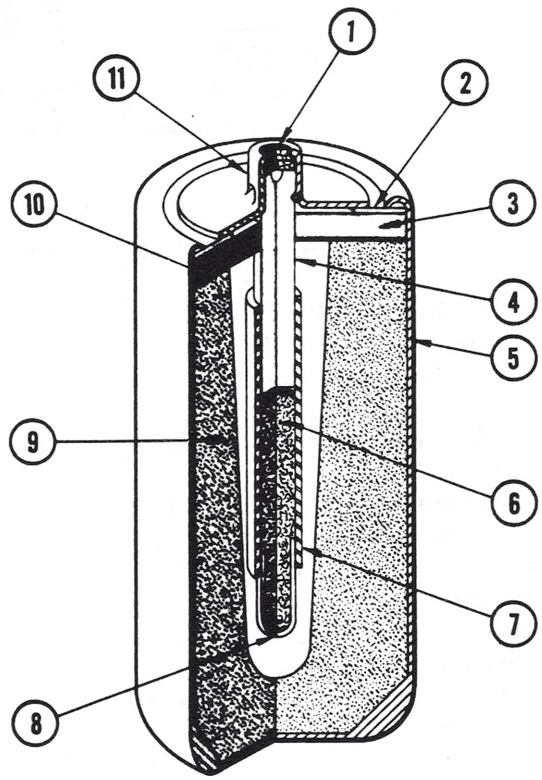
Figure 13–7 Tactical CS Canister E49

13–3. TACTICAL CS CANISTER E49

Tactical CS canister E49 is covered in this paragraph. Canister E49 is dispensed from Canister Clusters E158R2 and E159.

13–3.1 IDENTIFICATION.

13–3.1.1 TYPE. Tactical CS canister E49 (figure 13–7) is a burning type CS munition designed to be delivered by low performance aircraft and helicopters. There are 33 canisters in each module of canister clusters E158R2 and E159.



ORD D1879

1 Fuse ignition mix
2 Stiffer ring
3 Rubber disk assembly
4 Delay fuse
5 Aluminum canister
6 Ignition compound
7 Ignition tube
8 Capsule
9 OS Pyrotechnic mixture
10 Plastic sheet
11 Fuse retainer

Figure 13–8 Cross Section of Tactical CS Canister E49

13–3.1.2 PAINTING AND MARKING. One red band around the center of each aluminum canister indicates it contains a nonpersistent effect irritant agent.

13–3.2 FITTINGS AND FEATURES. The general characteristics of canister E49 are shown in figure 13–8. The canisters are 2½ inches high by 1¼ inches in diameter. The canisters are aluminum cylinders containing a CS pyrotechnic mixture.

13–3.3 WEIGHTS. As shown in the cross section (figure 13–8), canister E49 consists of an aluminum cylinder, a delay fuse, an ignition compound and a CS pyrotechnic mixture. The total weight of canister E49 is 58 grams. The CS pyrotechnic mixture weighs 36 grams.

13–3.4 HAZARDOUS COMPONENTS. The canister contains a CS pyrotechnic mixture, an ignition compound and a fuse ignition mix. The CS pyrotechnic mixture constitutes a fire hazard and a CS exposure hazard.

13–3.5 FUNCTIONING. At the end of a 4- to 6-second fuse burning period, the ignition compound is ignited. The burning of the ignition compound is so rapid that the burned fuse is blown out of the rubber disk assembly, and the canister may be propelled 40 feet as the CS pyrotechnic mixture is ignited by the ignition compound. As the CS pyrotechnic mixture begins to burn, pressure builds up and the canister is propelled along the ground in an erratic path, with some canisters becoming airborne. The chemical agent CS is disseminated during a 7- to 19-second pyrotechnic burning time.

13–3.6 SAFETY PRECAUTIONS.

a. Have a protective field mask available and remain upwind when disposing of canisters E49.

b. Cover the burning pit with a heavy wire mesh screen or other suitable barrier when disposing of canisters E49 to prevent the canisters from being ejected from the pit.

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13–4 BOMB, INCENDIARY, TH3, 4-POUND, M126 Bomb, Incendiary, TH3, 4-pound, M126, covered in this paragraph, is dispensed from Cluster. Incendiary Bomb, TH3, 750-pound M36.

13–4.1 IDENTIFICATION

13–4.1.1 TYPE. Bomb, Incendiary, TH3, 4-pound, M126 (figure 13–9) is a thermateloaded incendiary-type bomb, stabilized in flight by retracticable fins and gravity. Bomb, M126 is used in cluster M36. There are 182 bombs M126 loaded in cluster M36 in three bundles of 61, 60 and 61 each (figure 13–9).

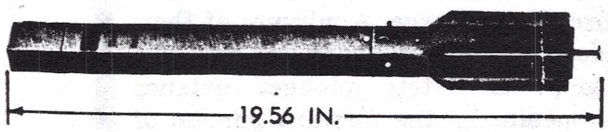


Figure 13–9 Bomb, Incendiary, TH3, 4-Pound, M126

13–4.1.2 PAINTING AND MARKING. M126 Bombs of earlier manufacture have the tail assembly painted gray and the forward end of the body has a purple color band and marking. M126 bombs of later marking are painted light red and have black marking.

13–4.2 FITTINGS AND FEATURES. The general characteristics of bomb, M126 are shown in figures 13–9 and 13–10. The length of the assembled bomb, with tail fins extended is 19.56 inches and the body width is 1.63 inches (hexagonal, across the flats). The hollow body is made of magnesium alloy, which constitutes the main incendiary charge and is filled with 0.63 lb. of TH3. The front end of the bomb is closed with a solid iron nose, which weights the bomb, so that it falls nose downward and penetrates a target without crumpling on impact. The M15 fin assembly consists of retractable fins (6, figure 13–10) in a hollow sheet-steel fin body. The fins retract when the tail plunger is pressed inward, compressing a spring. The M126 bomb weighs approximately 3.6 pounds.

13–4.3 HAZARDOUS COMPONENTS. The M126 bomb contains an incendiary filling of thermate, TH3, a first fire charge and a primer.

13–4.4 FUNCTIONING

(Key numbers in parentheses refer to figure 13–10.)

a. Before release from cluster. Safety plunger (3) is depressed by contact with another bomb in the cluster. Depression of the tail plunger (5) retracts the fins (6) into the fin body (4) and holds them retracted as long as the tail plunger (5) is held in a depressed position.

b. After release from cluster. When the bomb is released from the cluster, the tail fins (6) are extended by the force of the spring of the spring-loaded tail plunger (5) and the safety plunger (3) is forced downward by its spring, thus arming the bomb. The tail fins assist in keeping the

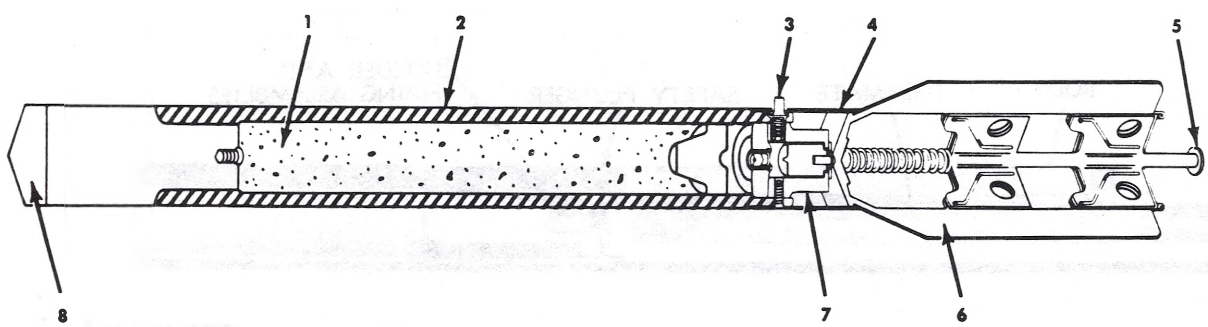


Figure 13–10 Bomb, Incendiary, TH3, 4-Pound, M126, Cutaway View

bomb turned nose downward during its fall.

c. Upon impact. When the bomb strikes the target. inertia causes the firing pin to move forward, striking the primer. The primer ignites the first-fire mixture which ignites the thermate filler. The burning thermate then ignites the magnesium section of the body. The bomb burns for approximately five to eight minutes.

13–4.5 SAFETY PRECAUTIONS. General safety precautions regarding unexploded ordnance and incendiaries must be observed.

13–4A BOMB INCENDIARY, 4-POUND, AN–M50 SERIES, TH3.

The bomb incendiary AN–M50 series TH3, covered in this paragraph is dispensed from Cluster, Incendiary Bomb M17 series, M22 series and M32.

13–4A.1 IDENTIFICATION

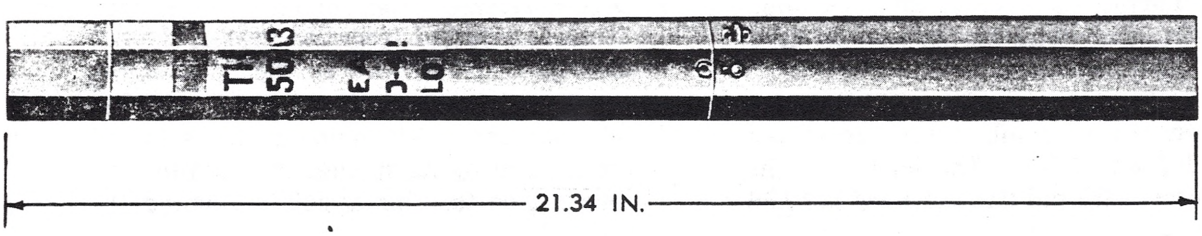
13–4A.1.1 Type. Bomb, Incendiary, AN–M50 series is a magnesium, TH3 combination type with integral, impact fuzing, stabilized in flight by a hollow hexagonal stabilizer.

13–4A.1.2 PAINTING AND MARKING. Bombs of earlier manufacture are painted gray overall with one purple band and markings in purple. Bombs of later manufacture are painted light red overall with markings in black.

13–4A.1.3 WEIGHTS AND DIMENSIONS. The complete bomb weighs 3.5 pounds. The TH3 mixture weighs 0.63-pound. The bomb is 21.3-inches long and 1.63-inches wide measured hexagonally across the flats.

13–4A.2 FITTINGS AND FEATURES. The general characteristics of the bomb, AN–M50 series are shown in figure 13–10.1. The hollow body is made of magnesium which constitutes the main incendiary charge. A mixture of thermate is loaded into the bomb body and acts as a starting agent. A safety plunger extends through an opening in the forward portion of the bomb tail. The front of the bomb is closed with a solid iron nose plug. The hollow tail section acts as a stabilizer when the bomb is in flight.

13–4A.3 HAZARDOUS COMPONENTS. In addition to the magnesium and TH3 these



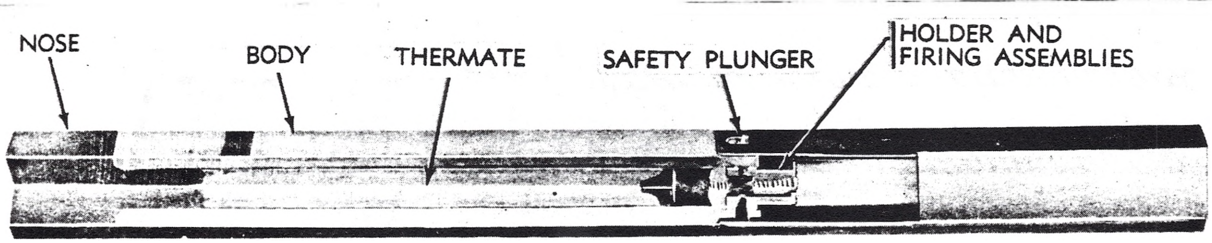


Figure 13–10.1 Bomb, Incendiary, TH3, 4-Pound, AN–M50A3

bombs contain a first fire mixture and a fuze primer.

13–4A.4 MATERIEL. The bomb body is magnesium, the nose plug is iron, and the tail section is sheet steel.

13–4A.5 FUNCTIONING. The firing assembly which consists of a firing pin. firing pin holder, anti-creep spring,. and a safety plunger is threaded into the rear of the bomb body. Prior to release from the cluster, the safety plunger is held in the depressed position by contact with another bomb in the cluster. With the safety plunger in the depressed position, forward movement of the firing pin holder is prevented. Upon release from the cluster, the safety plunger is forced outward by its spring. The firing pin holder is now held away from the primer by the anti-creep spring and a brass 'T' cross which functions as a sheer pin. Upon impact, inertia causes the firing pin holder to overcome the creep spring and the brass "T" cross, driving the firing pin into the primer, initiating the firing train.

13–4A6 SAFETY PRECAUTIONS. Burning bombs will produce heat in excess of 2300° F.

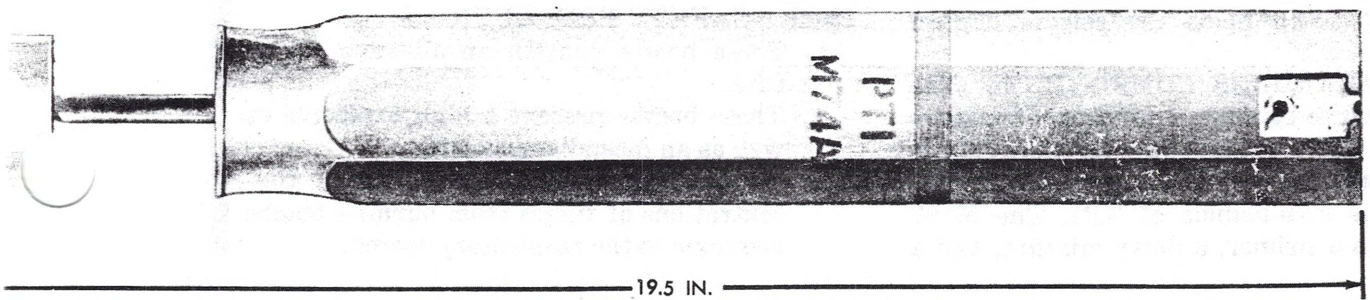
13–4B BOMB, INCENDIARY, PT1, 10-POUND, M74 SERIES.

The Bomb, incendiary, PT, 10-Pound, M74 series covered in this paragraph is dispensed from Cluster, Incendiary Bomb, PT, M31 and M35.

13–4B.1 IDENTIFICATION

13–4B.1.1 TYPE. The bomb incendiary M74 series is a cluster dispensed, base ejection, fin stabilized bomb, fuzed with the M197 all-ways acting fuze.

13–4B.1.2 PAINTING AND MARKING. Bombs manufactured prior to 1960 are painted gray. The tail fin is unpainted. The color band and lettering are purple. Bombs manufactured



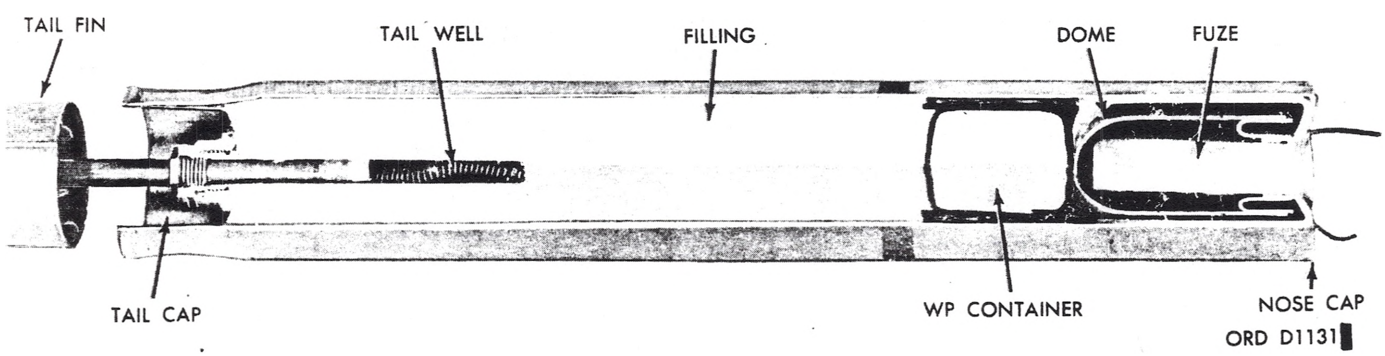


Figure 13–10.2 Bomb, Incendiary, PT1, 10-Pound, M74A1

after 1960 are painted light red overall with markings in black.

13-4B.1.3 WEIGHTS AND DIMENSIONS. The bomb incendiary M74 series is 19.5-inches long with tail fin retracted. The bomb measures 2.9-inches in diameter across the flats. The complete bomb weighs 8.5-pounds.

13–4B.2 FITTINGS AND FEATURES. The general arrangement and dimensional characteristics of the M74 series bomb are shown in figure 13–10.2. The bomb is hexagonal in cross section except at the tail end where it is cylindrical. The nose end of the bomb is closed by a nose cup into which the nose fuze is threaded. A dome located behind the nose cup, separates the fuze from the ignition charge and forms a container for the expelling charge. The plastic container containing the WP ignition charge is located behind the dome and forward of the PT1 filler.

When the bombs are clustered, the fuze retaining wire is withdrawn and the arming pin is held in the fuze by the release clip. The body of an adjacent bomb holds the release clip in place.

13–4B.3 HAZARDOUS COMPONENTS. The expelling charge contains a mixture of magnesium and black powder. The ignition charge contains approximately 6-ounces of WP. The main filler is 2.75-pounds of TP1. The M197 fuze contains a primer, a delay mixture, and a booster consisting of black powder and ignition powder.

13–4B.4 MATERIEL. The bomb body, fuze, and tail fin are steel. The WP ignition charge container and the expelling charge bags are plastic

13–4B.5 FUNCTIONING. As the clustered bombs are released from the cluster to drop free, the release clip falls away uncovering the arming pin. The arming pin stem is ejected from the fuze by the arming pin spring. Withdrawal of the stem allows two steel balls to move toward the center of the fuze, unlocking the striker from the sleeve. The striker and the sleeve are now free to move in any direction. Upon impact the firing pin is driven into the primer which initiates the delay mixture and booster. The booster ignites the expelling charge in the dome. This action breaks the WP container and at the same time, ejects the igniter and the incendiary filler. The WP ignites upon being exposed to the air and in turn ignites the incendiary filler.

13–4B.6 SAFETY PRECAUTIONS.

a. These bombs contain an all-ways acting fuze.
b. These bombs present a high explosive as well as an incendiary hazard.
c. Have a field mask available. Heavy concentrations of fumes from burning bombs are toxic to the respiratory system.

13–5 XM144 FRAGMENTATION BOMB.

The XM144 fragmentation bomb (figure 13–11) covered in this paragraph is dispensed from the XM18 Dispenser.

31–5.1 IDENTIFICATION

13–5.1.1 TYPE. The M144 bomb is a high-explosive, fragmentation type bomb. It is identical in appearance to the BLU–3/B and differs in functioning only in regard to the arming delay time. The XM18 Dispenser (modified SUU–14/A) loaded with 114 XM144 bombs comprises the XM25 Dispenser and Bomb System.

13–5.1.2 PAINTING AND MARKING. The XM144 bomb body is painted yellow, the vanes are cadmium plated, and the end cap is anodizd yellow. The markings are black.

13–5.1.3 FITTINGS AND FEATURES. The general characteristics of the XM144 bomb are shown in figures 13–11 and 13–12. The bomb is 4 inches high and 2.7 inches in diameter with the vanes closed. The bomb consists of an aluminum body imbedded with steel balls, a fuze assembly with end cap, six spring loaded stabilizing vanes, a safety strap and a spring tab.

13–5.2 HAZARDOUS COMPONENTS. The XM144 bomb contains a main charge of approximately 0.4 pound of RDX or cyclotol, a booster and a detonator.

13–5.3 FUNCTIONING. Upon release of the bomb from the dispenser, the spring tab is stripped from the bomb by the airstream. This unfastens the safety strap which, in turn, is ejected by the vanes as they spring open. The open vanes stabilize the bomb (figure 13–12). Opening of the vanes allows the spring-loaded end cap to move and withdraw the firing pin from the arming slide. The drive spring moves the arming slide which alines the detonator between the firing pin and booster. An escapement mechanism regulates the movement of the arming slide, providing an arming delay of approximately four seconds. On impact, the end cap drives the firing pin into the detonator, initiating the explosive train.

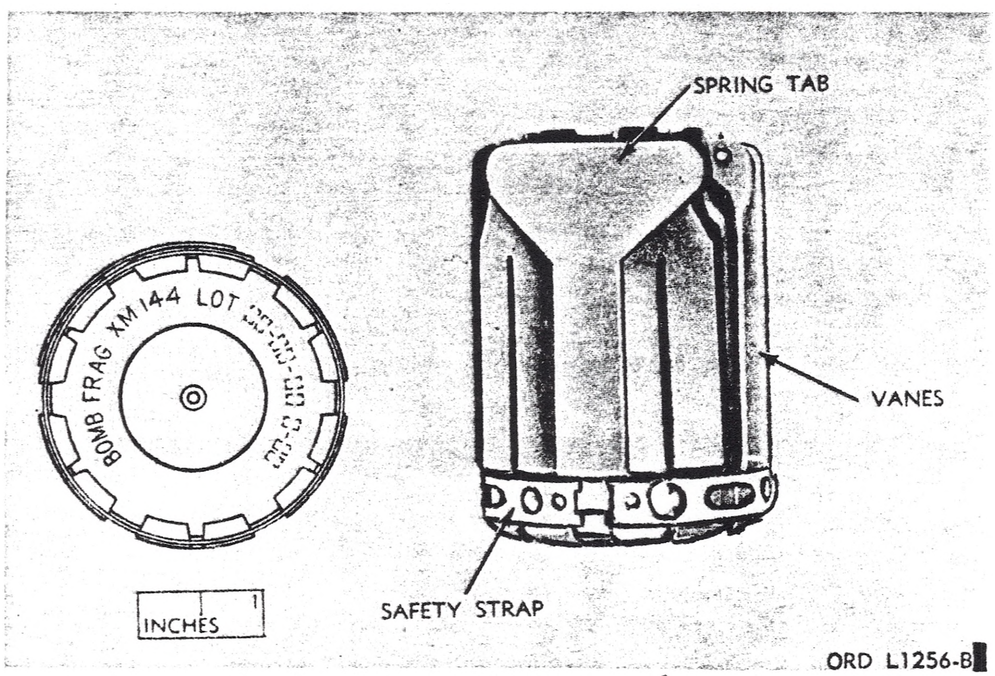


Figure 13–11 XM144 Bomb with Vanes Closed (Unarmed)

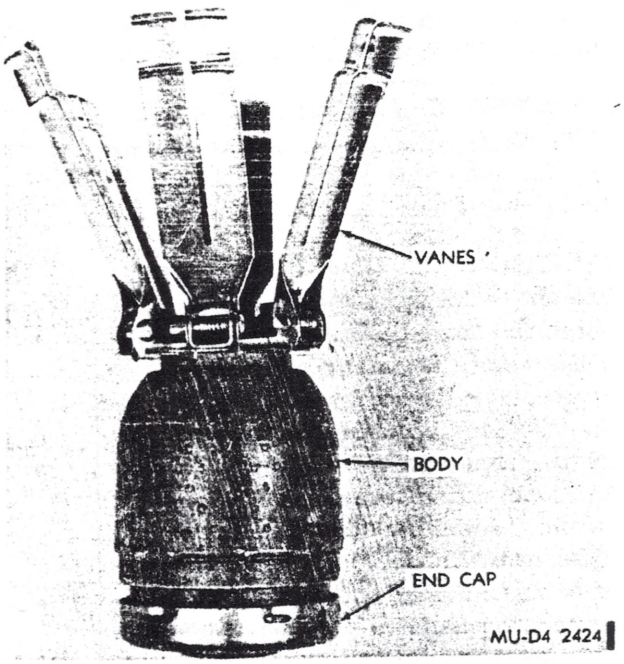


Figure 13-12. XM144 Bomb with Vanes Open (Armed).

13-5.4 Safety Precautions.

a. Consider the bomb armed if any of the vanes are open.

b. Do not drop, jar or strike a released or damaged bomb. Pressure applied to the end cap will cause detonation of an armed bomb.

c. Do not attempt to remove the end cap from the bomb.

d. Never move the end cap in any direction, as this may cause detonation of the bomb.

13-6 HEAT BOMBS BLU-7/B AND BLU-7A/B, AND PRACTICE BOMB BDU-37/B

13-6.1 IDENTIFICATION.

13-6.1.1 TYPE. The bomb BLU-7/B (figures 13-13 and 13-14) and bomb BLU-7A/B (figure 13-15) are impact-fired, parachute-stabilized, shaped-charge bombs containing impact-inertia fuzes. The fuzes are unnumbered and are an integral part of the bombs. The bomb BDU-37/B is an inert-loaded practice bomb. These bombs are dispensed from the systems listed below.

System designation	Dispenser designation	Payload	
		Designation	Quantity
CBU-3/A	SUU-10/A	BLU-7/B	371
CBU-3A/A	SUU-10A/A	BLU-7A/B	352
CBU-26/A	SUU-10A/A	BDU-37/B	352

13-6.1.2 PAINTING AND MARKING.

a. The BLU-7/B and BLU-7A/B bomb bodies are anodized black. The parachute protector is clear plastic. Markings are in yellow. The fuzes are unpainted.

b. The BDU-37/B bomb body is anodized blue. The parachute protector is clear plastic. Markings are in black.

13-6.1.3 WEIGHTS AND DIMENSIONS. The weight of each bomb BLU-7/B, BLU-7A/B, and BDU-37/B is 1.40 pounds, and the diameter is 2.75-inches. The BLU-7A/B and BDU-37/B are 8.28 inches long. The BLU-7/B is 7.86 inches long.

13-6.1.4 MATERIALS. The BLU-7/B, BLU-7A/B, and BDU-37/B bomb bodies are aluminum; the shaped-charge liner is copper; the parachute protector is clear plastic; and the wind tab, retaining strap, and fuze are steel.

