AMMUNITION FOR ANTI AIRCRAFT, TANK, ANTITANK, AND FIELD ARTILLERY WEAPONS

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CHAPTER I

GENERAL

Section 1. INTRODUCTION

1. Scope

   a. This manual is intended for instruction and the dissemination of such general and technical information concerning artillery ammunition, and components thereof, excluding mortar and recoiless rifle ammunition, as may be necessary for their proper care, handling, and use.

   b. Ammunition for use in artillery weapons, including field, antiaircraft, tank and antitank guns and howitzers, is described. Ammunition for mortar and recoiless rifle is shown in TM 9–1300–204 and TM 9–1300–205 (when published). This manual covers the characteristics of ammunition, specific data, means of identification, precautions in handling and use, and general information on packing and shipping. The final chapter concerns the methods of destruction of ammunition to prevent enemy use.

   c. This manual differs from TM 9–1901, 11 September 1950, as follows:

      (1) Adds information on ammunition for:

         (a) 40-mm automatic guns M2 and Mk 1 (Navy).

         (b) 75-mm gun M35.

         (c) 76-mm guns M32 and M48.

         (d) 90-mm guns M1A2, M1A3, M2A2, and M2A3.

         (e) 90-mm guns M36, M41, and M54.

         (f) 105-mm howitzers M2A2, M4A1, and M49.

         (g) 120-mm guns M1A1, M1A2, M1A3, and M58.

         (h) 155-mm gun M46 (T80).

         (i) 155-mm howitzer M45.

         (j) 8-inch howitzer M47 (T89).

         (k) 280-mm gun cannon M66.

         (l) Simulators.

      (2) Revises, rearranges, and adds information in text, tables, and charts on fuzes, fuze wrenches, primers, propelling charges, detonators, and other components.

      (3) Deletes reference to:

         (a) 37-mm gun M6.

         (b) 57-mm gun M1.

         (c) 75-mm gun M17.

         (d) 90-mm guns M3, M3A1, M3A2, and M26.

         (e) 8-inch gun M1.

         (f) 240-mm howitzer M1.

         (g) 75-mm howitzer M3.

         (h) 75-mm subcaliber gun M25.

         (i) 75-mm gun M6.

         (j) 76-mm guns M1A1C, M1A2, and T94.

   d. Any errors or omissions will be forwarded on DA Form 2028 direct to the Commanding Officer, Raritan Arsenal, Metuchen, New Jersey, ATTN: OPRA.

2. Arrangement of Text

   a. Chapter 1 covers ammunition terms, classification, identification, explosive charges, chemical fillers, packing and marking for shipment, storage precautions, care, handling, and preservation, use, and a discussion of projectiles.

   b. Chapter presents specific data for, and description of, service, practice, and dummy (drill) cartridges and projectiles used in artillery weapons.

   c. Chapter 3 deals with complete round components other than projectiles: fuzes, propelling charges, primers, boosters, bursters, plugs, and grommets.

   d. Chapter 4 discusses the methods of destruction of ammunition to prevent enemy use.

   e. A list of references is given in the appendix.
Section II. GENERAL DISCUSSION

3. Definitions

a. Ammunition. Ammunition comprises that class of supplies usually containing propellant and/or explosives or chemicals. It is intended for use in combat, simulated combat, or training. Artillery ammunition in this manual includes all ammunition used in artillery weapons 37-mm to 280-mm except small arms, recoilless rifles, and mortars.

b. Round (Complete Round). A round of artillery ammunition comprises all of the components necessary to fire a weapon once. This includes the following: a projectile; a propelling charge to develop a gas pressure when fired to propel the projectile out of the weapon with sufficient force to “project” it to its target; a primer to initiate the burning of the propelling charge; and a fuze fitted to each projectile having high explosive or chemical content to explode it at the time and under the conditions desired. For some projectiles, such as those of the solid type, fuzes are not required. Dependent on the manner in which these components are assembled for firing, complete rounds of artillery ammunition are known as fixed, semifixed, separated, and separate-loading. See TM 9-1900 for descriptions of these types of ammunition and for terms applied to their components.

c. Fixed Ammunition. In fixed ammunition, the propelling charge is fixed, that is, not adjustable, and the complete round is loaded into the weapon as a unit. As usually designed, the propellant is loose or in a cloth bag in the cartridge case. The case, to which the primer is fitted, is crimped rigidly to the projectile, either over or to the rear of the rotating band. The term cartridge is used for complete rounds of fixed ammunition.

d. Semifixed Ammunition. Semifixed ammunition is characterized by an accessible propelling charge which may be adjusted. Like fixed ammunition, it is loaded into the weapon as a unit. In this type of artillery ammunition, the cartridge case is a free fit over the projectile. The propelling charge is divided into sections, each containing loose propellant in a bag. To adjust the charge, the projectile is removed from the neck of the cartridge case, the sections (called increments) not required are removed, and the projectile then is put back into the neck of the cartridge case. As in fixed ammunition, the primer is fitted into the base of the cartridge case. In certain rounds for the 105-mm howitzer, even though the charge is fixed, the cartridge case is a free fit over the projectile to facilitate packing for shipment. The term cartridge is used for rounds of semifixed ammunition.

e. Separated Ammunition. Separated ammunition is characterized by the arrangement of the propelling charge and the projectile. The propelling charge (which is contained in a primed metallic cartridge case, is sealed with a plastic closing plug) and the projectile are separate. The mouth of the cartridge case does not fit over the base of the projectile as in fixed and semifixed ammunition. Although the propelling charge and projectile are separate, they are loaded into the gun in one operation, not separately as in separate-loading ammunition.

f. Separate-loading Ammunition. In separate-loading ammunition, the separate components—projectile (fuzed if required), propelling charge, and primer—are loaded into the weapon separately, because the projectile and propelling charge are too heavy or bulky to be handled as a unit. The projectile is inserted into the breech and rammed so that the rotating band seats in the forcing cone of the weapon; the propelling charge (usually in one or more cylindrical cloth bags tied with tying straps when required) is placed in the projectile chamber immediately to the rear of the projectile; and, after the breechblock of the weapon has been closed and locked behind the charge, the primer is inserted into the firing mechanism of the breechblock.

g. Normal and Deep-Cavity High-Explosive Projectiles. See paragraph 10 for description.

4. Classification

Artillery ammunition is classified according to use as service, target-practice (TP), blank, drill, or dummy. It is classified according to type of filler as explosive, chemical, or inert.
a. Service Ammunition. Service ammunition is fired for effect in combat. It also is fired for adjustment, registration, and target practice. Dependent upon the type of projectile, it may be high-explosive (HE), high-explosive plastic (HEP), high-explosive-antitank (HEAT-T), armor-piercing (AP-T) or armor-piercing capped (APC-T) (with explosive filler), hypervelocity armor-piercing (HVAP-T), incendiary, chemical (gas or smoke), or illuminating. The letter T following these symbols (as in AP-T) indicates that the projectile contains a tracer.

Warning: The use of service ammunition for training purposes, as a substitute for authorized dummy ammunition, is extremely hazardous and is not permitted under any circumstances.

See TM 9–1900 for description of these types of projectiles.

b. Target-Practice Ammunition. Target-practice (TP) ammunition is provided for training in marksmanship. The projectile in this type of ammunition may have a small quantity of low-explosive filler such as black powder to serve as a spotting charge, or the filler may be inert, or the projectile may be an empty cast-iron shell simulating a service projectile in ballistic properties.

c. Simulators. Airburst and groundburst simulators are used in connection with artillery training. They are pyrotechnic items, as they contain pyrotechnic compositions. For data on simulators, see TM 9–1370–200.

d. Blank Cartridge. Blank cartridge is provided in small and medium calibers for such purposes as saluting and training (simulated fire). It has no projectile.

Warning: Inspect blank cartridge for foreign matter on interior of case (above closing cup) before firing. Foreign matter may act as hazardous missile to personnel and damage gun tubes.

e. Dummy Ammunition. Dummy ammunition (projectile or cartridge) is used for training in handling and loading (“service of the piece”) and similar purposes. It is completely inert.

5. Standard Nomenclature (Description)

Standard nomenclature is established in order that each item supplied may be identified specifically by name. The standard nomenclature for artillery ammunition consists of an item name and a colon (:) followed by sufficient delineation of additional characteristics of the item of supply in order to differentiate between items having the same item name. An example of complete nomenclature for a cartridge is: CARTRIDGE, 76 MILLIMETER: HE, COMP B, M352, steel case, w/fuze, PD, M51A5, 0.05-sec delay, for guns M32 and M48.

6. Federal Stock Number and Department of Defense Ammunition Code

The Federal stock number, which is of the form 1315–028–4790, has replaced the Ammunition Identification Code (AIC) and the Ordnance stock number formerly used. There is a different Federal stock number for each item of supply as packed. The first four positions in a Federal stock number are always the Federal Supply Classification (FSC) class in which the item belongs. The next seven digits in the Federal stock number are called the Federal Item Identification Number (FIIN). The dash between the third and fourth position in the FIIN is to reduce errors in transmitting. There is a different FIIN for each item in a Department of the Army supply manual and United States Air Force stock list. Thus, the Federal stock number is composed of the Federal class (FSC) (first four positions) and the FIIN (next seven positions). In addition to the Federal stock number, a Department of Defense Ammunition Code (DOD Ammunition Code) has been developed to indicate interchangeability of ammunition and explosive items in FSC Group 13. The DOD Ammunition Code number is an eight-character number divided into two parts separated by a hyphen, e.g., 1315–C650. The first part consists of the four numerals which indicate the Federal supply class in which the item belongs. The second part consists of a letter and three numerals assigned to each item. The same four-character code number is assigned to those items within the class which are interchangeable as to function and use. For certain ammunition operations such as world-wide stock status reporting, requisitioning when specific items are not required, the eight-character DOD Ammuni-
tion Code will be used (e.g., 1815–C650). For other operations such as marking, requisitioning when specific items are required, the 11-digit Federal stock number will be used followed by the second part of the DOD Identification Code (DODIC) (e.g., 1315–028–4790–C650). (See TB 9–AMM–5 and pertinent SM’s.)

7. Explosives in Ammunition

a. General. In order to deliver a projectile at the target and to cause it to function as intended, it is necessary to employ different kinds of explosives, each of which has a specific role to play in the functioning of the round of ammunition. The characteristics of various types of explosives are given in TM 9–1900 and TM 9–1910.

b. Explosive Train. The arrangement of a series of explosives beginning with a small amount of sensitive explosive and ending with a larger amount of comparatively insensitive explosive is termed an explosive train. There are two kinds of explosive trains: the propelling charge explosive train and the bursting charge explosive train.

c. Basic Groups. For military purposes, explosives are divided into the two basic groups: propellants and high explosives. One of the chief differences between these two groups is in the nature of the characteristic reactions. The propellant is considered to react by burning, the rate of which depends upon such factors as pressure, grain form, grain size, and composition. High explosive is used for its detonating property which manifests itself as a detonation wave traveling through the high-explosive charge at an extremely high velocity (in the order of 22,000 to 28,000 fps). The velocity of detonation of a particular high explosive increases with increased density. The low limit of velocity of a detonation wave is considered to be the speed of sound in the explosive which is 5,000 to 8,000 feet per second.

(1) Propellants.

(a) Propellants in artillery ammunition are used to propel a projectile out of a weapon at a prescribed velocity. They are composed of nitrocellulose and were formerly known as smokeless powders. They are distinguished by such terms as: single base, those that are principally nitrocellulose; double base, those that are principally nitrocellulose and nitroglycerin; triple base, those which consist of some nitrocellulose and nitroglycerin, and principally nitroguanadine; and composite propellant, those that do not contain significant amounts of nitrocellulose or nitroglycerin and are mechanical mixtures of a fuel with an inorganic oxidant. A part or all of the fuel may also serve as a binding agent. Propellants are assigned model numbers, for example, M1, which is not to be confused with the M numbers assigned to propelling charges. Black powder (old-fashioned gunpowder) was long since superseded as a propellant but it is still used in auxiliary roles such as in spotting charges, igniters, and delay pellets. The usual form of propellant in artillery ammunition is a cylindrical grain with one or more perforations. Propellant in the form of balls is used in small caliber ammunition and in the form of sheets in mortar ammunition. A propelling charge containing grains of different perforations or different grain size is called a dual-grain charge.

(b) Cartridges of certain calibers, for example, 76-mm, 90-mm, and 105-mm, are designated as “flashless,” “smokeless,” or “flashless-smokeless,” which are known as the functional characteristics of the propellant upon firing. These designations are marked on the cartridge case of such rounds and on their packing containers. Such markings are known as “functional markings.” Whether ammunition upon firing is flashless, smokeless, or flashless-smokeless depends upon the weapons in which used, the type of ignition used, weapon wear, the temperature of the tube of the weapon, and the quantity and composition of the propellant. “Flash-
less” and “smokeless” are relative terms and have been defined as follows: Flashless propellant does not produce a flash at the muzzle more than 5 percent of the time in weapons having average wear under average conditions; smokeless propellant produces less than half the amount of smoke produced by propellant not so designated. Cartridges having both these characteristics are designated “flashless-smokeless.” For additional information refer to paragraphs 226 through 243.

(c) Flarebacks (rearward expulsion of flaming gases as the breech is opened) occur occasionally when firing 90-mm tank weapons of the M3 series. Flarebacks have occurred most frequently when firing high-explosive and smoke rounds loaded with propellant M6 without potassium sulfate. This ammunition is marked “smokeless.” Flarebacks occur very seldom, if ever, when ammunition marked “flashless” or “flashless-smokeless” is fired. The bore evacuator, used on current modification of the tank gun M3A2, practically eliminates the danger to the crew by drawing the flames and unburned gases out through the muzzle.

(2) High explosives. High explosives, because of their extremely rapid rate of detonation, produce a very high pressure wave front. When this high pressure is of relatively short duration, its disruptive action is characterized as shattering power, or brisance. When the period of high pressure is greater, its disrupting effects are called blast. Concentrating and/or directing this wave front, as for example in shaped charges, is called wave shaping. This can, through reinforcement, deliver very high pressures at desired focal points. High explosives may be divided into two categories; primary and secondary. Primary high explosives are those highly sensitive explosives used to initiate detonation in primers and detonators. Those now in common use are lead azide, lead stypnate (both basic and normal), lead mononitroresorcinate, and tetracene. Secondary high explosives are those relatively insensitive explosives used as explosive leads, boosters, and bursting charges. Explosive leads and boosters commonly consist of pellets of either tetryl or 98/2 RDX/stearic acid. The bursting charges most common are composition B (60/39/1 RDX/TNT/desensitizing wax); TNT (trinitrotoluene); composition A–3 (91/9 RDX) desensitizing wax, cycloclots, and octolts. For a detailed description of explosives, see TM 9–1910.

8. Chemical Fillers

Projectiles containing a chemical agent are classed generally as chemical projectiles. A military chemical agent is a substance which, by its ordinary and direct chemical action and in concentrations attainable in the field, produces a toxic (casualty) or an irritating (harassing) effect, a screening smoke, an incendiary action, or any combination of these. Military gases are classed as casualty or harassing and as persistent or nonpersistent. Gases used as chemical filler are GB, a blood and nerve poison, and H or HD (mustard gas), both casualty gases. A persistent gas remains effective at the point of release for more than 10 minutes. The most common smoke filler is white phosphorus (WP) which, in addition to producing a dense white smoke, also has a slight incendiary action. White phosphorus is a solid which melts at 111.4°F. A substitute for phosphorus is sulfur trioxide-chlorsulfonic acid mixture (FS); no mask is required for the FS smoke, the smoke being harmless except in very heavy concentrations. Some projectiles contain hexachlorethane-zinc mixture (H). HC is toxic. The chemical filler, CNS (tear gas), is a nonpersistent, irritant, harassing gas consisting of a solution of chloracetophenone (CN) and chloropicrin (PS) in chloroform. Further information on chemical agents will be found in FM 3–5, TM 3–215, and TM 9–1900.
9. Identification

a. General. Ammunition is identified completely, except as to grade, by painting and marking (which includes the ammunition lot number) on original packing containers. Once removed from their packing, rounds may be identified by painting and marking on the items. The muzzle velocity of projectiles may be obtained from the firing tables and ammunition data cards; in some rounds, the muzzle velocity also appears on the packing box.

b. Mark or Model. To identify a particular design, a model designation is assigned at the time the model is classified as an adopted type. This model designation becomes an essential part of the nomenclature and is included in the marking of the item. The model designation consists of the letter “M” followed by an Arabic numeral, for example “M1.” Modifications are indicated by adding the letter “A” and the appropriate Arabic numeral. Thus, “M1A1” indicates the first modification of an item for which the original model designation was “M1.” Wherever a “B” suffix appears in a model designation, it indicates an item of alternative design, material, or manufacture. A “T” or “XM” model designation signifies that the item is under development. An “E” with an Arabic numeral signifies a modification thereof. On ammunition made in Japan, the prefix “J” is added to the model number.

c. 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, this lot number is stamped or marked on the item, size permitting, as well as on all packing containers. It is required for all purposes of record, including reports on condition, functioning, and accidents in which the ammunition is involved. To provide for the most uniform functioning, all of the components in any one lot are manufactured under as nearly identical conditions as practicable. Insofar as the ammunition is concerned, to obtain the greatest accuracy when firing fixed or semifixed ammunition, successive rounds should be of the same lot number; when firing separate-loading ammunition, successive rounds should consist of projectiles of one lot number, propelling charges of one lot number, fuzes of one lot number, and primers of one lot number. On ammunition made in Japan, the prefix “J” is 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.

d. Painting and Marking.

(1) Painting. Ammunition is painted primarily to prevent rust. Secondary purposes are to provide, by the color and type of paint, means of identification and camouflage. See TM 9–1900 for additional data on painting and marking.

(2) Marking. The components of artillery rounds are marked as follows: 1 2

(a) Projectiles.

1. Stenciled on the body.

Federal Stock Number or Federal Stock Class (FSC) and Federal Item Identification Number (FIIN) on separate-loading projectiles. Caliber and type of cannon in which fired, e.g., 75 H. Kind of filler (“TNT,” “WP SMOKE,” “GB GAS,” etc.).

Type of model of projectile with “T” to indicate presence of a tracer (“SHELL M60,” “PROJ APC–T M61A1,” etc.). For ammunition manufactured in Japan the translation of the type of ammunition, in Chinese characters, is added.

“W/SUPPL CHG” when projectile has a deep cavity and contains a supplementary bursting charge.

1 In addition to the identification in (2), chemical projectiles are marked with color bands indicating the type and persistence of filler (1).
2 Navy projectiles are marked in accordance with Navy practice.
3 In older types and lots, Army Identification Code (AIC) symbol may be used instead of Federal Stock Class and Number.
(a) Inert loaded or empty ammunition items and components such as those used for classroom training and museum (display) purposes, except those whose condition is obvious, such as cutaway sections, shall be identified by impressed “INERT” or “EMPTY” markings as required.

(b) In addition to being marked by impressing “INERT” or “EMPTY,” components whose size permit, such as empty projectiles, bombs, inert loaded, and empty cartridge cases for use as shown in (a) above, shall have “FOUR” holes not smaller than \( \frac{1}{2} \) inch drilled through them 90 degrees apart. However, inert projectiles, such as those used in target practice, practice bombs, and other inert items, the designed usage of which would be impaired by the presence of drilled holes, shall be considered suitably identified when they are “INERT” marked.

(c) Cloth covered components, such as bagged propelling charges, shall be marked with durable, waterproof, sunfast ink.

(d) Personnel should be trained to handle all ammunition and ammunition components as potentially dangerous even though the items have been designated “INERT” or “EMPTY.”

10. Projectiles

An artillery projectile may be either solid or hollow. Hollow projectiles may be filled with explosive or inert material, depending on the type. Artillery projectiles, although differing in characteristic details, are of the same general shape in that they have a cylindrical body and generally an ogival or conical head (or windshield). An exception is the canister projectile which has a blunt head. The projectiles vary in length from 2 to 11 calibers, that is, 2 to 11 times the diameter. Their principal characteristic differences are described in TM 9–1900.

a. Normal-Cavity High-Explosive Projectiles. The term “normal-cavity” as applied to high-explosive cartridge refers to the type of fuze cavity in the loaded projectile of the cartridge. The fuze cavity at the forward end of the projectile is only large enough to take the boosters used with mechanical-type point-detonating and time fuzes. The projectile body consists of a hollow steel casing with boattailed base. The nose is formed to a long ogive and is threaded to receive standard contour fuzes. The fuze contour continues the long sweep of the projectile nose, maintaining a streamlined effect throughout.

b. Deep-Cavity High-Explosive Projectiles. The deep-cavity projectile is identical with the normal-cavity projectile described in a above, except for a deeper fuze cavity which makes the projectile adaptable for use with proximity fuzes or for mechanical-type fuzes and boosters with supplementary charge. For use with proximity fuzes, a deep fuze cavity at the forward end of the bursting charge is provided. Deep cavity projectiles contain an aluminum fuze well liner (some rounds on hand may have a cardboard liner), that also serves as a support for the HE filler. This liner is not to be removed. Insertion of a supplementary charge into the fuze cavity adapts the projectile for mechanical-type point fuzes and boosters. When deep-cavity projectiles are assembled with any authorized fuze, the data are the same as for the normal-cavity projectiles so fueled. Deep-cavity projectiles may be shipped with closing plug (with or without supplementary charge) or with supplementary charge and mechanical-type fuze.

11. Care, Handling and Preservation

Warning: Explosive ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuzes are particularly sensitive to shock and high temperature. Boxes containing ammunition should not be dropped, thrown, tumbled, or dragged.

a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Waterproof metal containers or moisture-resistant containers and suitable packing boxes
or crates are used to provide the desired protection for shipment and storage. Care must be observed to keep packing boxes from becoming broken or damaged. All broken boxes must be repaired immediately and careful attention given to the transfer of all markings to the new parts of the box. When the ammunition packing box contains a metal liner, the liner should be air-tested at 3 to 5 pounds per square inch and sealed, provided equipment for this work is available. This air-testing also is applicable to metal containers for separate-loading propelling charges.

b. Ammunition and ammunition components should be protected from mud, sand, moisture, frost, snow, ice, dirt, oil, grease, or other foreign matter. Wet or dirty ammunition should be wiped off at once and any verdigris or light corrosion removed. Ammunition should not be polished, however, to make it look better or brighter.

c. Since explosives are adversely affected by moisture and high temperature and frost and low temperatures, due consideration should be given to the following:

(1) Do not break the moisture-resistant seal on containers until ammunition is to be used. Ammunition removed from an air-tight container, particularly in damp climates, is liable to corrode, thereby causing the ammunition to become unserviceable.

(2) Protect ammunition, particularly fuzes and propelling charges, from sources of high temperatures, including the direct rays of the sun.

(3) Ammunition must be stored and transported within such ambient air temperature limits that it will not be permanently impaired. Except as otherwise indicated, these limits for storage are:

- Lower limit—80° F. for periods of not more than 3 days.
- Upper limit—160° F. for periods of not more than 4 hours per day.