13-6.2 HAZARDOUS COMPONENTS. Each bomb BLU-7/B and BLU-7A/B contains an M55 detonator, a booster (3.7 grams PBX), and a main charge (0.6 pound of Comp B). The bomb BDU-37/B contains no explosives.

13-6.3 FITTINGS AND FEATURES.

a. Bomb BLU-7/B.

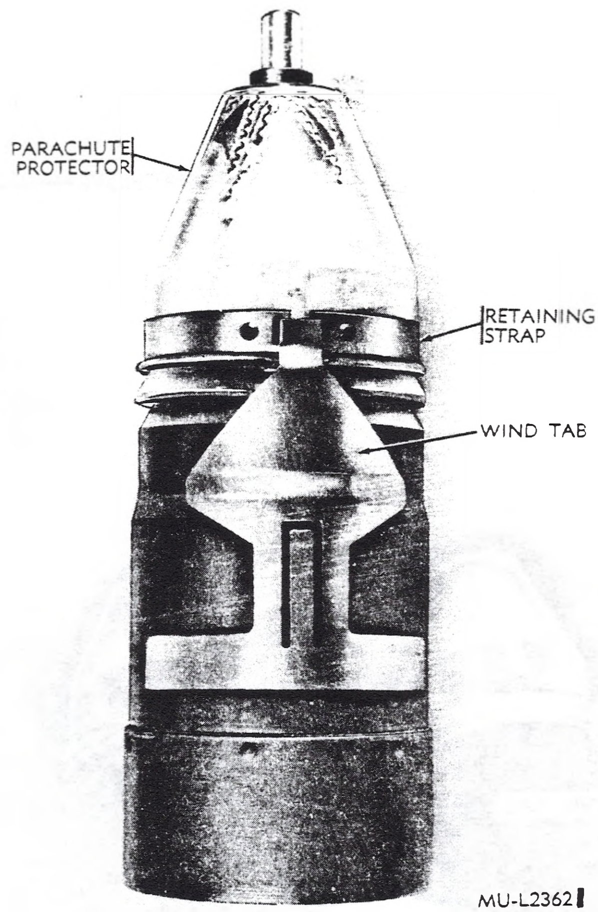


Figure 13-13. Unarmed Configuration of Bomb BLU-7/B

(1) The general characteristics of the bomb BLU-7/B are shown in figure 13-16. The bomb consists of a cylindrical body with the tail end formed in a truncated cone. The body contains the shaped charge. The tail of the bomb contains the fuze assembly and parachute. The parachute which is attached to the base of the inertia cap, consists of three strip panels (figure 13-17). A wind tab secures the retaining strap which holds the two-piece, clear plastic parachute protector in place. A safety clip fits through the firing pin sleeve and a slot in the threaded end of the safety thumb

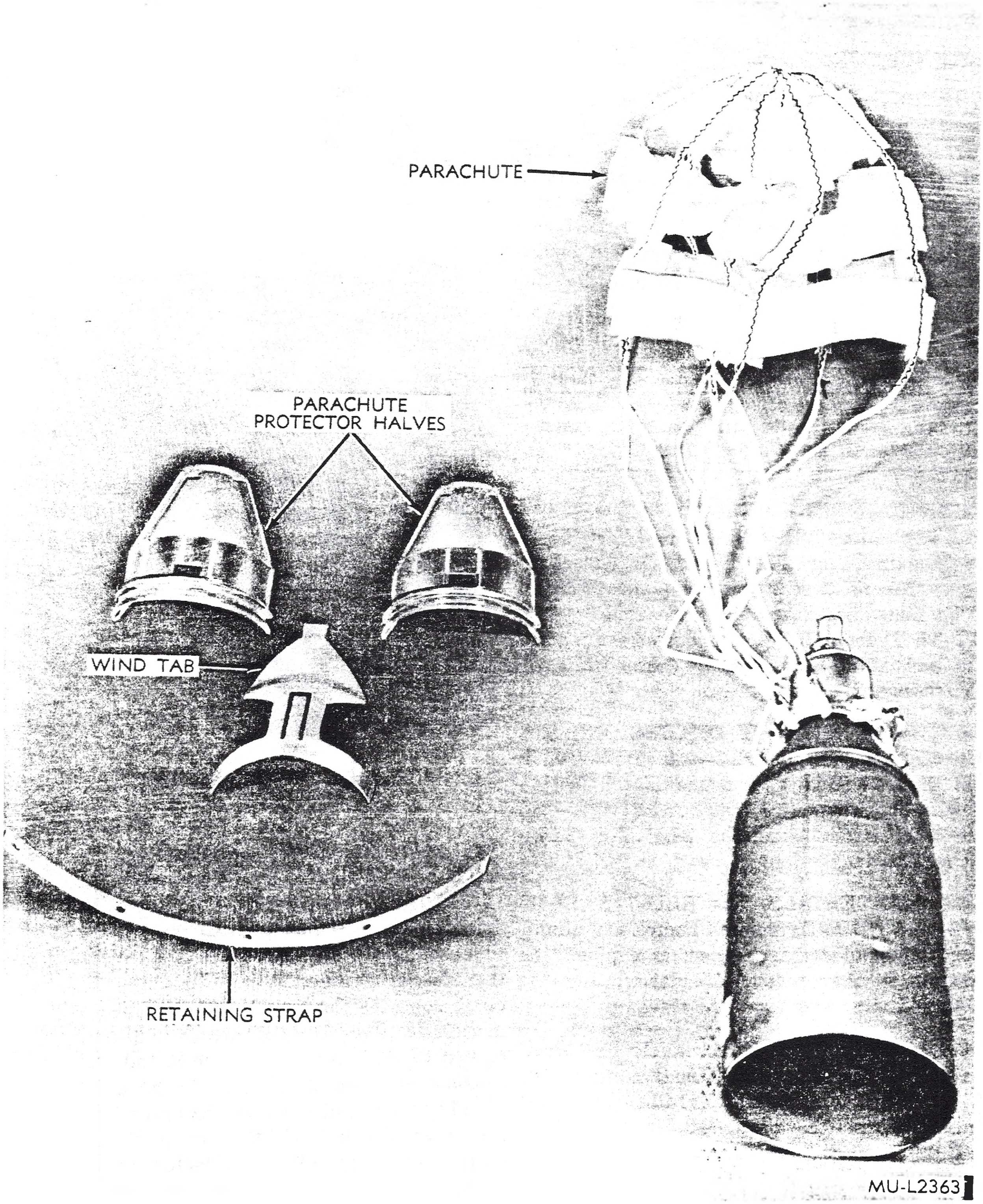


Figure 13–14. Component Parts of Bomb BLU–7/B

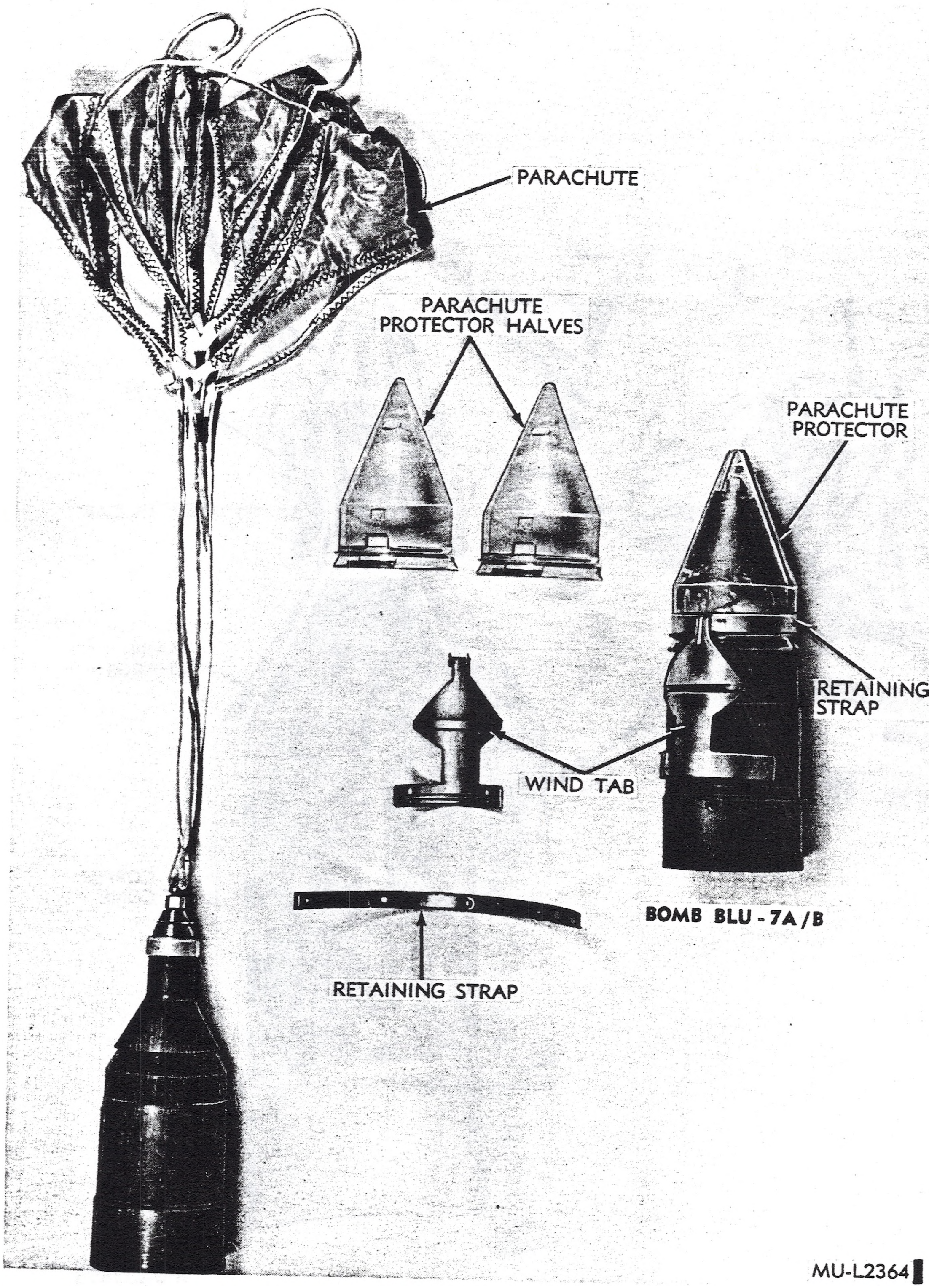


Figure 13-15 Component Parts of Bomb BLU-7A/B

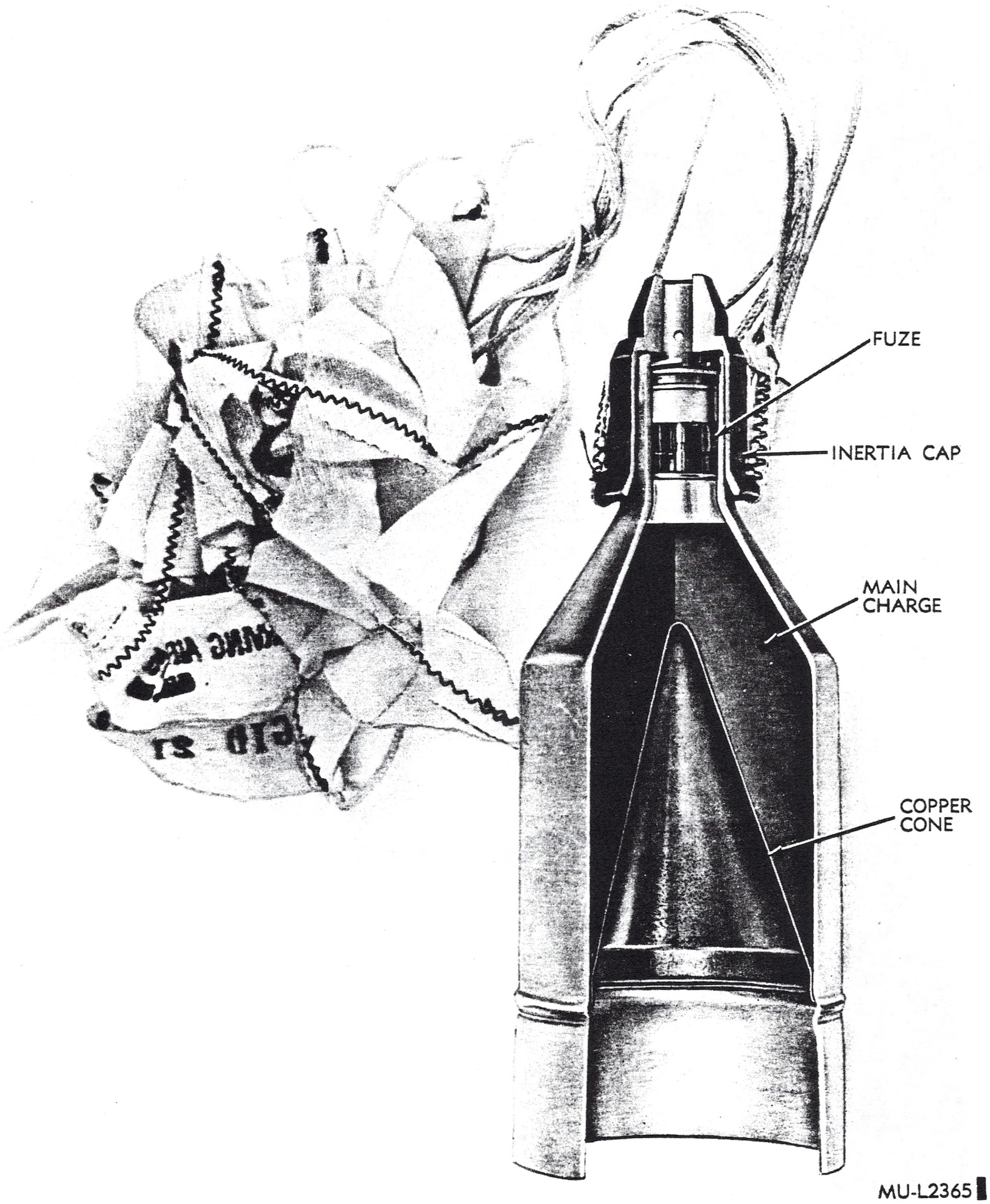


Figure 13-16 Cutaway View of Bomb BLU-7/B

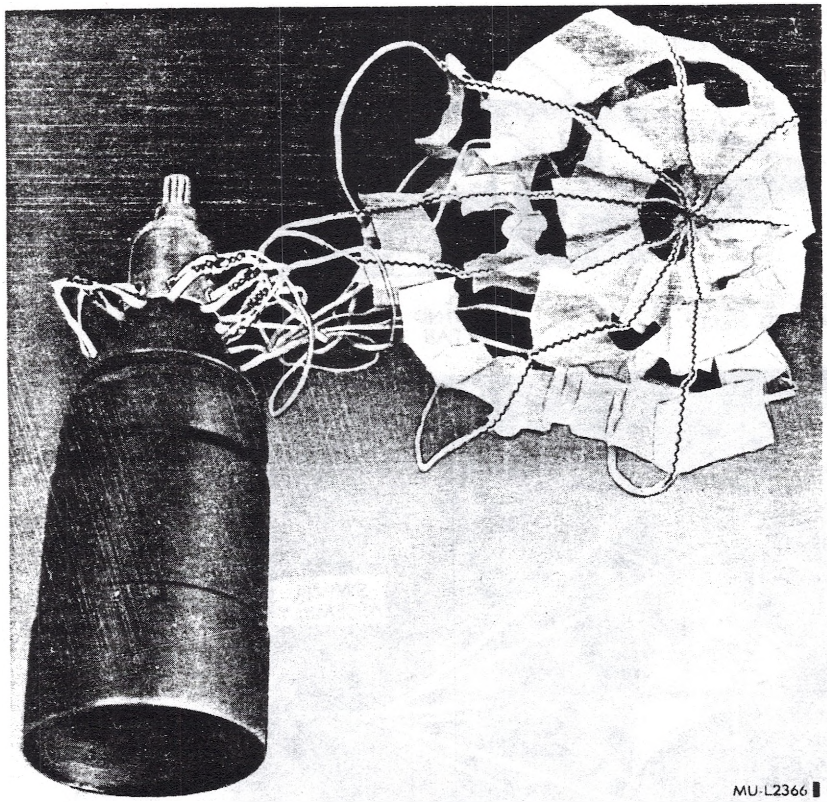


Figure 13–17 Dispensed Bomb BLU–7/B

screw. The clip prevents movement of the thumb screw which, in turn, prevents movement of the firing pin. The safety clip and safety thumb screw are removed prior to installing the bomb in the dispenser.

(2) The fuze mechanism incorporates an out-of-line detonator rotor, lead charge, delay fuze assembly (escapement mechanism), firing pin assembly, and an inertia cap. The detonator rotor is held in the out-of-line position by the firing pin.

b. BOMB BLU–7A/B.

(1) The general characteristics of the bomb BLU–7A/B are shown in figure 13–18. The bomb BLU–7A/B is similar in construction to the bomb BLU–7/B (figure 13–19) with the exception of the fuze assembly, parachute design, and parachute attachment. The fuze (figure 13–20) is fully enclosed in a plastic protector. The parachute consists of four triangular panels and is attached to the telescope pin by a swivel. A safety wire passes through the parachute protector, fuze body, and telescope pin. The safety wire prevents movement of the telescope pin which holds the firing pin against the compressed anticreep spring and locks the detonator rotor in the out-of-line position. In addition, a detent wire also holds the telescope pin in the down position. The safety wire is removed prior to loading the bomb in the dispenser.

(2) The fuze mechanism (figure 13–21) consists of a delay assembly (escapement mechanism), out-of-line detonator rotor, anticreep spring, firing pin, telescope pin, and detent wire.

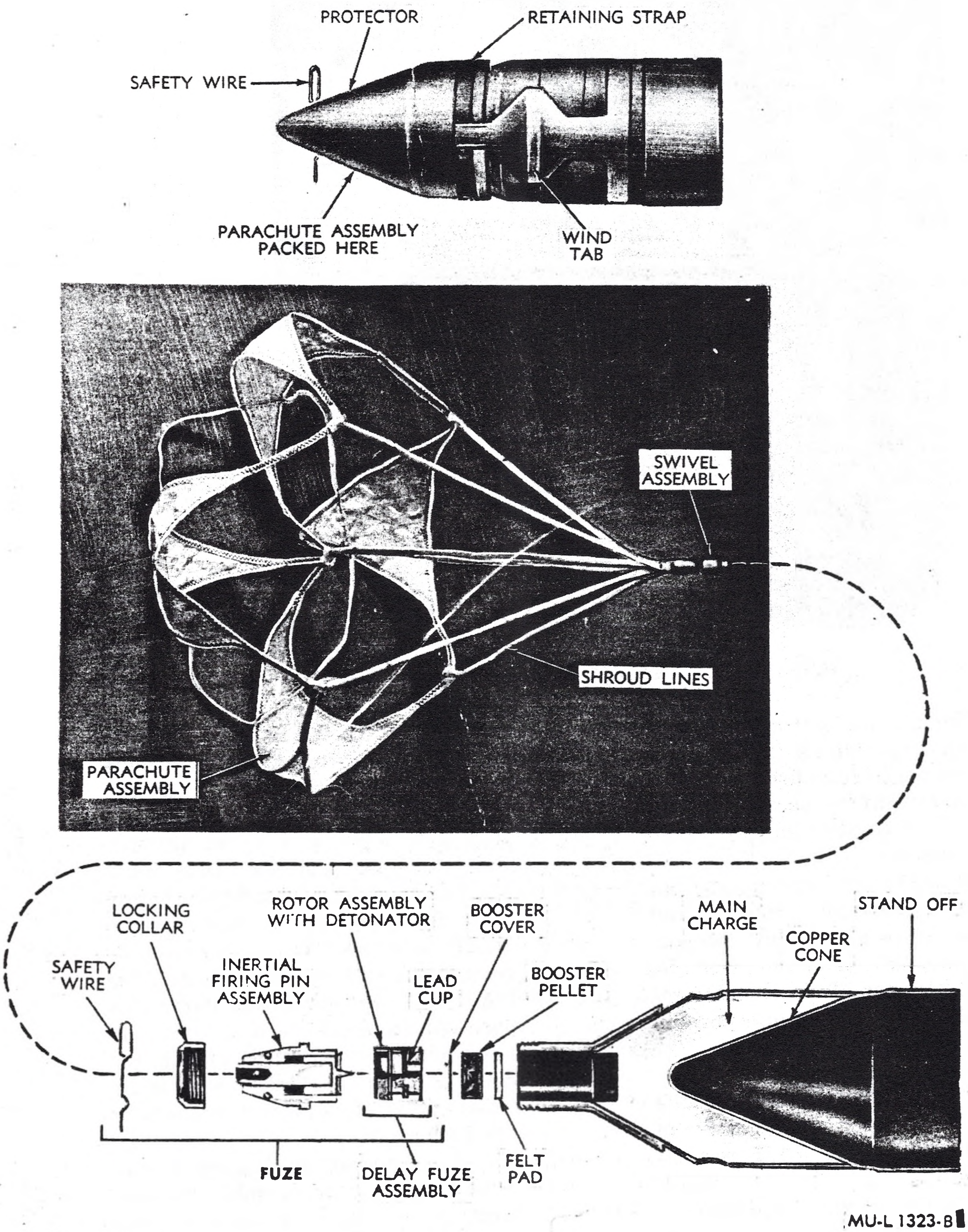


Figure 13–18 Characteristics of Bomb BLU–7A/B

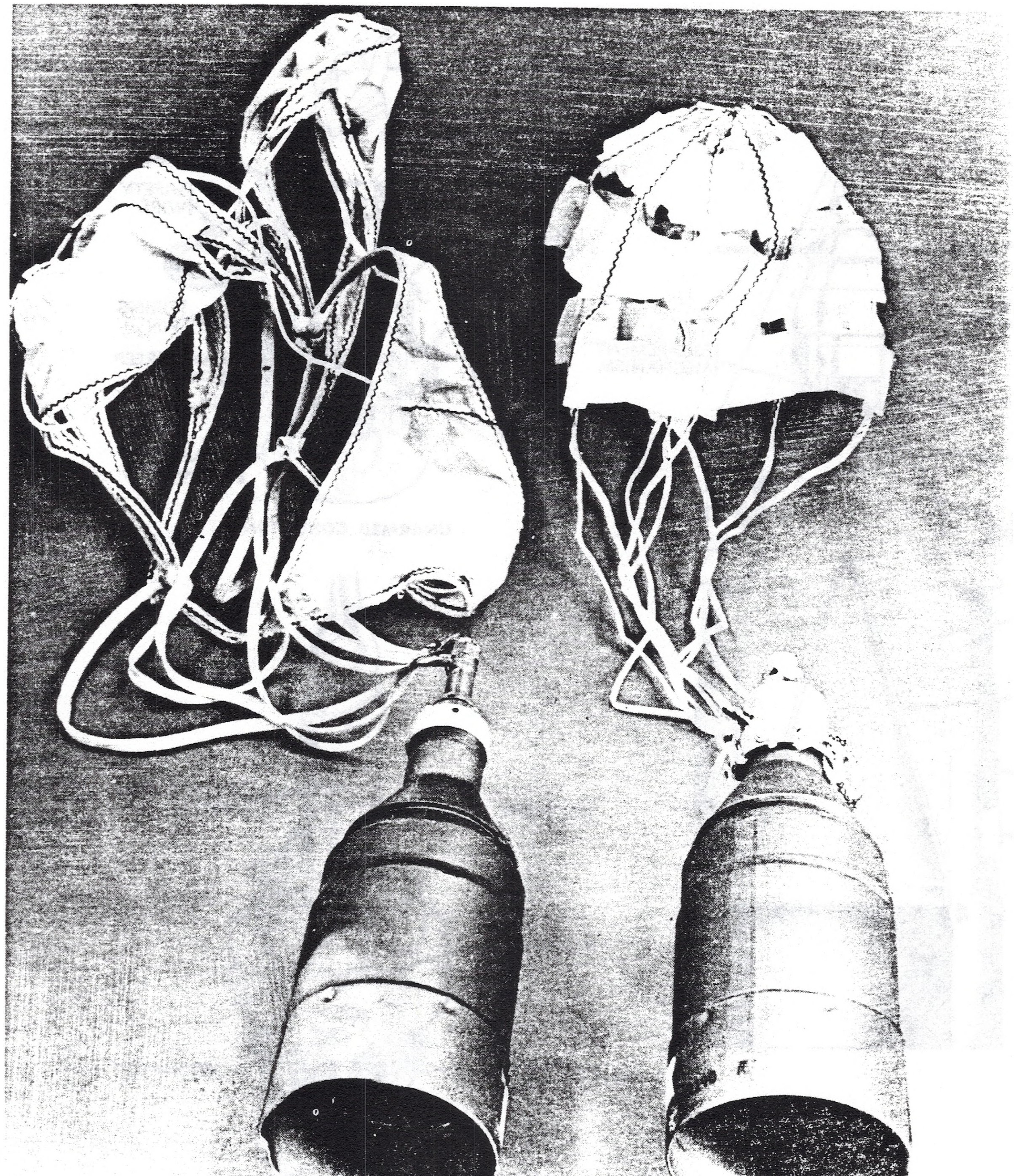


Figure 13–19 View Showing Differences Between BLU–7/B and BLU–7A/B

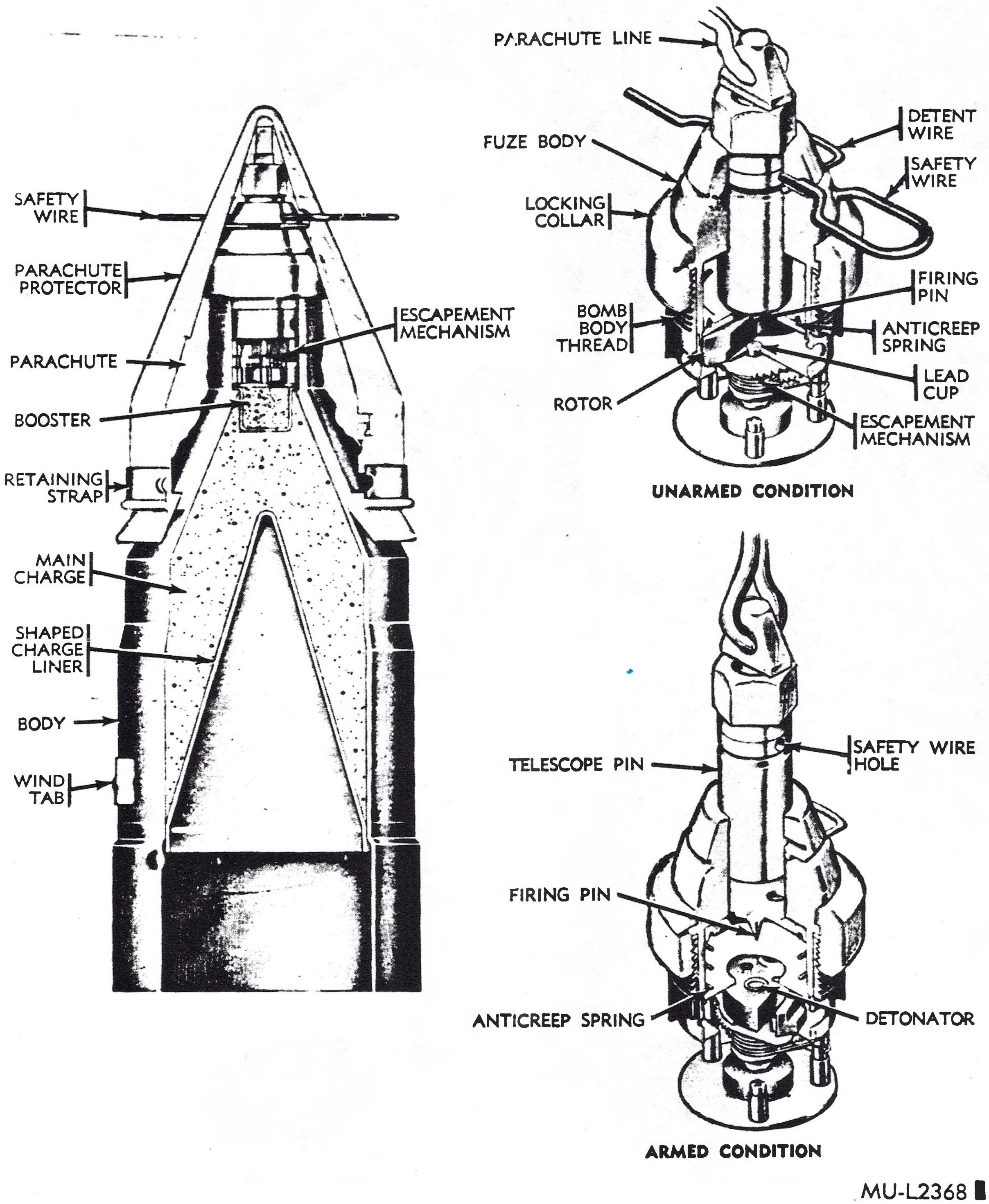


Figure 13–20 Bomb BLU–7A/B and Fuze Assembly—Cutaway Views

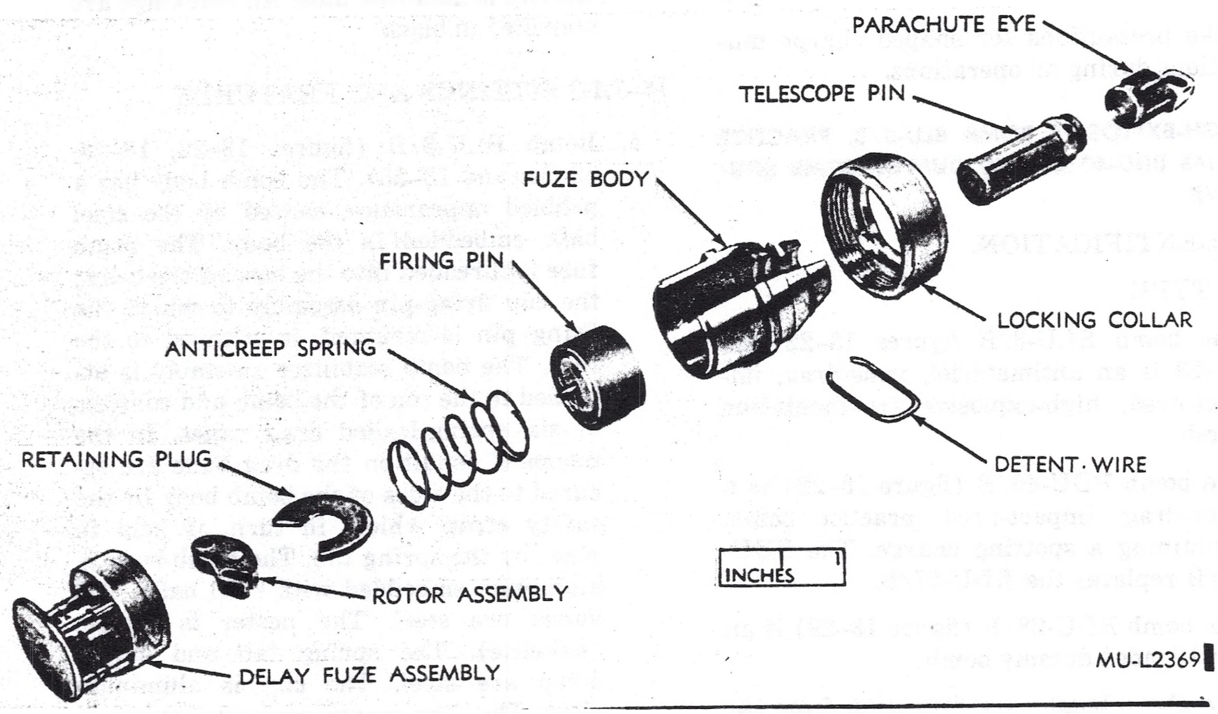


Figure 13-21 Fuze for Bomb BLU-7A/B—Exploded View

13-6.4 FUNCTIONING. Functioning of the bombs BLU-7/B, BLU-7A/B, and BDU-37/B is identical. As the bomb is released from the dispenser, the wind tab is stripped off by the airstream and unfastens the retaining strap. The parachute protector falls free allowing the parachute to be deployed.

NOTE

The bomb BDU-37/B and fuze are inert.

a. Bomb BLU-7/B. Parachute drag causes the inertia cap to move upward. Upward movement of the inertia cap causes the actuating pin to move upward and pull the firing pin clear of the detonator rotor assembly. As the firing pin clears the rotor, the rotor spring forces the detonator into alignment with the firing pin and lead charge. The escapement mechanism slows down rotor movement providing a short delay. Upon impact, the inertia cup moves downward driving the firing pin into the detonator, initiating the explosive train.

b. Bomb BLU-7A/B. Parachute drag pulls the telescope pin free of the detent wire. The firing pin, no longer restrained by the telescope pin, is forced upward by the anticreep spring. As the firing pin clears the rotor, the rotor spring forces the rotor to turn to the in-line position. Delay in arming is provided by the escapement mechanism slowing down the rotor movement. Upon impact, the firing pin overcomes the resistance of the anticreep spring and strikes the detonator, initiating the explosive train.

13-6.5 SAFETY PRECAUTIONS.

a. Make a positive identification of fuze prior to attempting procedure.

b. There is no external means of determining if a fuze has armed or misfired and whether the firing pin is embedded in the detonator.

c. Take precautions for shaped charge munitions during all operations.

13–7 HIGH-EXPLOSIVE BOMB BLU-3/B, PRACTICE BOMB BDU-40/B, AND DUMMY BOMB BDU-28/B

13–7.1 IDENTIFICATION.

13–7.1.1 TYPE.

a. The bomb BLU-3/B figures 13–22 and 13–23 is an antimateriel, vane-drag, impact-fired, high-explosive fragmentation bomb.

b. The bomb BDU-40/B (figure 13–22) is a vane-drag, impact-fired, practice bomb, containing a spotting charge. The BDU-40/B replaces the BDU-27/B.

c. The bomb BDU-28/B (figure 13–22) is an inert-loaded dummy bomb.

d. The above bombs are dispensed from the systems listed in table 13–2.

13–7.1.2 PAINTING AND MARKING.

a. The body of the bomb BLU-3/B is painted yellow and the cup is anodized a gold color. The drag vanes are anodized gold. All markings are in black.

NOTE

Inert loaded bombs BLU-3/B may be found. These bombs are painted blue over the original yellow. The cup is blue and stenciled to indicate that the bomb is inert loaded with an inert fuze.

b. The body of the bomb BDU-40/B (figure 13–9) practice bomb is painted red with a ¾-inch strip of brown tape wrapped around the midsection. The vanes are anodized gold and the cup (figure 13–10) is anodized brown. All other markings are in black.

c. The body of the bomb BDU-28/B is painted the same color red as the BDU-40/B. The vanes are anodized gold and the cup is anodized blue. All markings are stenciled in black.

13–7.1.3 FITTINGS AND FEATURES.

a. Bomb BLU-3/B (figures 13–22, 13–23, 13–24, and 13–25). The bomb body has a pebbled appearance, caused by the steel balls embedded in the body. The bomb fuze is threaded into the base of the body; the cup firing-pin assembly to which the firing pin is mounted, is crimped to the fuze. The bomb stabilizer assembly is attached to the top of the bomb and consists of six spring-loaded drag vanes. In the unarmed condition the drag vane are secured to the sides of the bomb body by the safety strap which, in turn, is held in place by the spring tab. The bomb body is aluminum embedded with steel balls. The vanes are steel. The nester is plastic (bakelite). The spring tab and safety strap are steel. The cup is aluminum alloy. The fuze escapement mechanism is brass, the arming slide is zinc alloy, and the remaining parts of the fuze are steel.

b. Bomb BDU-40/B (figure 13–22). The bomb body is smooth with a smoke emission hole. All other features are the same as the BLU-3/B. The bomb body is plastic; all other materials are the same as the BDU-3/B.

c. Bomb BDU-28/B (figure 13–22). The bomb body is completely smooth. The bomb body has a cup with firing pin, but no fuze. The stabilizer assembly is the same as the BLU-3/B. The bomb body is aluminum, all other materials are the same as the BLU-3/B. The BLU-28/B does not incorporate a drive spring, arming slide, detonator, or escapement mechanism.

d. Weights and Dimensions. The bombs BDU-3/B, BDU-40/B, and BDU-28/B are 3¾ inches in length with a maximum diameter of 2¾ inches and weigh 1.73 pounds.

Table 13-2. Dispensing Systems for Bombs BLU-3/B, BDU-40/B, and BDU-28/B

System designation	Dispenser designation	Payload	
		Designation	Quantity
CBU-2A	SUU-7A/A	BLU-3/B	360
CBU-2A/A	SUU-7A/A	BLU-3/B	406
CBU-2B-A	SUU-7B/A	BLU-3/B	409
CBU-2C/A	SUU-7C/A	BLU-3/B	409
CBU-8A/A	SUU-7C/A	BDU-40/B	409
CBU-9/A	SUU-7A/A	BDU-28/B	406
CBU-9A/A	SUU-7B/A	BDU-28/B	409
CBU-9B/A	SUU-7C/A	BDU-28/B	409
CBU-14/A	SUU-14/A	BLU-3/B	114
CBU-14A/A	SUU-14A/A	BLU-3/B	114
*ADU-253/B	SUU-24/A, NC-123X, B-57 Modular	BLU-3/B	74**
*ADU-253A/B	SUU-24/A, NC-123X, B-57 Modular	BLU-3/B	74**
*ADU-253B/B	SUU-24/A, NC-123X, B-57 Modular	BLU-3/B	74**

* Seventy-two ADU's comprise the payload for one SUU-24/A dispenser.
Thirty-six ADU's comprise the payload for one NC-123X dispenser.
Twenty-two ADU's comprise the payload for one B-57 modular dispenser.
** Seventy-four bombs BLU-3/B are contained in each ADU.

13-7.2 HAZARDOUS COMPONENTS.

a. Bomb BLU-3/B contains approximately 0.4 pound of RDX or cyclotol, a detonator, and a lead cup.

b. Bomb BDU-40/B contains a shot gun shell with approximately 5 grains of smokeless blank powder and a stab-type detonator which contains 102 milligrams of an explosive mixture.

c. Bomb BDU-28/B is an inert dummy bomb.

13-7.3 FUNCTIONING.

a. Bomb BLU-3/B (figure 13-26). Upon release from the dispenser, the spring tab is stripped off by the airstream, releasing the safety strap which is ejected by the drag vanes which are forced open by their springs. Release of the safety strap and the vanes allows the spring-loaded cup to move forward, withdrawing the firing pin from the cavity in the arming slide. In the late model bombs, opening of the vanes allows the spring loaded safety pin to move outward, releasing the arming slide. The drive spring moves the arming slide to aline the detonator, lead charge and firing pin. The bomb is now armed. The escapement mechanism provides a short delay in alining the arming slide. Upon impact, the cup drives the firing pin into the detonator, initiating the explosive train.

b. Bomb BDU-40/B. The bomb functions similar to the BLU-3/B, the exception being that the BDU-40/B does not contain a high-explosive charge. Upon

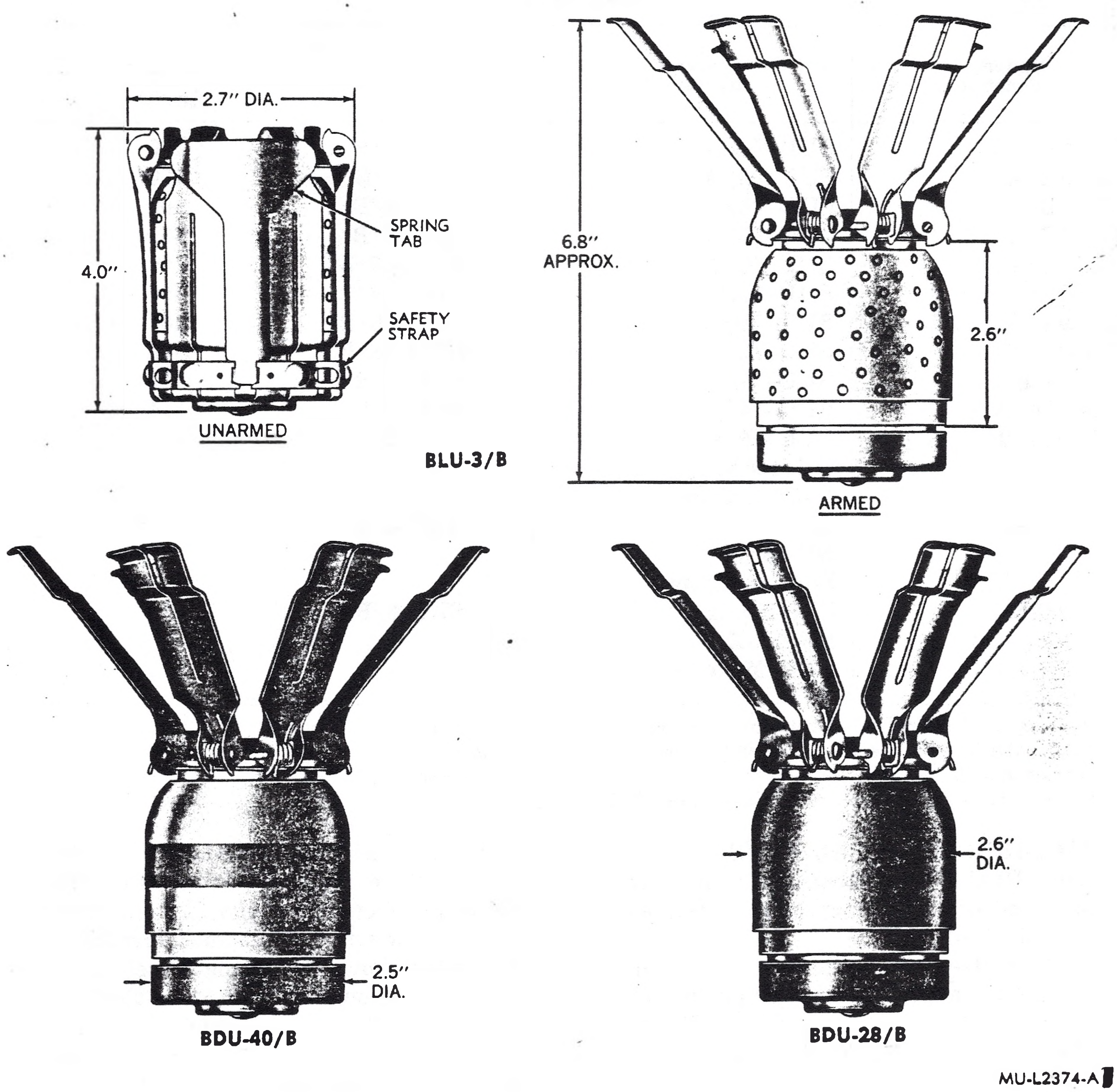


Figure 13–22 Bombs BLU–3/B, BDU–40/B, and BDU–28/B

impact, the detonator is initiated and functions the shotgun shell. The functioned shotgun shell forces the spotting charge through the bomb emission hole to mark the point of bomb impact.

c. Bombs BDU-28/B and Inert BLU-3/B. These bombs are inert. Their only functional parts are the stabilizer assembly and the cup.

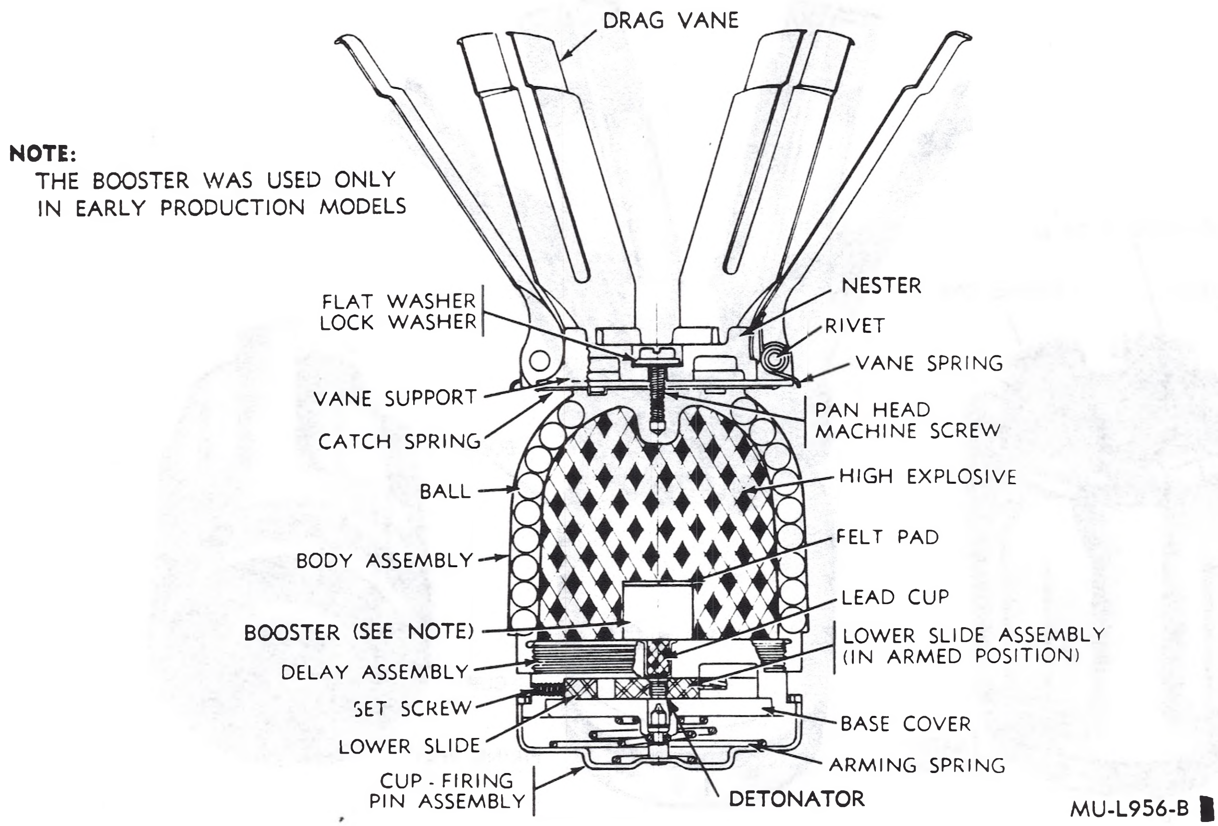


Figure 13–23 Bomb BLU–3/B

13–7.4 SAFETY PRECAUTIONS.

a. If positive identification of the bomb cannot be established, consider the bomb to be a high-explosive type (BLU-3/B).

b. Do not drop, jar, or strike a release or damaged bomb. Pressure applied to the cup will detonate an armed bomb.

c. Fire resulting from the ignition of the shotgun cartridge of the BDU-40/B can cause burns if any part of the body is adjacent to the emission hole.

13–8 GRENADE, GENERAL-PURPOSE: M43A1

13–8.1 IDENTIFICATION.

13–8.1.1 TYPE. The grenade M43A1 (figure 13–27) is an airburst, antipersonnel, rebounding-type munition designed to be dispersed from artillery projectiles.

13–8.2 PAINTING AND MARKINGS.
The M43A1 grenades are unpainted and unmarked.

13–8.3 FITTINGS AND FEATURES.

13–8.3.1 GRENADE CHARACTERISTICS.

13–8.3.2 The grenade M43A1 (figures 13–27 and 13–28) consists essentially of a wedge-shaped housing assembly, a spherically-shaped body assembly, a primer, a firing pin, a yoke, and two spring-loaded vanes.

13–8.3.3 The wedge-shaped grenades are fitted with slotted wind vanes which orient the grenades during descent.

13–8.4 HAZARDOUS COMPONENTS.
The main charge contains approximately 21–22 grams of RDX. The primer consists of approximately 0.047 gram of primer mixture plus lead

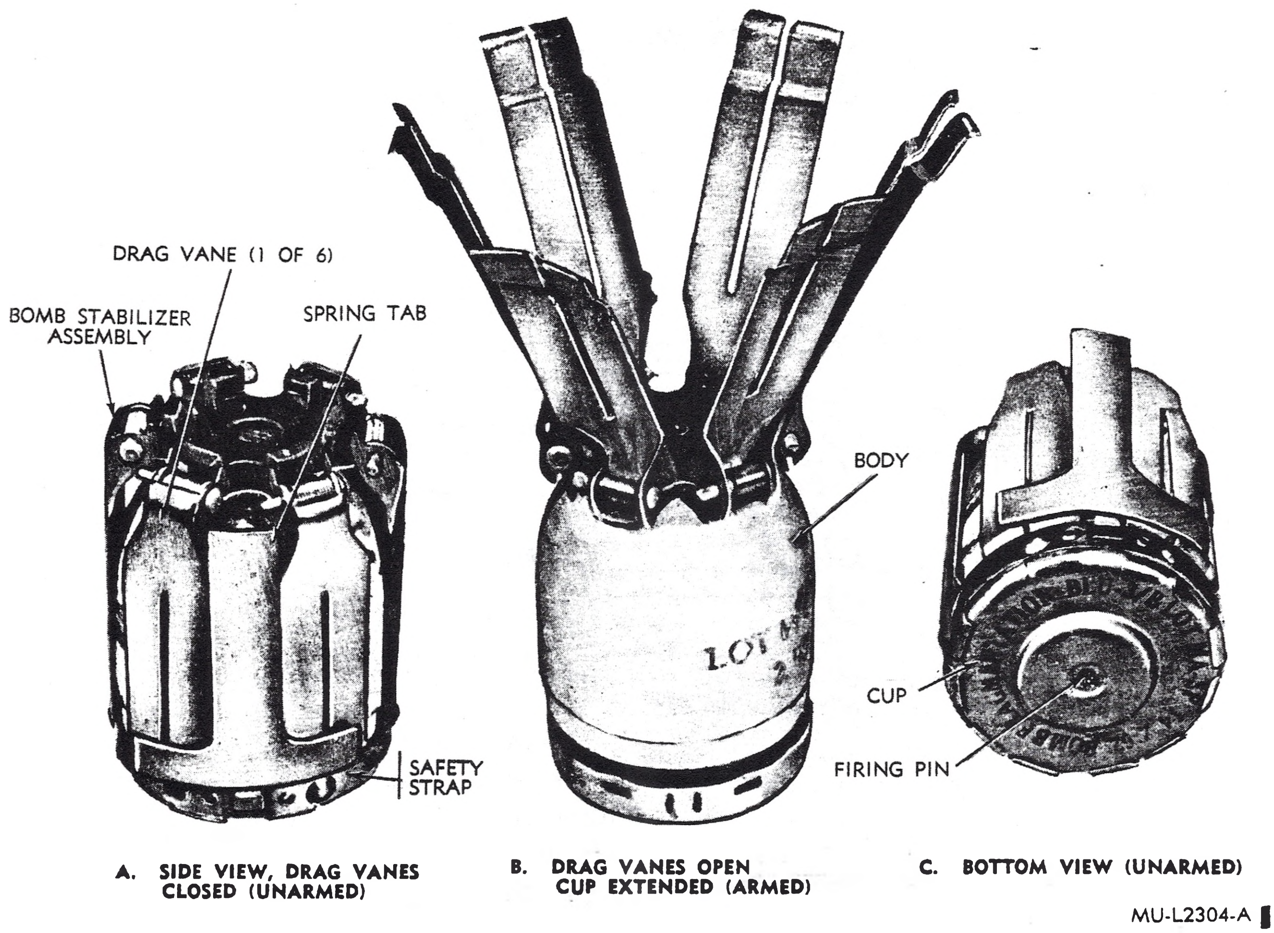


Figure 13–24 Bomb BLU–3/B—Armed and Unarmed

azide. The delay detonator consists of approximately 0.139 gram of RDX, lead azide, and delay composition. The container assembly (jump-up) contains approximately 0.185 gram of M5.