Temperature limits for firing except as otherwise indicated are:

- Lower limit—40° F.
- Upper limit—125° F.

Exceptions to these limits are indicated in paragraphs pertaining to the particular item.

(4) Temperatures of approximately 160° F. may be encountered within unventilated containers, inclosures, shelters, freight cars, closed vehicles, and similar structures when exposed to an air temperature of approximately 125° F. plus full impact of solar radiation, that is, 360 BTU per square foot per hour, for periods of 4 hours per day. For additional information, refer to AR 705–15.

(5) In addition to general precautions with regard to protection of ammunition against heat and moisture, further efforts should be made, when practicable, to protect it against heat and moisture when stored in hot, humid weather and against low temperatures and moisture when stored under extremely cold conditions. It must be remembered that accuracy of fire and safety in firing are best when ammunition is kept clean, dry, and at moderate and uniform temperatures. For additional information on care, handling, and storage, see TM 9–1903 and ORDM 7–224.

d. Projectiles containing phosphorus, or rounds having phosphorous-filled projectiles, should be stored or transported at temperatures below the melting point (111.4° F.) of the WP filler. If this is not practicable, the ammunition should be stored or transported on their bases so that should the WP filler melt, it will solidify when the temperature falls below the melting point of the filler, with the void space in its normal position in the nose of the projectile. Prematures have been caused by voids in the base end of WP projectiles and erratic performance may result from voids in its side. Complete rounds of recent manufacture are packed in boxes with their fuses pointing in the same direction; the boxes are marked "NOSE END" to indicate the fuze end.

e. When necessary to leave ammunition in the open, raise it on dunnage at least 6 inches from the ground and cover it with paulins (tarpaulins). Wherever possible, dunnage
should be used between each row to permit full air circulation. Suitable trenches should be dug to prevent water from flowing under the pile. Paulins should be arranged to permit free circulation of air through the pile and should be kept at least 6 inches from the pile on top, ends, and sides (TM 9–1903).

f. Separately packed detonating fuzes should be stored in accordance with TM 9–1903 or ORDM 7–224; shipment should be in accordance with ICC regulations.

g. Ammunition containers should be stored with the top side up. Labels or markings on boxes and containers, if in their proper places, indicate which side should be up.

h. Ammunition or components of ammunition prepared for firing but not fired will be returned, if possible, to their original condition and packings and be appropriately marked. Such ammunition will be used first in subsequent firings in order that stocks of opened packings may be kept at a minimum.

i. Do not attempt to disassemble any fuze into its components.

j. Any alteration of loaded ammunition except by the technical service concerned and under the supervision of a commissioned officer of that service is hazardous and therefore is prohibited (AR 385–63). Marking on packing boxes should indicate such alteration if any.

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

l. Cartridge cases are dented easily and should be protected from hard knocks and blows. A dented cartridge case may result in loss of obturation, jamming in the chamber, and difficulties in extraction.

m. Do not remove the eyebolt-lifting plug from unfuzed projectiles until the fuze is to be assembled thereto. The plug is provided to keep the fuze opening free of foreign matter as well as for convenience in handling. When separate-loading projectiles are stored in the field, frequent inspection of the plugs must be made for evidence of rust. The threads must be coated with a thin film of silicone compound or light, rust-preventive compound, to prevent the plug from sticking or “freezing” in the projectile.

Note. Such lubrication must be done very sparingly.

n. Blank cartridges with loose or broken closing cup will not be used or fired but will be reported to the ordnance officer for disposition.

o. Do not handle duds. Duds are extremely dangerous because their fuzes may be armed. Duds will not be moved or turned, but will be destroyed in place in accordance with TM 9–1900.

p. Precautions in handling ammunition, including procedures to be followed in case of misfires, hangfires, and cook-offs, are found in AR 385–63, TM 9–1900, and in the various technical manuals and field manuals pertaining to particular weapons. General information on care, handling, preservation, and destruction of ammunition is contained in TM 9–1903.

q. The following pertains to the storage and handling of proximity fuzes:

Note. These fuzes are classified CONFIDENTIAL (Modified Handling Permitted) and require suitable protection in storage and use to prevent any possible breach of security (AR 380–5).

1. Proximity fuzes and proximity-fuzed rounds should be protected from long exposure to high humidity and temperatures below –20° F. and above 130° F. Storage outside the indicated range, particularly prolonged storage at high temperatures, may permanently damage the fuze. However, FUZE, PROXIMITY, artillery, M513A2 may be stored at temperatures as high as +160° F. for periods up to 4 hours and as low as –65° F.

2. In temperate climates, provided adequate protection is given to fuzes after containers are opened, current models of proximity fuzes may be expected to remain serviceable for 2 years or more. The fuzes should not be removed from their original sealed containers, particularly in tropical climates, until just before use. Exposure to rain or immersion in water will result in accelerated deterioration.

3. Proximity fuzes are packed in specially designed metal containers and boxes in order to cushion the fuzes. They are packed to withstand conditions ordinarily encountered in the
field. Dropping and excessive rough handling will lead to an increased number of duds; however, fuze safety will not be decreased. These fuzes can be successfully air-dropped if parachutes are used. Fuzes visibly damaged by such dropping should not be fired but may be handled and disposed of safely.

(4) Proximity-fuzed ammunition may be safely transported short distances with normal care and handling. However, when such ammunition is to be transported for considerable distances, it is advisable to remove the fuzes from the projectiles and return the fuzes to their original marked containers. Tear-type containers should be sealed with adhesive tape and then placed into their original cans, cartons, or boxes prior to loading onto an ammunition carrier. The supplementary charges, nose plugs, or eyebolt-lifting plugs and gaskets, should be assembled to the unfuzed projectile. The felt pad end of the supplementary charge should be placed downward in the cavity.

(5) Unpacked fuzes are easily damaged by shocks such as those produced by dropping or striking of the fuzes against any object. Exercise care not to drop or strike fuzes or fuzed rounds as these actions may increase the number of duds.

(6) Since proximity fuzes are supplied as separate items of issue, their use results in an accumulation of mechanical-type fuzes, supplementary charges, closing plugs, and eyebolt-lifting plugs. To permit salvage and issue of these items, they will be packed in containers from which the proximity fuzes have been removed or other suitable containers. Particular attention should be given to defacing any original markings on boxes and to applying markings which correctly identify the contents. This will provide easy identification of the salvaged components. They should then be returned to an Ordnance ammunition depot whenever practicable.

(7) These fuzes should be stored in their original unopened containers and should receive the same care given all packed ammunition. Sealed containers should not be opened merely for inspection of proximity fuzes in storage. With proper care, fuzes in unopened containers will remain serviceable indefinitely.

(8) Duds are extremely dangerous because their fuzes may be armed. They will not be moved or touched but will be destroyed in place whenever possible, in accordance with TM 9–1900. Proximity fuzes may be considered safe for handling 24 hours after the projectile has been fired due to the discharge of arming capacitors. However, they should be handled with care, since the fuzes still contain an armed explosive train, a booster charge, and an electric impact element.

r. Use the following procedure for installing separately issued fuze on projectile.

(1) Select an appropriate work site for the fuzing operation. Prepare a suitable worktable using planks or empty boxes. If available, use a paulin to cover the surface.

(2) Place the unfuzed cartridge on its side. Protect the primer in the base of the cartridge case of 90-mm ammunition from being struck and the cartridge case from being damaged.

(3) Remove the closing plug and gasket with a suitable wrench. Turn the wrench in a counterclockwise direction (looking downward on the nose of the projectile).

(4) If the projectile contains a deep cavity, make sure that a supplementary charge is assembled thereto if a fuze VT is not used.

(5) Inspect the cavity for the presence of foreign material. Remove loose material from the cavity.
(6) Remove the required fuze MT or MTSQ from its container. Remove the safety pin (if present) from the booster. Do not remove the safety wire from the fuzes on which employed, until the cartridge is ready for use.

(7) Screw in the fuze in a clockwise direction by hand. If binding occurs, inspect the fuze cavity and threads of both fuze and projectile; reject damaged item.

(8) Tighten the fuze, using wrench, fuze, M18 or M7A1 for 90-mm cartridge and wrench, fuze, M19 (T15) for 120-mm projectiles. Use only such force as can be applied by hand. Make sure the fuze shoulder seats firmly against the projectile nose.

(9) With a round-nose punch, stake the body of the fuze to the projectile in at least two of the projectile notches. Perform the staking so that the metal from the fuze body is forced tightly into the projectile notches. Be careful not to cut the fuze body metal or peen it too thin. Staking must be done correctly so that the fuze will withstand the counterclockwise setting torque applied by fuze setters.

Caution: Be careful not to strike or damage the fuze during staking.

(10) Only install sufficient fuzes to meet expected requirements.

s. The following precautions are to be observed during assembly of fuzes.

(1) Do not stand a fixed round on its base. Pressure from a small pebble, nailhead, or high spot might accidentally fire the primer.

(2) Do not remove safety wires from fuzes on which employed until the cartridge is ready for firing.

(3) Avoid striking the primers and fuzes of fixed and separated rounds.

(4) Seat the fuze firmly against the nose of the projectile otherwise the staking will not be effective. If the staking is ineffective, the possibility of loosening a fuze (instead of setting it) exists when using the fuze-setter-rammer M20 (90-mm antiaircraft weapons). This setter-rammer has a pair of ramming rolls that holds the HE cartridge while a set of knives scores, grips, and turns the lower cap of the fuze counterclockwise. The possibility of loosening a fuze also exists when using the fuze-setter-rammer M19A1 (120-mm antiaircraft weapons) but to a lesser extent than in the setter-rammer M20. This setter-rammer employs two pawls, one of which engages the slot on the fuze body and the other engages the setting slot on the lower cap.

(5) Cartridges that have been fuzed in preparation for firing but are not fired, should be protected against accidental functioning or damage until fired. Since it is difficult to restore components of cartridges to their original condition and packing, only a sufficient number to meet expected requirements should be fuzed.

12. Packing and Marking for Shipment

a. General. Moisture-resistant containers are used for practically all ammunition except separate-loading projectiles. These packing containers are marked to furnish all essential information. Specific packing data for each ammunition item will be found in SM 9-5-1900 series.

b. Packing.

(1) Separate-loading components. Separate-loading projectiles do not require any outer packings; they are shipped unfuzed, with an eyebolt-lifting plug in the nose and a grommet to protect the rotating band (sec VI, ch 3). Separate-loading propelling charges are packed in airtight metal containers. Charges in fiber containers are overpacked in wooden boxes. An igniter protector cap, made of cloth, paper, or plastic, serves as protection to the igniter end of propelling charges as shipped. Separate-loading percussion primers are packed 48 to a sealed metal can and these cans are packed in a wooden box. Percussion
primer Mk 2A4 is packed in certain metal containers containing separate-loading propelling charges (service) with which the primer is used. The primer is packed in a moisture-resistant envelope in a protecting block called a retainer which is placed on top of the propelling charge within the metal container. The propelling charges with which the primers are packed are shown in paragraphs 226 through 243.

(2) Fixed and semifixed rounds. Rounds in fiber containers of 76-mm, 76-mm, 90-mm, and 105-mm calibers assembled with point-fuzed projectiles may have U-shaped packing stops fitted into the fuze wrench slots. These must be removed before firing. All rounds in fiber containers are overpacked in wooden boxes or in metal containers. For typical packing boxes, see TM 9-1900. One-round metal containers are used for packing single rounds of artillery ammunition under certain conditions when specifically authorized. The one-round metal container is cylindrical, made of steel, and sealed against moisture by a rubber gasket in the sealing cover. A screw and pressure plate cover assembly hooks under a locking ring on the container and provides pressure over the sealing cover and gasket. Cork and felt pads provide a snug fit for the round or the fiber container in which the round is packed. Metal containers are painted olive drab.

c. Sealing. Each container, after the contents are packed properly, is sealed in a manner which will indicate whether the container has been tampered with. Lead seals are stamped with the letters US, except that in the case of ammunition made in Japan, they are stamped UJS.

d. Palletization. Palletization is employed to reduce handling time and save man-hours in storing and shipping certain types of ammunition.

e. Marking for Shipment.

(1) Ammunition items are marked as described in paragraph 9. Packages are marked in accordance with user requirements DOD and Army Regulations, Military Specifications, and Interstate Commerce Commission (ICC) Regulations.

(2) Each package of supplies turned over for shipment on a Government bill of lading is marked with the following: However, only 10 percent of the items are marked on carload shipments.

(a) Name and address of destination or port officer (or code marking) preceded by word “To.”

(b) Name and address of ultimate consignee preceded by word “For.”

(c) List full, or abbreviated, description of contents.

(d) ICC shipping name and dangerous commodity designation.

(e) Federal Stock Number or Class of Federal Item Identification Number, published in SM 9-5-130 series.

(f) Gross weight in pounds and displacement in cubic feet.

(g) The number of the package or shipping ticket.

(h) The letters US or UJS in several conspicuous places.

(i) Order number or contract number.

(j) Ordnance insignia.

(k) Name or designation of consignee preceded by the word “From.”

(l) Ammunition lot number.

(m) Month and year packed.

(n) Inspector’s stamp.

(3) The adhesive sealing strips on fiber containers are in accordance with basic color scheme (TM 9-1900). For example, containers for blank ammunition have sealing strips in red to indicate low explosive (black powder); for rounds with high explosive projectiles, the strips are yellow.

1 May be omitted on individual packages in carload shipments of packages of standard weights and dimensions containing standard quantities.
Wooden packing boxes are unpainted with marking in black.

Metal containers for complete rounds are painted green (olive drab) with marking in yellow; for propelling charges, the containers are green with marking in black.

Containers for green bag or white bag propelling charges are painted with a green or white band or stripe, respectively.

The muzzle velocity of some rounds of smaller caliber is indicated on the packing box.

To distinguish rounds assembled with brass cartridge cases from those with steel cartridge cases, the words "STEEL CASE" are marked on those boxes containing steel case rounds.

For 76-mm, 90-mm, and 105-mm ammunition, functional marking consisting of the words FLASHLESS, SMOKELESS, or FLASHLESS-SMOKELESS (FLHLS, SMKLS, or FLHLS-SMKLS where space is limited) appears on packing containers.

For rounds containing deep cavities and supplementary bursting charges — "W/SUPPL CHG."

Linen data tags, containing pertinent information, are attached to separate-loading propelling charges.

Ammunition data cards for other ammunition accompany shipping tickets for ammunition packings.

13. Storage Precautions

a. When necessary to store artillery ammunition in the open, first consideration should be given to separate-loading projectiles.

b. The sites for outdoor storage should be carefully selected to avoid exposure to power lines and electric cables. Sites should not be adjacent to reservoirs, water mains, or sewer lines. Sites should be level, well drained, and free from readily ignitable and flammable materials. Do not store ammunition under trees or adjacent to towers and other structures that attract lightning.

c. Heavy, well supported dunnage should be used to keep the bottom tier of the stack off the ground to prevent its sinking into the ground. Allow at least 2 inches of space beneath the pile for air circulation. A hardstand of bituminous material of gravel and sand is preferable to excessive use of dunnage. Provisions should be made to allow air circulation through the stacks.

d. Nonflammable or fire-resistant overhead covers such as paulin should be provided for all ammunition containing solid propellants, torpex, trinitro, minol, and chemical munitions which may ignite spontaneously when exposed to the direct rays of the sun. An overhead air space of approximately 18 inches should be maintained between the paulin and the ammunition. The paulin should be kept at least 6 inches from the pile on the ends and sides to permit free circulation of air through the pile.

e. Separate detonating fuzes may be stored and transported separately from other explosive ammunition.

f. Primer boxes and containers should be stored with the top side up.

Projectiles containing phosphorus preferably should be stored or transported on their bases. Should such ammunition be stored or transported on their sides and the temperature reach 111.4° F., the melting point of phosphorus, this filler may flow to one side of the projectile and thereby cause erratic ballistics.

h. In addition to general precautions with regard to protection against heat and moisture, further efforts should be made when practicable to protect ammunition against heat and moisture when stored in hot, humid weather and against low temperatures and moisture when stored under extremely cold conditions, remembering that ammunition is best when kept clean, dry, and at moderate and uniform temperatures. For further storage precautions, see TM 9–1903.

14. Forms and Reports

a. Authorized Forms. The forms generally applicable to units operating or maintaining this materiel are listed in the appendix. For instructions on the use of these forms, refer to FM 9–5. For a listing of all forms, refer to DA Pam 310–2.
b. Field Report of Malfunctions and Accidents. Any malfunction of military ammunition must be reported promptly to the ordnance officer under whose supervision the materiel is maintained and issued. It is only by making immediate and complete reports of all abnormal functioning of military ammunition that danger may be eliminated and a reliable supply maintained. Immediately after the occurrence of a malfunction or an accident, all parts of the item involved in the malfunction or accident and the remaining items in the package or packing box from which the defective item was taken should be collected and carefully preserved pending instruction from the ordnance officer or the board appointed to investigate the malfunction or accident. An immediate report of malfunctions and accidents by the ordnance officer to the Chief of Ordnance is required by AR 700–1300–8. The name of the manufacturer of the materiel and the lot number will be reported. If fuzed, the name of the fuze manufacturer, type or model, and lot number will be reported.

c. Report of Discrepancies in Publications. Whenever technical discrepancies are noted in Department of the Army publications, they will be reported as indicated in AR 700–38.
CHAPTER 2
CARTRIDGES AND PROJECTILES

Section I. CARTRIDGES FOR 37-MM AUTOMATIC GUN M1A2

15. General

a. General Discussion. This weapon is a rapid firing automatic weapon intended primarily for antiaircraft fire although it can be used against ground targets. Ammunition for this gun is issued in the form of "fixed" complete rounds, that is, the propelling charge is nonadjustable. This ammunition is used for training only.

b. Identification. Painting and marking for identification is in accordance with the basic color scheme prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projectile, ammunition for this gun is classified as high-explosive with tracer (HE–T), armor-piercing capped with tracer (APC–T), target-practice with tracer (TP–T), and dummy.

d. Fuze. Point detonating (PD) fuze M56 is fitted to all high-explosive 37-mm ammunition employed against aircraft and similar targets. This is a superquick fuze which is supersensitive, since it will function on impact with light materiel targets. Dummy fuze M50 is provided for use with TP–T cartridge M55A1 and the dummy fuze M50B2 for dummy cartridge M21. See paragraphs 184 through 225 for detailed information.

e. Cartridge Case. The cartridge cases M17 (brass) and M17B1 (steel) are used with ammunition for the 37-mm gun M1A2. These cartridge cases have an extractor groove machined in the side of the head. The cartridge case M17 weighs 0.85 pound; the cartridge case M17B1 has a thinner head and primer seat, and weighs approximately 0.10 pound less.

f. Propelling Charge. The cartridges, dependent upon type, contain from 0.28 to 0.39 pound of propellant M1, M2, or M5. See paragraphs 226 through 243 for detailed information.

g. Primer. Percussion primer M38A1, a 55-grain primer, has replaced the 20-grain primer M23A2 for use with 37-mm service ammunition. Primer M38B2 is an alternative to primer M38A1. Some cartridges on hand are assembled with the primer M23A1 or M23A2. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. The cartridges for the 37-mm gun M1A2 are packed one per fiber container, 10, 12, 25, or 40 containers in a wooden box, also 20 rounds in a metal lined box. Packing and shipping data appear in SM 9–5–1310. Packing and marking for shipment is described in paragraphs 3 through 14.

16. Cartridge, 37 Millimeter, Dummy: M21, w/Fuze, Dummy, M50B2

This completely inert cartridge (fig. 1) simulates the HE cartridge M54 (par. 17) and is used for training in handling, loading, and firing. It consists of the steel cartridge case M17B1, assembled with a modified empty shell M54 and dummy fuze M50B2 (one-piece, steel). The shell and case are held together by means of a steel retaining rod, one end of which is inserted into the enlarged tracer cavity in the base of the shell. The other end is screwed into a cartridge case plug assembly which takes the place of the primer. This plug assembly is inserted with a free fit in the primer hole. A copper plug is assembled in the base of the plug assembly so that the firing pin of the weapon will not be damaged in simulated firings. The weight of the cartridge is 2.67 pounds; the length is 12.81 inches.

17. Cartridge, 37 Millimeter: HE–T, SD, M54, MV 2,600 w/Fuze, PD, M56

This cartridge is similar to cartridge M54A1 (par. 18) and differs only in the igniter and tracer charges.
18. Cartridge, 37 Millimeter: HE-T, SD, M54A1, MV 2,600 w/Fuze, PD, M56

a. General. This cartridge (fig. 2) is used for firing against aircraft, hence is fitted with a supersensitive type of superquick fuze. It is assembled with the cartridge case M17 which is stab cramped to the projectile. The projectile consists of a relatively thin-walled body, a tetryl or composition A–3 bursting charge, PD fuze M56, and a shell-destroying tracer. The nose is threaded to receive the fuze. The "boat-tailed" base is bored (and counterbored) and threaded to receive the relay igniting charge assembly. The tracer assembly, consisting of an igniter charge and a tracer charge, is pressed into the counterbore. When the cartridge is fired, the burning propellant initiates the igniter charge which, in turn, ignites the tracer charge. The tracer burns with a visible trace for about 8 seconds, equivalent to a range of about 3,500 yards. As the tracer burns out, the relay igniting charge is ignited and causes the bursting charge to detonate if prior functioning has not been caused by fuze impact.

b. Data.

| Weight of cartridge | 2.67 lb |
| Length of cartridge | 12.81 in |
| Length of fused projectile | 5.89 in |
| Length of cartridge case | 8.75 in |
| Width of rotating band | 0.74 in |
| Type of base | boat-tailed |
| Degree of taper of base | 9 deg |
| Radius of ogive | 4.34 cal |
| Muzzle velocity | 2,600 fps |
| Maximum theoretical horizontal range | 9,050 yd |

Maximum actual horizontal range (due to shell-destroying tracer) .......... 3,500 yd
Maximum theoretical vertical range .......... 6,300 yd

19. Cartridge, 37 Millimeter: TP-T, M55A1, MV 2,600, w/Fuze, Dummy, M50

a. General. This target practice cartridge (fig. 3) has the same ballistic characteristics as the high-explosive service cartridge M54A1 (par. 18). The cartridge case M17 (brass) or M17B1 (steel) and a service primer and propelling charge are used. Cartridges assembled with steel cases are for use for ground training only. The projectile is similar in contour to projectile M54A1 and of the same weight, but has no bursting charge and is fitted with a dummy fuze. In addition, the shell-destroying tracer of the service round is replaced by a composition for tracing purposes only. The tracer, consisting of an igniter composition and a red tracer composition, burns with a visible trace for about 8 seconds, equivalent to a range of about 3,500 yards. The dummy fuze M50 simulates the service fuze PD M56 but has no explosive elements.

b. Data.

| Weight of cartridge | 2.67 lb |
| Length of cartridge | 12.81 in |
| Length of fused projectile | 5.87 in |
| Length of cartridge case | 8.75 in |
| Width of rotating band | 0.74 in |
| Type of base | boat-tailed |
| Degree of taper of base | 8 deg 45 min |
| Muzzle velocity | 2,600 fps |
| Maximum horizontal range | 9,050 yd |
| Maximum vertical range | 6,300 yd |
Figure 2. Cartridge, 37 millimeter: HE-T, SD, M34A1, MV 2,000, w/ fuze, PD, M56.
Figure 4. Cartridge, 37 millimeter: TP-T, M55A1, MV 2,800, fuze, dummy, M50.
Figure 2. Cartridge, 37 millimeter: HE-T, SD, M54A1, MV 2,000, wftze, PD, M56.
Figure 4. Cartridge, 47 millimeter: TP-T, M55A1, MIV 2,600, w/finer, dummy, M50.
20. **Cartridge, 37 Millimeter: TP-T, M55A1, Steel Case, MV 2,600, w/Fuze, Dummy, M50**

This cartridge is the same as the cartridge in paragraph 19, except that this cartridge uses a steel cartridge case.