13–8.5 FUNCTIONING.

a. Upon expulsion from the projectile, the vanes open and orient the grenade in a vertical or near-vertical position. The energy of the vane springs and the airstream lock the two vanes in the open position and stabilize the grenade.

b. After the vanes are extended, a spring moves the yoke to the extended position. The firing pin, attached to the yoke, retracts from the slide assembly, permitting movement of this assembly which locates the detonator in the armed position. A delay in arming of the grenade is provided by restricting the air flow caused by movement of the slide assembly. This delay precludes premature grenade functioning caused by midair collision immediately after ejection from the projectile. Arming delay is achieved by allowing air to pass through a porous plug in the housing located adjacent to the slider recess.

c. When the grenade impacts the targets surface, the yoke drives the firing pin into the detonator which initiates the ejection charge. The ejection charge forces the steel ball with the retaining washer up

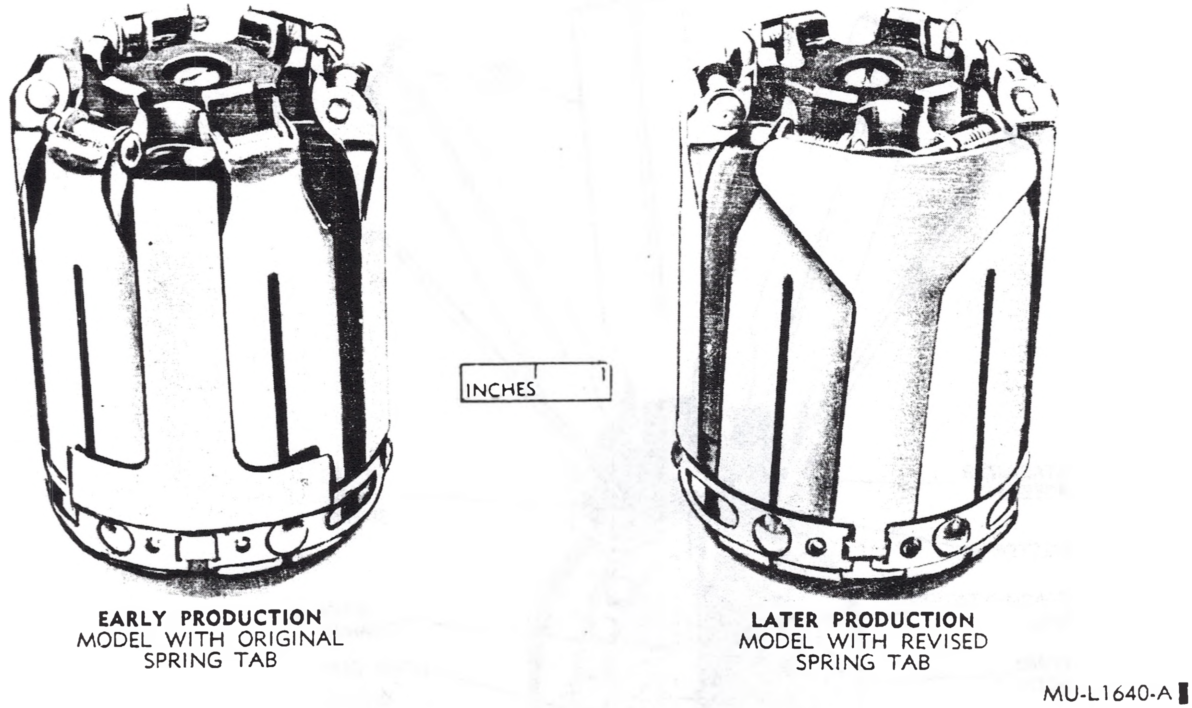


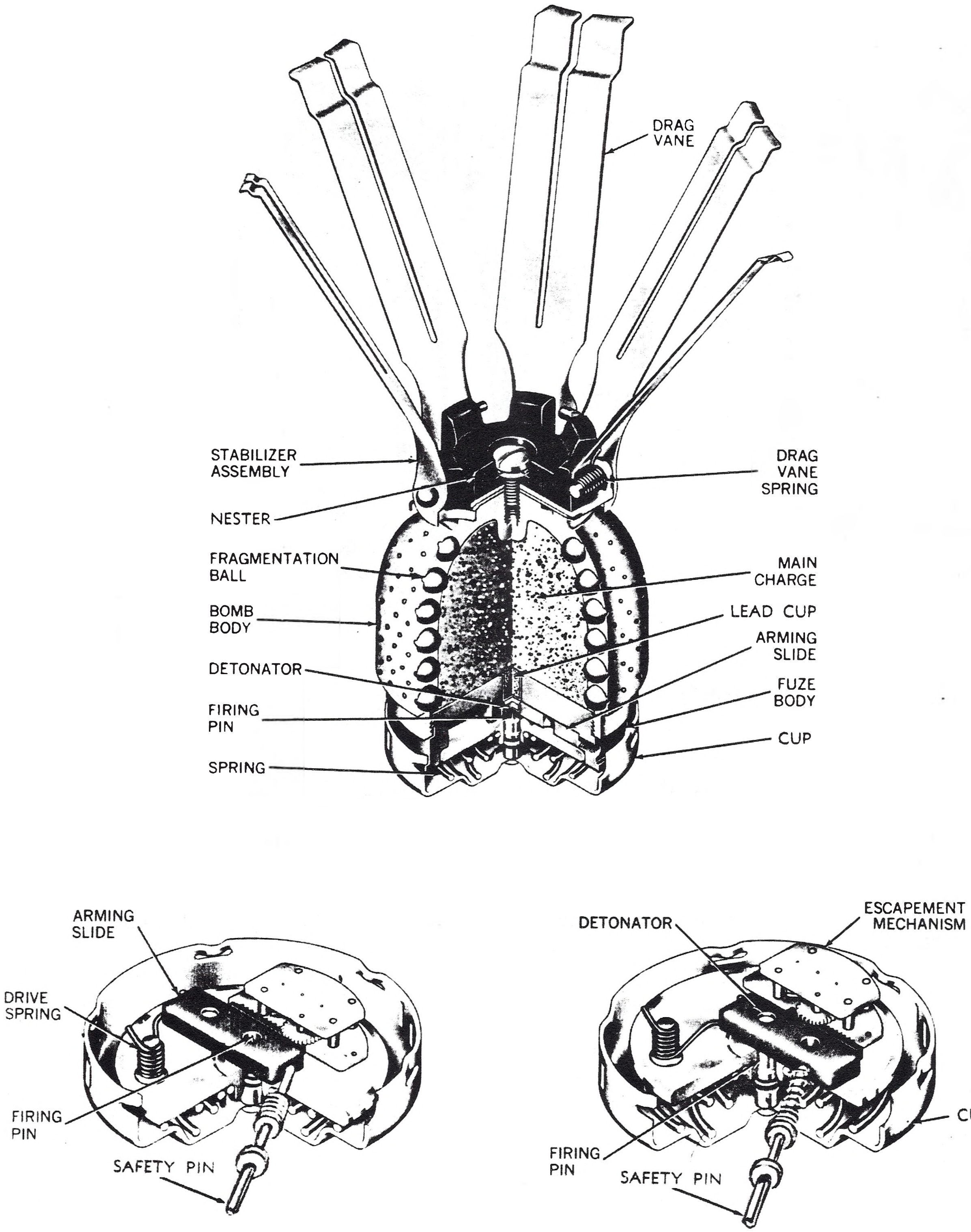
Figure 13–25 Bomb BLU–3/B With Original and Revised Spring Tab

and away from the housing, ignites the first-fire mixture in the delay detonator, and forces the detonator into the in-line position. The delay detonator functions the high-explosive RDX causing the grenade ball to fragment 4 to 6 feet above the impact surface.

13–8.6 SAFETY PRECAUTIONS.

13–8.6.1 General safety precautions regarding unexploded ordnance must be observed.

13–8.6.2 Do not jar, strike, or move individual grenades.



UNARMED CONDITION
(FUZE BODY NOT SHOWN)

ARMED CONDITION
(FUZE BODY NOT SHOWN)

MU-L2375-A

Figure 13–26 Bomb BLU–3/B—Internal View of Armed and Unarmed Condition

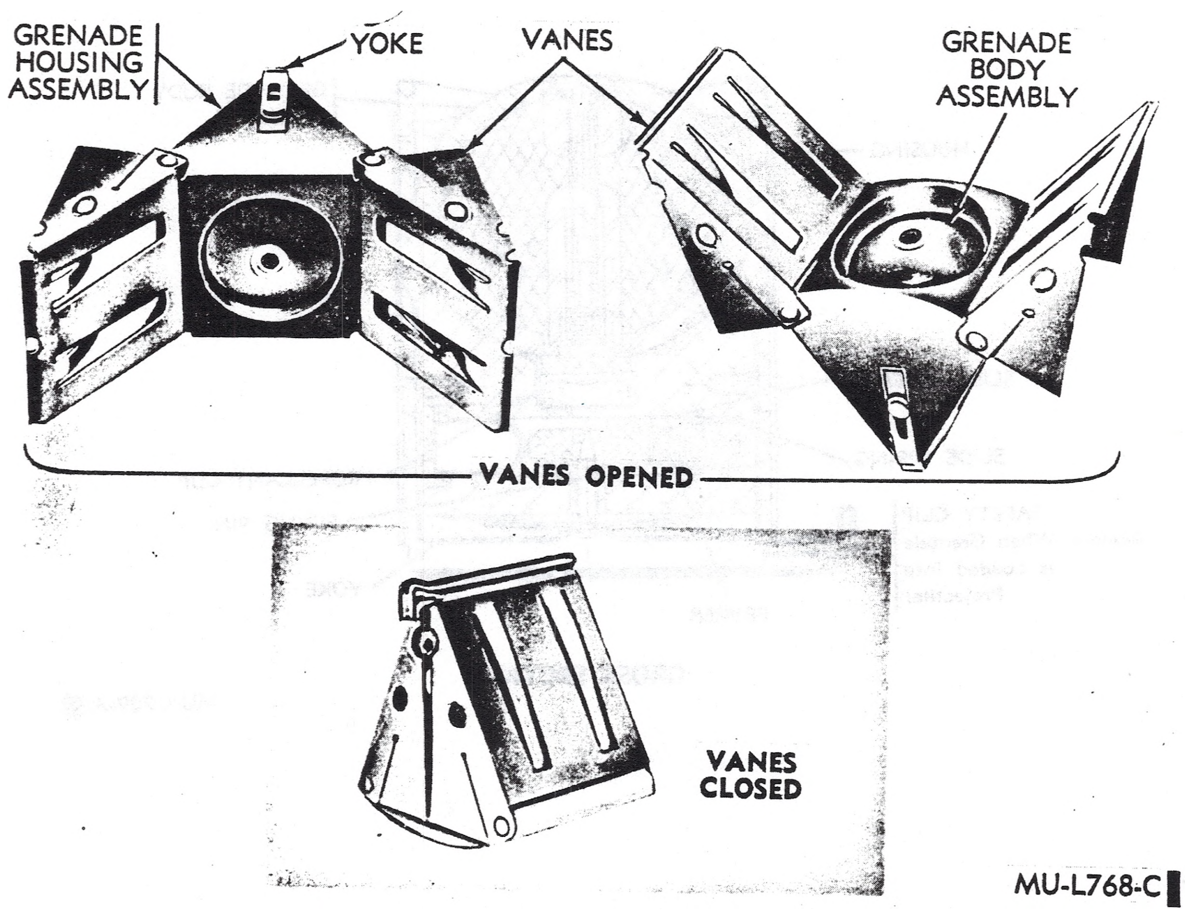


Figure 13-27 Grenade M43A1

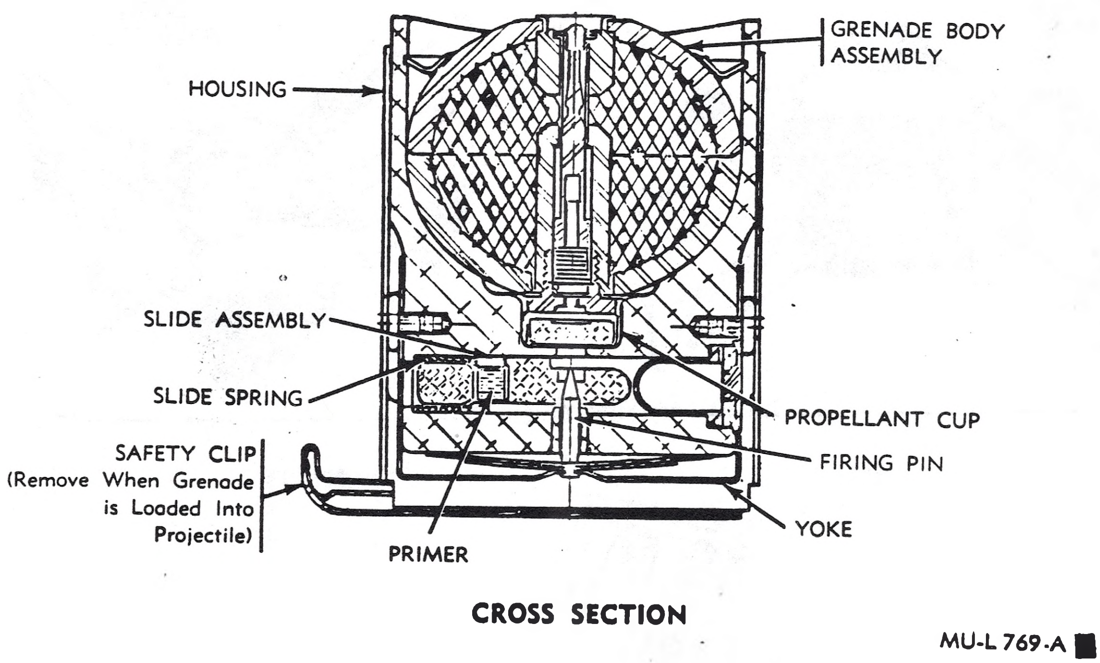


Figure 13-28 Grenade M43A1—Cross Section

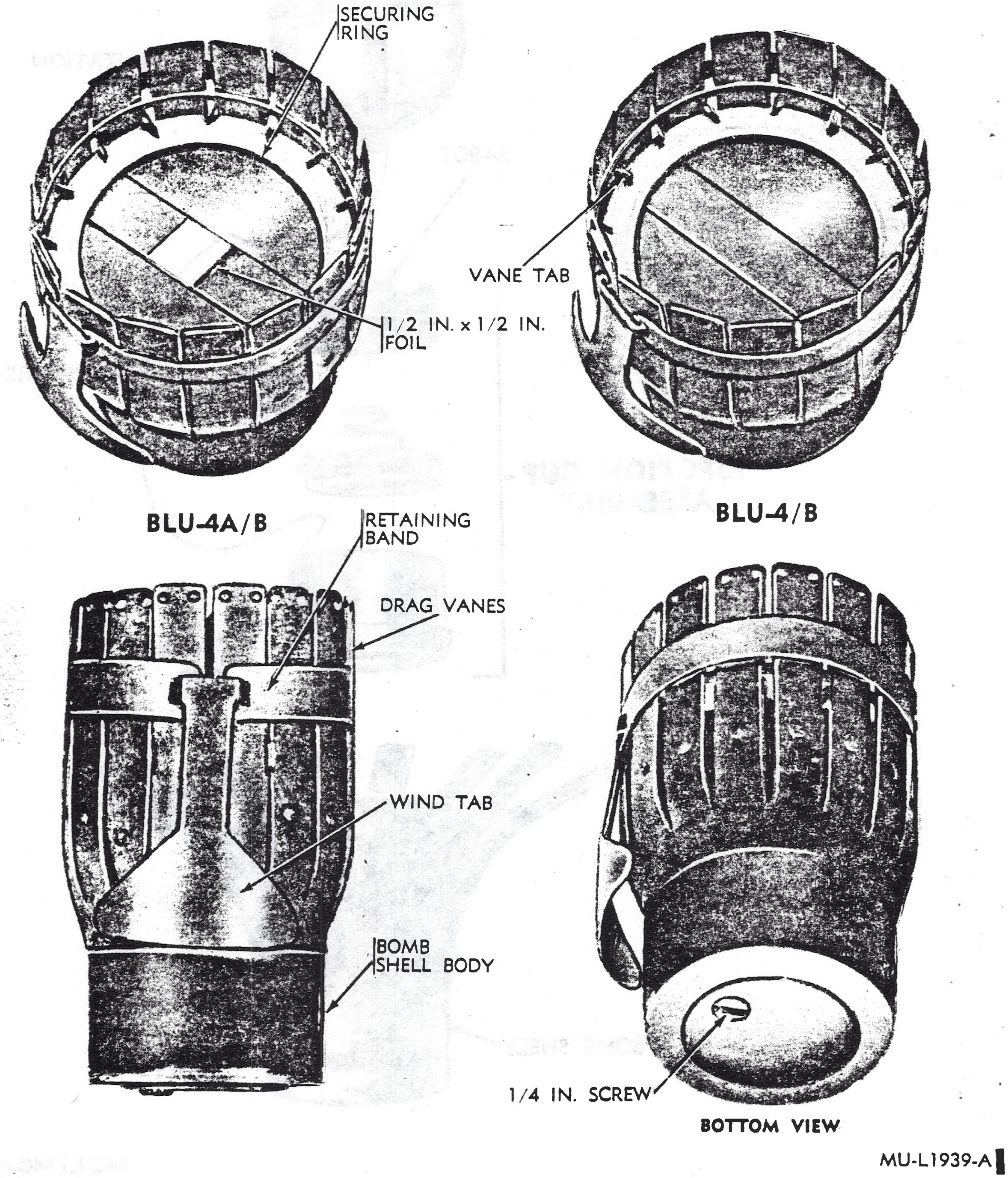


Figure 13–29. Fragmentation Bombs BLU–4/B and BLU–4A/B.

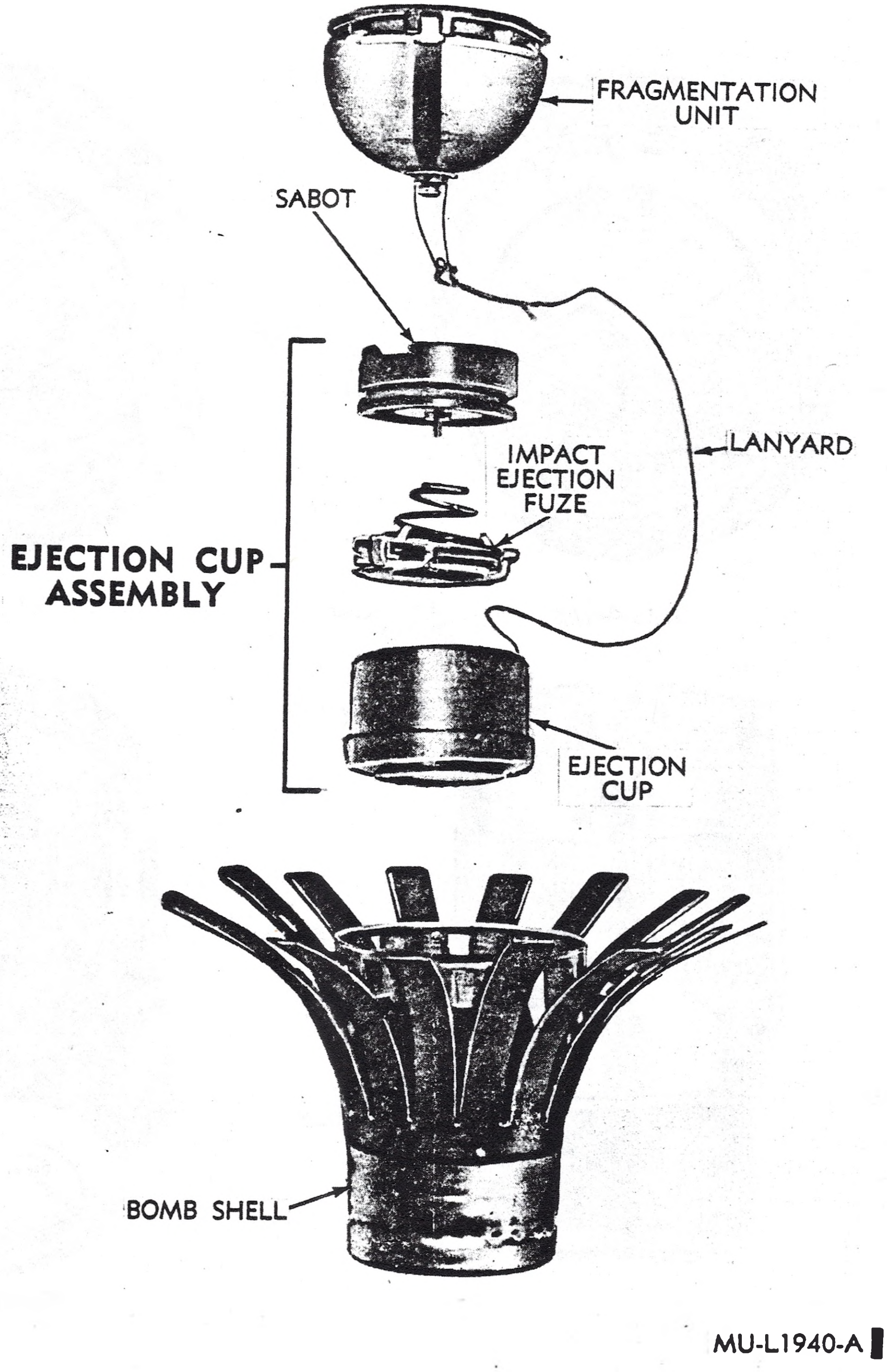


Figure 13–30. Major Components of BLU–4/B And BLU–4A/B Bombs—Explosive View (Retaining Band and Wind Tab Not Shown).

13-9. BOMBS BLU-4/B AND BLU-4A/B

13-9.1 Identification.

13-9.1.1 Type.

13-9.1.1.1 The bombs BLU-4/B and BLU-4A/B (figure 13-29) are air delivered, drag-vane stabilized, impact ejected, lanyard fired, high explosive, antipersonnel fragmentation bombs.

13-9.1.1.2 The bomb BLU-4/B is used with the SUU-7/A dispenser. This combination is designated CBU-1/A. The bomb BLU-4A/B is used with the SUU-7A/A dispenser. This combination is designated CBU-1A/A.

13-9.1.2 Painting and Marking. The bomb shell is brass colored. The drag vanes are painted olive drab. The sabot (adapter-striker) is colored black, with a steel colored steel firing pin. The fragmentation unit is colored silver.

The markings are either black or yellow.

13-9.1.3 Fittings and Features.

13-9.1.3.1 The external characteristics of the bombs BLU-4/B and BLU-4A/B are shown in figure 13-29. The components of these bombs are shown in figure 13-30. Each of these bombs consist of a bomb shell, an ejection cup assembly (with fuze), a fragmentation unit (with fuze), and a lanyard.

13-9.1.3.2 Bomb Shell. The bomb shell (figure 13-29) consists of the bomb shell body and a 16-drag-vane stabilizer. The drag vanes are held in the closed position by a ½-inch wide metal retaining band. The band in turn is secured by a metal wind tab. The bottom of these bombs contain a ¼-inch machine screw which is inserted just prior to the time the bomb is placed in the dispenser.

13-9.1.3.3 Ejection Cup Assembly. This component consists of an impact ejection fuze (with a conical spring), and a sabot, housed within the metal ejection cup. The ejection cup contains an ejection charge. The ejection cup assembly is located at the base of the bomb shell. A spring-loaded primer cam is held in the out-of-line position by the firing pin which fits into a hole in the cam.

13-9.1.3.4 The Fragmentation Unit. The fragmentation unit (figure 13-30 and 13-31) is hemispherical in shape and is located in the upper portion of the bomb shell, above the ejec-

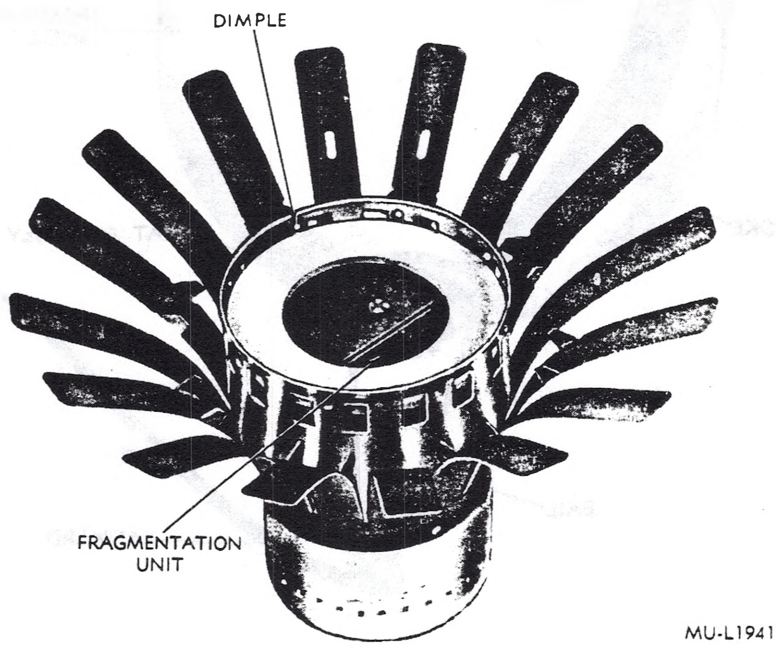


Figure 13-31 Fragmentation Unit (Armed)

tion cup assembly. A fuzing device, containing a spring-loaded detonator slide, is held in the safe position by a spring-loaded locking pin. The locking pin is held in the "in" positon by a yoke which has one end locked under the hat assembly, the other end is fitted into a groove on the base of the fuzing device.

13–9.1.3.5 Lanyard. The lanyard (figure 13–30) which is 10 feet long, has one end attached to a bail on the hat assembly, (figure 13–32). The opposite end is secured to the bomb shell under the ejection detonator rotor.

13–9.1.3.6 Weights. The BLU–4/A and BLU–4A/B bombs weigh 1.18 pounds.

13–9.1.3.7 Materials. The bomb shell body, wind tab, retaining band, and framentation unit body are steel. The sabot is made of phenolic and steel (steel firing pin embedded in plastic). The fragmentation unit fuzing assembly is aluminum. The lanyard is nylon.