21. **Cartridge, 37 Millimeter: APC-T, M59, MV 2,050**

a. **General.** This cartridge is used against light armor and similar targets. The projectile is made up of a hard steel core or body and a pointed steel armor-piercing cap. The projectile depends on striking power for penetration of the target. The use of an armor-piercing cap is intended to adapt the projectile for defeating face-hardened plate. Since there is no windshield, the projectile has a blunt, flat nosed appearance. There is no bursting charge, the projectile being solid except for a small cavity in the base. The small cavity holds a red tracer composition which burns for approximately 3 seconds. The cartridge is assembled with the cartridge case M17.

b. **Data.**
- Weight of cartridge: 3.17 lb
- Length of cartridge: 12.88 in.
- Length of projectile: 4.71 in.
- Length of cartridge case: 8.75 in.
- Width of rotating band: 0.74 in.
- Type of base: square
- Muzzle velocity: 2,050 fps
- Maximum horizontal range: 5,790 yd
- Maximum vertical range: 4,000 yd

22. **Cartridge, 37 Millimeter: APC-T, M59, Steel Case, MV 2,050**

This cartridge is the same as the cartridge in paragraph 21 except that it has a steel cartridge case. Cartridges assembled with steel cases are a substitute for brass case cartridges and are for use for training only.

### Section II. CARTRIDGES FOR 37-MM SUBCALIBER GUNS M12, M13, M14, M15, AND M1916

23. **General**

a. **General Discussion.** Subcaliber ammunition is fired from subcaliber devices of either the exterior type or the interior type in connection with artillery weapons, adapting them for firing smaller caliber (subcaliber) ammunition. The purpose of subcaliber devices is to save wear on the weapon subcalibered, to conserve service ammunition, and to permit the safe use of reduced size firing ranges when practice firing during training. Interior-type 37-mm subcaliber guns M12, M15, M14, and M13 inserted, respectively, in the bore of 75-mm howitzers, 76-mm gun, 90-mm guns, and 105-mm howitzers adapt them for firing 37-mm subcaliber ammunition. The 155-mm gun and howitzer and 8-inch howitzer are equipped to fire 37-mm subcaliber ammunition by the external mounting of 37-mm subcaliber gun M1916. See table I.

b. **Identification.** Subcaliber ammunition is identified by means of painting and marking in accordance with the basic color scheme in TM 9-1900.

c. **Projectiles.** Dependent on the type of projectile, subcaliber ammunition is target practice (TP), training, high explosive (HE), or smoke (WP).

d. **Fuses.** The 37-mm TP cartridge M63 Mod 1 uses the practice BD fuze M58. Other subcaliber cartridges are service ammunition using the service fuze or no fuze. See paragraphs 184 through 225 for detailed information.

e. **Cartridge Cases.** The 37-mm subcaliber rounds utilize either the brass cartridge case Mk 1A2 or the steel cartridge case Mk 1A2B1 which is 0.02 pound lighter.

f. **Propelling Charge.** The propelling charge for 37-mm subcaliber ammunition consists of 0.06 pound of propellant for the TP cartridge M63 Mod 1. Other subcaliber ammunition are service rounds using the same weight of propellant as service rounds. See paragraphs 226 through 243 for detailed information.

g. **Primers.** Subcaliber rounds for 37-mm subcaliber guns use percussion primer M25A2 (cartridge M63 Mod 1). See paragraphs 244 through 263 for detailed information.
h. Packing and Shipping Data. Subcaliber rounds for 37-mm subcaliber guns are packed each in a fiber container either 10, 25, or 40 rounds per wooden box. Other subcaliber ammunition is packed in the same manner as service ammunition of the same caliber. Packing and shipping data for 37-mm rounds appear in SM 9–5–1310.

Table I. Ammunition for Subcaliber Weapons

<table>
<thead>
<tr>
<th>Weapon subcalibered</th>
<th>Subcaliber weapon</th>
<th>Subcaliber ammunition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANNON, 75-mm HOWITZER, M1A1</td>
<td>GUN, subcaliber, 37-mm, M12</td>
<td>CARTRIDGE, 37 MILLIMETER: TP, M63, Mod 1, for 37-mm subcaliber guns.</td>
</tr>
<tr>
<td>CANNON, 76-mm GUN, M1A2</td>
<td>GUN, subcaliber, 37-mm, M15</td>
<td>CARTRIDGE, 37 MILLIMETER: TP, M63, Mod 1, steel case, for 37-mm subcaliber guns.</td>
</tr>
<tr>
<td>CANNON, 90-mm GUN, M1, M1A1 (AMTB mount M3) only.</td>
<td>GUN, subcaliber, 37-mm, M14.</td>
<td>CARTRIDGE, 37 MILLIMETER: TP, M63, Mod 1, for 37-mm subcaliber guns.</td>
</tr>
<tr>
<td>CANNON, 105-mm HOWITZER, M2A1, M2A2, M4, and M4A1 (35062).</td>
<td>GUN, subcaliber, 37-mm, M13.</td>
<td>CARTRIDGE, 37 MILLIMETER: TP, M63, Mod 1, for 37-mm subcaliber guns.</td>
</tr>
<tr>
<td>CANNON, 155-mm GUN, M2</td>
<td>GUN, subcaliber, 37-mm, M1916.</td>
<td></td>
</tr>
<tr>
<td>CANNON, 155-mm, HOWITZER, M1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CANNON, 8-inch HOWITZER, M2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CANNON, 280-mm GUN, M66</td>
<td>CANNON, PACK, HOWITZER, 75-mm, M1A1.</td>
<td>CARTRIDGE, 75 MILLIMETER: HE, M48, w/fuze, MTSQ, M500, or M500A1 for 75-mm howitzers M1A1 and M3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg and fuze, MTSQ, M500 or M500A1, for 75-mm howitzers M1A1 and M3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg and fuze, PD, M51A4 (M48A2), 0.15-sec delay, for 75-mm howitzers M1A1 and M3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay, for 75-mm howitzers M1A1 and M3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CARTRIDGE, 75 MILLIMETER: smoke, WP, M64, w/fuze, PD, M48A3, 0.05-sec delay, for 75-mm howitzers M1A1 and M3.</td>
</tr>
</tbody>
</table>
24. Cartridge, 37 Millimeter: TP, M63, Mod 1

a. General. This cartridge (fig. 4) consists of the TP projectile M63 Mod 1 loaded with 0.056 pound of pressed black powder, fitted with the base detonating practice fuze M58, and crimped to the primed cartridge case Mk 1A2 containing 0.56 pound of propellant. Cartridges on hand have the steel cartridge case Mk 1A2B1.

Section III. CARTRIDGES FOR 40-MM GUN CANNONS M1, M1A1, M2, AND MK 1 (NAVY)

25. General

a. General Discussion. These guns are rapid fire automatic weapons intended primarily for antiaircraft fire although they can be used against ground targets. Ammunition for these guns is issued in the form of fixed complete rounds. Since the Army guns are basically the same as Navy and British 40-mm guns, the ammunition is interchangeable.

b. Identification. Cartridge of Army procurement are painted and marked for identification in accordance with the basic color scheme prescribed in TM 9–1900. In other cases, painting and marking may follow practices of other services.

c. Projectile. Dependent upon type of projectile, ammunition for these weapons is classified as armor-piercing with tracer (AP-T), high-explosive with tracer (HE-T), high-explosive with incendiary (HE-I), target-practice with tracer (TP-T), and dummy.

d. Fuze. Point detonating (PD) fuze Mk 27 is fitted to all 40-mm HE projectiles with one exception; the HE projectile equipped with "self-destroying" tracer M3 contains the PD fuze M64A1. Both fuzes are single-action superquick type designed to function upon light impact. Dummy fuze M69 or M69B1 is fitted to target practice projectiles. See paragraphs 184 through 225 for detailed information.

e. Cartridge Case. The cartridge case M25 (brass) or M25B1 (steel) is used with ammunition of Army procurement for these 40-mm guns. The cartridge cases have an extractor groove machined in the side of the head; another groove in the base of the head provides for engagement by the charger clip hook. The cartridge case M25 weighs 1.94 pounds; the cartridge case M25B1, which has a thinner head and primer seat, weighs approximately 1.68 pounds. Ammunition of Navy design will have the brass case Mk 2 Mod 1 or the steel case Mk 3; the brass case weighs 1.89 pounds and the steel case weighs 0.86 pound less.

f. Propelling Charge. The cartridges, dependent upon type, contain from 0.65 to 0.718 pound of propellant M1. The dummy cartridges do not contain any propellant. See paragraphs 226 through 243 for detailed information.

g. Primer. Percussion primer M38A1, a 55-grain primer, is used for cartridges of Army procurement. Cartridges of early manufacture were assembled with the 20-grain percussion primer M23A2. Alternative primers are M38B2 and the Navy Mk 22. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. These cartridges for the 40-mm guns are packed one per fiber container, 6, 8, 12, or 24 containers in a wooden box, also four in a charger clip, four clips in a metal box. Packing and shipping data appear in SM 9–5–1310. Packing and marking for shipment is described in paragraphs 3 through 14.

26. Cartridge, 40 Millimeter: AP-T, M81

The cartridge M81 differs from the cartridge M81A1 (par. 27) only in the method of attaching the windshield and the primer used. This cartridge has a windshield that is secured to the projectile by means of an adapter; the cartridge M81A1 has a windshield that is crimped directly to the projectile. This cartridge is assembled with the percussion primer M23A2; the cartridge M81A1 uses the percussion primer M38A1. Some of these cartridges, intended for use during the early stages of training, have a vapor-trail-producing dipcoating compound on their windshields.
Figure 4. Cartridge, 37 millimeter: TP, M63, Mod 1.
24. Cartridge, 37 Millimeter: TP, M63, Mod 1

a. General. This cartridge (fig. 4) consists of the TP projectile M63 Mod 1 loaded with 0.056 pound of pressed black powder, fitted with the base detonating practice fuze M58, and crimped to the primed cartridge case Mk 1A2 containing 0.56 pound of propellant. Cartridges on hand have the steel cartridge case Mk 1A2B1.

Section III. CARTRIDGES FOR 40-MM GUN CANNONS M1, M1A1, M2, AND MK I (NAVY)

25. General

a. General Discussion. These guns are rapid fire automatic weapons intended primarily for antiaircraft fire although they can be used against ground targets. Ammunition for these guns is issued in the form of fixed complete rounds. Since the Army guns are basically the same as Navy and British 40-mm guns, the ammunition is interchangeable.

b. Identification. Cartridge of Army procurement are painted and marked for identification in accordance with the scheme prescribed in TM 9-1900. In other cases, painting and marking may follow practices of other services.

c. Projectile. Dependent upon type of projectile, ammunition for these weapons is classified as armor-piercing with tracer (AP-T), high-explosive with tracer (HE-T), high-explosive with incendiary (HE-I), target-practice with tracer (TP-T), and dummy.

d. Fuze. Point detonating (PD) fuze Mk 27 is fitted to all 40-mm HE projectiles with one exception; the HE projectile equipped with "self-destroying" tracer M3 contains the PD fuze M64A1. Both fuzes are single-action superquick type designed to function upon light impact. Dummy fuze M69 or M69B1 is fitted to target practice projectiles. See paragraphs 184 through 225 for detailed information.

e. Cartridge Case. The cartridge case M25 (brass) or M25B1 (steel) is used with ammunition of Army procurement for these 40-mm guns. The cartridge cases have an extractor groove machined in the side of the head; another groove in the base of the head provides for engagement to the charger clip hook. The cartridge case M25 weighs 1.94 pounds; the cartridge case M25B1, which has a thinner head and primer seat, weighs approximately 1.68 pounds. Ammunition of Navy design will have the brass case Mk 2 Mod 1 or the steel case Mk 3; the brass case weighs 1.89 pounds and the steel case weighs 0.36 pound less.

f. Propelling Charge. The cartridges, dependent upon type, contain from 0.65 to 0.718 pound of propellant M1. The dummy cartridges do not contain any propellant. See paragraphs 226 through 213 for detailed information.

g. Primer. Percussion primer M88A1, a 55-grain primer, is used for cartridges of Army procurement. Cartridges of early manufacture were assembled with the 20-grain percussion primer M23A2. Alternative primers are M138B2 and the Navy Mk 22. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. These cartridges for the 40-mm guns are packed one per fiber container, 6, 8, 12, or 24 containers in a wooden box, also four in a charger clip, four clips in a metal box. Packing and shipping data appear in SM 9-5-1310. Packing and marking for shipment is described in paragraphs 3 through 14.

26. Cartridge, 40 Millimeter: AP-T, M81

The cartridge M81 differs from the cartridge M81A1 (par. 27) only in the method of attaching the windshield and the primer used. This cartridge has a windshield that is secured to the projectile by means of an adapter; the cartridge M81A1 has a windshield that is crimped directly to the projectile. This cartridge is assembled with the percussion primer M23A2; the cartridge M81A1 uses the percussion primer M88A1. Some of these cartridges, intended for use during the early stages of training, have a vapor-trail-producing dipcoating compound on their windshields.
Figure 4. Cartridge, .37 millimeter: TP, Mk.4, Mod 1.
27. Cartridge, 40 Millimeter: AP-T, M81A1

a. General. This cartridge is used for firing against armored and similar targets. The hardened steel projectile is of the monobloc type; a tracer cavity in its base contains a red tracer composition which burns for about 12 seconds. The nose of the body proper is shaped to a relatively blunt ogive. However, a long false ogive is provided to impart optimum ballistic properties, by means of a lightweight wind¬shield (ballistic cap) secured to the projectile body. The windshield is attached to the nose crimping groove by means of a 360-degree crimp. Certain lots of these cartridges having defective tracer elements have a vapor-trail-producing dipcoating compound applied to their windshields. The dipcoating compound will produce a vapor trail that begins immediately after the projectile leaves the muzzle of the gun and continues to be visible up to a range of 1,000 yards. Visibility of the vapor trail is limited to daytime firing. Ammunition having this dipcoating is intended for use during the early stages of training only and is not intended for use in the final stages of training or in combat except in an emergency. This cartridge is also issued with a steel case.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>4.58 lb</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>1.96 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>17.60 in.</td>
</tr>
<tr>
<td>Length of projectile</td>
<td>6.19 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>12.24 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>0.64 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Radius of ogive</td>
<td>5.96 cal.</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>2,870 fps</td>
</tr>
</tbody>
</table>

Maximum horizontal range .................9,600 yd

28. Cartridge, 40 Millimeter, Dummy: M17 or M17B1

This completely inert cartridge (fig. 5) simulates the service cartridges and is used for training in handling and loading. The service projectile and cartridge case are simulated by a one-piece bronze or malleable iron body (M17B1). The nose end of the assembly is threaded to hold a bronze or iron plug resembling a service fuze. The base end of the body is threaded to hold a cold-drawn steel base which screws into the body. The base provides for extraction of the cartridge after loading in the gun. The complete cartridge weighs 4.75 pounds; length is 17.60 inches.

29. Cartridge, 40 Millimeter, Dummy: M25, w/Fuze, Dummy, M69 or M69B1

This dummy cartridge (fig. 6) is provided as an alternative for use in 40-mm guns. The cartridge consists of a modified service shell body Mk 2 and a modified steel cartridge case M25B1. The shell and cartridge case are held together by means of a steel retaining rod. One end of the rod is screwed into the threaded tracer cavity in the base of the shell; the other end is threaded to receive the cartridge case plug assembly. A copper rivet is pressed into the rear of the plug to simulate the primer head and to prevent damage to the firing pin of the weapon in simulated firings. Dummy fuze M69 completes the assembly. The complete dummy cartridge weighs 4.75 pounds; the length is 17.60 inches.

Figure 5. Cartridge, 40 millimeter, dummy: M17.
30. Cartridge, 40 Millimeter: HEI-T, SD, Mk 11, Mk 2, MV 2,890, w/Fuze, PD, Mk 27

This cartridge (fig. 7) is used for firing against aircraft. If differs from the cartridge in paragraph 34 by cartridge case (Mk 2 and Mod 1 or Mk 3), percussion primer (Mk 22), and powder composition (TNT and incendiary charge) in the projectile. The cartridge case Mk 2 and Mod 1 or Mk 3 (steel) is crimped rigidly to the projectile by means of a 360-degree crimp. The 40-mm projectile Mk 2 consists of a relatively thin-walled projectile body, a bursting charge of TNT weighing 63 grams, an incendiary charge (magnesium, 23 percent; aluminum, 23 percent; paraffin, 3 percent; barium nitrate, 48.5 percent; graphite, 2.5 percent) weighing 36 grams, the PD fuze Mk 27, and a “shell-destroying” (SD) tracer (fig. 9). The nose of the projectile is threaded to receive the fuze. The “boat-tailed” base is threaded internally to receive the “shell-destroying” tracer assembly Mk 11 or Mk 11 and Mods (Navy origin); this assembly protrudes beyond the base of the projectile for approximately 0.50 inch. The “shell-destroying” tracer consists of an igniting charge, a red tracer composition, and a relay igniting charge of black powder. The red tracer composition burns with a visible trace for 8 to 10 seconds, equivalent to a range of 3,800 to 4,300 yards. As the tracer burns out, the relay igniting charge is ignited and causes the bursting charge to detonate if prior functioning has not been caused by fuze impact. The 40-mm HEI-T and HEI-T cartridges used by the Navy may be distinguished by the painting on the fuzes: the fuze for the HEI-T cartridge is painted red and white (red tip on fuze); the fuze for the HEI-T cartridge is painted red and white (red tip on fuze).

31. Cartridge, 40 Millimeter: HEI-T, SD, Mk 11, Mk 2, MV 2,890, Steel Case, w/Fuze, PD, Mk 27

This cartridge is similar to that in paragraph 30, with the exception that this cartridge utilizes a steel cartridge case.

32. Cartridge, 40 Millimeter: HEI-T, SD, M3, Mk 2, MV 2,700, w/Fuze, PD, M64A1

This cartridge is similar to the cartridge in paragraph 34, except that the projectile has the tracer M3, and PD fuze M64A1, is 7.88 inches in length, and is loaded with tetryl. The projectile, as fired, weighs 2.06 pounds; maximum horizontal range is 5,700 yards.

33. Cartridge, 40 Millimeter: HEI-T, SD, M3A1, Mk 2, MV 2,700, w/Fuze, PD, MK 27

This cartridge is similar to that described in paragraph 32, except that the projectile has the tracer M3A1 and PD fuze Mk 27.

34. Cartridge, 40 Millimeter: HEI-T, SD, Mk 11, Mk 2, MV 2,870, w/Fuze, PD, MK 27

a. General. This cartridge (fig. 8) is used for firing against aircraft. The cartridge is assembled with the cartridge case M25, which is crimped rigidly to the projectile by means of a 360-degree crimp. The projectile Mk 2 consists of a relatively thin-walled projectile body, a bursting charge of pressed TNT, the PD fuze Mk 27, and a shell-destroying (SD) tracer (fig. 9). The nose of the projectile is threaded to receive the fuze. The “boat-tailed” base is threaded internally to receive the shell-destroy-
Figure 7. Cartridge, 40 millimeter: HEI-T, SD, Mk 11, Mk 2, MV 2,890, steel case w/fuse, PD, Mk 27.
ing tracer assembly Mk 11 or Mk 11 Mod 2 (Navy origin); this assembly protrudes beyond the base of the projectile for approximately 0.596 inch. The shell-destroying tracer consists of an igniting charge, a red tracer composition, and a relay igniting charge of black powder. The red tracer composition burns with a visible trace for 8 to 10 seconds, equivalent to a range of 3,800 to 4,300 yards. As the tracer burns out, the relay igniting charge is ignited and causes the bursting charge to detonate if prior functioning has not been caused by fuze impact. This cartridge is also made with a steel cartridge case.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>4.75 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of projectile, as fired</td>
<td>1.985 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>17.60 in</td>
</tr>
<tr>
<td>Length of fired projectile</td>
<td>7.68 in</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>12.24 in</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>0.64 in</td>
</tr>
<tr>
<td>Type of base</td>
<td>boat-tailed</td>
</tr>
<tr>
<td>Degree of taper of base</td>
<td>7 deg 45 min</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>2,870 fps</td>
</tr>
<tr>
<td>Maximum theoretical horizontal range</td>
<td>11,000 yd</td>
</tr>
<tr>
<td>Maximum actual horizontal range</td>
<td>5,200 yd</td>
</tr>
<tr>
<td>(due to shell-destroying tracer)</td>
<td>7,800 yd</td>
</tr>
</tbody>
</table>

35. Cartridge, 40 Millimeter: TP-T, M91, w/ Fuze, Dummy, M69

a. General. This cartridge (fig. 10) is similar to the 40-mm HE-T cartridge Mk 2 (par. 34) and is used for target practice purposes. The steel projectile resembles the HE projectile Mk 2 but has a solid base except for the tracer cavity. This cavity contains a red tracer composition which burns for about 12 seconds. The projectile which is loaded with an inert material is fused with either dummy fuze M69 or M69B1 or an inert PD fuze Mk 27.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>4.72 lb</th>
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</thead>
<tbody>
<tr>
<td>Weight of projectile, as fired</td>
<td>1.96 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>17.60 in</td>
</tr>
<tr>
<td>Length of fired projectile</td>
<td>7.10 in</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>12.24 in</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>0.64 in</td>
</tr>
<tr>
<td>Type of base</td>
<td>boat-tailed</td>
</tr>
<tr>
<td>Degree of taper of base</td>
<td>7 deg 45 min</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>2,870 fps</td>
</tr>
<tr>
<td>Maximum theoretical horizontal range</td>
<td>11,000 yd</td>
</tr>
<tr>
<td>Maximum theoretical vertical range</td>
<td>7,800 yd</td>
</tr>
</tbody>
</table>

Section IV. CARTRIDGES FOR 75-MM GUN CANNON M3

36. General

a. General Discussion. Cartridges for this weapon, which is used principally as a tank and antitank weapon, are issued in the form of “fixed” complete rounds (par. 3c).

b. Identification. Painting and marking for identification are in accordance with the basic color scheme as prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projectile, ammunition for this weapon is classified as armor-piercing with tracer (AP–T), armor-piercing capped with tracer (APC–T), blank, dummy, high-explosive (HE), and smoke.

d. Fuzes. The armor-piercing with tracer cartridge (AP–T) contains no fuze. The armor-piercing capped with tracer cartridge (APC–T) is fitted with the base detonating fuze M66A1. The blank cartridge contains no fuze. The dummy cartridges are fitted with inert fuzes. The high-explosive cartridges may be fitted with the MTSQ fuze M500 or MTSQ M500A1, PD fuze M51A4 (M48A2), PD fuze M51A5, or TSQ fuze M55A3 (M54). The point detonating fuze M57, which is used in conjunction with burster initiator M1, is fitted to the smoke cartridge.

e. Cartridge Case. Cartridge case M18 (brass) or M18B1 (steel) is used with all types of ammunition for this weapon except blank. The steel case has a thinner head and primer seat and is approximately 0.22 pound lighter than the brass case. The cartridge case M9A1 is used with blank cartridge; modified cartridge case M18 or M18B1 may be used.

f. Propelling Charge. The cartridges, dependent upon type, contain propellant M1, M2, or M17. See paragraphs 226 through 243 for detailed information.
Figure 2: Cartridge, 30 millimeter: HE1-T, SD, MK 11, Mk 2, MV 2.800, steel case w/fuze, PI, Mk 27.
mg tracer assembly Mk 11 or Mk 11 Mod 2 (Navy origin); this assembly protrudes beyond the base of the projectile for approximately 0.396 inch. The shell-destroying tracer consists of an igniting charge, a red tracer composition, and a relay igniting charge of black powder. The red tracer composition burns with a visible trace for 8 to 10 seconds, equivalent to a range of 3,800 to 1,300 yards. As the tracer burns out, the relay igniting charge is ignited and causes the bursting charge to detonate if prior functioning has not been caused by tracer impact. This cartridge is also made with a steel cartridge case.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>4.75 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of projectile, as fired</td>
<td>1.985 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>17.60 in.</td>
</tr>
<tr>
<td>Length of fuzed projectile</td>
<td>7.68 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>12.21 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>0.04 in.</td>
</tr>
<tr>
<td>Type of fuze</td>
<td>Empty-tailed</td>
</tr>
</tbody>
</table>

Maximum actual vertical range (due to shell-destroying tracer) 5,100 yd

Maximum theoretical horizontal range 11,600 yd

Maximum theoretical vertical range 7,500 yd

Section IV. CARTRIDGES FOR 75-MM GUN CANNON M3

35. Cartridge, 40 Millimeter: TP-T, M91, w/ Fuze, Dummy, M69

a. General. This cartridge (fig. 10) is similar to the 40-mm HE-T cartridge Mk 2 (par. 34) and is used for target practice purposes. The steel projectile resembles the HE projectile Mk 2 but has a solid base except for the tracer cavity. This cavity contains a red tracer composition which burns for about 12 seconds. The projectile which is loaded with an inert material is fuzed with either dummy fuze M69 or M69B1 or an inert PD fuze Mk 27.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>4.72 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of projectile, as fired</td>
<td>1.96 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>17.60 in.</td>
</tr>
<tr>
<td>Length of fuzed projectile</td>
<td>7.10 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>12.21 in.</td>
</tr>
</tbody>
</table>

Maximum range of shot

Maximum theoretical horizontal range 11,000 yd

Maximum theoretical vertical range 7,500 yd

36. General

a. General Discussion. Cartridges for this weapon, which is used principally as a tank and antitank weapon, are issued in the form of “fixed” complete rounds (par. 3c).

b. Identification. Painting and marking for identification are in accordance with the basic color scheme as prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projectile, ammunition for this weapon is classified as armor-piercing with tracer (AP-T), armor-piercing capped with tracer (APC-T), blank, dummy, high-explosive (HE), and smoke.

d. Fuze. The armor-piercing with tracer cartridge (AP-T) contains no fuze. The armor-piercing capped with tracer cartridge (APC-T) my cartridges are fitted with inert fuzes. The high-explosive cartridges may be fitted with the MTSQ fuze M500 or MTSQ M500A1, PD fuze M51A4 (M48A2), PD fuze M51A5, or TSQ fuze M55A3 (M54). The point detoning fuze M57, which is used in conjunction with burster initiator M1, is fitted to the smoke cartridge.

e. Cartridge Case. Cartridge case M18 (brass) or M18B1 (steel) is used with all types of ammunition for this weapon except blank. The steel case has a thinner head and primer seat and is approximately 0.22 pound lighter than the brass case. The cartridge case M9A1 is used with blank cartridge; modified cartridge case M18 or M18B1 may be used.

f. Propelling Charge. The cartridges, dependent upon type, contain propellant M1, M2, M17, and M26.
Figure 8. Cartridge, 40 millimeter: HE-T, SD, Mk 11, Mk 2, MV 2,870, w/fuze, PD, Mk 27.
Figure 9. Shell-destroying (SD) tracers for 40-mm HE shell Mk 2.

Figure 10. Cartridge, 40 millimeter: TP-T, M81, w/fuze, dummy, M49.
Figure 8. Cartridge, 40 millimeter: Hk. T. SD, Mk 11, Mk 2, MV 2870, w/fuze, PD, Mk 27.
Figure 9. Shell-destroying (SD) tracers for 40-mm HE shell Mk 2.
g. Primers. Three types of primers, assembled to the cartridge case, are used with ammunition for these weapons. The 150-grain percussion primer M31B2 in the high-explosive supercharge round and the 65-grain percussion primer M22A3 in the high-explosive round and reduced charge rounds. The armor-piercing cartridge uses the 150-grain percussion primer M31A2 and blank ammunition uses the 100-grain percussion primer M1B1A2. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. Ammunition for this weapon is packed as complete rounds. The blank cartridge is packed one per fiber container, 15 or 20 per wooden box. Packing and shipping data appear in SM 9-5-1315. Packing and marking for shipment is described in paragraphs 3 through 14.

37. Cartridge, 75 Millimeter: APC-T, M61, w/Fuze, BD, M66A1

This cartridge is similar to the cartridge M61A1 in paragraph 38, except for the method of crimping the steel windshield to the armor-piercing cap of the projectile. In the cartridge M61A1, a 360-degree roll crimp is used near the end of the windshield, whereas in the cartridge M61, the end of the windshield is cramped into a groove. This cartridge is also made with a steel case.

38. Cartridge, 75 Millimeter: APC-T, M61A1, w/Fuze, BD, M66A1

a. General. The APC-T cartridge M61A1 is used against ground targets, particularly armored materiel. The projectile consists of three parts: a steel body which contains a small charge of explosive D, a steel armor-piercing cap, and a lightweight steel or aluminum ballistic cap or windshield. The base is threaded to accommodate the base detonating fuze M66A1. This fuze functions with delay action, providing an opportunity for penetration before detonation occurs. The base of the fuze protrudes about ¾ inch beyond the rear of the projectile. This portion of the fuze contains a red tracer composition which operates independent of the fuze mechanism. When the tracer is ignited by the flame from the propelling charge upon firing, it burns for approximately 3 seconds, thereby providing a visible trace during 1,800 yards of flight for observation purposes.

b. Physical Data.

- Weight of cartridge ........................................... 19.91 lb
- Length of cartridge ........................................... 25.55 in.
- Length of projectile .......................................... 14.94 in.
- Length of cartridge case .................................... 13.82 in.
- Width of rotating band ...................................... 0.49 in.
- Type of base .................................................... square
- Radius of ogive (false ogive) ................................. 7.17 cal.

39. Cartridge, 75 Millimeter: AP-T, M338A1

a. General. This cartridge (fig. 11), which will eventually replace APC-T cartridge M61A1 (par. 38), is used against ground targets, particularly armored materiel. The body proper of the projectile, which is a hardened steel monobloc shot, has a flat nose. An aluminum or steel windshield is welded onto the forward end of shot body. The shot is equipped with a replaceable tracer M5A2B1, which consists of igniter composition K29 and tracer composition R45 protected by a moisture-proof closure. The cartridge case contains the propellant M17.

b. Physical Data.

- Weight of cartridge ........................................... 18.26 lb
- Length of cartridge ........................................... 23.67 in.
- Weight of projectile, as fired ............................... 18.25 lb
- Length of cartridge case .................................... 13.82 in.
- Weight of projectile ......................................... 13.16 lb
- Weight of propellant ........................................ 2.10 lb

c. Ballistic Data.

- Muzzle velocity ................................................ 2,340 fps
- Maximum range ................................................. 5,000 yd

(79 mils)

40. Cartridge, 75 Millimeter Blank: Double Pellet Charge

This cartridge consists of the same components as used for the round described below (par. 41), except for the double pellet black powder charge and the chipboard tube. The charge in this ammunition is compressed and is in the form of two pellets weighing 0.87 pound in all. The complete round weighs 3.07 pounds and is 7.25 inches in length.
41. Cartridge, 75 Millimeter Blank: Single Pellet Charge

This ammunition is provided for simulated firing and consists of a cartridge case M9A1 containing a (100 grain) primer M1B1A2 and a single pellet of compressed black powder weighing 0.43 pound. The cartridge case M9A1 may be a service (M18) case cut to a 7.25-inch length (about 60 percent of the service length). The black powder pellet, which has a hole in the center, fits over the primer. The pellet is wrapped in cellophane for protection and is held firmly in position against the cartridge case by a chipboard tube which, in turn, is held in position by a closing cup assembly. The closing cup is inserted and cemented in position about 2-3/4 inches from the cartridge case mouth with Pettman cement. Rounds with a damaged or loose closing cup will not be fired. The complete round weighs 2.68 pounds and is 7.25 inches in length. Future production will be assembled with a loose powder charge (no bags), fiberglass pad, and a plastic closing cup.

42. Cartridge, 75 Millimeter Blank: M337, M337A1

This blank cartridge (fig. 12) is provided for saluting purposes and simulated firing. It consists of a cartridge case M9A1 containing percussion primer M1B1A2 and a 1-pound loose charge of potassium nitrate black powder in a cotton bag. The cartridge weighs 3.25 pounds. It uses the same metal components as the single and double pellet blank charges which it supersedes. The M337A1 is similar to the M337, except that there is loose sodium nitrate black powder in a cotton bag.

43. Cartridge, 75 Millimeter Dummy: M7, w/ Fuze, Combination, 21-Sec, M1907M, Inert

This cartridge is a completely inert assembly provided for the 75-mm tank weapons for simulating the handling of service ammunition during training of gun crews. The cartridge case and projectile of a service round are simulated by a formed one-piece unit made of bronze and steel. The cartridge case base is a sliding fit, held in normal closed position by a steel rod and spring. The cartridge may be fitted with an inert 21-second combination fuze M1907M. The cartridge is packed with the 21-second combination fuze M1907M. It is also packed as a dummy cartridge kit. For components of the cartridge kit, see SM 9-5-1315. The fuzed cartridge weighs 20.38 pounds and is 23.42 inches in length.
Figure 12. Cartridge, 75 millimeter blank.
44. Cartridge, 75 Millimeter Dummy: M16, w/Fuze, Dummy, M59

This cartridge (fig. 13) is functionally similar to that described in paragraph 43 and also is fitted with a sliding-type spring-held base. The body is made of bronze (M16) or malleable iron (M16B1) and is fitted with dummy fuze M59. This fuze simulates the selective-type fuzes M48 and M51 series. The fuzed cartridge weighs 18.75 pounds.

45. Cartridge, 75 Millimeter: HE, M48, Normal Charge, w/Fuze, PD, M51A4 (M48A2) 0.15-Sec Delay

This cartridge is similar to the cartridge in paragraph 46, except that the projectile is fitted with the PD fuze M51A4 (M48A2). Data given in paragraph 46 applies equally to this round. This cartridge is also made with a steel case.

46. Cartridge, 75 Millimeter: HE, M48, Normal Charge, w/Fuze, PD, M51A5, 0.05-Sec Delay
   a. General. This cartridge (fig. 14) has the projectile M48 which is used in cartridges having super and reduced propelling charges as well as the normal charge. The projectile body is relatively thin-walled forged-steel cylinder. Efficient flight characteristics are obtained as a result of the boat-tailed shape of the base (9-degree taper) and the ogival shape of the nose of 7.47 caliber radius. The cartridge may be fired for fragmentation and blast effect with either superquick action giving a surface burst or with a delay of as much as 0.15 second to permit penetration before detonation. The primer M22A3 is used with the normal charge round. The cartridge case is loaded with 1.15 pounds of propellant M1. This cartridge is also made with a steel case.
   b. Physical Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>Length of cartridge</th>
<th>Length of fused projectile</th>
<th>Length of cartridge case</th>
<th>Width of rotating band</th>
<th>Type of base</th>
<th>Degree of taper</th>
<th>Radius of ogive</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1874 lb</td>
<td>26.63 in.</td>
<td>15.04 in.</td>
<td>13.82 in.</td>
<td>0.49 in.</td>
<td>boat-tailed</td>
<td>9 deg</td>
<td>7.47 cal.</td>
</tr>
</tbody>
</table>

c. Ballistic Data.

Muzzle velocity: 1,500 fps

Maximum range: 11,285 yd

47. Cartridge, 75 Millimeter: HE, M48, Reduced Charge, w/Fuze, PD, M51A4 (M48A2), 0.15-Sec Delay or w/Fuze, TSQ, M55A3 (M54)

This cartridge is the same as the cartridge in paragraph 46, except that the cartridge case contains a reduced charge (0.59 lb) of propellant M2 and the projectile is fitted with PD fuze M51A4 (M48A2), or TSQ, fuze M55A3 (M54). It weighs 18.18 pounds and has a muzzle velocity of 950 feet per second. Maximum range is 6,990 yards. Other description and data given in paragraph 46 apply to this round.
60. Cartridge, 75 Millimeter Dummy: T146B1, w/Fuze, Dummy, M59

This cartridge simulates the service cartridge and is used for training in handling and loading. The cartridge consists of a malleable iron body and steel base and is assembled with dummy fuze M59. The cartridge will be loaded manually only. Weight of complete cartridge is 21.50 pounds; length is 33.50 inches.

61. Cartridge, 75 Millimeter: HE, M334 (T50E2), Steel Case, MV 2,800, w/Suppl Chg, w/o Fuze

a. General. This cartridge is intended principally for fragmentation, blast, or mining effect against both air and terrestrial targets. It consists of a percussion primer M58 and 3.62 pounds of propellant M6 in cartridge case (brass) M35 or (steel) M35B1. The cartridge case is crimped rigidly to the projectile. A ½-ounce strip of tin-lead foil, which acts as a de-coppering agent to prevent the formation of copper deposits in the bore of the gun, is included in the cartridge case on top of the propelling charge. The projectile is a conventionally designed deep-cavity nose-fuzed projectile with a hemispherical base. The projectile contains a high-explosive bursting charge of 1.42 pounds TNT and a supplementary bursting charge of 0.33 pound TNT contained in an aluminum sheet liner. The nomenclature of the item will indicate the appropriate muzzle velocity. The cartridge is shipped unfuzed with a closing plug assembled in the nose of the projectile. This cartridge case is made of brass.

b. Data.

- Weight of cartridge (steel) (w/plug)........20.06 lb
- Length of cartridge (w/plug)...............30.45 in.
- Weight of projectile (w/plug).............8.79 lb
- Weight of projectile (w/o plug)..........8.40 lb
- Length of projectile (w/plug)............11.96 in.
- Length of cartridge case..................21.30 in.
- Width of rotating band...................0.87 in.
- Type of base..................................hemispherical
- Radius of ogive.............................6.01 cal.
- Muzzle velocity.............................2,800 fps
- Maximum horizontal range................14,418 yd
- Maximum vertical range...................10,000 yd

62. Cartridge, 75 Millimeter: Empty, M334 (T50E2), w/Fuze, Inert, M51A5

This cartridge, which contains no explosive, is similar to that in paragraph 61 except for the inert fuze.

63. Cartridge, 75 Millimeter: HE, Comp B, M334 (T50E2), Steel Case, MV 2,800, w/ Suppl Chg, w/o Fuze

This cartridge is similar to the cartridge in paragraph 61, except that the projectile is loaded with a high-explosive bursting charge of 1.42 pounds of composition B.

---

Figure 15. Cartridge, 75 millimeter: HE, comp B, M334 (T50E2), MV 2,800, w/suppl chg, w/o fuze.
64. Cartridge, 75 Millimeter: HE, Comp B, M334 (T50E2), MV 2,825, w/Suppl Chg, w/o Fuze
This cartridge is similar to the cartridge in paragraph 61, except that the projectile is loaded with a high-explosive bursting charge of 1.42 pounds of composition B.

Section VI. CARTRIDGES FOR 75-MM PACK HOWITZER CANNON M1A1

65. General
a. General Discussion. The 75-mm howitzer cannon M1A1 is used as airborne, pack, or truck-drawn artillery against ground and water-borne targets, also as a saluting gun and a subcaliber gun for the 280-mm gun cannon M66. High-explosive (HE) and chemical (WP smoke) ammunition for this cannon are issued in the form of semifixed rounds, that is, they have adjustable propelling charges to permit "charge" (zone) firing. The cartridge is loaded into the cannon in one unit. HE cartridge may be issued with fuze or without fuze but with supplementary charge and closing plug. Deep-cavity projectiles of early manufacture were issued without a supplementary charge but with a closing plug.
b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.
c. Projectile. Dependent upon type of projectile, ammunition for this cannon is classified as high-explosive (HE), smoke (WP), blank, dummy, and training.
d. Fuze. Fuzes used with ammunition for this cannon are of the terrestrial-target type. Brief descriptions of these fuzes are given in (1) through (3) below. See paragraphs 184 through 225 for complete description of these fuzes.

(1) MTSQ fuzes. The MTSQ fuzes M500, M500A1, and M520 are mechanical time fuzes that permit adjustment of time setting. The MTSQ fuze M500 series also incorporates an impact element.
(2) VT fuzes. The VT fuze M513 series is a variable-time proximity fuze.
(3) Impact action-type fuzes. The PD fuzes M51A4 (M48A2), M51A5, M535 (T177E3), T177E4 and CP fuze M78; and M78A1 with booster M25 are impact-type fuzes and are used with smoke and HE rounds.
e. Cartridge Case. Cartridge case M5A1 (brass) type 1 or M5A1B1 (steel) type 1 is used with all types of ammunition for these howitzers, except blank. The cartridge case M5A1 weighs 2.46 pounds, cartridge case M5A1B1 weighs 2.18 pounds. Cartridge case M9A1 is used with 75-mm howitzer blank cartridge and weighs 2.38 pounds.
f. Propelling Charge. All 75-mm pack howitzer cannon cartridges, except HEAT rounds, contain propellant M1, which is composed of a base charge (charge 1) and three increments (numbered 2, 3, and 4) for fire adjustment.
g. Primer. Percussion primer M64 is used with the HE cartridge M48. Alternative primer is percussion primer M1A2. Some cartridges on hand are assembled with percussion primer M1B1A2. The primer M1B1A2 or alternative primer M1A2 is used with the smoke cartridge M64. Percussion primer M1, M1A1, or M1B1A1 may also be used with the cartridges HE M48 and the smoke M64. The primer M1B1A2 is used with blank cartridge. See paragraphs 244 through 268 for detailed information.

66. Cartridge, 75 Millimeter Blank: Double Pellet Charge
This ammunition is described in paragraph 40.

67. Cartridge, 75 Millimeter Blank: Single Pellet Charge
This ammunition is described in paragraph 41.

68. Cartridge, 75 Millimeter Blank: M337 or M337A1
This cartridge is described in paragraph 42 and illustrated in figure 12.
69. Cartridge, 75 Millimeter, Dummy: M2A2, w/Fuze, Combination, 21-sec, M1907M, Inert.

This cartridge consists of a bronze body and bronze base and is assembled with inert 21-second combination fuze M1907M (burned out or inert fuze parts only are used). Weight of cartridge is 19.2 pounds; length is 20.00 inches.

70. Cartridge, 75 Millimeter, Dummy: M19 or M19B1, w/Fuze, Dummy, M59

This cartridge (fig. 17) consists of a malleable iron body and steel base and is assembled with dummy fuze M59. The alternative dummy cartridge M19B1 has a bronze body. The dummy fuze M59 simulates weight and contour of PD fuze M48A3. Weight of cartridge is 18.25 pounds; length is 23.485 inches.

71. Cartridge, 75 Millimeter: Training, M28

This cartridge is similar to dummy cartridge M19 described in paragraph 70, except that the steel base is replaced with a modified base chambered to receive a 10-gage blank cartridge. The modified base has indentations on either side of the chamber to facilitate removal of the blank cartridge after firing. A spring and ball retainer, assembled adjacent to the shoulder of the base cap to hold the blank cartridge in the chamber, is also provided on the modified base. The dummy fuze M59 is replaced with a modified dummy fuze which has a hole through the center to allow the escape of burned gases.

72. High-Explosive Cartridge for 75-mm Pack Howitzer Cannon M1A1


(1) Description. See paragraph 10.

(2) Normal-cavity projectiles. Normal-cavity projectiles are assembled loosely with the cartridge case M51A1 (brass) type I or M51A1B1 (steel) type I', fitted with the percussion primer M64 or M1B1A1, or M1A1 or M1, or alternative percussion primer M1A2 (some cartridges on hand are assembled with percussion primer M1B1A2), and a propelling charge of propellant M1 various models of fuzes to make up the following list:

CARTRIDGE, 75 MILLIMETER: HE, M48, w/fuze, PD, M51A4 (M48A2), 0.05 or 0.15-sec delay.

CARTRIDGE, 75 MILLIMETER: HE, M48, w/fuze, PD, M51A5, 0.05-sec delay.

(3) Physical data for above cartridge.

| Weight of cartridge (w/PD fuze M51A5) | 18.24 lb |
| Length of cartridge (w/PD fuze M51A5) | 23.50 in |
| Weight of projectile, as fired (w/PD fuze M51A5) | 14.70 lb |
| Length of fuzeed projectile | 15.08 in |
| Length of cartridge case | 10.69 in |
| Width of rotating band | 0.49 in |
| Type of base | boat-tailed |
| Degree of taper | 9 deg |
| Radius of ogive | 7.47 cal |

Figure 16. Cartridge, 75 millimeter dummy: M2A2, w/fuze, combination, 21-sec, M1907M, inert.
Figure 17. Cartridge, 75 millimeter, dummy: M19, w/fuze, dummy, M59.

(4) Ballistic data (maximum ranges with PD fuze to ground impact).

<table>
<thead>
<tr>
<th>Charge</th>
<th>Muzzle velocity (fps)</th>
<th>Maximum range (yd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge 1 (base charge only)</td>
<td>700</td>
<td>4,195 (44 deg)</td>
</tr>
<tr>
<td>Charge 2 (base charge and 1 increment)</td>
<td>810</td>
<td>5,350 (45 deg 48 min)</td>
</tr>
<tr>
<td>Charge 3 (base charge and 2 increments)</td>
<td>950</td>
<td>6,920 (45 deg 25 min)</td>
</tr>
<tr>
<td>Charge 4 (base charge and 3 increments)</td>
<td>1,250</td>
<td>9,620 (45 deg 30 min)</td>
</tr>
</tbody>
</table>


(1) Description. See paragraph 10.