13–9.1.3.8 Hazardous Components. The BLU–4/B contains approximately 2.82-ounces (approximately 81 grams) of RDX. The BLU–4A/B contains approximately 2.82-ounces (approximately 81 grams) of RDX or cyclotol.

13–9.1.4 Fuctioning. When the bomb is dispensed, the air stream strips the wind tab from the drag vane retaining band. The retaining band falls free, allowing the drag vanes to open. Opening of the drag vanes allows the conical spring (on the impact ejection fuze) to force the sabot and the fragmentation unit slightly

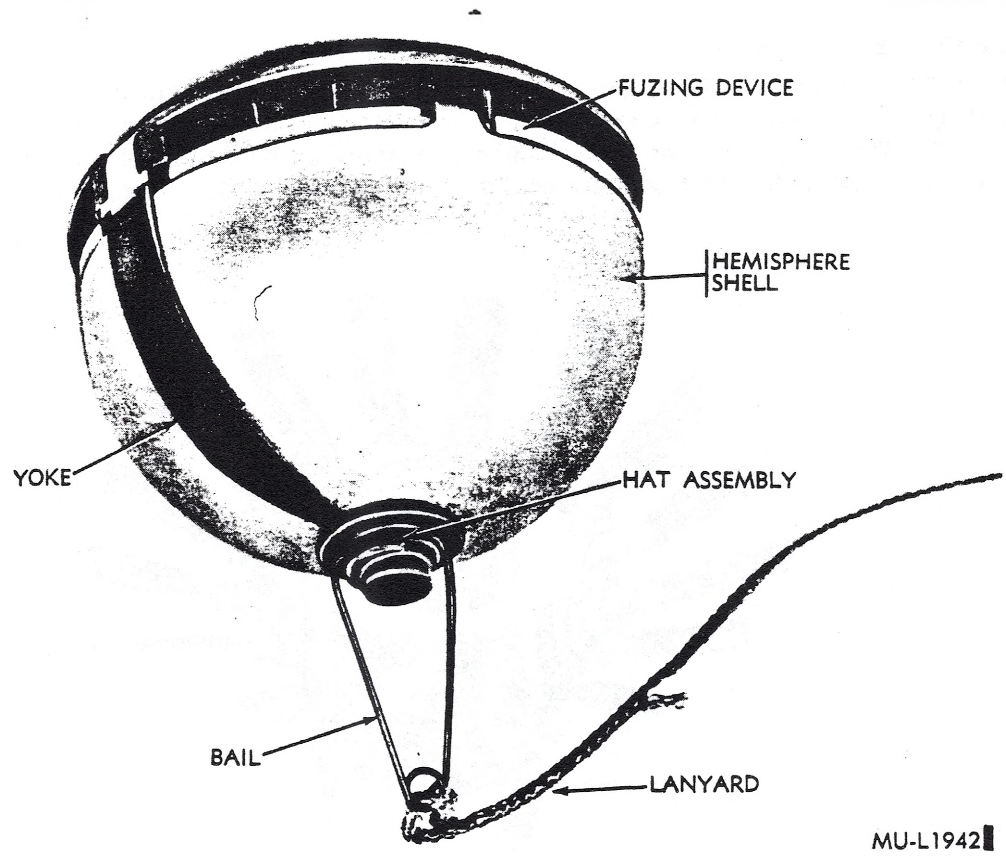


Figure 13–32 Fragmentation Unit (Unarmed)

upward, removing the firing pin from the hole in the cam which incorporates the primer. This action allows the rotor to rotate to the in-line position, arming the ejection cup assembly.

Upon impact, the firing pin is driven into the primer of the delay assembly located above the ejection charge, igniting the ejection charge (figure 13-33). Gas pressure from the ejection charge drives the fragmentation unit and the sabot into the air. The fragmentation unit is arrested in flight by the lanyard. The tension on the lanyard causes the bail on the fragmentation unit to move down and out, thereby allowing the yoke to be ejected. Removal of the yoke from beneath the yoke releases spring permits the release pin of the fragmentation unit fuze to disengage itself frcm the slide, thereby permitting the spring loaded detonator slide to move. The movable detonator slide is forced into the fixed firing pin of the explosive fuze assembly, firing the M55 stab detonator which initiates the explosive train and detonates the fragmentation unit.

13-9.1.5 SAFETY PRECAUTIONS

a. The fixed firing pin may be resting upon the detonator of the spring loaded detonator slide, or the detonator slide may not have completed its movement.

b. Do not disturb or jar a bomb which has been ejected from a dispenser.

c. Do not attempt to disassemble these bombs.

d. Do not attempt to disentangle a tangled lanyard.

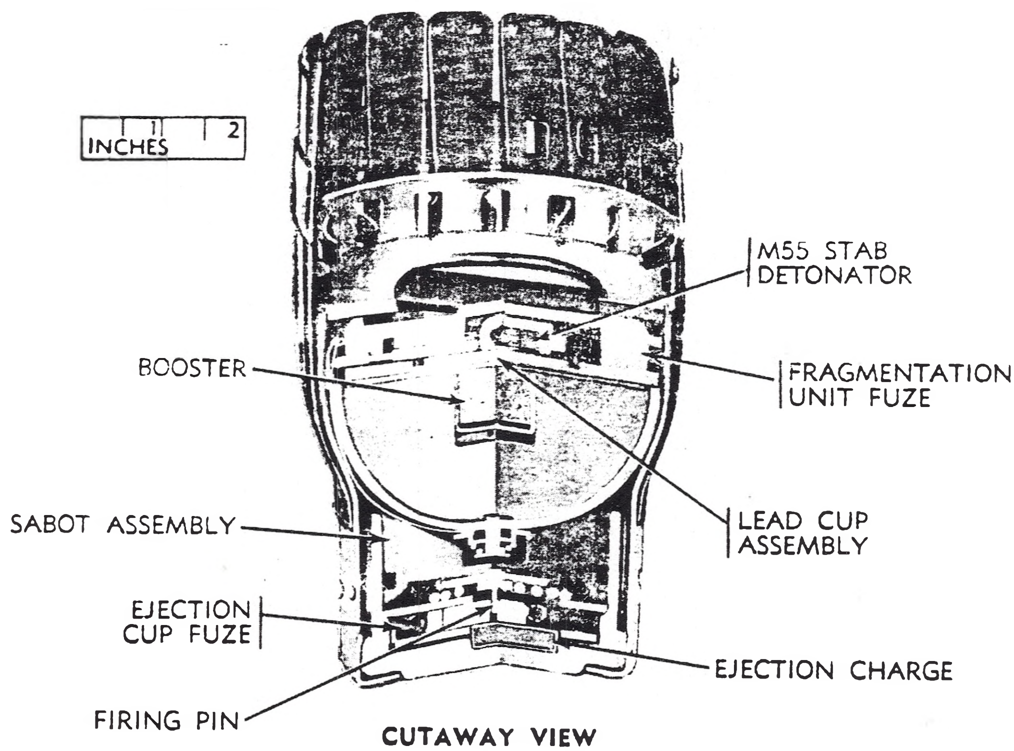


Figure 13-33 Cutaway of BLU-4/B or BLU-4A/B Bomb

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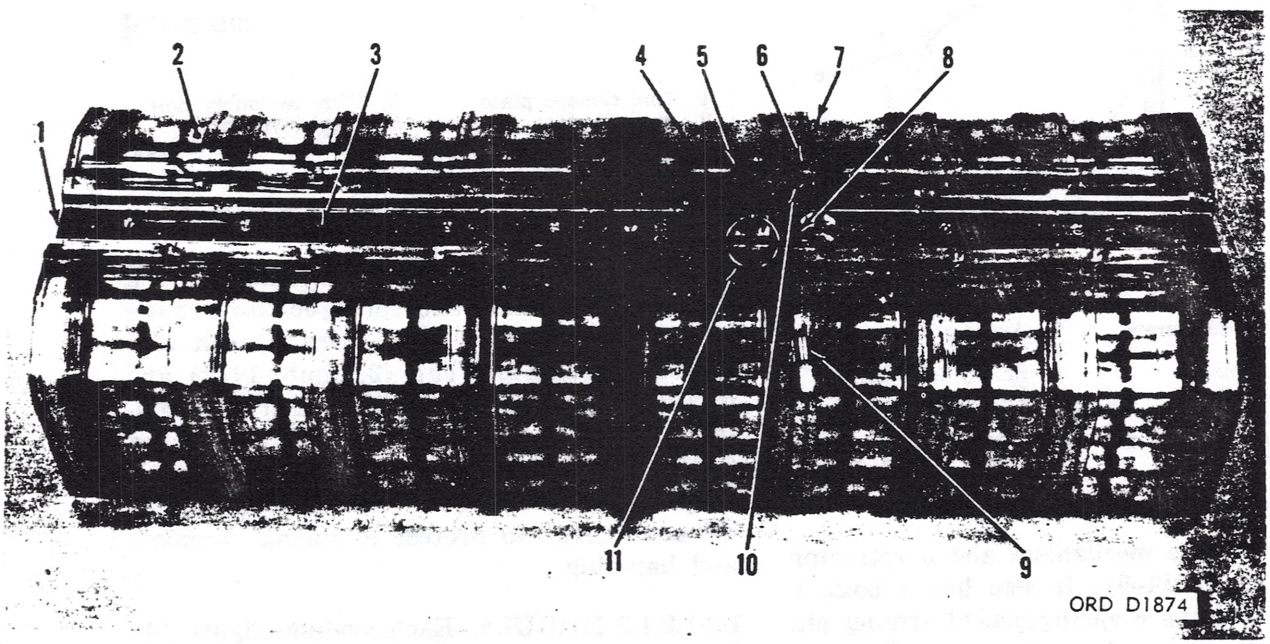
SECTION 14

DISPENSERS, CLUSTERS AND CLUSTER ADAPTERS

14-1. CANISTER CLUSTERS.
50-Pound Tactical CS Canister Cluster, E158-R2, with Mechanical Time Initiator E63R2 is covered in this paragraph.
14-1.1 IDENTIFICATION.
14-1.1.1 TYPE. Canister Cluster E158R2 is a hand-dropped, helicopter-delivered cluster, consisting of eight modules. Each module contains 33 CS Canisters E49.
14-1.1.2 PAINTING AND MARKING. The canister cluster is clear plastic with a gray decal affixed to each of the outer modules. The decal has one red and one yellow stripe. All data markings are in red.

14-1.2 FITTINGS AND FEATURES.

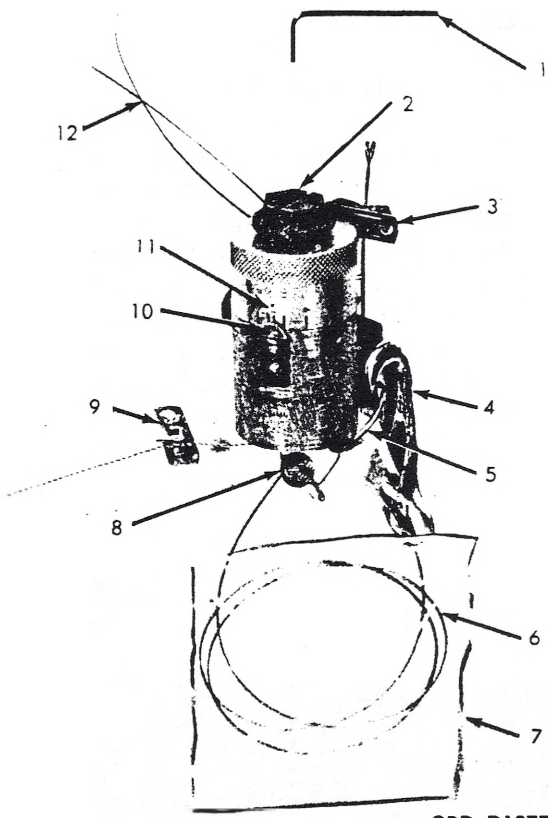
14-1.2.1 CANISTER CLUSTER E158R2. The cluster consists of Initiator E63R2 (figure 14-2), eight heat-sealed modules (figure 14-3), two junction blocks (figure 14-1), a fuze bar assembly (figure 14-1) and a fuze assembly (figure 14-4). The fuze assembly consists of a red safety cap (1, figure 14-1), a safety cotter pin (11), and eyebolt (10), and a spring-loaded detonator slide (8) held in place by a fuze arming wire (6). The fuze arming wire has a loop (7) and a rubber sleeve (9).



1 Fuze bar assembly
2 Module
3 Junction block
4 Fuze assembly
5 Red safety cap
6 Fuze arming wire
7 Loop
8 Spring-loaded detonator slide
9 Rubber sleeve
10 Eyebolt
11 Safety cotter pin

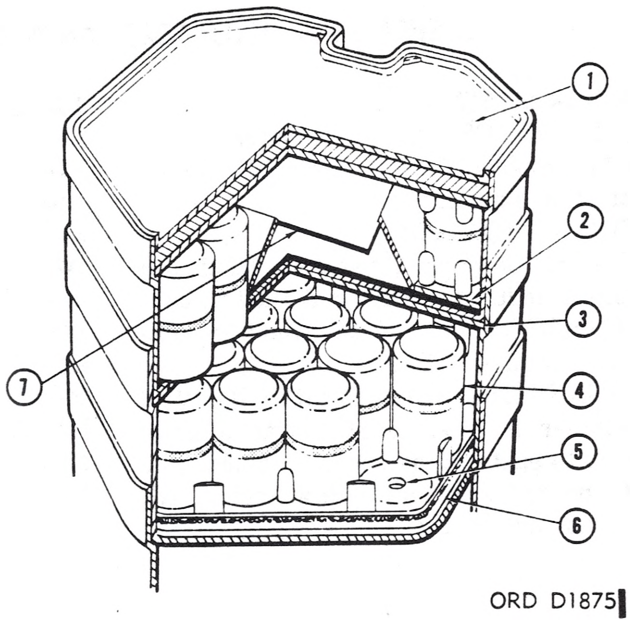
Figure 14-1 50-Pound Tactical CS Canister Cluster E158R2

14-1.2.1.1 INITIATOR E63R2 (figures 14-2 and 14-5). Initiator E63R2 is a mechanical time initiator that provides an air burst capability to Canister Cluster E158R2. The initiator does not contain any explosive items. The initiator is a cylindrical aluminum body



1	Socket-head screw key	6	Arming wire
2	Plastic plug	7	Bag
3	Fahnstock clip	8	Safety lock wire
4	Large snap hook	9	Fahnstock clip
5	Safety ring and pin assembly	10	Altitude indicator
		11	Altitude setting scale
		12	Locking wire

Figure 14–2 Initiator E63R2



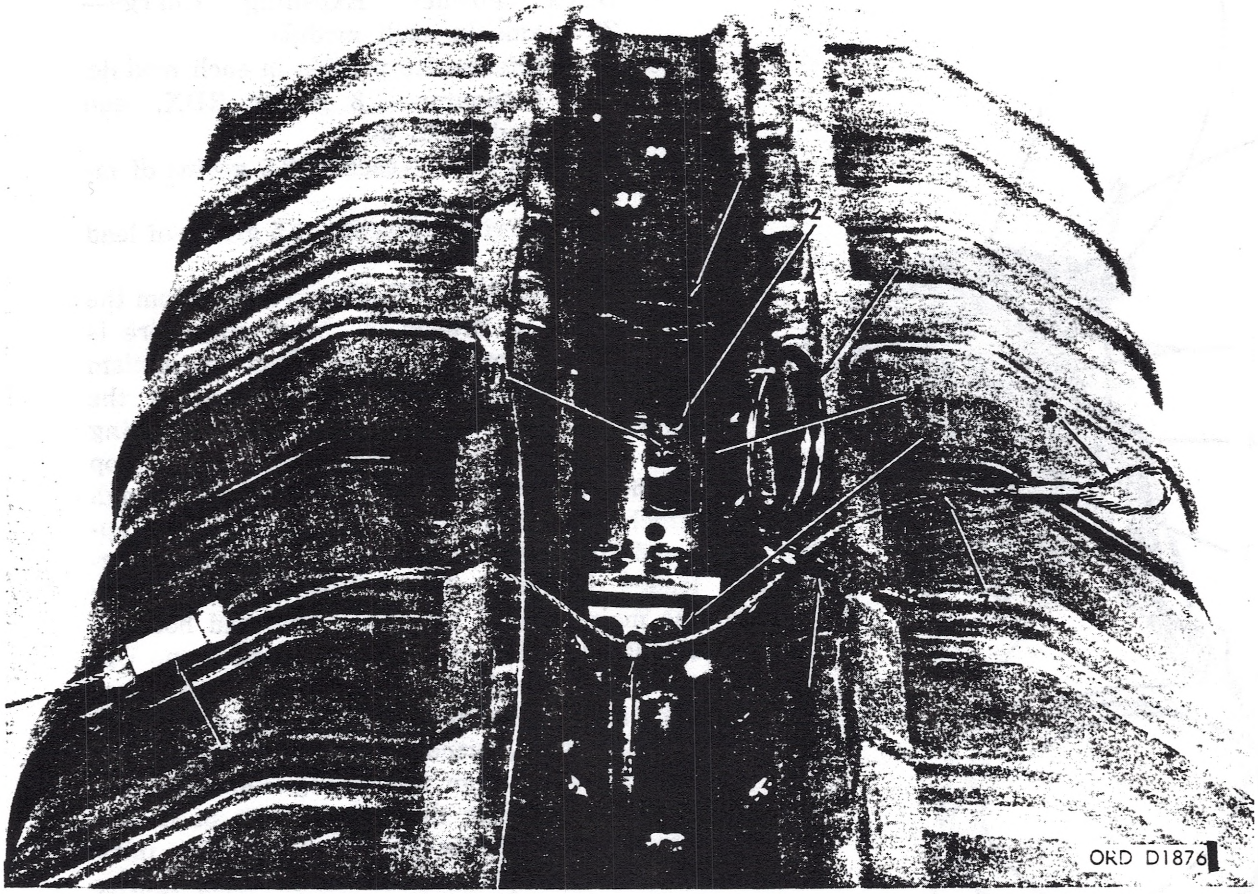
1	End closure plate	5	Fuze assembly hole
2	Pusher plate	6	Explosive pads
3	Cover plate	7	Black powder charge
4	Canister E49		

Figure 14–3 Cross Section of Two Modules

containing a time mechanism and a retractor shaft (1, figure 14–5). It also has a boss, a bracket containing a spring-loaded arming pin (4), a safety ring and pin assembly (5, figure 14–2), a red locking screw (2, figure 14–5) an altitude indicator (10, figure 14–2), an altitude setting scale (11), and locking wire (12). A lead sealed safety lockwire (8) secures the safety ring and pin assembly (5) to the boss prior to air drop. In addition, the initiator has a three-branch arming wire (6). One branch has a formed wire clip (3, figure 14–5) which connects to the fuze arming wire on the cluster; the second branch contains a fahnstock clip (9, figure 14–2) and is fed through the bracket and spring-loaded arming pin (4, figure 14–5); the third branch also contains a fahnstock clip (3, figure 14–2) and is fed through the boss. The other end contains a large snap hook (4) which is attached to the ring and pin assembly (5) prior to air drop. A plastic plug (2) is attached to the retractor shaft to protect it during shipment and handling.

14–1.2.1.2 MODULE. Each module (figure 14–3) is made of molded plastic and contains 33 Tactical CS Canisters E49 (4). The fuze retainer of Tactical CS Canister E49 fits into the fuze assembly hole (5) in a plastic pusher plate (2) which rests on a plastic bag containing a black powder charge (7). Fuzes lead from the black powder charge to the fuze bar assembly.

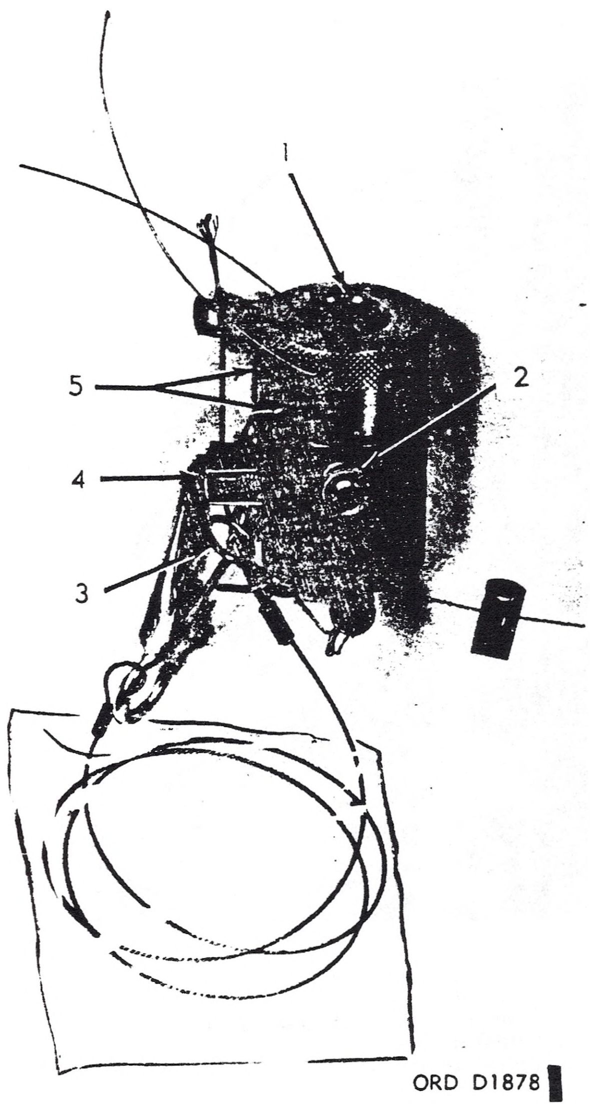
14–1.2.1.3 FUZE ASSEMBLY. The cluster fuze assembly provides a method of initiation,



1 Red safety cap
2 Setscrew
3 Safety cotter pin
4 Slide release pin housing
5 Fuze housing
6 Loop
7 Fuze arming wire
8 Eyebolt
9 Spring-loaded detonator slide
10 Rubber sleeve
11 Slide release pin

Figure 14–4 Fuze Assembly

delay and explusion of the E158R2 cluster payload. The fuze assembly (figure 14–4) consists of a slide-release pin housing (4) secured to a fuze housing (5), a safety cotter pin (3), a red safety cap (1), and a slide-release pin (11) which contains a setscrew (2) a firing pin, two Primers X310A, and a spring-loaded detonator slide (9) containing Detonator M55. A fuze arming wire (7) is threaded through an eyebolt (8), a hole in the rib on top of the cluster and the spring-loaded detonator slide (9). One end is retained by a rubber sleeve (10) fastened to the cluster, and the other end contains a loop (6). The spring-loaded detonator is held in the retarded position by the retractor shaft of Initiator E63R2. The internal fuzing, delay and expulsion system are shown in figure 14–6. The two delay fuzes are located on the top-center line of the cluster and are covered by an aluminum bar. The eight lead-jacketed delay fuzes and the eight expelling charges are located internally. There is one black powder expelling charge located on the inner side of each module.



1 Retractor shaft
2 Red locking screw
3 Formed wire clip
4 Spring-loading arming pin
5 Stop pins

Figure 14–5 Initiator E63R2

14–1.3 WEIGHTS AND DIMENSIONS.

Length	27.5 inches
Height	10.02 inches
Width	10.28 inches
Weight	47 pounds

14–1.4 MATERIALS. The initiator, fuze, and fuze bar cover are aluminum. The modules and fuze bar are plastic.

14–1.5 HAZARDOUS COMPONENTS.

a. Black Powder Expelling Charge—25 grams in each module.
b. CS Mixture—2.6 pounds in each module.
c. M55 Detonator—1.3 grains RDX, lead azide and NOL 30.
d. Junction Block (each)—2.5 grains of ignition mix.
e. X310A Primer (each)—1.5 grains of lead azide.

14–1.6 FUNCTIONING. Upon release from the helicopter, one branch of the arming wire is withdrawn, allowing the clockwork mechanism of the initiator to start functioning. At the same time, a second branch of the arming wire is withdrawn from the boss on the top of the initiator, clearing an opening through which the retractor pin may move in an upward direction. The arming wire in the spring-loaded detonator slide, which is connected to the main arming wire by a loop and hook, is the last arming wire to be withdrawn. Upon expiration of the time set on the initiator, the initiator retractor shaft is withdrawn which, in turn, withdraws the slide-release pin (figure 14–6) from the spring-loaded detonator slide, allowing the detonator to be driven into the fixed firing pin. The detonator initiates the two primers which, in turn, ignites the two delay fuzes and functions the following components in sequence: the ignition compound in the junction blocks, eight delay fuzes, eight ignition cup assemblies and eight black powder expelling charges. The expelling charges are initiated at half-second intervals, starting at the two outer modules. As the modules are expelled, the ignition compound in Canisters E49 is ignited, functioning the canisters.