(2) Fuzed deep-cavity projectile. Deep-cavity projectiles are issued assembled with various models of fuzes to make up the following list:

CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg and fuze, PD M51A4 (M48A2), 0.15-sec delay.

CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg and fuze, PD M51A5, 0.05-sec delay.

(3) Unfuzed deep-cavity projectile. These projectiles are issued with or without supplementary charge but with closing plug:

CARTRIDGE, 75 MILLIMETER: HE, M48, w/o fuze, adapted for proximity fuze.

CARTRIDGE, 75 MILLIMETER: HE, M48, steel case, w/o fuze, adapted for proximity fuze.

CARTRIDGE, 75 MILLIMETER: HE, M48, w/suppl chg, w/o fuze.

73. Cartridge, 75 Millimeter: Smoke, WP, M64, w/Fuze, PD, M48A3, 0.05-sec Delay

a. General. This cartridge (fig. 18) is used to produce screening smoke and for spotting purposes. The projectile M64 is assembled loosely in the cartridge case M5A1 type 1; and the propelling charge is adjustable. In external contour and ballistically, this projectile matches the high-explosive projectile (par. 72). The projectile body is a steel casing having a boat-tailed base and contains 1.34-pounds of white phosphorus (WP). The projectile body is internally threaded at the nose to receive a steel adapter to accommodate the fuze and burster casing M6 containing burster initiator M1 and burster M8 (see V, ch 3). Functioning of the fuze on impact causes detonation of the burster initiator and burster, rupturing the projectile body and dispersing the WP smoke charge which ignites on contact with the air creating dense, white smoke.

b. Physical Data.

Weight of cartridge ........................................ 19.00 lb
Length of cartridge .......................................... 23.50 in.
Weight of projectile, as fired ........................... 14.70 lb
Length of fuzed projectile ......................... 15.04 in.
Width of rotating band .................... 0.49 in.
Degree of taper of base ....................... 8 deg 45 min
Radius of ogive ............................ 7.47 cal.

c. **Ballistic Data.** The muzzle velocity and maximum ground impact range for each charge is the same as that given for the HE cartridges in paragraph 72a(4).

74. **Cartridge, 75 Millimeter: Smoke, WP, M64, w/Fuze, PD, M57**

This cartridge is similar to that described in paragraph 73, except that it has PD fuze M57. This cartridge is not the same as used for the M3 gun. While the projectile is similar, the cartridge case is the M18 or M18B1 which is longer.

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Figure 18. Cartridge, 75 millimeter: smoke, WP, M64, w/fuze, PD, M48A3, 0.05-sec delay.

**Section VII. CARTRIDGES FOR 75-MM PACK HOWITZER CANNON M1A1 USED AS SUBCALIBER WEAPON**

75. **General**

a. **General Discussion.** The 75-mm pack howitzer cannon M1A1 is used as a subcaliber weapon when practice firing the 280-mm gun cannon M66. See table I for list of ammunition. See paragraph 23 for general discussion on subcaliber ammunition.

b. **Cartridge Case.** The 75-mm service cartridge case is used with 75-mm cartridge.

c. **Propelling Charge.** The 75-mm howitzer cannon M1A1 uses service cartridges.

d. **Projectile.** Depending on the type of projectile, ammunition used in the howitzer M1A1 is high-explosive (HE), smoke (WP), or training.

e. **Fuzes.** Service fuzes are used with the cartridges listed in table I for 75-mm pack howitzer cannon M1A1.

f. **Primers.** Percussion primer M64 is used with high-explosive cartridge and percussion primer M1B1A2 for smoke cartridge for the howitzer M1A1.

g. **Packing and Shipping.** See SM 9–5–1315 for packing and shipping data on 75-mm cartridges.

76. **75-Millimeter Subcaliber Ammunition**

The cartridges used for subcaliber purposes for 75-mm howitzer M1A1 are listed in table I and described in section VI.
Section VIII. CARTRIDGES FOR 76-MM GUN CANNONS M32 AND M48

77. General

a. General Discussion. These 76-mm gun cannons are lightweight high-velocity tank and antitank weapons. The chambers of these cannons differ from the chambers of other 76-mm weapons; therefore, the ammunition authorized for use in the 76-mm gun cannons M32 (T91E3) and M48 (T124E2) cannot be used in other 76-mm weapons.

Caution: No attempt should be made to use ammunition designed for other 76-mm weapons in these guns under any circumstances.

An outstanding characteristic of cartridges for these cannons is the case-over-band construction. The specially designed rotating band has a shoulder on its forward edge and a crimping groove midway to its rear, which permits the cartridge case to be assembled over the rotating band and be rigidly crimped to it. Ammunition for these cannons is issued in the form of fixed rounds (par. 3c).

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9-1900.

c. Projectile. Dependent upon type of projectile, ammunition for these cannons is classified as armor-piercing with tracer (AP-T), blank, canister, high-explosive (HE), hypervelocity armor-piercing with tracer (HVAP-T), hypervelocity armor-piercing-discarding sabot with tracer (HVAP-DS-T), hypervelocity target practice with tracer (HVTP-T), smoke, and target-practice with tracer (TP-T).

d. Fuze. Mechanical time superquick (MTSQ) and point detonating (including concrete-piercing) (PD) fuzes are authorized for use with ammunition for these cannons. A brief description of these fuzes is given in (1) and (2) below. See paragraphs 184 through 225 for complete descriptions of fuzes.

(1) Fuzes used with HE projectiles. Point detonating (PD) concrete-piercing fuze M78A1 (or M78) (w/booster M25), an impact-type fuze, is used against concrete targets. The MTSQ fuze M500A1 (or M500) is a mechanical time and impact fuze that permits adjustment of time setting to 75 seconds. The PD fuzes M51A5 and M48A3 are impact-type fuzes with superquick or 0.05-second delay action.

(2) Fuzes used with smoke projectiles. The PD fuze M48A3 is used with smoke projectiles.

e. Tracer. A tracer of the M5 series is used in the AP-T cartridge M339, HVAP-DS-T cartridge M331 series, HVAP-T cartridge T66E3, HVTP-T cartridge T74E1, and TP-T cartridge M340 series. The tracer is a lightweight-capsule-replaceable type that gives a more brilliant trace than former types. This tracer assembly, which has an improved moisture-proof closure and contains 30-grains igniter composition K29, and 35-grains tracer composition R45, is screwed into the base of the projectile. The tracer housing is either steel or aluminum, 0.755 inch long and 0.885 inch wide. The steel tracer assembly weighs 0.10 pound, aluminum tracer assembly weighs 0.045 pound.

f. Cartridge Case. Cartridge case M88 (T19E1 (brass) or M88B1 (T19E1B1) (steel) is used with all types of cartridges for these guns, except blank cartridges and the HVAP-DS-T cartridge. The cartridge case M88 (T19E1) weighs 6.66 pounds and is 22.83 inches long. The cartridge case M88B1 (T19E1B1) weighs 6.22 pounds and is 22.83 inches long. Cartridge case M101 (brass) weighs 3.03 pounds and M101B1 (steel) weighs 2.79 pounds. They are used with 76-mm blank ammunition, and are 6.627 inches long. The cartridge case M33 is used with the HVAP-DS-T cartridge.

g. Propelling Charge. The cartridges contain propellant M6 or M17. See paragraphs 226 through 243 for detailed information.

h. Primer. The percussion primer M58 is used with the AP-T, HE, HVAP-T, HVAP-DS-T, HVTP-T, TP-T, and WP smoke rounds. The percussion primer M68, which will eventually replace the primer M68, may also be used with the HE and WP smoke rounds. Percussion primer M70 is used with blank cartridge. The canister round is fitted with the percussion primer M62. See paragraphs 244 through 268 for detailed information.
78. Packing and Shipping Data

The cartridges for the 76-mm gun cannons M32 (T91E3) and M48 (T124E2) are packed one per fiber container, two fiber containers per wooden box. Blank cartridge is packed one per fiber container, eight per wooden box. Packing and shipping data appear in SM 9–5–1315. Packing and marking for shipment is described in paragraphs 3 through 14.


a. General. This cartridge (fig. 19) has an armor-piercing projectile intended for use against heavily armored targets. The projectile is a monobloc-type (uncapped) solid shot fitted with a lightweight windshield and a tracer of the M6 series. The tracer, which is in the base of the projectile, provides a luminous trace for observation during the first stages of the projectile’s flight. The cartridge case M88 (T19E1) is loaded with 5.60 pounds of propellant M17 and is fitted with percussion primer M58.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>27.32 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cartridge</td>
<td>32.89 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>22.83 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>14.56 lb</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.44 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>2,200 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>18,080 yd</td>
</tr>
</tbody>
</table>

80. Cartridge, 76 Millimeter: AP–T, M339, Steel Case

This cartridge is the same as the cartridge in paragraph 79, except for the steel cartridge case M88B1. The cartridge weighs 26.88 pounds.

81. Cartridge, 76 Millimeter, Blank: M355

The blank cartridge (fig. 20) is provided for salutes and simulated fire. The cartridge is composed of a single charge of 1.25-pounds potassium nitrate black powder held in a closed cotton or silk cartridge cloth bag. The percussion primer M70 is assembled to the cartridge case M101. The charge is held firmly in position by a closing cup assembly which is cemented securely 1.91 inches from the mouth of the cartridge case. The blank cartridge is 6.63 inches long and weighs 4.33 pounds. The cartridge when assembled with an alternative charge of 1.50 pounds of sodium nitrate black powder weighs 4.61 pounds. This cartridge will be assembled in the future with a loose powder charge (no bags) fiberglass pad and a plastic closing cup.

82. Cartridge, 76 Millimeter, Blank: M355, Steel Case

This cartridge is the same as the cartridge in paragraph 81, except for the steel cartridge case.

83. Cartridge, 76 Millimeter: Canister, M363 (T3E7)

a. General. The canister cartridge (fig. 21) is similar in assembly to the standard HE cartridge, except that the canister replaces the standard HE projectile and fuze. It is intended primarily against personnel at close range. The canister body is filled with approximately 909 steel balls. Immediately after the projectile leaves the muzzle of the gun, air pressure on the closing disk and centrifugal force acting on the body and balls cause the canister to break at four slits on the body, with resultant dispersion of the balls. The projectile has maximum lethal effect at a range of from 0 to 170 yards. At a distance of 150 yards, the pattern density for the canister is one penetration per 3.55 square feet of 1-inch yellow pine board. The cartridge case M88 is loaded with 5 pounds of the propellant M6 and is fitted with the percussion primer M62.

b. Data.

<table>
<thead>
<tr>
<th>Weight of complete round</th>
<th>27.18 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of projectile, as fired</td>
<td>16.00 lb</td>
</tr>
<tr>
<td>Length of complete round</td>
<td>32.00 in.</td>
</tr>
<tr>
<td>Weight of propellant</td>
<td>5.00 lb</td>
</tr>
</tbody>
</table>
Figure 20. Cartridge, 75 millimeter, blank: M355.
78. Packing and Shipping Data

The cartridges for the 76-mm gun cannons M32 (T91E3) and M48 (T124E2) are packed one per fiber container, two fiber containers per wooden box. Blank cartridge is packed one per fiber container, eight per wooden box. Packing and shipping data appear in SM 9–5–1315. Packing and marking for shipment is described in paragraphs 3 through 14.


a. General. This cartridge (fig. 19) has an armor-piercing projectile intended for use against heavily armored targets. The projectile is a monobloc-type (uncapped) solid shot fitted with a lightweight windshield and a tracer of the M6 series. The tracer, which is in the base of the projectile, provides a luminous trace for observation during the first stages of the projectile's flight. The cartridge case M88 (T19E1) is loaded with 5.60 pounds of propellant M17 and is fitted with percussion primer M58.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>27.32 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>32.89 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>22.33 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>14.66 lb</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.44 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>3,300 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>16,080 yd</td>
</tr>
</tbody>
</table>

80. Cartridge, 76 Millimeter: AP–T, M339, Steel Case

This cartridge is the same as the cartridge in paragraph 79, except for the steel cartridge case M88B1. The cartridge weighs 26.88 pounds.

81. Cartridge, 76 Millimeter, Blank: M355

The blank cartridge (fig. 20) is provided for salutes and simulated fire. The cartridge is composed of a single charge of 1.25-pounds potassium nitrate black powder held in a closed cotton or silk cartridge cloth bag. The percussion primer M70 is assembled to the cartridge case M101. The charge is held firmly in position by a closing cup assembly which is cemented securely 1.91 inches from the mouth of the cartridge case. The blank cartridge is 6.63 inches long and weighs 4.33 pounds. The cartridge when assembled with an alternative charge of 1.50 pounds of sodium nitrate black powder weighs 4.61 pounds. This cartridge will be assembled in the future with a loose powder charge (no bags) fiberglass pad and a plastic closing cup.

82. Cartridge, 76 Millimeter, Blank: M355, Steel Case

This cartridge is the same as the cartridge in paragraph 81, except for the steel cartridge case.

83. Cartridge, 76 Millimeter: Canister, M363 (T3E7)

a. General. The canister cartridge (fig. 21) is similar in assembly to the standard HE cartridge, except that the canister replaces the standard HE projectile and fuze. It is intended primarily against personnel at close range. The canister body is filled with approximately 909 steel balls. Immediately after the projectile leaves the muzzle of the gun, air pressure on the closing disk and centrifugal force acting on the body and balls causes the canister to break at four slits on the body, with resultant dispersion of the balls. The projectile has maximum lethal effect at a range of from 0 to 170 yards. At a distance of 150 yards, the pattern density for the canister is one penetration per 8.55 square feet of 1-inch yellow pine board. The cartridge case M88 is loaded with 5 pounds of the propellant M6 and is fitted with the percussion primer M62.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of complete round</td>
<td>27.18 lb</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>15.00 lb</td>
</tr>
<tr>
<td>Length of complete round</td>
<td>32.00 in.</td>
</tr>
<tr>
<td>Weight of propellant</td>
<td>5.00 lb</td>
</tr>
</tbody>
</table>
Figure 19. Cartridge, 76 millimeter: AP-T, M339.

Figure 20. Cartridge, 76 millimeter, blank: M355.
78. Packing and Shipping Data

The cartridges for the 76-mm gun cannons M32 (T91E3) and M48 (T124E2) are packed one per fiber container, two fiber containers per wooden box. Blank cartridge is packed one per fiber container, eight per wooden box. Packing and shipping data appear in SM 9–5–1315. Packing and marking for shipment is described in paragraphs 3 through 14.


a. General. This cartridge (fig. 19) has an armor-piercing projectile intended for use against heavily armored targets. The projectile is a monobloc-type (uncapped) solid shot fitted with a lightweight windshield and a tracer of the M5 series. The tracer, which is in the base of the projectile, provides a luminous trace for observation during the first stages of the projectile’s flight. The cartridge case M88 (T19E1) is loaded with 5.60 pounds of propellant M17 and is fitted with percussion primer M58.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>27.32 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cartridge</td>
<td>32.89 in.</td>
</tr>
<tr>
<td>Weight of cartridge case</td>
<td>22.83 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>14.56 lb</td>
</tr>
<tr>
<td>Length of rotating band</td>
<td>1.44 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>3,500 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>16,080 yd</td>
</tr>
</tbody>
</table>

80. Cartridge, 76 Millimeter: AP–T, M339, Steel Case

This cartridge is the same as the cartridge in paragraph 79, except for the steel cartridge case M88B1. The cartridge weighs 26.88 pounds.

81. Cartridge, 76 Millimeter, Blank: M355

The blank cartridge (fig. 20) is provided for salutes and simulated fire. The cartridge is composed of a single charge of 1.25-pounds potassium nitrate black powder held in a closed cotton or silk cartridge cloth bag. The percussion primer M70 is assembled to the cartridge case M101. The charge is held firmly in position by a closing cup assembly which is cemented securely 1.91 inches from the mouth of the cartridge case. The blank cartridge is 6.63 inches long and weighs 4.33 pounds. The cartridge when assembled with an alternative charge of 1.50 pounds of sodium nitrate black powder weighs 4.61 pounds. This cartridge will be assembled in the future with a loose powder charge (no bags) fiberglass pad and a plastic closing cup.

82. Cartridge, 76 Millimeter, Blank: M355, Steel Case

This cartridge is the same as the cartridge in paragraph 81, except for the steel cartridge case.

83. Cartridge, 76 Millimeter: Canister, M363 (T3E7)

a. General. The canister cartridge (fig. 21) is similar in assembly to the standard HE cartridge, except that the canister replaces the standard HE projectile and fuze. It is intended primarily against personnel at close range. The canister body is filled with approximately 909 steel balls. Immediately after the projectile leaves the muzzle of the gun, air pressure on the closing disk and centrifugal force acting on the body and balls cause the canister to break at four slits on the body, with resultant dispersion of the balls. The projectile has maximum lethal effect at a range of from 0 to 170 yards. At a distance of 150 yards, the pattern density for the canister is one penetration per 3.55 square feet of 1-inch yellow pine board. The cartridge case M88 is loaded with 5 pounds of the propellant M6 and is fitted with the percussion primer M62.

b. Data.

| Weight of complete round | 27.18 lb |
| Weight of projectile, as fired | 15.00 lb |
| Length of complete round | 32.00 in. |
| Weight of propellant | 6.00 lb |
Figure 19. Cartridge, 76 millimeter: AP-T, M339.

Figure 20. Cartridge, 76 millimeter, blank: M355.
Figure 21. Cartridge, 76 millimeter: Canister, M363 (T387).
84. Cartridge, 76 Millimeter: HE, Comp B, M352, w/ Fuze, PD, M51A5, 0.05-Sec Delay

a. General. This cartridge (fig. 22) is intended for fragmentation, blast, or mining effect at the target for use against personnel and light materiel. The cartridge consists of cartridge case M88 (T19E1), percussion primer M58 or M68, 3.64 pounds of propellant M6, and a fuzed high-explosive projectile. The projectile is a conventionally designed nose fuzed shell containing a high-explosive charge of 1.46 pounds of composition B. The shell body is a relatively thin-walled forged steel casing having the explosive charge cavity extending almost the full length of the body. This cartridge is also issued with steel case M88B1.

b. Data.

Weight of cartridge ............................................ 25.83 lb
Weight of projectile, as fired .................................. 15.00 lb
Length of cartridge ............................................ 34.05 in.
Length of fuzed projectile ...................................... 14.49 in.
Length of cartridge case ...................................... 22.83 in.
Width of rotating band ......................................... 1.44 in.
Type of base ..................................................... boat-tailed
Degree of taper .................................................. 9 deg 45 min
Radius of ogive .................................................. 7.34 cal.
Muzzle velocity .................................................. 2,400 fps
Maximum range .................................................. 15,889 yd

85. Cartridge, 76 Millimeter: HVAP-T, M319 (T66E3), MV 4,135

a. General. This cartridge is intended for use against heavily armored targets. The cartridge consists of cartridge case M88 (T19E1), percussion primer M58, and a projectile. The projectile consists of 3.95 pounds tungsten carbide core, aluminum body, nose, and windshield, and a steel base with gilding metal rotating band. A steel ring seated on the front end of the body serves as the bourrelet. A tracer of the M5 series screws into a small well in the base of the projectile. The tracer, which is initiated by the propelling charge upon firing, provides a bright glow for observation purposes during the first stages of the projectile’s flight. The cartridge case is loaded with 5.03 pounds of propellant M6. This cartridge is also issued with steel case M88B1.

b. Data.

Weight of cartridge ............................................ 19.33 lb
Length of cartridge ............................................ 32.60 in.
Weight of projectile, as fired .................................. 7.13 lb
Length of projectile ............................................ 10.59 in.
Length of cartridge case ...................................... 22.83 in.
Type of base ..................................................... square
Width of rotating band ......................................... 1.44 in.
Muzzle velocity .................................................. 4,135 fps
Maximum range .................................................. 10,810 yd

86. Cartridge, 76 Millimeter: HVAP-DS-T, M331A1 or M331A2, Steel Case, MV 4,125 (M17 [T12] Propellant)

a. General. This cartridge (fig. 23) is intended for use against heavily armored targets. The cartridge consists of cartridge case M88B1, percussion primer M58, and a projectile. The projectile consists of a steel sheath, a dense core of tungsten carbide, and a sabot or cup. The sabot fits over the sheath and, upon firing, separates, from the sheath a short distance from the gun. The dense core, which is the armor-piercing element, is carried within the sheath. The projectile is inert, except for a tracer of the M5 series in its base. The cartridge case is loaded with 5.75 pounds of propellant M17.

b. Data.

Weight of cartridge (steel) ..................................... 20.72 lb
Length of cartridge ............................................ 30.93 in.
Weight of projectile, as fired .................................. 8.22 lb
Length of projectile ............................................ 8.95 in.
Length of cartridge case ...................................... 22.83 in.
Type of base ..................................................... square
Muzzle velocity .................................................. 4,125 fps
Maximum range .................................................. 23,830 yd

87. Cartridge, 76 Millimeter: HVT, M320 (T74E1), MV 4,135

a. General. This cartridge, intended for target practice, is similar to the HVAP-T cartridge M319 (T66E3) described in paragraph 85. The projectile consists of a steel body with gilding metal rotating band and an aluminum windshield. A tracer of the M5 series screws into the base of the projectile. The projectile is inert except for the tracer element in its base. The cartridge case M88B1 (T19E1B1) is loaded with 5.03 pounds of propellant M6.
84. Cartridge, 76 Millimeter: HE, Comp B, M352, w/ Fuze, PD, M51A5, 0.05-Sec Delay

a. General. This cartridge (fig. 22) is intended for fragmentation, blast, or mining effect at the target for use against personnel and light materiel. The cartridge consists of cartridge case M88 (T19E1), percussion primer M58 or M68, 3.64 pounds of propellant M6, and a fuzed high-explosive projectile. The projectile is a conventionally designed nose fuzed shell containing a high-explosive charge of 1.46 pounds of composition B. The shell body is a relatively thin-walled forged steel casing having the explosive charge cavity extending almost the full length of the body. This cartridge is also issued with steel case M88B1.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>25.83 lb</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>15.00 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>34.05 in.</td>
</tr>
<tr>
<td>Length of fuzed projectile</td>
<td>14.49 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>22.82 in.</td>
</tr>
<tr>
<td>Weight of rotating band</td>
<td>1.44 lb</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>1,400 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>15,680 yd</td>
</tr>
</tbody>
</table>

85. Cartridge, 76 Millimeter: HVAP-T, M319 (T66E3), MV 4,135

a. General. This cartridge is intended for use against heavily armored targets. The cartridge consists of cartridge case M88 (T19E1), percussion primer M58, and a projectile. The projectile consists of 3.95 pounds of tungsten carbide core, aluminum body, nose, and windshield, and a steel base with gilding metal rotating band. A steel ring seated on the front end of the body serves as the bourrelet. A tracer of the M5 series screws into a small well in the base of the projectile. The tracer, which is initiated by the propelling charge upon firing, provides a bright glow for observation purposes during the first stages of the projectile’s flight. The cartridge case is loaded with 5.03 pounds of propellant M6. This cartridge is also issued with steel case M88B1.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge (steel)</td>
<td>20.72 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>30.88 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>8.22 lb</td>
</tr>
<tr>
<td>Length of projectile</td>
<td>8.96 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>22.83 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>4,125 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>23,630 yd</td>
</tr>
</tbody>
</table>

86. Cartridge, 76 Millimeter: HVAP-DS-T, M331A1 or M331A2, Steel Case, MV 4,125 (M17 [T12] Propellant)

a. General. This cartridge (fig. 23) is intended for use against heavily armored targets. The cartridge consists of cartridge case M88B1, percussion primer M58, and a projectile. The projectile consists of a steel sheath, a dense core of tungsten carbide, and a sabot or cup. The sabot fits over the sheath and, upon firing, separates from the sheath a short distance from the gun. The dense core, which is the armor-piercing element, is carried within the sheath. The projectile is inert, except for a “screw” of element M17. The cartridge case is loaded with 5.75 pounds of propellant M17.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>19.33 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>25.69 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>7.13 lb</td>
</tr>
<tr>
<td>Length of projectile</td>
<td>10.59 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>22.83 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>square</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.44 in.</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>4,135 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>10,810 yd</td>
</tr>
</tbody>
</table>

87. Cartridge, 76 Millimeter: HVTP-T, M320 (T74E1), MV 4,135

a. General. This cartridge, intended for target practice, is similar to the HVAP-T cartridge M319 (T66E3) described in paragraph 85. The projectile consists of a steel body with gilding metal rotating band and an aluminum windshield. A tracer of the M5 series screws into the base of the projectile. The projectile is inert except for the tracer element in its base. The cartridge case M88B1 (T19E1B1) is loaded with 5.03 pounds of propellant M6.
Figure 22. Cartridge, 76 millimeter: HE, comp B, M152, w/fuze, PD, M51A5, 0.05-sec delay.

Figure 23. Cartridge, 76 millimeter: HVAP-DS-T, M331A2, MV 4,125.
Section IX. CARTRIDGES FOR 90-MM GUN CANNONS M1A2, M1A3, M2A1, M2A2, and M2A3

90. General

a. General Discussion. The 90-mm cannon was originally intended for antiaircraft defense only. It has also been adapted by the use of various mounts for use against ground and waterborne targets. These 90-mm cannons have the same type of chambers and can fire the same ammunition. The 90-mm tank and antitank cannons M36, M41, and M54, which are relatively new weapons (sec X), differ as to chamber dimensions from the M1 series, M2 series, M3A2, and M26 guns, but all rounds authorized for 90-mm cannons M1 and M2 series, will chamber satisfactorily in (but only certain ones are authorized for use in) the M36, M41, and M54 cannons. Ammunition for the 90-mm cannons M36, M41, and M54 cannot be used in the 90-mm cannons M1 and M2 series, due to the chamber differences.

Caution: No attempt should be made to force ammunition designed for the 90-mm cannons M36, M41, and M54 into the chambers of the 90-mm cannons M1 and M2 series. Ammunition for these cannons are issued in the form of “fixed” rounds (par 3c). HE cartridges for antiaircraft use may be issued with fuze or without fuze but with supplementary charge and closing plug. Deep-cavity projec-
Figure 22. Cartridge, 76 millimeter: HE, comp B, M:52, w/fuze, PD, M51A5, 0.05-sec delay.

Figure 23. Cartridge, 76 millimeter: HV, IV, BS-T, M331A2, MV 4,125.
88. Cartridge, 76 Millimeter: Smoke, WP, M361 (T140), w/Fuze, PD, M48A3, 0.05-Sec Delay

a. General. This cartridge (fig. 24), although it also has a slight incendiary effect, is intended for screening and spotting purposes. The body of this shell is similar to that of the high-explosive shell M352, except that the smoke shell has thinner side walls forward of the rotating band. An adapter, in addition to serving as a seat for the fuze, provides a tight seal for the WP smoke filler and a means of seating the front end of the burster casing M12. The burster charge M23, held in the burster casing, consists of 524 grains of tetrytol. It extends approximately the full length of the shell cavity. Other components of this round are the cartridge case M88 (T19E1) containing 3.64 pounds of propellant M6 and percussion primer M58 or M68. This cartridge is also issued with steel case M88B1 and weighs 25.38 pounds.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>Length of cartridge</th>
<th>Weight of projectile, as fired</th>
<th>Length of projectile</th>
<th>Length of cartridge case</th>
<th>Type of base</th>
<th>Width of rotating band</th>
<th>Muzzle velocity</th>
<th>Maximum range</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.13 lb</td>
<td>32.64 in.</td>
<td>6.93 lb</td>
<td>10.81 in.</td>
<td>22.83 in.</td>
<td>square</td>
<td>1.375 in.</td>
<td>4,135 fps</td>
<td>10,810 yd</td>
</tr>
</tbody>
</table>

89. Cartridge, 76 Millimeter: TP-T, M340, or M340A1

a. General. This cartridge (fig. 25), intended for target practice, is similar to the AP-T cartridge M339 described in paragraph 79. The projectile consists of a steel body with gilding metal rotating band and an aluminum wind shield. A tracer of the M5 series screws into the base of the projectile. The cartridge case M88 (T19E1) is loaded with 5.60 pounds of propellant M17 and is fitted with percussion primer M58. This cartridge is also issued with steel case M88B1 and weighs 26.88 pounds.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>Length of cartridge</th>
<th>Weight of projectile, as fired</th>
<th>Length of projectile</th>
<th>Length of cartridge case</th>
<th>Type of base</th>
<th>Width of rotating band</th>
<th>Muzzle velocity</th>
<th>Maximum range</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.82 lb</td>
<td>34.05 in.</td>
<td>15.71 lb</td>
<td>14.45 in.</td>
<td>22.83 in.</td>
<td>square</td>
<td>1.44 in.</td>
<td>2,400 fps</td>
<td>16,070 yd</td>
</tr>
</tbody>
</table>

Section IX. CARTRIDGES FOR 90-MM GUN CANNONS M1A2, M1A3, M2A1, M2A2, and M2A3

90. General

a. General Discussion. The 90-mm cannon was originally intended for antiaircraft defense only. It has also been adapted by the use of various mounts for use against ground and waterborne targets. These 90-mm cannons have the same type of chambers and can fire the same ammunition. The 90-mm tank and antitank cannons M36, M41, and M54, which are relatively new weapons (sec X), differ as to chamber dimensions from the M1 series, M2 series, M3A2, and M26 guns, but all rounds authorized for 90-mm cannons M1 and M2 series, will chamber satisfactorily in (but only certain ones are authorized for use in) the M36, M41, and M54 cannons. Ammunition for the 90-mm cannons M36, M41, and M54 cannot be used in the 90-mm cannons M1 and M2 series, due to the chamber differences.

Caution: No attempt should be made to force ammunition designed for the 90-mm cannons M36, M41, and M54 into the chambers of the 90-mm cannons M1 and M2 series.

Ammunition for these cannons are issued in the form of “fixed” rounds (par 3r). HE cartridges for antiaircraft use may be issued with fuze or without fuze but with supplementary charge and closing plug. Deep-cavity projec-
tiles of early manufacture were issued without a supplementary charge but with closing plug. HE ammunition for terrestrial use, smoke cartridges, and certain armor-piercing cartridge is issued fuzed.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.

Note. Identification of 90-mm ammunition assembled with fired resized cartridge cases is made by the 100-series interfix number in the ammunition lot number as GR–100–5, RN–101–1, LS–103–4.

c. Projectile. Dependent upon type of projectile, ammunition for these cannons are classified as armor-piercing with tracer (AP–T), armor-piercing capped with tracer (APC–T), blank, canister, dummy, high-explosive (HE), high-explosive plastic with tracer (HEP–T), high-explosive, antitank (HE, AT), hypervelocity armor-piercing with tracer (HVAP–T), hypervelocity target practice with tracer (HVTP–T), smoke, target–practice (TP), and target–practice with tracer (TP–T).

d. Fuze. Fuzes used with ammunition for these cannons are of two basic types, antiaircraft type and terrestrial-target type. Brief description of these types of fuzes is given in (1) and (2) below. See paragraphs 184 through 225 for complete description of these fuzes.

(1) Antiaircraft-type fuzes used with HE rounds. The MTSQ fuzes M502 and M502A1 and MT fuzes M43A3 and M43A4 are mechanical time fuzes that permit adjustment of time setting. The MTSQ fuze M502 or M502A1 also incorporates a supersensitive superquick impact element. The TSQ M55A3 is a combination time and superquick fuze with settings for delay time action and for superquick action. Proximity fuze M515 (T225) is used for normal antiaircraft use. It incorporates an impact element and has a “bracket arming” feature.

(2) Terrestrial-target-type fuzes. The MTSQ fuze M500 series and MT fuze M67 series are mechanical time fuzes that permit adjustment of time setting, and are used with HE cartridges. The MTSQ fuze M500 series also incorporates an impact element. The PD fuze M48A3, M51A4 (M48A2), M51A5, and M48A3 are impact-type fuzes and are used with smoke and HE cartridges. The BD fuze M68 series and the BD fuze M91 series are of the inertia type and are used with APC–T and HE cartridges. The PI BD M509 is a point-initiating base-detonating-type fuze and is used with HE, AT cartridges. Proximity fuze M513 (T226) is used for terrestrial fire. It incorporates an impact element and has a “delay arming” feature. Point detonating (PD) (concrete-piercing) fuzes M78 and M78A1 (w/booster M29) are used with HE projectiles when effect against concrete targets is required.

e. Tracer. The tracer M5 series is used in the HVAP–T projectiles M332A1 and M332B1A1, the HVTP–T projectiles M317A2 and M333A1, and projectile APC–T M82 (when fused with the BD fuze M68A1). The HVAP–T projectiles M304 and APC–T M82 with BD fuze M68 have tracer composition M3 pressed directly into the tracer cavity. The tracer M5 is a lightweight-capsule-replaceable type that gives a more brilliant trace than former types. This tracer assembly, which has an improved moisture-proof closure and contains igniter composition K29 and tracer composition R45, is screwed into the base of the projectile.

f. Cartridge Case. Cartridge case M19 (brass) or M19B1 (steel) is used with all types of ammunition for these guns, except blank and HE, AT cartridge. The cartridge case M19 weighs 11 pounds, cartridge case M19B1 weighs 10.10 pounds. Cartridge case M27 is used with the 90-mm blank cartridge and weighs 6.4 pounds. Ballistic properties or safety are not affected by the use of fired resized cartridge cases (b above).

g. Propelling Charge. The cartridges, dependent upon type, contain propellant M6, M15, or M17. See paragraphs 226 through 243 for detailed information.
Figure 24. Cartridge, 76 millimeter: smoke, WP, M361 (T140E2), w/fuze, PD, M48A3, 0.05-sec delay.
tiles of early manufacture were issued without a supplementary charge but with closing plug. HE ammunition for terrestrial use, smoke cartridges, and certain armor-piercing cartridge is issued fused.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.

Note. Identification of 90-mm ammunition assembled with fired resized cartridge cases is made by the 100-series interfix number in the ammunition lot number as GR–100–5, RN–101–1, LS–103–4.

c. Projectile. Dependent upon type of projectile, ammunition for these cannons is classified as armor-piercing with tracer (AP–T), armor-piercing capped with tracer (APC–T), blank, canister, dummy, high-explosive (HE), high-explosive plastic with tracer (HEP–T), high-explosive, antitank (HE, AT), hypervelocity armor-piercing with tracer (HVAP–T), hypervelocity target practice with tracer (HVTP–T), smoke, target-practice (TP), and target-practice with tracer (TP–T).

d. Fuze. Fuze used with ammunition for aircraft type and terrestrial-target type. Brief description of these types of fuzes is given in (1) and (2) below. See paragraphs 184 through 225 for complete description of these fuzes.

1. Antiaircraft-type fuzes used with HE rounds. The MTSQ fuzes M502 and M502A1 and MT fuzes M43A3 and M43A4 are mechanical time fuzes that permit adjustment of time setting. The MTSQ fuze M502 or M502A1 also incorporates a supersensitive superquick impact element. The TSQ M55A3 is a combination time and superquick fuze with settings for delay time action and for superquick action. Proximity fuze M515 (T225) is used for normal antiaircraft use. It incorporates an impact element and has a “bracket arming” feature.

2. Terrestrial-target-type fuzes. The MTSQ fuze M500 series and MT fuze M57 series are mechanical time fuzes that permit adjustment of time setting, and are used with HE cartridges. The MTSQ fuze M500 series also incorporates an impact element. The PD fuze M48A3, M51A4 (M48A2), M51A5, and M48A3 are impact-type fuzes and are used with smoke and HE cartridges. The BD fuze M68 series and the BD fuze M91 series are of the inertia type and are used with APC–T and HE cartridges. The PI BD M509 is a point-initiating base-detonating-type fuze and is used with HE, AT cartridges. Proximity fuze M513 (T226) is used for terrestrial fire. It incorporates an impact element and has a “delay arming” feature. Point detonating (PD) (concrete-piercing) fuzes M78 and M78A1 (w/booster M25) are used with HE projectiles when effect against concrete targets is required.

e. Tracer. The tracer M5 series is used in the HVAP–T projectiles M532A1 and M332B1A1, the HVTP–T projectiles M317A2 and M355A1, and projectiles AP–T and M58 (when fuze with the RD fuze M68A1). The HVAP–T projectiles M304 and APC–T M82 with BD fuze M68 have tracer composition M3 pressed directly into the tracer cavity. The tracer M5 is a lightweight-capsule-replaceable type that gives a more brilliant trace than former types. This tracer assembly, which has an improved moisture-proof closure and contains igniter composition K29 and tracer composition R45, is screwed into the base of the projectile.

f. Cartridge Case. Cartridge case M19 (brass) or M19B1 (steel) is used with all types of ammunition for these guns, except blank and HE, AT cartridge. The cartridge case M19 weighs 11 pounds, cartridge case M19B1 weighs 10.10 pounds. Cartridge case M27 is used with the 90-mm blank cartridge and weighs 6.4 pounds. Ballistic properties or safety are not affected by the use of fired resized cartridge cases (b above).

g. Propelling Charge. The cartridges, dependent upon type, contain propellant M6, M15, or M17. See paragraphs 226 through 243 for detailed information.
Figure 24. Cartridge, 76 millimeter: smoke, H.E. M48A1 (T740E2), w/fuze, P.I.
h. Igniter Charge. The igniter charge consists of 2 ounces of black powder contained in a silk envelope. The igniter charge is held in place on top of the propelling charge by a distance wad. It is used with the following rounds: AP-T M318 series, HE, APC-T M82, HVAP-T M304, HVTP-T M31TA1 and M31TA2, and TP-T M353A1. See paragraphs 226 through 243 for detailed information.

i. Primer. Percussion primer M28A2 is used for all antiaircraft (time-fuzed) ammunition for 90-mm cannons. Alternative primer is percussion primer M28B2 (steel) or percussion primer M28A1 or M28B1A2. The primer M49 is used for impact-fuzed rounds and the primer M40A1 is used with the HVAP-T M304 and HVTP-T M31TA1 and M31TA2 rounds. The primer T69 is used for HEAT T108 series rounds. Percussion primer M1B1A2 is used with blank cartridge. The dummy cartridges contain no primer. See paragraphs 244 through 268 for detailed information.

j. Adjustment of Recoil Mechanism. Because of high muzzle energy, use of cartridges AP-T M318 series, APC-T M82, HVAP-T M304 and M322, HVTP-T M31TA1 and M31TA2, and M33 necessitates adjustment of recoil mechanism to prevent excessive recoil. The importance of these adjustments prior to the use of the above types of ammunition cannot be overstressed. If proper adjustments, as described in technical manuals on the weapon are not made, irreparable damage to the recoil mechanism may result. Do not fire the 90-mm cannon M1 series and M2 series at elevations above 800 mils when using the above types of ammunition, as this may cause the gun to strike the top carriage during recoil.

k. Packing and Shipping Data. Cartridges for the 90-mm cannons M2 series, M3A2, and M26 are packed one per fiber container, two containers per wooden box; one per fiber container, four containers per wooden box. Blank cartridges are packed one per fiber container, eight containers per wooden box. Packing and shipping data appear in SM 9-5-1315.

91. Cartridge, 90 Millimeter: AP-T, M77

a. General. This cartridge is smokeless and is used for training purposes. The projectile is a monobloc steel slug and has no wind shield. The projectile base contains a small cavity into which a tracer plug is screwed. The tracer composition M3 is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when the round is fired.

b. Data.
   Weight of cartridge ..................................................42.04 lb
   Length of cartridge ..................................................32.75 in.
   Weight of projectile, as fired ......................................23.40 lb
   Length of projectile ..................................................10.00 in.
   Length of cartridge case .............................................23.70 in.
   Width of rotating band ..............................................1.20 in.
   Type of base ..........................................................square
   Radius of ogive .......................................................1.51 cal.
   Muzzle velocity ......................................................2,700 fps
   Range .................................................................3,500 yd

92. Cartridge, 90 Millimeter: AP-T, M318, MV 2,800

a. General. This cartridge which is flashless is for use against ground targets, particularly armored materiel. The projectile is similar in outward appearance to other armor-piercing types of ammunition. The body of the projectile is made of hard steel, has a square base and a nose that is shaped to a relatively short ogive. A lightweight aluminum alloy wind shield is attached to the projectile by means of six tack welds. The base of the projectile contains a small threaded cavity into which a tracer plug is screwed. The tracer composition is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when fired. The cartridge case M19 for this round contains propelling charge M1 and percussion primer T33.

b. Data.
   Weight of cartridge ..................................................45.98 lb
   Length of cartridge ..................................................37.48 in.
   Weight of projectile, as fired ......................................24.15 lb
   Length of projectile with wind shield ............................14.73 in.
   Length of cartridge case .............................................23.70 in.
   Width of rotating band ..............................................1.20 in.
   Type of base ..........................................................square
   Muzzle velocity ......................................................2,800 fps
   Range .................................................................7,000 yd
Figure 25. Cartridge, 76 millimeter: TP-T, M840A1.

Figure 26. Cartridge, 90 millimeter: AP T, M418A1C (T33E7), MV 2,800.
h. Igniter Charge. The igniter charge consists of 2 ounces of black powder contained in a silk envelope. The igniter charge is held in place on top of the propelling charge by a distance wad. It is used with the following rounds: AP-T M318 series, HE, APC-T M82, HVAP-T M304, HVTP-T M317A1 and M317A2, and TP-T M353A1. See paragraphs 226 through 243 for detailed information.

i. Primer. Percussion primer M28A2 is used for all antiaircraft (time-fused) ammunition for 90-mm cannons. Alternative primer is percussion primer M28B2 (steel) or percussion primer M28A1 or M28B1A2. The primer M49 is used for impact-fuzed rounds and the primer M40A1 is used with the HVAP-T M304 and HVTP-T M317A1 and M317A2 rounds. The primer T69 is used for HEAT T108 series rounds. Percussion primer M1B1A2 is used with blank cartridge. The dummy cartridges contain no primer. See paragraphs 244 through 268 for detailed information.

Attachment of Recoil Mechanism. Because of the high pressure and strength of 90-mm cannon rounds, AP-T M318 series, APC-T M82, HVAP-T M304 and M322, HVTP-T M317A1 and M317A2, and M33 necessitates adjustment of recoil mechanism to prevent excessive recoil. The importance of these adjustments prior to the use of the above types of ammunition cannot be overstressed. If proper adjustments, as prescribed in technical manuals on the weapon are not made, irreparable damage to the recoil mechanism may result. Do not fire the 90-mm cannon M1 series and M2 series at elevations above 800 mils when using the above types of ammunition, as this may cause the gun to strike the top carriage during recoil.

k. Packing and Shipping Data. Cartridges for the 90-mm cannons M2 series, M3A2, and M26 are packed one per fiber container, two containers per wooden box; one per fiber container, four containers per wooden box. Blank cartridges are packed one per fiber container, eight containers per wooden box. Packing and shipping data appear in SM 9–5–1315.

91. Cartridge, 90 Millimeter: AP-T, M77

a. General. This cartridge is smokeless and is used for training purposes. The projectile is a monobloc steel slug and has no windshield. The projectile base contains a small cavity into which a tracer plug is screwed. The tracer composition M3 is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when the round is fired.

b. Data.

Weight of cartridge ........................................ 42.04 lb
Length of cartridge ........................................... 32.75 in.
Weight of projectile, as fired ............................. 23.40 lb
Length of projectile ........................................... 10.00 in.
Length of cartridge case ................................. 23.70 in.
Width of rotating band ................................... 1.20 in.
Type of base .................................................. square
Radius of ogive .............................................. 1.31 cal.
Muzzle velocity .............................................. 2,700 fps
Range ............................................................ 3,500 yd

92. Cartridge, 90 Millimeter: AP-T, M318, MV 2,800

a. General. This cartridge which is flashless is for use against ground targets, particularly armor-piercing. The somewhat outward appearance to other armor-piercing types of ammunition. The body of the projectile is made of hard steel, has a square base and a nose that is shaped to a relatively short ogive. A lightweight aluminum alloy windshield is attached to the projectile by means of six tack welds. The base of the projectile contains a small threaded cavity into which a tracer plug is screwed. The tracer composition is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when fired. The cartridge case M19 for this round contains propelling charge M1 and percussion primer T33.

b. Data.

Weight of cartridge ........................................ 43.98 lb
Length of cartridge ........................................... 37.43 in.
Weight of projectile, as fired ............................. 24.15 lb
Length of projectile with windshield ................. 14.73 in.
Length of cartridge case ................................. 23.70 in.
Width of rotating band ................................... 1.20 in.
Type of base .................................................. square
Muzzle velocity .............................................. 2,800 fps
Range ............................................................ 7,000 yd
Figure 25. Cartridge, 76 millimeter, TP-T, M340A1.

Figure 26. Cartridge, 90 millimeter: AT-1, M18A1C (T41E7), MV 2,800.
93. Cartridge, 90 Millimeter: AP-T, M318A1C (T33E7) MV 2,800

a. General. This cartridge (fig. 28) which is used against ground targets, particularly armored materiel, is similar to 90-mm cartridge M318 in paragraph 92, except for the attachment of windshield and tracer. The cartridge is an uncapped monobloc shot to which an aluminum windshield is cemented. The base of the projectile contains a small threaded cavity into which the tracer assembly M6A2 is screwed. The tracer is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when the round is fired. The projectile is assembled with the cartridge case M19, propellant M17, and percussion primer M58. This cartridge is also issued with a steel case and weighs 43.77 pounds.

b. Data.