14–1.7 SAFETY PRECAUTIONS AND HAZARDS.

a. Remain upwind and have a protective field mask available when disposing of Clusters E158R2.
b. In the event Canister Cluster E158R2 accidentally functions, Canisters E49 are ejected at approximately 60 feet per sec-

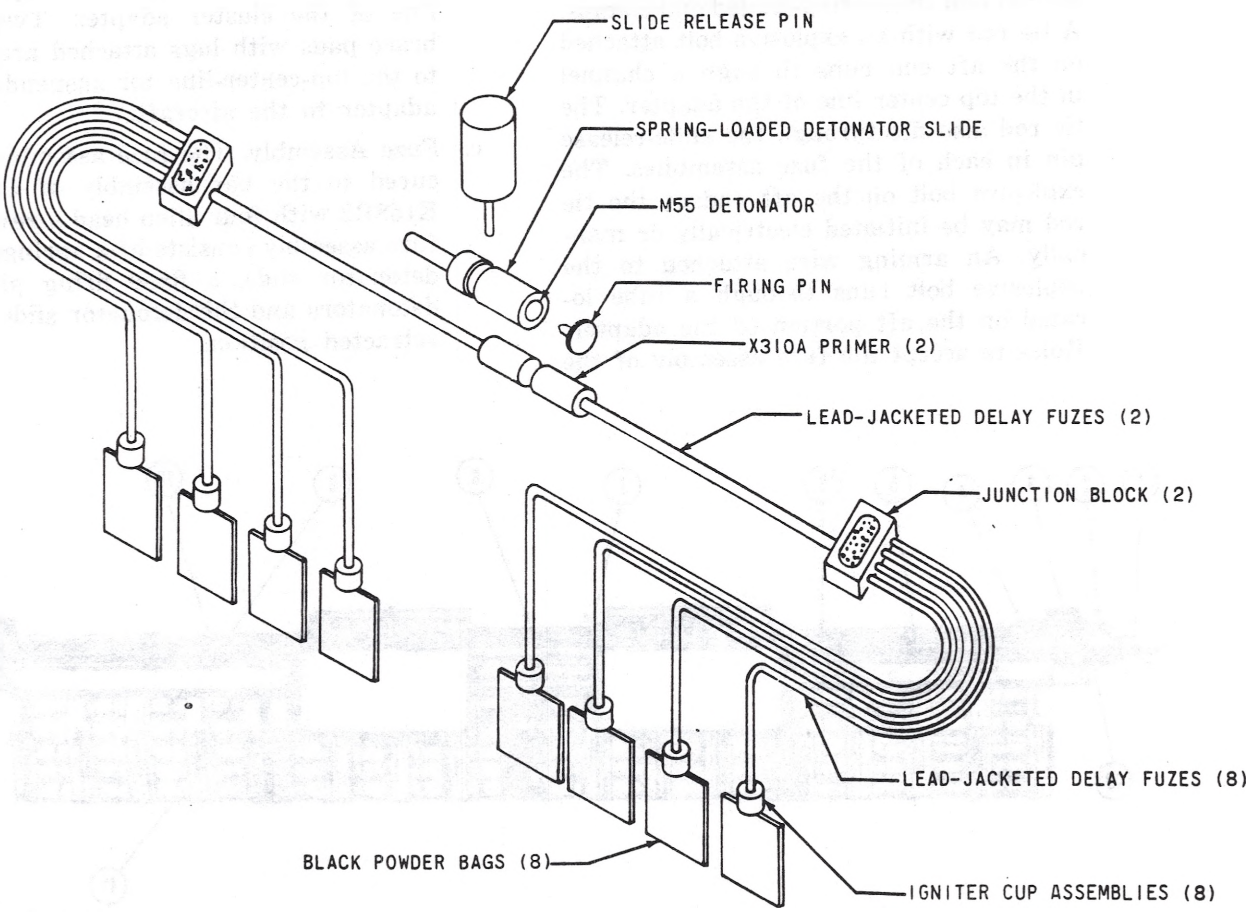


Figure 14-6 Fuzing System of CS Canister Cluster E158R2

ond, may travel approximately 500 feet and start secondary fires.

c. Place a heavy wire mesh screen or other suitable barrier over the burning pit when disposing of Canisters Clusters E158R2 to prevent the canisters from becoming ejected from the pit.

14-2. TACTICAL CS CANISTER CLUSTER 130 POUND, E159.

The 130 pound Tactical CS Canister Cluster E159 is covered in this paragraph.

14-2.1 IDENTIFICATION.

14-2.1.1 TYPE. Canister Cluster E159 (figure 14-7) is composed of two Canister Clusters E158R2 assembled to Cluster Adapter XM43. Canister E159 is designed to be released from fixed-wing low-performance aircraft or helicopter.

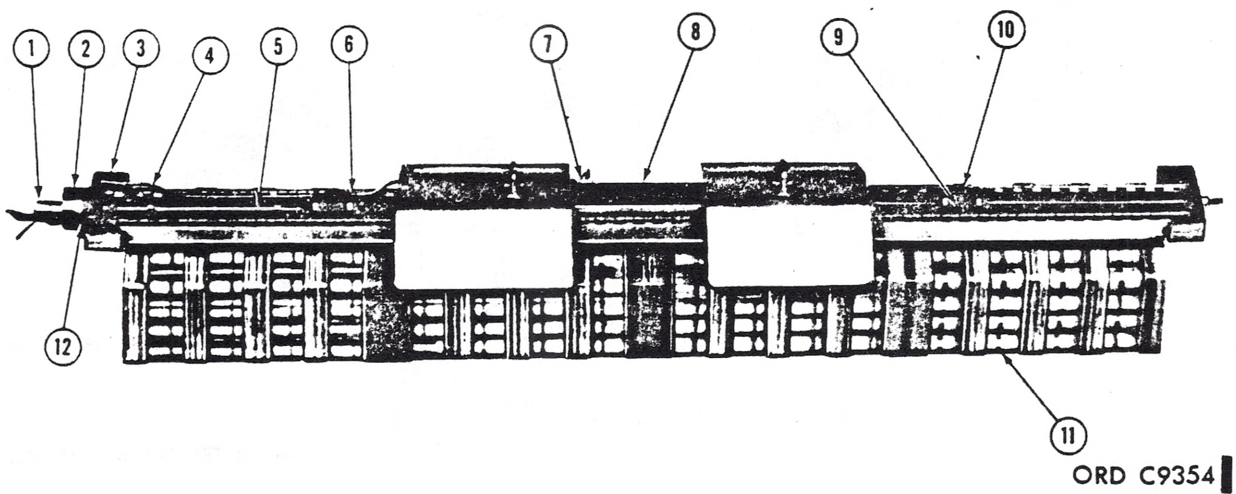
14-2.1.2 PAINTING AND MARKING. The clusters are clear plastic with a gray decal affixed to each of the outer modules and a gray decal affixed to the sway brace pad of the cluster adapter. The decals have one red and one yellow stripe. All data markings are in red.

14-2.2 FITTINGS AND FEATURES.

a. The general characteristics of Canister Cluster E159 are shown in figure 14-7.

b. The cluster adapter consists of a rectangular, hinged, spring-loaded center section and two spring-loaded end clamps. A tie rod with an explosive bolt attached on the aft end runs through a channel in the top center line of the adapter. The tie rod also fits through the slide-release pin in each of the fuze assemblies. The explosive bolt on the aft end of the tie rod may be initiated electrically or manually. An arming wire attached to the explosive bolt runs through a tube located on the aft portion of the adapter. Holes to accept the fuze assembly of the canister clusters are located at the 1/4 and 3/4 positions along the top-center-line of the cluster adapter. Two sway brace pads with lugs attached are bolted to the top-center-line for suspending the adapter to the aircraft.

c. Fuze Assembly. The fuze assembly is secured to the bar assembly of Canister E158R2 with four allen head screws. The fuze assembly consists of a spring-loaded detonator slide, a fixed firing pin, two detonators and the detonator slide in the retracted position.



1 Explosive bolt assembly
2 Collar
3 Spring-loaded end clamps
4 Arming wire tube
5 Tie rod
6 Bracket release
7 Arming wire
8 Strongback assembly
9 Safety cotter pin
10 Safety cap
11 Canister Cluster E158
12 Electrical connector

Figure 14–7 130 Pound Tactical CS Canister Cluster E159

14–2.3 WEIGHTS AND DIMENSIONS.

Length	62.46 inches
Height (less suspension lugs)	10.02 inches
Width	10.28 inches
Weight	130.00 pounds

14–2.4 MATERIALS. The cluster adapter, explosive bolt assembly, fuze assembly and the fuse bar cover are aluminum. T[illegible] modules are clear plastic.

14–2.5 HAZARDOUS COMPONENTS.

a. Black Powder Expelling Charge—25 grams each module—total 1 pound (approximately).

b. CS Mixture—2.6 pounds each module—total 41 pounds (approximately).

c. M55 Detonator—1.3 grains RDX, lead azide and NOL 130—2 each.

d. Junction Block—2.5 grains of ignition mix, 4 each.

e. X310A Primer—1.5 grains lead azide—4 each.
f. Explosive Bolt—0.38 grain RDX.

14–2.6 FUNCTIONING.

NOTE

When two Canister Clusters E158R2 are adapted to the cluster adapter to comprise Canister Cluster E159, Mechanical Time Fuze Initiator E63R1 is not installed.

a. General. Canister Cluster E159 may be initiated by electrical or mechanical means. When the two Canister Clusters E158R2 are assembled to the cluster adapter, the cluster adapter tie rod is passed through a hole in the shaft of the slide release pin of the two fuze assemblies. The spring-loaded explosive bolt is attached to the aft end of the tie rod and a common hex bolt is attached to the forward end.

b. Electrical Release.
 (1) When the explosive bolt is initiated by the pilot, the aft end of the tie rod is sheared off, allowing the spring-loaded end caps to move outward. The outward movement of the end caps frees the hinged, spring-loaded flanges of the cluster adapter to move upward, freeing the two Canister Clusters E158R2. The clusters are thrust downward by four leaf springs located on the underside of the cluster adapter.
 (2) When Canister Clusters E158R2 separate from the cluster adapter, the slide release pin is withdrawn from the fuze assembly. Withdrawal of the slide release pin frees the spring-loaded detonator, allowing it to impinge on the fixed firing pin, initiating the detonator which, in turn, initiates the two primers.
 (3) The primers ignite the two delay fuses and function the following components in sequence: the ignition compound in the junction blocks, the eight delay fuses, the eight igniter cup assemblies, and the eight black powder expelling charges. Ignition of the black powder charges separates the modules and causes CS Canisters E49 to be initiated. The black powder charges are initiated at half-second intervals, starting at the two outer charges.

c. Mechanical Release. When Canister Cluster E159 is released mechanically, the cluster adapter is released with the two Canister Clusters E158R2 attached. An arming wire is attached to the shackle of the bomb rack and to explosive bolt on the cluster adapter. When the cluster adapter is released, the arming wire remains in the bomb shackle and is withdrawn from the spring-loaded explosive bolt. Initiation of the explosive bolt shears the end of adapter tie rod, allowing Canister Clusters E158R2 to be ejected. The operational sequence is the same as that for Canister Cluster E158-R2.

14-3. BOMB CLUSTERS.

Cluster, Incendiary Bomb, PT1, 750-pounds, M35 Cluster, Incendiary Bomb, TH3, 750-pound, M36, and M36E1 are covered in this paragraph.

14-3.1 IDENTIFICATION.

14-3.1.1 TYPE. Incendiary bomb clusters M35, M36 and M36E1 are hinged aimable type clusters with aerial burst being accomplished with two M152A1 mechanical time tail fuzes. Each cluster contains a number of incendiary bombs. The M35 and M36 are designed for internal carriage. The M36E1 is designed for external carriage.

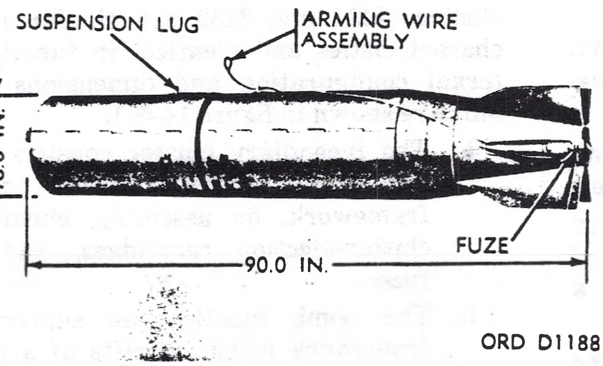


Figure 14-8. Cluster Incendiary Bomb, PT1, 750-Pound, M35.

14-3.1.2 PAINTING AND MARKING. M35 and M36 cluster of earlier manufacturer were painted gray with a purple band near the middle to identify them as an incendiary-type. Incendiary clusters of later manufacture are painted olive drab with a two-inch wide red band near the forward end. A 3/4 inch wide yellow band is located 1/2 inch to the rear of the red band. All other markings are painted in red lettering to the rear of the bands.

14-3.2 FITTINGS AND FEATURES.

14.3.2.1 The M35 and M36 are similar in outward appearance. The difference is in the payload. The M36E1 differs from the M36 in appearance in that it has a nose fairing and a reinforced tail fin. Either cluster consists of a cluster adapter M30 fitted with a burster, fin assembly M14, two tail fuzes and an arming wire M23 figure 14-9).

a. Bombs. The M35 cluster contains 57 incendiary bombs M74A1 (figure 5-2) loaded in cluster adapter M30 in three bundles of 19 bombs each. The total weight of a loaded M35 cluster is approximately 690.0 pounds. The M36 and M36E1 cluster contains incendiary bombs M126 loaded in cluster adapter M30 in three bundles of 61, 60 and 61 each. The total loaded weight of the M36 and M36E1 cluster is approximately 900.0 pounds. In either the M35, M36 or the M36E1 cluster, the bombs are arranged in bundles in such a way that the release bar or safety plunger on each bomb is depressed by an adjacent bomb.

b. Burster. The burster on either cluster consists of 19 feet of detonating cord, threaded through the hinge tube of the adapter when the cluster is manufactured, the continuing through the clips on the tie-rod, the guide tubes, and fuze holders of the fin assembly.

c. Fin Assembly. The fin assembly M14 consists of a sheet-steel fin-blade assembly and a tubular steel tie-rod assembly which holds the fin-blade assembly to the cluster by a threaded locking ring. Two fuze holders in fairings are welded to the fin-blade assembly. Fuze adapters are installed in the fuze holders, and guide tubes lead from each fuze adapter to the interior of the fin assembly. A fuze receptacle for an electric fuze is located in the threaded end of the tubular tie-rod assembly, and a plug receptacle, covered by a plastic plug, is located at the opposite end.

d. Fuzing. Two of either the M152 or AN-M152A1 mechanical time bomb fuzes are used for in-flight opening.

14-3.3 HAZARDOUS COMPONENTS.

a. Mechanical Time Fuzes, M152, AN-M-152A1 (para. 5-3).

b. Detonating Cord Burster.

c. Each M74A1 Bomb contains

(1) An incendiary filling of approximately 2.75 pounds of PT1, a mixture of magnesium with gasoline and other petroleum products thickened with isobutyl methacrylate.

(2) An igniting charge of approximately 6.0 ounces of white phosphorous.

(3) An expelling charge composed of two small bags of magnesium-black powder mixture.

(4) One M197 fuze containing a primer, a

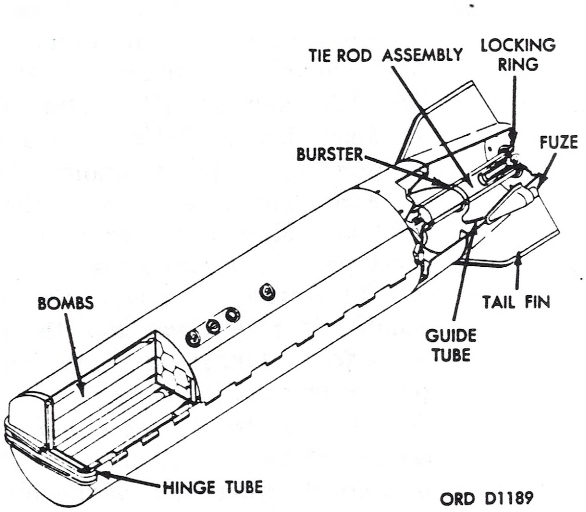


Figure 14–9. Cluster, Incendiary Bomb, PT1, 750-Pound, M35, Cutaway View.

delay mixture and a booster consisting of black powder and ignition powder.

d. Each M126 Bomb contains an incendiary filling of approximately nine ounces of thermate, TH3, a first-fire charge and a primer.

14–3.4 FUNCTIONING. Upon release of the cluster, the arming wires are withdrawn from the two mechanical time fuzes, allowing the arming pin spring to eject the arming pin. This allows the arming vane to rotate, arming the fuze when the primer detonator and the booster lead-in are brought into alignment. The timing disk is released, initiating action that frees the spring-loaded firing pin, which is driven into the primer-detonator. The primer-detonator sets off the detonating cord, cuasing separation of the cluster adapter, allowing the bombs to fall away separately, becoming armed as they separate from the bundles and from the cluster.

14–3A. INCENDIARY BOMB CLUSTER.

Cluster, Incendiary Bomb PT, 500-pounds. M31 and Cluster Incendiary Bomb, TH3, 500-pound, M32 are covered in this paragraph.

14–3A.1 IDENTIFICATION.

14–3A1.1 TYPE. Incendiary bomb clusters, M31 and M32 are nose ejection, aimable clusters, dual fuzed with the M152 series, mechanical time fuzes. Cluster M31 contains two bundles, each bundle contains 19 bombs of M74. Cluster M32 contains two bundles, each bundle contains 54 bombs AN–M50 series.

14–3A.1.2 PAINTING AND MARKINGS. Clusters M31 and M32 manufactured prior to 1960 were painted gray overall with a purple band and markings in purple. Clusters manufactured after 1960 are painted olive drab overall with a two-inch wide red band and a 3/4-inch yellow band. All markings are in red.

14–3A.1.3 WEIGHTS AND DIMENSIONS.

a. Cluster M31. This cluster is 57-inches long and 15.125-inches in diameter. The cluster weighs 562 pounds when assembled.

b. Cluster M32. This cluster is 60-inches long and 14.9 inches in diameter. When assembled, the cluster weighs 617 pounds.

14–3A.2 FITTINGS AND FEATURES. The clusters M31 and M32 are similar in physical characteristics and identical in functioning. External configuration and dimensions of cluster M31 are shown in figure 14–9.1.

a. The incendiary cluster consists of a cluster adapter, adapter casing, nose plate, framework, fin assembly, cluster burster, cluster-ejection cartridges, and two tail fuzes.

b. The bomb bundles are supported by a framework which consists of a buckle bar, cluster bar, strapping band, front end plate and a rear end plate.

c. Three cluster-ejection cartridges are installed in the cartridge containers. The cartridges are similar to shot gun shells and furnish the gases which eject the framework from the casing.

d. The M152 series tail fuzes are mechanical time, delay arming, airburst type fuzes

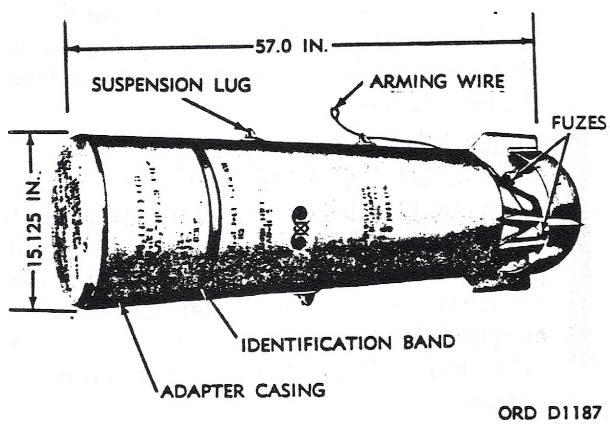


Figure 14–9.1. Cluster, Incendiary Bomb: PT1, 500–Pound, M31.

containing a cocked firing pin. The fuze vanes are painted red.

14-3A.3 HAZARDOUS COMPONENTS. Each cluster contains a burster (40-inches of detonating cord), three ejection charges containing black powder, two M152 series tail fuzes. The payload of the Cluster M31 consists of 38 bombs M74, each bomb contains 3.75-pounds of PT1. The payload of the cluster M32 consists of 108 bombs M50 series, each bomb contains .63-pound of TH3.

14-3A.4 MATERIELS. The clusters M31 and M32 bodies and inert components are made of steel.

14-3A.5 FUNCTIONING. Release of the cluster withdraws the arming wires from the fuzes, allowing the arming pin to be ejected, starting the clock mechanism. At a preset time, the firing pin is released and is driven into the detonator. The detonator, through a lead-in initiates the booster which in turn detonates the burster. Concussion from the burster depresses the diaphrams of the cartridge ejection assembly, causing the strikers to be driven into the ejection cartridge primers. Gas pressure from the functioned ejection cartridges force the rear end plate of the framework toward the nose of the cluster, carrying the bomb bundles with it. As the framework clears the cluster casing, the strapping falls away, the assembly breaks apart, freeing the individual bombs.

14-3A.6 SAFETY PRECAUTIONS

a. The fuzes of these clusters contain cocked strikers.
b. Have a field service mask available when performing procedures on clusters containing irritant agents.
c. Clusters containing incendiary agents present a fire hazard.

14-3B. SAFETY PRECAUTIONS AND HAZARDS.

a. Thermate fires cannot be extinguished. Water should never be used. Sand may be used to insulate the fire from other objects and material.
b. The M152 series fuzes contain a cocked striker.
c. Fumes from burning TH3 are toxic.
d. The firing mechanism of the M126 bomb contains a free floating striker.

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14–4 XM18 DISPENSER.

14–4.1 IDENTIFICATION.

14–4.1.1 TYPE. The XM18 dispenser (figure 14–10) is designed to be carried externally on low-performance aircraft. XM18 is a modification of the SUU–14/A dispenser.

14–4.1.2 PAINTING AND MARKING. The dispenser is anodyne treated and unpainted. 14–10) is designed to be carried externally on low-performance aircraft. XM18 is a modification of the SUU–14/A dispenser.

14–4.1.2 PAINTING AND MARKING. The dispeser is anodyne treated and unpainted. Color bands on the nose fairing assembly indicate the type of filler loaded in the munition. All data markings are stenciled in yellow on the skin assembly of the dispenser.

14–4.2 FITTINGS AND FEATURES.

a. The XM 18 dispenser is composed of six exposed tubes stacked together to form a triangular configuration. A skin assembly located midway between the ends of the dispenser, support the tubes and two suspension lugs are attached to the skin assembly. The forward end of the dispenser is covered with a nose fairing.

b. The nose fairing covers the RADHAZ filter, selector switch and an electrical harness.

c. A jumper plug access cover and part of the main electrical harness are located on the nose fairing which is attached to a bulkhead by screws.

d. A lock pin with a red tag attached is located on the nose fairing. When the lock pin is in place, the electrical circuit of the dispenser is open and grounded. A left or right adapter is connected to an umbilical cord.

e. Breech blocks thread into the breech assemblies which are attached to the bulkhead. Each breech assembly houses an ejector cartridge and electrical contacts.

f. Each tube contains a payload, a spring, a piston and an end plug. The end plugs are secured in the aft end of the tubes by rivets.

14–4.3 HAZARDOUS COMPONENTS. The tubes of this dispenser contain the payload. Each of the breech assemblies contains an ejection cartridge.

14–4.4 MATERIALS. The dispensers are made of aluminum, except for the pistons, suspension lugs and springs, which are made of steel.

14–4.5 FUNCTIONING.

a. Prior to take-off, the electrical circuit of the dispenser is closed by removing the lock pin from the nose fairing.

b. Electric current from the aircraft, through the firing circuit, fires the ejection cartridges. The cartridges then produce gas pressure within the breechblocks and tubes. This pressure causes the end plugs to be blown off the tubes and the spring, piston and payload are ejected from the aft end of each tube.

c. A selector switch is located in the aircraft. When the selector switch is set for single-tube firing, the payload of a single tube is dispensed each time the firing switch is depressed. If the selector switch is set for ripple firing, all six tubes fire in sequence to dispense the payload when the firing switch is depressed.

14–4.6 SAFETY PRECAUTIONS.

a. Avoid electrical initiation of the ejection cartridges in the dispenser. Initiation of cartridges will result in the ejection of munitions from the dispenser tubes.

b. Isolate the ejection cartridges from the dispenser electrical circuit before removing the dispenser from an aircraft or when it is suspected that a dropped dispenser contains a full or partial payload.

c. Do not attempt to pry or force munitions from the tubes. Movement of one munition against another could cause a detonation.