- Weight of cartridge (brass case) ........ 44.67 lb
- Length of cartridge .......................... 37.11 in.
- Weight of projectile, as fired ............ 24.18 lb
- Length of projectile with windshield .... 14.18 in.
- Length of projectile .......................... 10.24 in.
- Length of cartridge case .................... 23.70 in.
- Width of rotating band ........................ 1.20 in.
- Type of base .................................. square
- Muzzle velocity .................................. 2,800 fps
- Maximum range .................................. 21,400 yd

94. Cartridge, 90 Millimeter: APC-T, M82, Flashless, MV 2,600 w/Fuze, BD, M68 or M68A1

The APC-T cartridge M82 is used against ground targets, particularly armored materiel. The body of the projectile, which is made of hard steel, has a square base and a nose shaped to a relatively short ogive. A lightweight steel or aluminum alloy windshield is screwed or crimped on the armor-piercing cap. The rear portion of the body contains a small cavity which holds a charge of explosive D. The base hole is threaded for the base detonating M68 or M68A1. This fuze, a simple inertia type, functions with delay action. The rear housing of the fuze extends approximately ¾ inch beyond the rear surface of the projectile base. This portion of the fuze contains a tracer composition for observation purposes. Functioning independently of the fuze mechanism, the tracer composition is ignited by the propelling charge when the cartridge is fired. It burns with a visible trace for a minimum of 3 seconds, equivalent to a minimum range of 2,400 yards. For a muzzle velocity of 2,600 feet per second, a short primer M28A2 and 7.31 pounds of propellant is used. This cartridge weighs 42.75 pounds.

95. Cartridge, 90 Millimeter: APC-T, Flashless, M82, MV 2,800, w/Fuze, BD, M68 or M68A1

This cartridge differs from the cartridge in paragraph 94 by an igniter type of primer and weight of propellant. By using primer M49, 8.06 pounds of propellant and an igniter charge at the top of the propellant charge, the projectile attains a muzzle velocity of 2,800 feet per second. This cartridge weighs 43.87 pounds. This cartridge is also issued with smokeless propellant.

96. Cartridge, 90 Millimeter: APC-T, M82, Smokeless, MV 2,800, w/Fuze, BD, M68 or M68A1

This cartridge differs from that described in paragraph 94 by an igniter type of primer and weight of propellant. By using primer M49, 8.06 pounds of propellant and an igniter charge at the top of the propellant charge, the projectile attains a muzzle velocity of 2,800 feet per second. The propellant is smokeless.

97. Cartridge, 90 Millimeter, Blank: M394

This blank cartridge (fig. 27) is provided for salutes and simulated fire and consists of the cartridge case M27, a 100-grain primer M18A2, and a 1.5-pound charge of black powder. The black powder charge is held in a cotton bag which is loaded into the cartridge case to surround the primer. The charge is held firmly in position by a closing cup or plug assembly. The closing cup assembly consists of either two pulpboard disks glued one to each surface of a hard hair felt disk or a palmetto pulp plug. The assembly is inserted into the case and glued securely in position about 2.625 inches from the mouth of the case. The weight of the cartridge is 8.23 pounds and the length is 7.27 inches. In the future, this cartridge will be assembled with a loose powder charge (no bags), fiberglass pad, and a plastic closing cup.
98. Cartridge, 90 Millimeter, Blank: M394, Steel case M27B1

This cartridge differs from the cartridge in paragraph 97 in that a steel cartridge case is used. The cartridge weighs 6.83 pounds.

99. Cartridge, 90 Millimeter: Canister, M336

a. General. The canister cartridge is intended primarily for antipersonnel use at close range. The canister consists of a relatively thin steel cylindrical body which is welded to a heavy steel cup-shape base having a gilded metal rotating band. The canister body is filled with 1,281 stacked steel cylindrical pellets which are held in place by a closing disk. Immediately after the canister leaves the muzzle of the gun, air pressure on the closing disk and centrifugal force acting on the body and pellets cause the canister to break at the four slits on the body with resultant dispersion of the pellets. The round has maximum lethal effect at a range of from 0 to 600 feet. The minimum pattern density for this canister is one complete penetration per 6 square feet on a target of pine board 1 inch thick x 8 feet high x 90 feet wide at a range of 400 feet. The minimum angle of dispersion is approximately 9 degrees. This cartridge is suitable for use in the arctic. This cartridge is also issued with a steel case.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>Length of cartridge</th>
<th>Weight of canister, as fired</th>
<th>Length of canister</th>
<th>Length of cartridge case</th>
<th>Width of rotating band</th>
<th>Type of base</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.61 lb</td>
<td>33.74 in</td>
<td>23.24 lb</td>
<td>11.05 in</td>
<td>23.70 in</td>
<td>1.20 in</td>
<td>skirted</td>
</tr>
</tbody>
</table>

100. Cartridge, 90 Millimeter, Dummy: M12, w/Fuze, Dummy, M44A2

This cartridge consists of a bronze body and bronze base, and is assembled with dummy fuze M44A2. When this cartridge is used in the M2 series guns, the automatic rammer will be made inoperative and the cartridge will be rammed by hand. The cartridge weighs 42.04 pounds; length is 37.44 inches.

101. Cartridge, 90 Millimeter, Dummy: M12B1, w/Fuze, MT, M43A2 and Mods, Inert

This cartridge consists of a malleable iron body with a steel base and is assembled with an inert mechanical time fuze M43A2. When this cartridge is used in the gun M2 series, the automatic rammer will be made inoperative and the cartridge will be rammed by hand. The weight of the cartridge is 42.04 pounds; length is 37.44 inches.
102. Cartridge, 90 Millimeter, Dummy: M12B1, w/o Fuze

This dummy cartridge is the same as the cartridge in paragraph 101, except that it does not have a fuze. The cartridge weighs 40.63 pounds.

103. Cartridge, 90 Millimeter, Dummy: M12B2, w/Fuze, MT, M43A2, Inert

This cartridge (fig. 28) consists of a manganese bronze body and steel base, and is assembled with an inert mechanical time fuze M43A2. When this cartridge is used in the series cannon M2, the automatic rammer will be made inoperative and the cartridge will be rammed by hand. The weight of the cartridge is 42.94 pounds; length is 37.44 inches.

104. Cartridge, 90 Millimeter, Dummy: M12B2, w/Fuze, Dummy, M80

This cartridge is identical with the cartridge in paragraph 103, except for fuzing. The dummy cartridge which is fitted with the dummy fuze M80, weighs 44 pounds.

105. Cartridge, 90 Millimeter, Dummy: M12B2, w/o Fuze

This cartridge is similar to the cartridge in paragraph 103, except that no specific fuze is specified for this cartridge.

106. High-Explosive Cartridge M71 for 90-mm Guns

   (1) For description, see paragraph 10. The projectile bursting charge is composition B. Some of the earlier rounds are loaded with TNT (some stocks are loaded with 50-50 amatol). With amatol loading, a “booster surround” of a small amount of TNT is used. The projectile body consists of a hollowed steel casing with boat-tailed base. The nose is formed to a long ogive and is threaded to hold a standard point detonating fuze. Weight of projectile as fired 23.40 pounds.
   (2) The normal-cavity projectile is assembled with the cartridge case M19, fitted with the primer M28A2 or M49, and a propelling charge of M6 or M15 propellant, and various models of fuzes to make up the following cartridges of flashless, flashless-smokeless, and smokeless ammunition. Length of case is 23.70 inches.

   (a) Flashless cartridges.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, time, mechanical, M43A3 or M43A4.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, MTSQ, M500.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, MTSQ, M502.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, PD, M51A4 (M48A2), 0.05-sec delay.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, PD, M51A4 (M48A2), 0.15-sec delay.

   CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/fuze, PD, M51A5, 0.05-sec delay.

   (b) Smokeless cartridges.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, time, mechanical, M43A3 or M43A4.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, MTSQ, M500.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, MTSQ, M502.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, PD, M51A4 (M48A2), 0.05-sec delay.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, PD, M51A4 (M48A2), 0.15-sec delay.

   CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/fuze, PD, M51A5, 0.05-sec delay.

   CARTRIDGE, 90 MILLIMETER: HE, Comp B, M71, steel case, smokeless, w/fuze, PD, M51A5, 0.05-sec delay.

(1) Most rounds of current manufacture are assembled with supplementary charge and plug; rounds of early manufacture were assembled with supplementary charge and point detonating fuze.

(2) Deep-cavity projectiles have been assembled with various models of fuzes to make up the following cartridges of flashless, flashless-smokeless, and smokeless ammunition.

(a) Fuzed cartridges shipped.

1. Flashless.

- **CARTRIDGE, 90 MILLIMETER**: HE, M71, flashless, w/suppl chg and fuze, time, mechanical M43A4.
- **CARTRIDGE, 90 MILLIMETER**: HE, M71, flashless, w/suppl chg and fuze, MTSQ, M502 or M502A1.
- **CARTRIDGE, 90 MILLIMETER**: HE, M71, steel case, flashless, w/suppl chg and fuze, MTSQ, M502A1.
- **CARTRIDGE, 90 MILLIMETER**: HE, M71, flashless, w/suppl chg and fuze, PD, M51A4 (M48A2), 0.05-sec delay.

2. Flashless-smokeless

- **CARTRIDGE, 90 MILLIMETER**: HE, M71, flashless-smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
- **CARTRIDGE, 90 MILLIMETER**: HE, Comp B, M71, steel case, flashless-smokeless, w/suppl chg and fuze, MTSQ, M502 or M502A1.
- **CARTRIDGE, 90 MILLIMETER**: HE, Comp B, M71, steel case, flashless-smokeless, w/suppl chg and fuze, MTSQ, M502, 0.05-sec delay.

- **CARTRIDGE, 90 MILLIMETER**: HE, Comp B, M71, steel case, flashless-smokeless, w/suppl chg and fuze, MTSQ, M502.
Figure 29. Cartridge, 90 millimeter: HE, M71, smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, flashless-smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.


CARTRIDGE, 90 MILLIMETER:
HE, M71, smokeless, w/suppl chg and fuze, MTSQ, M502 or M502A1.

CARTRIDGE, 90 MILLIMETER:
HE, M71, smokeless, w/suppl chg and fuze, PD, M51A4 (M48A2), 0.05-sec delay.

CARTRIDGE, 90 MILLIMETER:
HE, M71, smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay (fig. 29).

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, smokeless w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, steel case, smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.

(b) Unfuzed cartridges as shipped.
These cartridges are issued unfuzed with fuze openings in projectiles protected by closing plugs. Length of cartridge w/plug 35 to 36.50 inches. Cartridges of earlier manufacture were assembled without supplementary charges; later manufacture had the charge and spacers inserted in the deep cavity. Weight as fired 23.40 pounds.

CARTRIDGE, 90 MILLIMETER:
HE, M71, flashless, w/o fuze, adapted for proximity fuze.

CARTRIDGE, 90 MILLIMETER:
HE, M71, flashless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, M71, steel case, flashless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, flashless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, steel case, flashless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, M71, flashless-smokeless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, M71, steel case, flashless-smokeless, w/suppl chg w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, flashless-smokeless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, M71, smokeless, w/suppl chg, w/o fuze.

CARTRIDGE, 90 MILLIMETER:
HE, Comp B, M71, smokeless, w/suppl chg, w/o fuze.

107. Cartridge, 90 Millimeter: HEAT, M348 (T108E40), w/Fuze, PI, BD, M509 (T208E7)
This cartridge consists of a shaped-charge projectile, the rear portion of which is assembled in cartridge case T27 fitted with primer T69. The cartridge weighs 37.84 pounds.

108. Cartridge, 90 Millimeter: HEAT, T108E46, w/Fuze, PI, BD, M509
a. General. This cartridge (fig. 30) is intended for use against armored targets. The projectile contains a shaped charge in the rear portion of the projectile cavity. The 1.56 pound of cast composition B is loaded to the rear of a hemispherical, funnel-shaped copper liner which is positioned about midway in the projectile. The igniter fin assembly T33E2 screws into the projectile. The retainer assembly screws into the base of the igniter fin assembly. The percussion primer T69 which is seated in the base of the cartridge case screws into the base of the retainer assembly. The igniter fin assembly contains 400 grains of black powder. The retainer assembly has approximately 20 grains of black powder; and the percussion primer is loaded with approximately 7 grains of black powder. The PI BD fuze M509 which is in the base of the projectile is powered by the Lucky power source positioned in the nose of the projectile. When the nose of the projectile is crushed against the target, Lucky is deformed generating an electric impulse which initiates the electric detonator in the fuze. The principal differences between the 90-mm car-
A—TYPE, MODEL, AND ACTION OF FUZE
B—WEIGHT ZONE MARKING
C—CALIBER AND TYPE OF WEAPON
D—KIND OF FILLER
E—MODEL OF CARTRIDGE
F—FOR DEEP CAVITY PROJECTILE CONTAINING SUPPLEMENTARY CHARGE
G—LOT NUMBER OF FILLED PROJECTILE
H—AMMUNITION LOT NUMBER
J—CALIBER AND MODEL OF CASE
K—LOT NUMBER OF CASE
L—YEAR OF MANUFACTURE
M—PERFORMANCE OF ROUND UPON FIRING, AS FLASHLESS, OR FLHLS; SMOKELESS, OR SMKLS; FLASHLESS-SMOKELESS, OR FLHLS-SMKLS
N—MODEL OF CARTRIDGE
CARTRIDGE, 90 MILLIMETER: HE, Comp B, M71, flashless-smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.


CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/suppl chg and fuze, MTSQ, M502 or M502A1.
CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/suppl chg and fuze, PD, M51A4 (M48A2), 0.05-sec delay.
CARTRIDGE, 90 MILLIMETER: HE, M71, smokeless, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay (fig. 29).

(b) Unfuzed cartridges as shipped. These cartridges are issued unfuzed with fuze openings in projectiles protected by closing plugs. Length of cartridge w/plug 35 to 36.50 inches. Cartridges of earlier manufacture were assembled without supplementary charges; later manufacture had the charge and spacers inserted in the deep cavity. Weight as fired 23.40 pounds.

CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/o fuze, adapted for proximity fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, flashless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, steel case, flashless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, Comp B, flashless, w/suppl chg, w/o fuze.
ACARTRIDGE, 90 MILLIMETER: HE, Comp B, M71, steel case, flashless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, steel case, flashless-smokeless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, steel case, flashless-smokeless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, Comp B, M71, flashless-smokeless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, steel case, flashless-smokeless, w/suppl chg, w/o fuze.
CARTRIDGE, 90 MILLIMETER: HE, M71, steel case, flashless-smokeless, w/suppl chg, w/o fuze.

107. Cartridge, 90 Millimeter: HEAT, M348 (T108E40), w/Fuze, PI, BD, M509 [T08E7]

This cartridge consists of a shaped-charge projectile, the rear portion of which is assembled in cartridge case T27 fitted with primer T69. The cartridge weighs 37.81 pounds.

108. Cartridge, 90 Millimeter: HEAT, T108E46, w/Fuze, PI, BD, M509

a. General. This cartridge (fig. 30) is intended for use against armored targets. The projectile contains a shaped charge in the rear portion of the projectile cavity. The 1.56 pound of cast composition B is loaded to the rear of a hemispherical, funnel-shaped copper liner which is positioned about midway in the projectile. The igniter fin assembly T33E2 screws into the projectile. The retainer assembly screws into the base of the igniter fin assembly. The percussion primer T69 which is seated in the base of the cartridge case screws into the base of the retainer assembly. The igniter fin assembly contains 400 grains of black powder. The retainer assembly has approximately 20 grains of black powder; and the percussion primer is loaded with approximately 7 grains of black powder. The PI, BD fuze M509 which is in the base of the projectile is powered by the Lucky power source positioned in the nose of the projectile. When the nose of the projectile is crushed against the target, Lucky is deformed generating an electric impulse which initiates the electric detonator in the fuze. The principal differences between the 90-mm car-
tridge T108E46 and 90-mm cartridge M348 (T108E40) are the length, cone design, and fin design. The projectile of the T108E46 round contains a cone whereas the projectile for the M348 (T108E40) round has a cone with a cone tube extension attached. The outer edges of the fins for the T108E46 round have a T-shape whereas the fin edges for the M348 (T108E40) are straight. The T-shape fins on the T108E46 cartridge prevent the fins from cutting into the bore of the gun.

b. Data.

Weight of cartridge ........................................ 34.79 lb
Length of cartridge ........................................ 33.74 in.
Length of fuzed projectile .................................. 17.76 in.
Length of cartridge case ...................................... 23.70 in.
Muzzle velocity ............................................... 2,800 fps
Maximum range .............................................. 15,010 yd

109. Cartridge, 90 Millimeter: HEP-T, T142 and T142E3, w/Fuze, BD, M91 or BD, M91A1

This cartridge consists of a high-explosive projectile to which is crimped cartridge case M19 or M19B1 fitted with percussion primer M28B2. The projectile is effective against tanks at large as well as small angles of obliquity. Additional information is classified. This cartridge is also issued with a steel case.

110. Cartridge, 90 Millimeter: HVAP-T, M304, Smokeless

a. General. This hypervelocity armor-piercing cartridge is provided for the 90-mm guns for use against armored targets. The projectile is a lightweight hypervelocity projectile having a very hard armor-piercing core of tungsten carbide steel. The projectile is made up of a very hard armor-piercing core weighing 8 pounds, a tracer-loaded steel base with integral rotating band, an aluminum body with a pressed on steel bourrelet, an aluminum or cast iron nose plug, and a screwed-on cast aluminum alloy windshield. The tracer is ignited by the propelling charge and burns with a visible trace for a minimum of 3 seconds when fired. This cartridge is also issued “smokeless” with a steel case and “flashless” with a brass case.

b. Data.

Weight of cartridge ........................................ 37.13 lb
Length of cartridge .......................................... 35.92 in.
Weight of projectile, as fired ............................. 16.80 lb
Length of projectile ......................................... 13.22 in.
Length of cartridge case .................................... 23.70 in.
Double rotating band, width of each ........................ 0.50 in.
Type of base ..................................................... skirted
Type of ogive .................................................... conical
Muzzle velocity ............................................. 3,250 fps
Maximum range .............................................. 15,130 yd

111. Cartridge, 90 Millimeter: HVAP-T, M332, M332A1, or M332B1, MV 3,875, Smokeless

a. General. This hypervelocity armor-piercing cartridge (fig. 31) is provided for the 90-mm weapons for use against heavy armored targets. The projectile is a lightweight hypervelocity projectile having a very hard armor-piercing core of tungsten carbide steel. The projectile is made up of a very hard armor-piercing core weighing 8 pounds, an aluminum alloy body with two sintered iron rotating bands near the base, a steel bourrelet at the forward end, a tracer assembly screwed into the base, an aluminum alloy nose, and an aluminum alloy windshield. The tracer is ignited by the propelling charge and burns with a visible trace for a minimum of 8 seconds when fired. This cartridge is also issued with a steel case.

b. Data.

Weight of cartridge ........................................ 32.30 lb
Length of cartridge .......................................... 35.92 in.
Weight of projectile, as fired ............................. 12.44 lb
Length of projectile ......................................... 13.22 in.
Length of cartridge case .................................... 23.70 in.
Double rotating band, width of each ........................ 0.50 in.
Type of base ..................................................... skirted
Type of ogive .................................................... conical
Muzzle velocity ............................................. 3,875 fps
Maximum range .............................................. 15,700 yd

112. Cartridge, 90 Millimeter: HVAP-T, M332A1, MV 3,825, Smokeless

This cartridge is similar to the cartridge in paragraph 111. The principal difference between the two cartridges is in the method of assembling the tracer and the muzzle velocity. This cartridge is also issued with a steel case.
Figure 50. Cartridge, 90 millimeter: HEAT, T50, 61, PI, BD, M509.
tride T108E16 and 90-mm cartridge M348 (T108E10) are the length, cone design, and fin design. The projectile of the T108E16 round contains a cone whereas the projectile for the M348 (T108E10) round has a cone with a cone tube extension attached. The outer edges of the fins for the T108E16 round have a T-shape whereas the fin edges for the M348 (T108E10) are straight. The T-shape fins on the T108E16 cartridge prevent the fins from cutting into the bore of the gun.

b. Data.

Weight of cartridge ......................... 34.79 lb
Length of cartridge ......................... 33.74 in.
Length of fuzed projectile ................. 17.76 in.
Length of cartridge case ................. 23.70 in.
Muzzle velocity ............................. 2,800 fps
Maximum range ................................... 13,010 yd

109. Cartridge, 90 Millimeter: HEP-T, T142 and T142E3, w/Fuze, BD, M91 or BD, M91A1

The cartridge consists of M28B2. The projectile is effective against tanks at large as well as small angles of obliquity. Additional information is classified. This cartridge is also issued with a steel case.

110. Cartridge, 90 Millimeter: HVAP-T, M304, Smokeless

a. General. This hypervelocity armor-piercing cartridge is provided for the 90-mm guns for use against armored targets. The projectile is a lightweight hypervelocity projectile having a very hard armor-piercing core of tungsten carbide steel. The projectile is made up of a very hard armor-piercing core weighing 8 pounds, an aluminum alloy base, an aluminum alloy tail, and a tracer assembly. The core is a very hard armor-piercing core of tungsten carbide steel. The base, an aluminum alloy nose, and an aluminum alloy windshield. The tracer is ignited by the propelling charge and burns with a visible trace for a minimum of 8 seconds when fired. This cartridge is also issued with a steel case.

b. Data.

Weight of cartridge ......................... 37.13 lb
Length of cartridge ......................... 35.92 in.
Weight of projectile, as fired ............. 16.80 lb
Length of projectile ......................... 13.29 in.
Length of cartridge case .................. 23.70 in.
Width of rotating band ...................... 1.20 in.
Type of base .................................... skirted
Type of ogive .................................. conical
Muzzle velocity ............................... 3,350 fps
Maximum range ................................... 13,160 yd

111. Cartridge, 90 Millimeter: HVAP-T, M332, M332A1, or M332B1, MV 3,875, Smokeless

a. General. This hypervelocity armor-piercing cartridge (fig. 31) is provided for the 90-mm weapons for use against heavy armored targets. The projectile is a lightweight hypervelocity projectile having a very hard armor-piercing core of tungsten carbide steel. The projectile is made up of a very hard armor-piercing core weighing 8 pounds, an aluminum alloy base, an aluminum alloy tail, and a tracer assembly. The core is a very hard armor-piercing core of tungsten carbide steel. The base, an aluminum alloy nose, and an aluminum alloy windshield. The tracer is ignited by the propelling charge and burns with a visible trace for a minimum of 8 seconds when fired. This cartridge is also issued with a steel case.

b. Data.

Weight of cartridge ......................... 32.30 lb
Length of cartridge ......................... 35.92 in.
Weight of projectile, as fired ............. 12.44 lb
Length of projectile ......................... 13.22 in.
Length of cartridge case .................. 23.70 in.
Double rotating band, width of each ... 0.50 in.
Type of base .................................... skirted
Type of ogive .................................. conical
Muzzle velocity ............................... 3,875 fps
Maximum range ................................... 15,700 yd

112. Cartridge, 90 Millimeter: HVAP-T, M332A1, MV 3,825, Smokeless

This cartridge is similar to the cartridge in paragraph 111. The principal difference between the two cartridges is in the method of assembling the tracer and the muzzle velocity.
Figure 40. Cartridge, 90 millimeter: HEAT w/fuze, PI, BD, M509.
Figure 31. Cartridge, 90 millimeter: HVAP-T, M332A1, MV 3825, smokeless.