1. ACCESS COVER
2. ACCESS COVER GASKET
3. ELECTRICAL JUMPER PLUG
4. LOCK PIN AND STREAMER
5. NOSE FAIRING ASSEMBLY
6. MAIN WIRING HARNESS
7. ELECTRICAL HARNESS ASSEMBLY
8. SAFETY SWITCH ASSEMBLY
9. SELECTOR SWITCH ASSEMBLY
10. ROTARY SELECTOR
11. LEADS
12. RADHAZ FILTER ASSEMBLY
13. BREECH BLOCK ASSEMBLY
14. EJECTION CARTRIDGE ASSEMBLY
15. BULKHEAD ASSEMBLY
16. BREECH ASSEMBLY
17. PISTON AND SPRING ASSEMBLY
18. BOMB XM144
19. END PLUG
20. TUBE
21. SUSPENSION LUG
22. LUG ADAPTER
23. SKIN ASSEMBLY

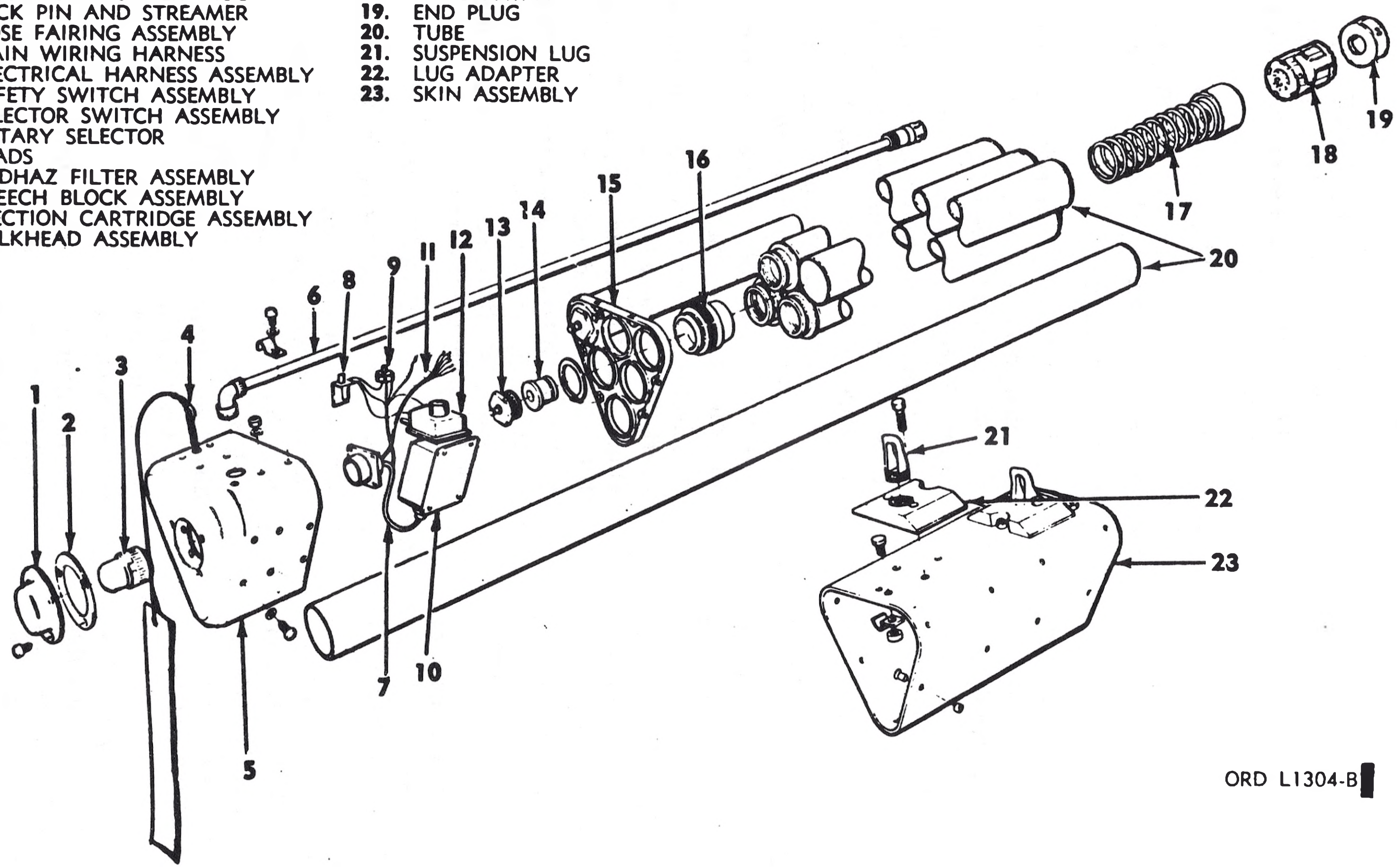


Figure 14–10. XM18 Aircraft Dispenser

SECTION 15

TOXIC CHEMICAL AGENT MUNITIONS

(U) NOTICE

The following applies during peacetime operations only.

a. Public Laws 91-121, 91-441, and 91-190 place certain restrictions on movement and disposal of lethal chemical and biological warfare agents and munitions. However, none of these restrictions will prevent the EOD commander from taking immediate action to provide for necessary transport and chemical neutralization of lethal chemical or biological material when the health or safety of any person is endangered.

b. Normally, however, immediate disposal should not be necessary. When time permits, the EOD unit commander should contact his EOD control detachment so that the best possible equipment and expertise available in the Army may be brought to bear. The Army wishes to avoid any possible dual standard in disposal operations. Technical assistance in handling suspected chemical rounds and agents can be received by contacting the US Army EOD Center, Picatinny Arsenal, Dover, New Jersey (Duty: 201-328-4010/4241, non-duty 201-328-4021; AUTOVON 880 plus extension).

c. EOD units responding to incidents involving suspected or actual chemical or biological agents will furnish the information contained in the Explosive Ordnance Incident Report, DA Form 3265-R, by priority message to:

DA for LOG-DPD-PB-EOD and for FOR-CN.

CGUSAMC for AMCSA-ND.

d. Initial report will be protected, as a minimum, as For Official Use Only.

This section contains information on munitions containing the below listed torix chemical agents. Decontamination of these agents is contained in FM 9–15.

a. Choking Agents (CG and DP). These agents cause injury to the respiratory tract (nose, throat, and lungs). In extreme cases, membranes swell, lungs become filled with liquid, and death results from lack of oxygen.

b. Blood Agents (AC and CK). These agents are absorbed into the body primarily by breathing, and affect the body functions by interfering with the normal transfer ox oxygen from the lungs via the blood and body tissues.

c. Blister Agents (HD, HT, HN, HI, L, PD, ED, MD, and CX). Blister agents are intended for casualty effect; the use of ground may be restricted, movement slowed, and use of materiel or installations hampered. These agents affect the eyes and lungs and blister the skin. Most blister agents are insidious in action, there is little or no pain at the time of exposure except to L and CX which causing pain immediately upon contact.

d. Incapacitating Agents (BZ). Incapacitating agents produce physiological or mental effects (mental aberrations) that prevent exposed personnel from performing their duties for a significant period of time; there is complete recovery from the effects.

e. Nerve Agents (GA, GB, GD and VX). Nerve agents may be absorbed into the body by breathing, ingestion or through the skin. These agents are highly toxic, lethal agents which act as anticholinesterase, causing incapacitation or death, depending upon the degree to which the cholinesterase if affected. These agents affect the nervous systems to disturb breathing, vision, and muscular control. The following paragraphs list and contain information on dispenser for these agents.
15–1—Land Mines
15–3—Rockets
15–3—Bombs

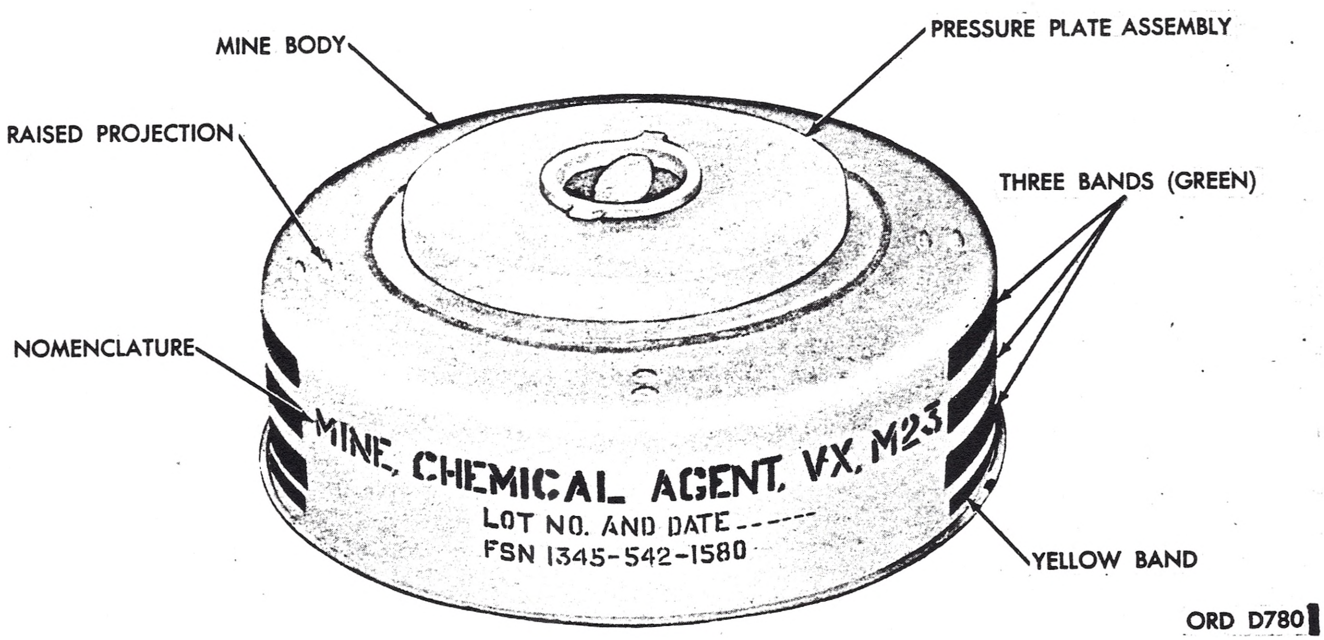


Figure 15–1. Mine Chemical Agent, VX, M23.

15-4—Clusters (Bombs)
15-5—Dispensed Munitions
15-6—Artillery Projectiles

15-1 LAND MINES

Mine, Chemical Agent, VX, M23 and Mine, Land, Chemical, 1-Gallon, are covered in this section.

15-1.1 MINE CHEMICAL AGENT, VX, M23 is covered in this paragraph.

15-1.1.1 IDENTIFICATION

15-1.1.1.1 TYPE. The mine M23 is used to disperse a nerve agent. It may be fuzed for contact or remote static detonation and may be used as an antitank mine or antipersonnel mine.

15-1.1.1.2 PAINTING AND MARKINGS. The mine is painted gray overall with three green bands and one yellow band around the body. All marking in green.

15-1.1.1.3 FITTINGS AND FEATURES. The configuration and components of the mine are shown in figures 15-1 and 15-2. The mine can be distinguished from the HE loaded M15 mine by eight raised projections, at 90-degree intervals, spaced in pairs around the periphery of the mine. The side fuze well contains a tetryl burster which is held in place by a retaining ring. The bottom fuze well is part of a cover adapter plate which holds a composition B burster cone in place. The pressure plate assembly consists of a pressure plate, a belleville spring, a fuze retaining spring and an arming plug. Later model mines use a coil spring instead of a belleville spring.

15-1.1.1.4 WEIGHTS AND DIMENSIONS. The total weight of the mine is 26.5 pounds. The filler weighs 11.44 pounds, the burster .75 pound, the booster .75 ounce. The mine is 5-inches high and 13-inches in diameter.

15-1.1.1.5 MATERIAL. The mine filler is a nerve agent. The initiator is tetryl or Composi-

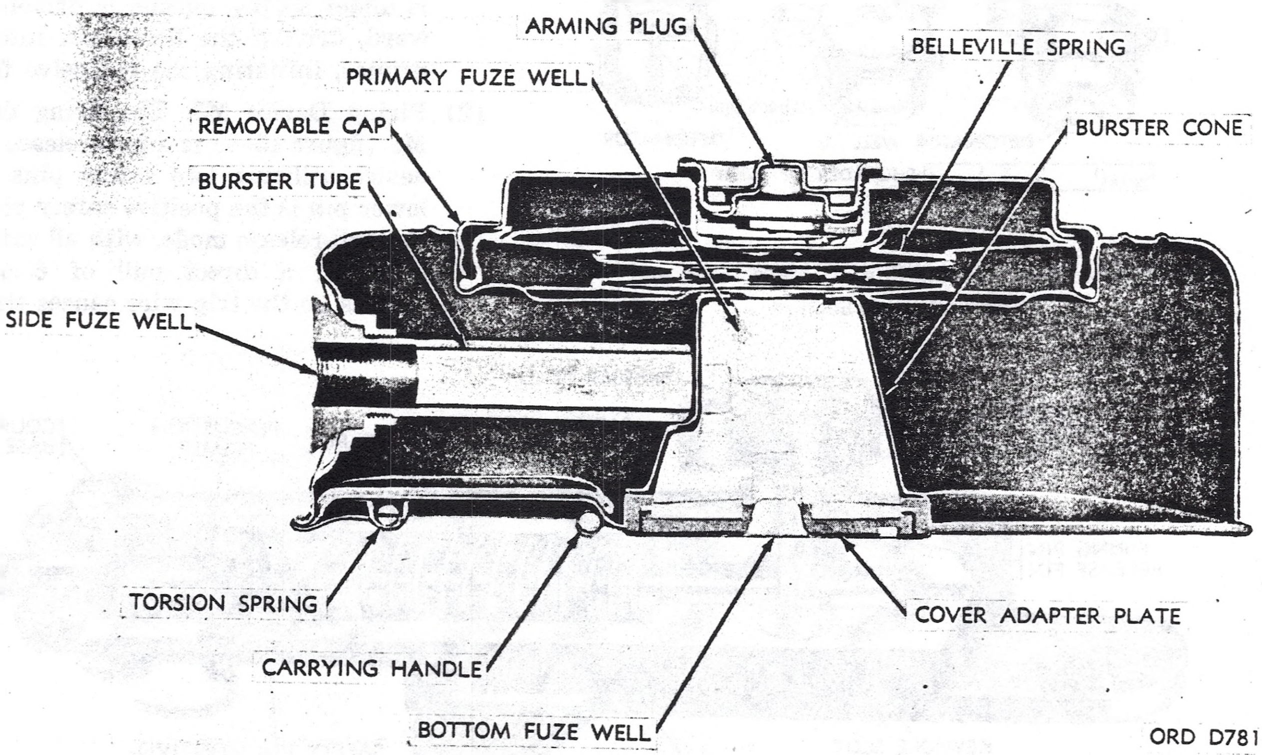


Figure 15-2 Mine, Chemical Agent, VX, M23—Cross Section.

tion B, the burster is Composition B or Composition B4, the booster is tetryl.

15–1.2 FUNCTIONING.

a. Fuze M603. The fuze M603 (figure 15–3) is an instantaneous mechanical-pressure type fuze. When the shutter of the arming plug is in the armed position, the fuze is designed to function when a force of 300 to 400 pounds exerted on the pressure plate depresses the mine spring. As the pressure plate is depressed, the shutter depresses the pressure plate of the fuze. A force of 140 to 240 pounds on the fuze pressure plate, depresses the fuze belleville spring, causing it to snap into a reversed position, driving the firing pin into the detonator. Initiation of the detonator functions the booster which in turn initiates the burster and the filler is dispersed.

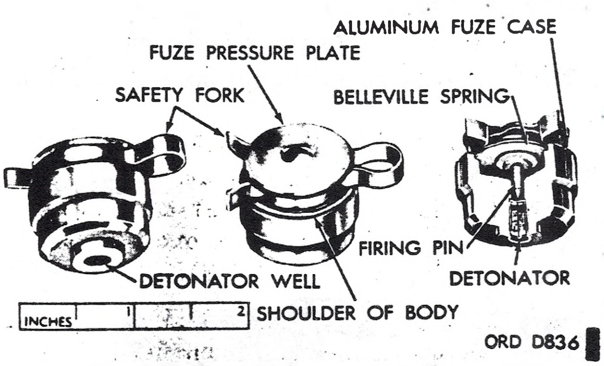


Figure 15–3 Fuse, Mine, AT M603–Bottom, Top and Cross Section

b. Firing Devices M1A1, M3 and M5.

WARNING

The firing devices M1A1, M3, and M5 contain cocked strikers.

(1) Firing Devices M1A1 (figures 15–4 and 15–5) is a pressure type device using a safety fork and a positive safety pin. With the safeties removed, a pressure of 20-pounds on the pressure cap or the three pronged pressure head forces the firing pin release pin downward. When the release pin is forced downward, an enlarged keyhole slot in the release pin shaft is presented to the striker spindle, releasing the striker. The striker which is under spring tension is driven forward, driving the firing pin into the primer, initiating the explosive train.

(2) Firing Device M3. The firing device M3 (figure 15–6) is a pull-release type device utilizing two safety pins. The lower pin is the positive safety pin. In the pull-release mode, with all safeties removed, a direct pull of 6-to 10-pounds on the trip wire causes the re-

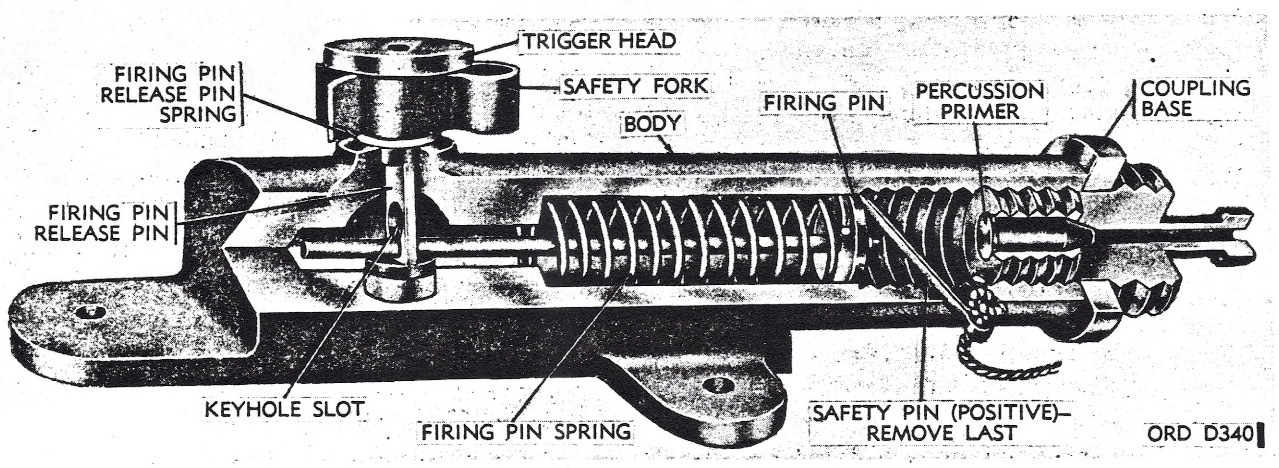


Figure 15–4 Firing Device, Demolition: M1A1, Pressure Type Sectioned

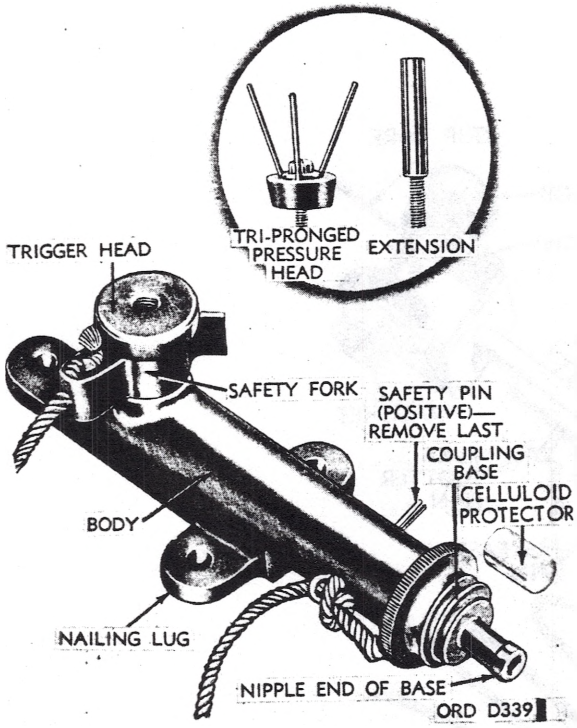


Figure 15-5 Firing Device, Demolition: M1A1, Pressure Type

lease pin and the firing pin to be pulled rearward. When the jaw ends of the firing pin is to the rear of the constricted opening of the firing device body, the jaws spread open. With the jaws open, the knob of the release pin is withdrawn from the firing pin allowing the jaws to close again to a size smaller than the contruction of the firing device body. The firing pin spring drives the firing pin into the primer initiating the explosive train.

(3) Firing Device M5. The firing device M5 (figure 15-7) is a pressure release (mouse trap) type device utilizing one safety pin. Provisions are also provided for an interceptor or improvised positive safety. With the device installed and safeties removed, the release plate will allow the firing pin to be released if sufficient weight is removed from the device. A five-eighths of movement of the release plate will allow the firing pin spring to drive the firing pin into the primer, initiating the explosive train.

NOTE

A weight of at least five pounds is necessary to prevent movement of the pressure plate.

15-1.3 MINE, LAND, CHEMICAL, 1-gallon is covered in this paragraph.

15-1.3.1 IDENTIFICATION

15-1.3.1.1 TYPE. The mine, land, chemical, 1-gallon is unfuzed, improvised type mine used to dispense blister agent.

15-1.3.1.2 PAINTING AND MARKINGS. The mine is painted gray overall with two green bands and markings in green.

15-1.3.1.3 FITTINGS AND FEATURES. The 1-gallon chemical mine (figure 15-8) consists of a 1-gallon (varnish type) can. Two short copper wires are soldered to one side to secure the bursting charge (fig. 15-9).

15-1.3.1.4 WEIGHTS AND DIMENSION. The mine weighs 11 pounds when filled. The filler weighs 9.9 pounds. The mine is $10\frac{9}{16}$-inches high, $6\frac{9}{16}$-inches wide and $4\frac{1}{8}$-inches deep.

15-1.3.1.5 MATERIAL. The mine is made of light gage metal.

15-1.4 HAZARDOUS COMPONENTS. The filler of the mine is a blister agent. The burster is a 4-foot length of detonating cord. Dependent upon the method of initiation, an electric or nonelectric blasting cap may be used.

15-1.5 FUNCTIONING. The mine is not filled until it is ready to be implanted. With the detonating cord attached, the cord may be initiated remotely by electric or nonelectric method. The bursting detonating cord ruptures the mine and disperses the agent.

15-1.6 SAFETY PRECAUTIONS.

a. The metal casing of the mine may deteri-

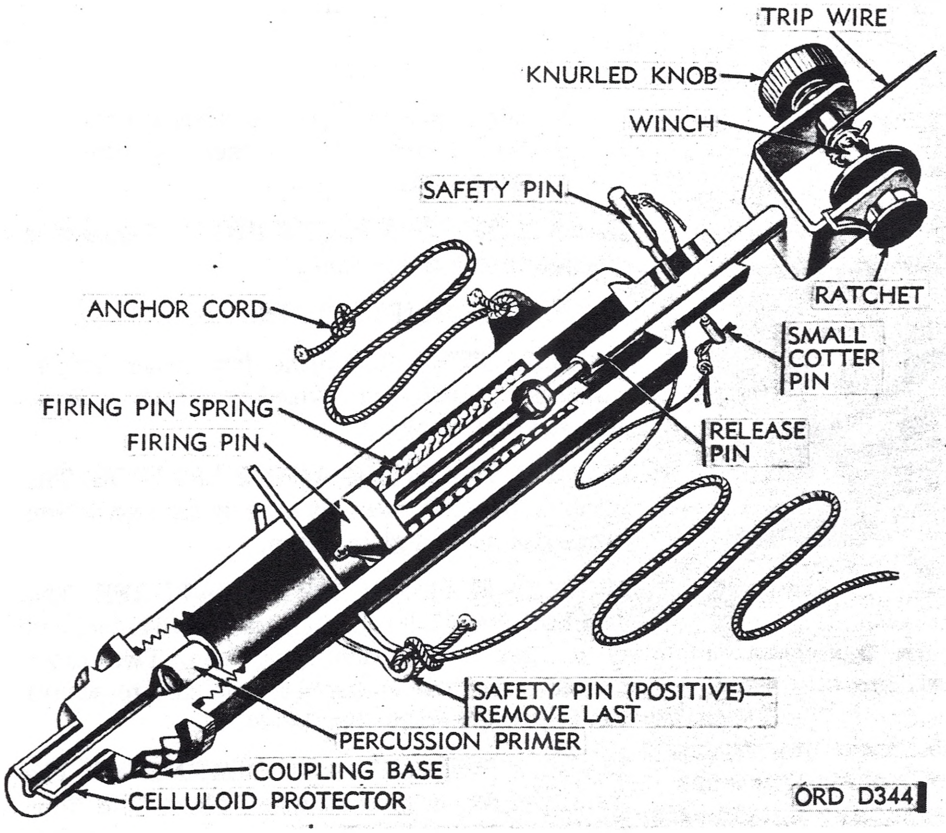


Figure 15–6 Firing Device, Demolition: M3, Pull-Release Type

orate if the mine is exposed to the elements for prolonged periods.

b. Do not operate radios in the vicinity of laid mines.

c. Wear full protective clothing and approach laid mines from upwind.

15-2 ROCKETS.

15–2.1 IDENTIFICATION. Rocket, chemical agent, 115-mm, M55, and Rocket, Practice, M61 are covered in this paragraph.

15–2.2 TYPE. These rockets are folding fin stabilized, surface to surface type, fuzed with the M417 PD, fuze. The M55 Rocket Warhead may contain VX or GB agent. The M61 Rocket Warhead contains simulate agent EG.

15–2.3 PAINTING AND MARKING.

a. Rocket, M55. The warhead is unpainted aluminum. A gray decal with three green stripes, one yellow stripe and lettering in green is affixed to the warhead. The rocket motor case is painted gray. There may or may not be a brown band around the motor case.

b. Rocket, M61. The warhead is unpainted aluminum. A blue decal with one yellow band and lettering in white is affixed to the warhead. The rocket motor case is

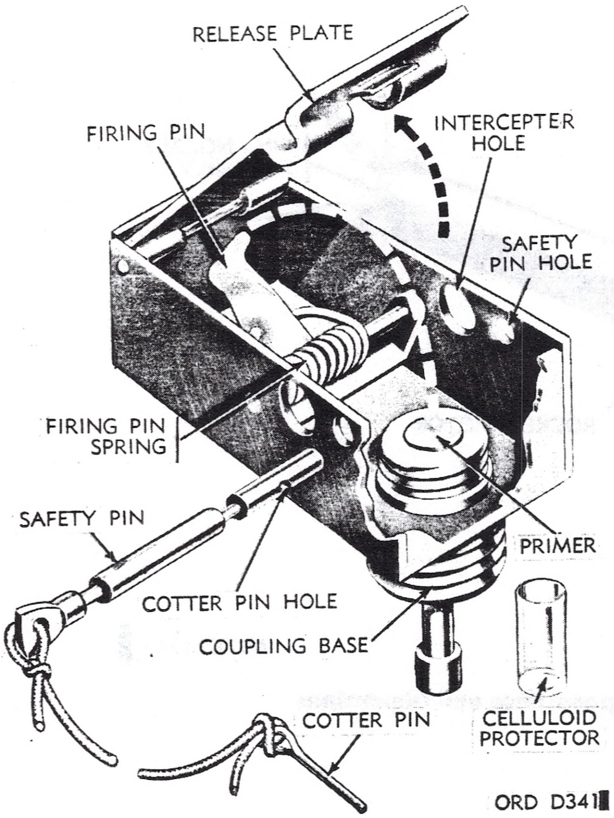


Figure 15-7 Firing Device, Demolition: M5, Pressure Release Type

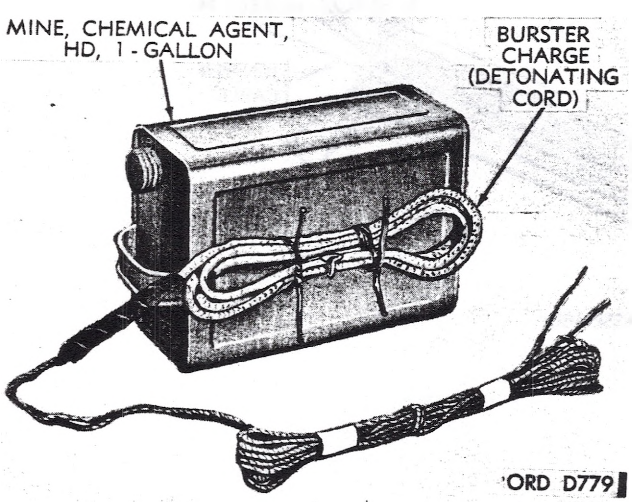
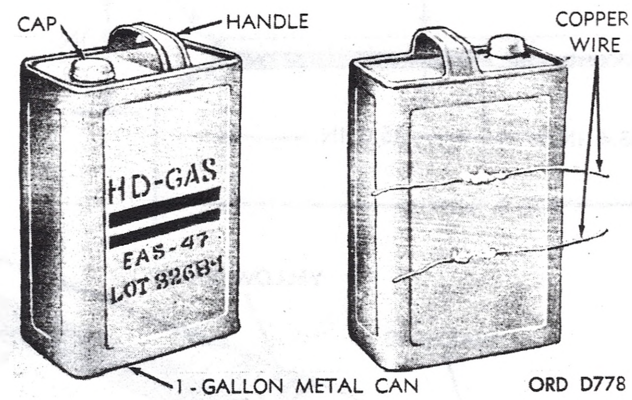


Figure 15-8 Mine, Land, Chemical, One-Gallon



15-9 Mine, Land, Chemical, One-Gallon

painted blue overall, there may or may not be a brown band painted around the motor case.

15-2.4 FITTINGS AND FEATURES.

a. The Rockets M55, and M61 are shipped and stored in a fiberglas container. The container with rocket is loaded into the launcher as a unit. The fired configuration and components of the rocket M55 are shown in figures 15-10 and 15-11. The M61 rocket is similar to the M55 rocket except for the warhead filler. The warhead contains a central burster which is threaded at one end to receive the fuze adapter. The rocket motor is threaded at the forward end to receive the warhead and at the rear end to receive the nozzle plate and fin-nozzle assembly. The fin-nozzle assembly contains a nozzle plate with four nozzles. Four folding fins are attached to the nozzle plate. The igniter lead wire passes through one of the four nozzles.

b. Fuze, PD, M417. The visible portion and internal components of the fuze are shown in figure 15-12. The detonator rotor is held in the out-of-line position by a setback weight. Arming delay is provided by an escapement mechanism that is geared to the rotor. The body of the fuze has two visible wrench flats.

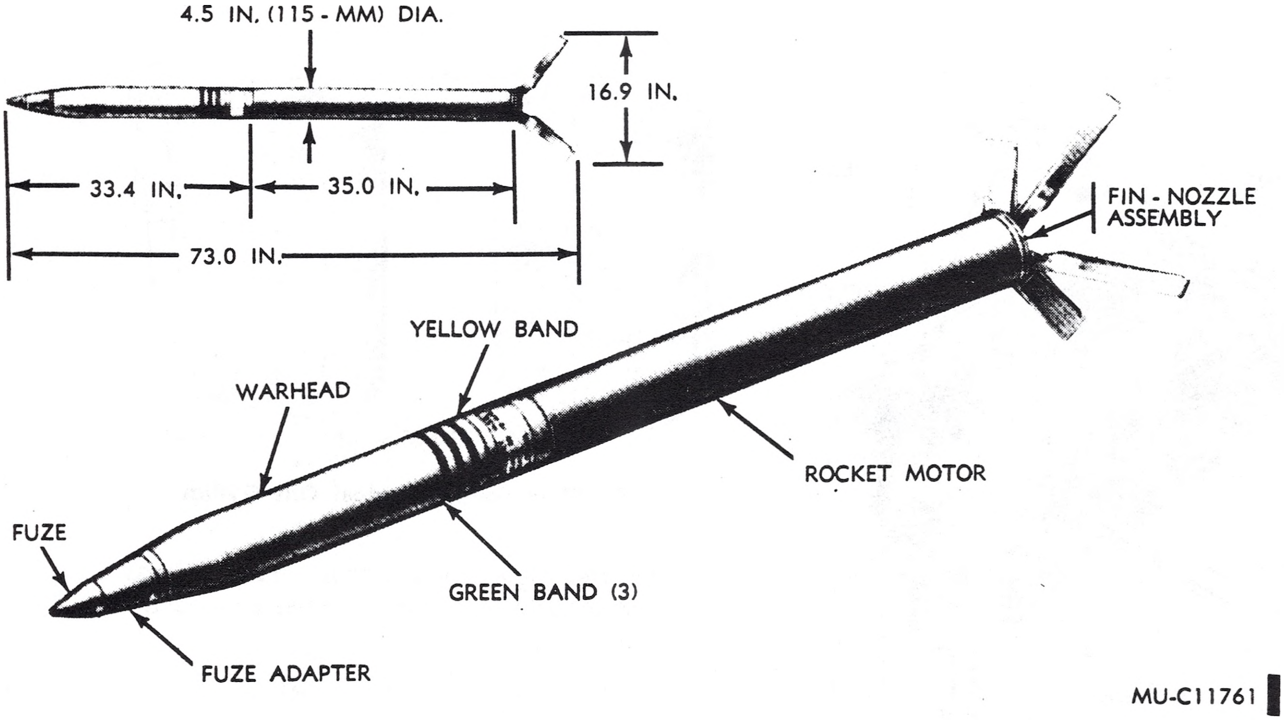


Figure 15–10 Rocket, Gas, 115-mm: M55, General Appearance and Dimensions

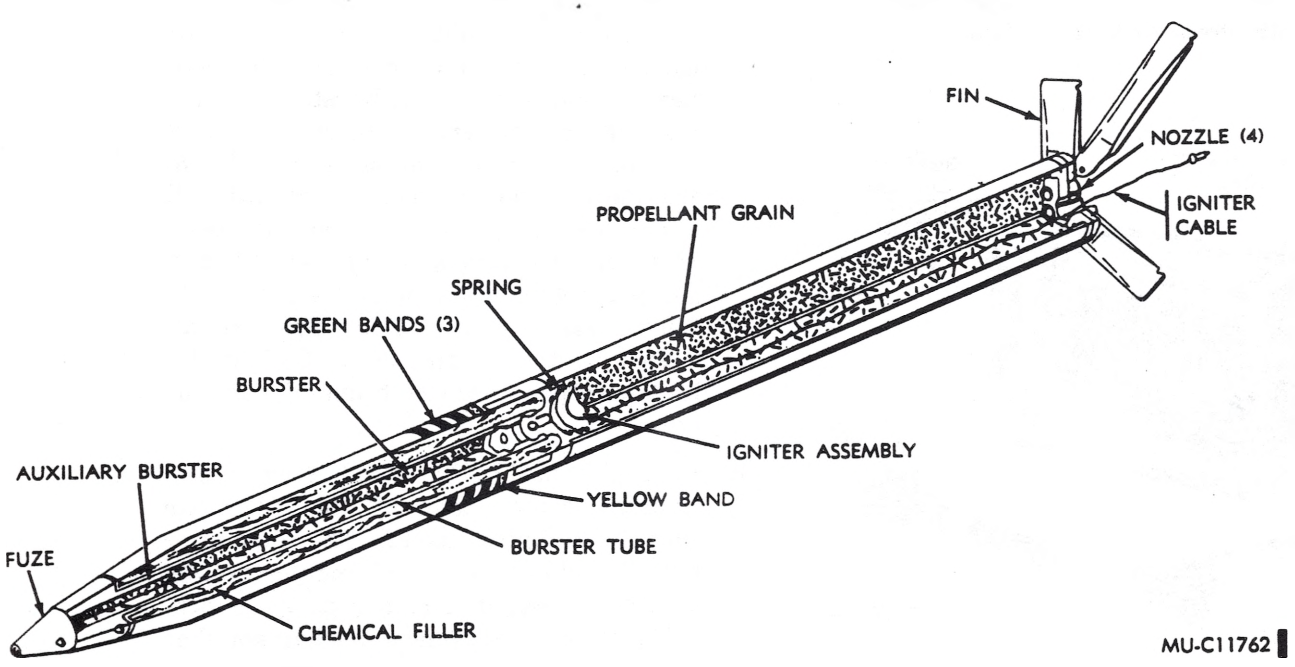


Figure 15–11 Rocket, Gas, 115-mm: M55, Cutaway View

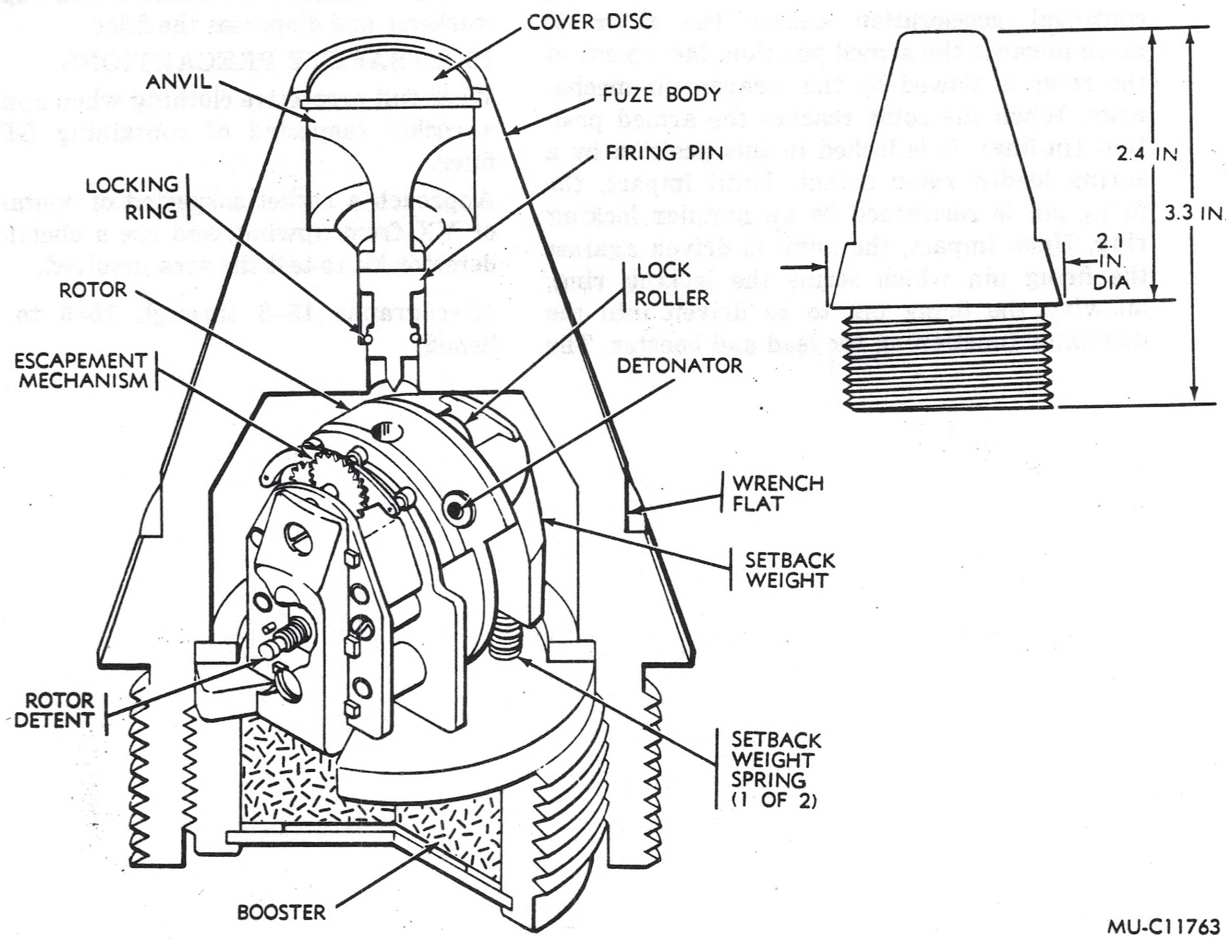


Figure 15-12 Fuze, Rocket: Point Detonating, M417, Cutaway View Unarmed Condition

15-2.5 WEIGHTS AND DIMENSIONS. The rocket motor weighs 35 pounds, the GB filled warhead weighs 21.2 pounds, the VX filled warhead weighs 20.2 pounds. The overall length with fins extended is 6 feet 1 inch, the motor is 35 inches, the warhead with fuze is 33.4 inches long.

15-2.6 MATERIALS. The warhead body and fins are aluminum, rocket motor case and fuze are steel.

15-2.7 HAZARDOUS COMPONENTS. The warhead contains 11.4 pounds of GB, or 10.5 pounds of VX. The rocket motor contains 33.5 pounds of double-base, solid propellant. The igniter contains 48 grams of black powder and magnesium flakes. The fuze contains an M63 detonator and RDX booster and lead. The burster contains 3 pounds of Composition B, the auxiliary burster contains 1 pound of Composition B.

15-2.8 FUNCTIONING. When the rocket is fired, setback causes the setback weight to move rearward, freeing the lockroller, releasing the detonator rotor. As the rotor is unbalanced, continual acceleration causes the rotor to move towards the armed position. Movement of the rotor is slowed by the escapement mechanism. When the rotor reaches the armed position (in-line), it is locked in this position by a spring loaded rotor detent. Until impact, the firing pin is restrained by an annular locking ring. Upon impact, the anvil is driven against the firing pin which strips the locking ring, allowing the firing pin to be driven into the detonator functioning the lead and booster. The booster initiates the burster which ruptures the warhead and disperses the filler.

15-2.9 SAFETY PRECAUTIONS.

Wear full protective clothing when approaching a rocket suspected of containing GB or VX filler.

Approach a rocket suspected of containing GB or VX from upwind, and use a chemical agent detector kit to test the area involved.

(Paragraphs 15-3 through 15-6 to be published)

APPENDIX A

REFERENCES

A1-1 INDEXES.

Refer to the following indexes frequently for latest changes or revisions of references listed in this appendix and for new publications relating to material covered in this technical manual.

DA Pam 310-1	Index of Administrative Publications
DA Pam 310-2	Index of Blank Forms
DA Pam 310-3	Index of Doctrinal, Training, and Organizational Publications
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, & 9), Supply Bulletins, and Lubrication Orders.

A1-2 SUPPLY MANUAL.

SC 1385-94-CL-P01	Shop Set, Ammunition and Explosive Ordnance Disposal (FSN 1385-378-4354) (Line Item T23769)

A1-3 OTHER PUBLICATIONS.

AR 75-15	Responsibilities and Procedures for Explosive Ordnance Disposal
AR 385-65	Identification of Inert Ammunition and Ammunition Components
AR 700-1300-8	Malfunctions Involving Ammunition and Explosives
AR 755-20	Defense Disposal Manual
FM 5-25	Explosives and Demolitions
FM 20-32	Land Mine Warfare
FM 21-40	Small Unit Procedures in Chemical, Biological and Radiological (CBR) Operations.
FM 23-30	Grenades and Pyrotechnics
SR 755-140-1	Ammunition
TB 9-AMM-5	Ammunition: Federal Stock Numbers and Department of Defense Codes
TB MED 242	Health Hazards from Propellant Fuels and Oxidizers
TB 34-9-42	Stove, Cooking, Gasoline, M-1950 One Burner.
TB 9-1375-200-50/1	Disposal by Burning Nitric Acid Propellant
TM 3-215	Military Chemistry and Chemical Agents
TM 3-220	Chemical, Biological, and Radiological Decontamination
TM 3-400	Chemical Bombs and Clusters
TM 9-243	Use and Care of Handtools and Measuring Tools
(S)TM 9-1185-1	Precautions and Procedures for Handling Tritium in Tritium-Bearing Weapons (U).
TM 9-1300-203	Artillery Ammunition
TM 9-1300-206	Care, Handling, Preservation, and Destruction of Ammunition
TM 9-1305-200	Small Arms Ammunition
TM 9-1325-200	Bomb and Bomb Components
TM 9-1345-200	Land Mines
TM 9-1370-200	Military Pyrotechnics
TM 9-1375-200	Demolition Materials
TM 9-1385-9	Explosive Ordnance Reconnaissance
TM 9-1385-51	Identification of Ammunition (Conventional) for Explosive Ordnance Disposal.

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APPENDIX A
(Continued)

TM 9-1385-201-10	Stethoscope, Explosive Ordnance Disposal Mk 15 Mod 0, Description and Operation.
TM 9-1900	Ammunition, General
TM 9-1907	Ballistic Data, Performance of Ammunition
TM 9-1910	Military Explosives
TM 9-1950	Rockets
TM 9-1955	Rocket Motors, General
TM 38-750	Army Equipment Record Procedures

APPENDIX B

CARTRIDGE/PROJECTILE-FUZE COMBINATIONS FOR GUNS

WEAPON	CARTRIDGE / PROJECTILE	FUZE: PD																PIBD		MT				MTSQ					TSQ	BD					PROX.			
		M48A2	M48A3	M51A4	M51A5	M57 (MOD)	M57 (MOD) W/BOOSTER	M64A1	M78 SERIES(CP)	M508 SERIES	M521	M535	M557	M572	MK27	T234E2	XM720 SERIES	M509 SERIES	XM539E4	M43 SERIES	M67A3	XM571E3	XM711	M501 SERIES	M502 SERIES	M518 SERIES	M520 SERIES	M564	M55A3	M62 SERIES	M68 SERIES	M91 SERIES	M534 SERIES	M578	M513 SERIES	M514 SERIES	M515	M516
40 MILLIMETER	HE-T, HEI-T, MK2, SD, MK11, M3A1														■																							
	HE-T, MK2, SD, M3							■																														
75 MILLIMETER	HE, M334 (DEEP CAVITY)			■	■							■	■			■									■	■	■	■										P
76 MILLIMETER	HE, HE-T, M352 SERIES			■	■				■			■	■								■						■	■	■									
	HEAT-T, M496																	■																				
	WP, M361 SERIES										■																											
90 MILLIMETER	APC-T, M82																														■							
	APERS, XM580E1																						■															
	HE, M71 (NORMAL CAVITY)			■	■		■		■			■	■							■	■						■	■	■									
	HE, M71 (DEEP CAVITY)			■	■		■		■			■	■							■	■						■	■	■						P		P	
	HE-T, M71A1				■							■	■																									
	HE-T, T91			■	■		■		■			■	■								■						■	■	■									
	HEAT, M348 SERIES																	■																				
	HEAT-T, M431																	■																				
	HEP-T, T142 SERIES																															■						
	SMOKE, WP, M313 SERIES	■	■			■																		■														
105 MILLIMETER	APERS-T, XM494E3																					■																
	HEAT-T, M456 SERIES																	■																				
	HEP-T, M393 SERIES																																■	■				
	SMOKE, WP-T, M416																																■					
120 MILLIMETER	HE-T, M356			■	■		■		■			■	■								■						■	■	■									
	HEAT-T, M469																	■																				
	SMOKE, WP, M357			■	■		■					■	■								■						■	■	■									
152 MILLIMETER	HE-T, XM657E2																■																					
	HEAT-T-MP, XM409 SERIES																		■																			
	TP-T, XM411E3												■																									
155 MILLIMETER	GB, M122									■																												
	HE, M101 (NORMAL CAVITY)			■	■		■		■			■	■								■						■	■	■									
	HE, M101 (DEEP CAVITY)			■	■		■		■			■	■								■						■	■	■							P		
	SMOKE, WP OR GAS, HD, M104			■	■		■					■	■								■						■	■	■									
165 MILLIMETER	HEP, M123A1																													■								
175 MILLIMETER	HE, M437 SERIES													■																						P		

KEY

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APPENDIX C

CARTRIDGE/PROJECTILE-FUZE COMBINATIONS FOR HOWITZERS

WEAPON	CARTRIDGE/PROJECTILE	FUZE: PD										MT					MTSQ						TSQ	BD		PROX.	
		M48A2	M48A3	M51A4	M51A5	M57 (MOD)	M57 (MOD) W/BOOSTER	M78 SERIES (CP)	M508 SERIES	M535	M557	M67A3	M562	XM563 SERIES	M565	M565 (MOD)	M501 SERIES	M520 SERIES	M548	M548 (MOD)	M554	M564	M55A3	M62 SERIES	M91 SERIES	M513 SERIES	M514 SERIES
75 MILLIMETER	HE, M48 (NORMAL CAVITY)			■	■		■	■		■	■	■						■				■	■				
	HE, M48 (DEEP CAVITY)			■	■		■	■		■	■	■						■				■	■			P	
	HEAT-T, M66																							■	■		
	SMOKE, WP, M64	■	■			■																					
105 MILLIMETER	APERS-T, XM546													■													
	BE, M84, M84B1	■	■														■										
	CS, XM629														■				■								
	GB, M360								■																		
	HE, M1 (NORMAL CAVITY)			■	■		■	■		■	■	■						■				■	■				
	HE, M1 (DEEP CAVITY)			■	■		■	■		■	■	■						■				■	■			P	
	HE, M413																				■						
	HE, M444															■				■							
	HEAT, M67																							■			
	HEAT-T, M67																								■		
	HEP, M327																							■			
	HEP-T, M327																								■		
	HE, RA, XM548			■	■		■	■		■	■	■						■				■	■			P	
	ILLUM, M314A2, M314A2B1																■										
	ILLUM, M314A2E1														■				■								
	SMOKE, WP OR GAS, H, HD, M60			■	■		■			■	■	■						■				■	■				
155 MILLIMETER	BE, M116	■	■														■										
	CS, XM631														■				■								
	GB OR VX, M121A1								■																		P
	HE, M107 (NORMAL CAVITY)			■	■		■	■		■	■	■						■				■	■				
	HE, M107 (DEEP CAVITY)			■	■		■	■		■	■	■						■				■	■				P
	HE, M449														■				■								
	ILLUM, M118 SERIES																■										
	ILLUM, M485 SERIES														■				■								
	SMOKE, WP OR GAS, HD, M110			■	■		■			■	■	■						■				■	■				
	SMOKE, WP, M105			■	■		■			■	■	■						■				■	■				
8-INCH	GB OR VX, M436								■																		P
	HE, M106 (NORMAL CAVITY)			■	■		■	■		■	■	■						■				■	■				
	HE, M106 (DEEP CAVITY)			■	■		■	■		■	■	■						■				■	■				P
	HE, M404														■				■								

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APPENDIX D

CARTRIDGE-FUZE COMBINATIONS FOR MORTARS

WEAPON	CARTRIDGE	FUZE: PD																MT		MTSQ			T		TSQ		PROX.		
			M8	M9	M48A3	M51A4	M51A5	M521	M524 SERIES	M525 SERIES	M526 SERIES	M527 SERIES	M535	M557	XM716	XM717	XM719	M67A3	M565	M520 SERIES	M548	M564	M65	M84	M55A3	M77	M513 SERIES	M517	M532
60 MILLIMETER	HE, M49 SERIES									■						■													
	ILLUM, M83 SERIES																						■						
	SMOKE, WP, M302 SERIES											■					■												
	TP, M50A2E1									■																			
81 MILLIMETER	HE, M43 SERIES									■						■													
	HE OR TP, M362 SERIES								■		■				■													■	■
	HE, M374 SERIES								■		■				■														■
	ILLUM, M301 SERIES																							■					
	SMOKE, WP OR FS, M57 SERIES									■																■			
	SMOKE, WP, M370								■		■				■														
	SMOKE, WP, M375 SERIES								■		■				■														■
	TP, M43 SERIES									■																			
4.2 INCH	CS, XM630																		■		■								
	GAS OR WP, M2 SERIES		■																										
	HE, M3 (NORMAL CAVITY)			■																									
	HE, M3A1 (DEEP CAVITY)					■	■						■	■				■		■		■			■		P		
	HE, M329 SERIES					■	■						■	■				■		■		■			■		P		
	ILLUM, M335A1																		■										
	ILLUM, M335A2																		■										
	SMOKE, WP, M328 SERIES				■			■																					

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APPENDIX E

CARTRIDGE-FUZE COMBINATIONS FOR RECOILLESS RIFLES

WEAPON	CARTRIDGE	FUZE: PD												PI			MT		MTSQ		TSQ	BD		PROX.
		M48A2	M48A3	M51A4	M51A5	M57 (MOD)	M57 (MOD) W/BOOSTER	M78 SERIES (CP)	M89	M503 SERIES	M535	M557	XM593 SERIES	M90 SERIES	M509 SERIES (BD)	M530 SERIES (BD)	M67A3	XM592 SERIES	M520 SERIES	M564	M55A3	M62 SERIES	M91 SERIES	M513 SERIES
57 MILLIMETER	HE, M306								■															
	HE, M306A1									■														
	HEAT, M307 SERIES													■										
	SMOKE, WP, M308								■															
	SMOKE, WP, M308A1									■														
	TP, M306A1									■														
75 MILLIMETER	HE, M309 SERIES			■	■						■	■							■	■				
	HEAT, M310																					■		
	HEAT-T, M310A1																						■	
	HEP-T, M349																						■	
	SMOKE, WP, M311	■	■			■																		
	SMOKE, WP, M311A1		■			■																		
	TP, M309A1				■							■												
90 MILLIMETER	HE, XM591												■											
	HEAT, M371 SERIES															■								
	PRACTICE, M371															■								
105 MILLIMETER	HE, M323 (DEEP CAVITY)			■	■		■	■			■	■					■		■	■	■			P
	HEAT, M324																					■		
	HEAT-T, M324																						■	
	HEAT, M341														■									
	HEP, M326																					■		
	HEP-T, M326																						■	
	SMOKE, WP, M325			■	■		■				■	■					■		■	■	■			
106 MILLIMETER	APERS-T, XM581																	■						
	HEAT, M344 SERIES														■									
	HEP-T, M346 SERIES																						■	

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HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, D. C. 2 February 1967

BY ORDER OF THE SECRETARY OF THE ARMY

HAROLD K. JOHNSON
General, U. S. Army
Chief of Staff

OFFICIAL:
KENNETH G. WICKHAM
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