Figure 32. Cartridge, 90 millimeter: smoke, WP, M313, flashless-smokeless, w/fuze, PD, M48A2, 0.05-sec delay.
113. Cartridge, 90 Millimeter: HVTP-T, M317A1 or M317A2, Smokeless

a. General. This cartridge is provided for training in marksmanship. The projectile is a lightweight hypervelocity projectile, having a body made of steel, a bourrelet which is integral with the body, a gilding metal rotating band, and a plug tracer M4A2 fitted into the base.

b. Data.

Weight of cartridge .................................................. 37.49 lb
Length of cartridge ................................................... 33.94 in.
Weight of projectile, as fired ....................................... 16.75 lb
Length of projectile ................................................... 13.20 in.
Length of cartridge case ............................................. 23.70 in.
Width of rotating band ............................................... 1.20 in.
Type of base ............................................................ skirted
Muzzle velocity ........................................................ 3,250 fps
Maximum range ......................................................... 15,130 yd

114. Cartridge, 90 Millimeter: HVTP-T, M333A1, M5 3,825

This cartridge is provided for training in marksmanship. This target practice round is similar in appearance to the HVAP-T cartridge, M332A1 except that the body of the projectile is made of steel and the bourrelet is integral with the body. All data pertaining to the HVAP-T cartridge M332A1 also applies to the HVTP-T, cartridge, M333A1 except the muzzle velocity of 3,875. This cartridge is also issued with a steel case.

115. Cartridge, 90 Millimeter: TP, M71, Flashless, w/Fuze, Dummy, M73

This cartridge is provided for training in marksmanship. It is similar to the HE service cartridge M71 except that the projectile is loaded with inert material and is assembled with fummy fuze M73. This cartridge contains 7.31 pounds of propellant.

116. Cartridge, 90 Millimeter: TP, M71, Smokeless, w/Fuze, Dummy, M73

This cartridge is the same as the cartridge in paragraph 115, except for the propellant. This cartridge contains 7.31 pounds of propellant M15. This cartridge is also issued with a steel case.

117. Cartridge, 90 Millimeter: Smoke, WP, M313, Flashless-Smokeless, w/Fuze, PD, M48A3, 0.05-sec Delay

a. General. This cartridge is assembled with the WP smoke projectile M313 which resembles the high-explosive projectile in outward appearance (fig. 32). The projectile is boat-tailed and the ogival nose is threaded to receive an adapter. The adapter provides a tight seal for the chemical filler of the projectile and is threaded internally to receive a point fuze. The adapter also provides a seat for the forward end of the burster casing assembly M13. This assembly is a thin-walled steel tube extending from the adapter to the rear of the projectile cavity and contains the burster charge M24 and the initiator-burster M2. The initiator-burster and the burster charge, when properly functioned by the fuze, ruptures the projectile casing and disperses the chemical filler. White phosphorus is a smoke-producing chemical which is used for spotting and screening purposes. It also has a very limited incendiary effect. This round which is fitted with PD fuze M48A3 with 0.05-sec delay contains propellant M15 and the percussion primer M49. This cartridge is also issued with a steel case.

b. Data.

Weight of cartridge .................................................. 42.52 lb
Length of cartridge ................................................... 37.46 in.
Weight of projectile, as fired ....................................... 23.64 lb
Length of cartridge case ............................................. 23.70 in.
Width of rotating band ............................................... 1.20 in.
Type of base ............................................................ boat-tailed

118. Cartridge, 90 Millimeter: Smoke, WP, M313, Smokeless, w/Fuze, PD, M48A2, 0.05-Sec Delay

This cartridge is similar to the cartridge in paragraph 117, except for the fuze, primer, and propellant. This cartridge, the projectile of which is fitted with PD fuze M48A3 with 0.05-sec delay, contains propellant M6 and the percussion M28B2.
113. Cartridge, 90 Millimeter: HVTP-T, M317A1 or M317A2, Smokeless

a. General. This cartridge is provided for training in marksmanship. The projectile is a lightweight hypervelocity projectile, having a body made of steel, a bourrelet which is integral with the body, a gilding metal rotating band, and a plug tracer M4A2 fitted into the base.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Weight of cartridge</td>
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</tr>
<tr>
<td>Length of cartridge</td>
<td>55.92 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>16.75 lb</td>
</tr>
<tr>
<td>Length of projectile</td>
<td>13.20 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>23.70 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.20 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>Skirted</td>
</tr>
<tr>
<td>Muzzle velocity</td>
<td>3,350 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>15,130 yd</td>
</tr>
</tbody>
</table>

114. Cartridge, 90 Millimeter: HVTP-T, M333A1, MV 3,825

This cartridge is provided for training in marksmanship. This target practice round is similar in appearance to the HVAP-T cartridge, M332A1 except that the body of the projectile is made of steel and the bourrelet is integral with the body. All data pertaining to the HVAP-T cartridge M332A1 also applies to the HVTP-T, cartridge, M333A1 except the muzzle velocity of 3,875. This cartridge is also issued with a steel case.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>42.52 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>37.46 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>23.64 lb</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>23.70 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.20 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>Boat-tailed</td>
</tr>
</tbody>
</table>

115. Cartridge, 90 Millimeter: TP, M71, Flashless, w/Fuze, Dummy, M73

This cartridge is provided for training in marksmanship. It is similar to the HE service cartridge M71 except that the projectile is loaded with inert material and is assembled with dummy fuze M73. This cartridge contains 7.31 pounds of propellant.

116. Cartridge, 90 Millimeter: TP, M71, Smokeless, w/Fuze, Dummy, M73

This cartridge is the same as the cartridge in paragraph 115, except for the propellant. This cartridge contains 7.31 pounds of propellant M15. This cartridge is also issued with a steel case.

117. Cartridge, 90 Millimeter: Smoke, WP, M313, Flashless-Smokeless, w/Fuze, PD, M48A3, 0.05-sec Delay

a. General. This cartridge is assembled with the WP smoke projectile M313 which resembles the high-explosive projectile in outward appearance (fig. 32). The projectile is boat-tailed and the ogival nose is threaded to receive an adapter. The adapter provides a tight seal for the chemical filler of the projectile and is threaded internally to receive a point fuze. The adapter also provides a seat for the forward end of the burster casing assembly M13. This assembly is a thin-walled steel tube extending from the adapter to the rear of the projectile cavity and contains the burster charge M24 and the initiator-burster M2. The initiator-burster and the burster charge, when properly functioning by the fuze, ruptures the projectile casing and disperses the chemical filler. White phosphorus is a smoke-producing chemical which is used for spotting and screening purposes. It also has a very limited incendiary effect. This round which is fitted with PD fuze M48A3 with 0.05-sec delay contains propellant M15 and the percussion primer M49. This cartridge is also issued with a steel case.

b. Data.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cartridge</td>
<td>42.52 lb</td>
</tr>
<tr>
<td>Length of cartridge</td>
<td>37.46 in.</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>23.64 lb</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>23.70 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>1.20 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>Boat-tailed</td>
</tr>
</tbody>
</table>

118. Cartridge, 90 Millimeter: Smoke, WP, M313, Smokeless, w/Fuze, PD, M48A2, 0.05-sec Delay

This cartridge is similar to the cartridge in paragraph 117, except for the fuze, primer, and propellant. This cartridge, the projectile of which is fitted with PD fuze M48A3 with 0.05-sec delay, contains propellant M6 and the percussion M28B2.
119. Cartridge, 90 Millimeter: Smoke, WP, M313, Smokeless, w/Fuze, PD, M48A3, 0.05-sec Delay

This cartridge is the same as the cartridge in paragraph 117, except for the primer and propellant. This smoke cartridge is assembled with the propellant M6 and percussion primer M2B2. This cartridge is also issued with a steel case.

120. Cartridge, 90 Millimeter: Smoke, WP, M313, Smokeless, w/Fuze, PD, M57

This cartridge is the same as the cartridge in paragraph 118, except for fuzing. The projectile is fitted with PD fuze M57.

Section X. CARTRIDGES FOR 90-MM GUN CANNONS M36, M41, AND M54

121. General

a. General Discussion. The 90-mm gun cannons M36 and M41 are used as tank and antitank weapons, and the 90-mm gun cannon M54 (T125) is used in self-propelled vehicles. The ammunition for these cannons cannot be used in the 90-mm cannons M1, M2, M3A2, and M26 (T8) due to certain differences in chamber dimensions. However, ammunition authorized for use in 90-mm cannons M1 and M2 series, will chamber satisfactorily in the M36, M41, and M54 cannons. All the rounds authorized for use in the 90-mm cannons M1 and M2 series, except antiaircraft types (unfuzed rounds and rounds unfuzed with MTSQ fuze M502 or M502A1, or with MT fuze M43A3 or M43A4), are authorized for use in these tank cannons. Ammunition for these cannons is issued in the form of fixed complete rounds, that is, they have nonaddatable propelling charges. The cartridge is loaded into the weapon in one unit.

Caution: Ammunition for the 90-mm gun cannons M36, M41, and M54 (T125) cannot be used in the 90-mm cannons M1 and M2 series, due to chamber differences. No attempt should be made to force ammunition designed for the 90-mm gun cannons M36, M41, and M54 (T125) into the chambers of the 90-mm cannons M1 and M2 series.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9-1900.

c. Projectile. Dependent upon the type of projectile, ammunition authorized for these cannons only, is classified as armor-piercing with tracer (AP-T), high-explosive with tracer (HE-T) and (HEP-T), and target-practice with tracer (TP-T). See paragraph 90c, procedure for assembly separately issued fuze to projectile.

d. Fuze. Fuzes used with ammunition for these cannons are of the terrestrial-target type. The BD fuzes M91 series are of the inertia type and are used with HEP-T rounds. The PD fuzes M48A3 and M51A5 are impact-type fuzes and are used with smoke and HE rounds respectively. The point detonating (PD) concrete-piercing fuzes M78 and M78A1 (w/ booster M25) are used with HE projectiles against concrete targets. See paragraphs 225 through 225 for complete description of these fuzes.

e. Tracer. The tracer M5 series is used in the AP-T, M318 (T33E7) and M318A1; HE-T, T91; and TP-T, M358 (T225E1) cartridges and with HEP-T cartridge T142E3 when unfuzed with BD fuze M91A1. The tracer M5 is a lightweight-capsule-replaceable type that gives more brilliant trace than former types. This tracer assembly, which has an improved moisture-proof closure and contains igniter composition K29 and tracer composition R45, is screwed into the base of the projectile. The tracer for HEP-T cartridge T142E3, when unfuzed with BD fuze M91, has the same tracer and igniter composition as the M5 series of tracers. However, these compositions are pressed directly into the base cavity of the fuze.

f. Cartridge Case. Cartridge case M108 (T24) (brass) or M108B1 (T24B1) (steel) is used with all types of ammunition for these cannons. The cartridge case M108 (T24) weighs 11.00 pounds and cartridge case M108B1 (T24B1) weighs 10.80 pounds.

g. Propelling Charge. The cartridges, dependent upon type, contain propellant M1 or M17 (T12). See paragraphs 226 through 243 for detailed information.
h. Igniter Charge. The igniter charge consists of 2 ounces of black powder contained in a silk envelope. The igniter charge is held in place on top of the propelling charge by a distance wad. It is used with AP-T, M518 (T33E7); and M318A1 and TP-T, M553 (T225E1) rounds. See paragraphs 244 through 268 for detailed information.

i. Primer. Percussion primer M58 (T66) is used with AP-T, M318 (T33E7) and M318A1; cartridge and primer M68 (T70) is used with HE-T, T91 cartridge. See section IX for primers used with ammunition for 90-mm cannons M1 and M2 series. See paragraphs 226 through 243 for detailed information.

j. Packing and Shipping Data. Cartridges for the 90-mm gun cannons M36, M41, and M54 are packed one per fiber container, two containers per wooden box. Packing and shipping data appear in SM 9-5-1315.

122. Cartridge, 90 Millimeter: AP-T, M318 (T33E7) or M318A1, MV 3,000

This cartridge which is flashless is used against ground targets, particularly armored materiel. The projectile is a monobloc steel slug to which an aluminum die-cast windshied is cycle welded. A gilding metal rotating band 1.20 inches wide is fitted to the rear end of the projectile. The base contains a small cavity into which a tracer assembly of the M6 series is screwed. The tracer composition is ignited by the propelling charge M17 (T12) and burns with a visible trace for a minimum of 3 seconds when the round is fired. The cartridge case is fitted with percussion primer M58. The complete cartridge weighs 44.97 pounds. This cartridge is also issued with a steel case.

123. Cartridge, 90 Millimeter: HE-T, T91, w/ Fuze, MTSQ, M500

a. General. This cartridge was designed to replace the standard 90-mm M71 cartridge. The cartridge consists of the cartridge case M108 (T24), percussion primer M68 (T70), 4.438 pounds of propellant M1, and a fused high-explosive projectile. The projectile body is a relatively thin-walled forged steel casing having an explosive charge cavity extending almost the full length of the body. The projectile is fitted with the fuze M500, a fuze providing mechanical time and superquick action. A tracer of the M5 series screws into the base of the projectile. The HE-T cartridges T91 have been assembled with projectiles loaded in only three weight zones. The appropriate zone, dependent on the weight of the loaded projectile, is indicated on the projectile by one, two, or three squares of the same color as the marking.

b. Data.

Weight of cartridge ........................................ 34.30 lb
Weight of projectile, as fired .......................... 18.61 lb
Length of cartridge ........................................ 37.46 in.
Length of fused projectile .............................. 17.18 in.
Length of cartridge case ................................ 23.70 in.
Width of rotating band ................................... 0.47 in.
Type of base ................................................. hemispherical
Radius of ogive ............................................. 8.96 cal.
Muzzle velocity .............................................. 2,406 fps
Maximum range ............................................ 14,000 yds

124. Cartridge, 90 Millimeter: HE-T, Comp B, T91, Steel Case, w/Fuze, MTSQ, M500

This cartridge (fig. 33) is similar to the TNT loaded cartridge (par. 123), except that the bursting charge is composition B instead of TNT. All data pertaining to the TNT loaded cartridge also pertains to the composition B loaded cartridge, except that the weight of the complete cartridge is 33.54 pounds.

125. Cartridge, 90 Millimeter: HE-T, T91, w/ Fuze, PD, M51A5, 0.05-sec Delay

This cartridge is similar to the TNT loaded cartridge (par. 123), except that it is fitted with PD fuze M51A5. This cartridge is also issued with a steel case.

126. Cartridge, 90 Millimeter: HE-T, Comp B, T91, w/Fuze, PD, M51A5, 0.05-see Delay

This cartridge is similar to the cartridge in paragraph 124, except that it is fitted with PD fuze M51A5. This cartridge is also issued with a steel case.

127. Cartridge, 90 Millimeter: HEP-T, T142E3, w/Fuze, BD, M91

This cartridge consists of a high-explosive projectile to which is crimped cartridge case M19. The projectile is effective against tanks at large as well as small angles of obliquity. Other information is classified. This cartridge is also issued with the M19B1 steel case.
Figure 33. Cartridge, 90 millimeter: HE-T, comp B, T91, w/fuse, MTSQ, M500.
128. Cartridge, 90 Millimeter: TP-T, M353 (T225E1)

This cartridge is provided for training in marksmanship. It is similar in appearance to AP-T cartridge M318, except that the light-weight aluminum alloy windshield is screwed on the projectile. All data pertaining to AP-T cartridge M318 (par. 122) also applies to this cartridge. This cartridge is also issued with a steel case.

Section XI. CARTRIDGES FOR 105-MM HOWITZER CANNONS
M2A1, M2A2, M4, M4A1, and M49 (T96)

129. General

a. General Discussion. The 105-mm howitzer cannons M2A1 and M2A2 are used as field artillery pieces and as armament for motor carriages. The 105-mm howitzer cannons M4, M4A1, and M49 are mounted in various types of motor carriages and tanks. All these 105-mm weapons have the same type of chambers and can fire the same ammunition. Cartridges for these weapons are issued in the form of semi-fixed rounds, and all have adjustable propelling charges for charge (zone) firing, except the HEP, HEAT, and TP-T cartridges which are special types in that the propelling charge is fixed, that is, nonadjustable. The cartridges are loaded into the weapon in one unit. HE cartridges assembled with deep-cavity projectiles may be issued with supplementary charge and fuze, or without fuze but with supplementary charge and closing plug. Deep-cavity projectiles of early manufacture were issued without a supplementary charge but with closing plug. Chemical (gas and smoke) HEP and HEAT cartridges are issued fuzed.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projectile, cartridges for these howitzers are classified as blank, drill, gas (persistent—H) (non-persistent—GB), high-explosive (HE), high-explosive antitank (HEAT), high-explosive antitank with tracer (HEAT-T), high-explosive plastic (HEP), high-explosive plastic with tracer (HEP-T), illuminating, smoke (colored, HC, and WP), and target-practice with tracer (TP-T).

d. Fuze. Fuzes used with cartridges for these weapons are of the terrestrial-target type.

Brief description of these fuzes involving different types of actions is given in (1) through (4) below. See paragraphs 184 through 225 for complete description of these fuzes.

(1) MTSQ and MT action-type fuzes. The MTSQ fuze M520, MTSQ fuzes M500 series, M501 series, M520 and MT fuzes M67 series are mechanical time fuzes that permit adjustment of time setting. The MTSQ fuzes M500 series and MT fuzes M67 series are used with HE cartridges and the MTSQ fuzes M501 series are used with illuminating and base-ejection smoke cartridges. The MTSQ fuzes M500 series and M501 series also incorporate an impact element.

(2) VT fuze, proximity, artillery, M513 series. See paragraph 222 for description.

(3) Impact action-type fuzes. The PD fuzes M51A4 (M48A2), M51A5, M57, T177E3, and CP point detonating (PD) concrete-piercing fuzes M78 and M78A1 (w/booster M25) are impact-type fuzes and are used with gas, HE, and smoke cartridges. The PD fuze M57 does not contain a delay element. The point detonating (PD) concrete-piercing fuzes M78 and M78A1 (w/booster M25) are used with HE projectiles against concrete targets.

(4) Inertia action-type fuzes. The BD fuze M62A1 and BD fuze M91 or M91A1 are of the inertia type and are used with HEAT and HEP cartridges. The BD fuzes M91 and M91A1 have an integral tracer in their base.
Figure 33: Cartridge, 90 millimeter: HE T. 4377 b. 2041, w/fuzc, MTSQ, M600.
128. Cartridge, 90 Millimeter: TP-T, M353
(T225E1)

This cartridge is provided for training in
marksmanship. It is similar in appearance to
AP-T cartridge M318, except that the light-
weight aluminum alloy windshield is screwed
on the projectile. All data pertaining to AP-T
cartridge M318 (par. 122) also applies to this
cartridge. This cartridge is also issued with a
steel case.

Section XI. CARTRIDGES FOR 105-MM HOWITZER CANNONS
M2A1, M2A2, M4, M4A1, and M49 (T96)

129. General

a. General Discussion. The 105-mm howitzer
cannons M2A1 and M2A2 are used as field ar-
tillery pieces and as armament for motor car-
rriages. The 105-mm howitzer cannons M4,
M4A1, and M49 are mounted in various types
of motor carriages and tanks. All these 105-mm
weapons have the same type of chambers and
can fire the same ammunition. Cartridges for
these weapons are issued in the form of semi-
fixed rounds, and all have adjustable propel-
ling charges for charge (zone) firing, except
the HEP, HEAT, and TP-T cartridges which
are special types in that the propelling charge
is fixed, that is, nonadjustable. The cartridges
are loaded into the weapon in one unit. HE
cartridges assembled with deep-cavity projec-
tiles may be issued with supplementary charge
and fuze, or without fuze but with supplemen-
tary charge and closing plug. Deep-cavity pro-
jectiles of early manufacture were issued with-
out a supplementary charge but with closing
plug. Chemical (gas and smoke) HEP and
HEAT cartridges are issued fused.

b. Identification. Painting and marking for
identification are in accordance with the basic
color scheme prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projec-
tile, cartridges for these howitzers are classi-
cified as blank, drill, gas (persistent—H) (non-
persistent—GB), high-explosive (HE), high-
explosive antitank (HEAT), high-explosive
antitank with tracer (HEAT–T), high-explo-
sive plastic (HEP), high-explosive plastic with
tracer (HEP–T), illuminating, smoke (colored,
HC, and WP), and target-practice with tracer
(TP–T).

d. Fuze. Fuzes used with cartridges for these
weapons are of the terrestrial-target type.

Brief description of these fuzes involving dif-
ferent types of actions is given in (1) through
(4) below. See paragraphs 184 through 225
for complete description of these fuzes.

1) MTSQ and MT action-type fuzes. The
MTSQ fuze M520, MTSQ fuzes M500
series, M501 series, M520 and MT
fuzes M67 series are mechanical time
fuzes that permit adjustment of time
setting. The MTSQ fuzes M500 series
and MT fuzes M67 series are used with
HE cartridges and the MTSQ
fuzes M501 series are used with illu-
minating and base-ejection smoke
cartridges. The MTSQ fuzes M500
series and M501 series also incorpo-
rate an impact element.

2) VT fuze, proximity, artillery, M513
series. See paragraph 222 for descrip-
tion.

3) Impact action-type fuzes. The PD
fuzes M51A4 (M48A2), M51A5, M57,
T177E3, and CP point detonating
(PD) concrete-piercing fuzes M78
and M78A1 (w/booster M25) are im-
 pact-type fuzes and are used with gas,
HE, and smoke cartridges. The PD
fuze M57 does not contain a delay
element. The point detonating (PD)
crrete-piercing fuzes M78 and
M78A1 (w/booster M25) are used
with HE projectiles against concrete
targets.

4) Inertia action-type fuzes. The BD fuze
M62A1 and BD fuze M91 or M91A1
are of the inertia type and are used
with HEAT and HEP cartridges. The
BD fuzes M91 and M91A1 have an
integral tracer in their base.
e. Cartridge Case. Cartridge case M14 (brass) or M14B1 (steel) is used with all types of ammunition for these howitzers. The cartridge case M14 weighs 5.9 pounds; cartridge case M14B1 weighs 5.4 pounds. Cartridge case M14B2 (M14E1) spiral wrapped steel is used in some 105-mm cartridges. Both the M14 and the M14B2 case have not been type classified as standard B. The steel case M14B1 and the three piece spiral wrapped case M14B3 have been type classified as standard A.

f. Propelling Charge. All 105-mm cartridges of recent manufacture, except HEP-T, HEAT, and TP-T cartridges contain zoned charges of propellant M1 of dual granulation composed of a base charge (charge 1) and six increment charges (charges 2, 3, 4, 5, 6, and 7) (fig. 34) for charge adjustment. The HEAT and TP-T cartridges contain propellant M1 of single granulation (fig. 34), in a single bag charge which is nonadjustable. Some rounds (other than HEAT and TP-T) of older manufacture, containing propellant M1, single granulation, are still on hand. The HEP-T cartridge uses a single charge of M6, single granulation, and the charge is in a single bag and is not adjustable. See paragraphs 226 through 243 for detailed information.

g. Primer. Percussion primer M28A2 is used for all service and practice ammunition for 105-mm weapons. Alternative primer is percussion primer M28B2 (steel). Percussion primer M1B1A2 or alternative primer M1A2 is used with blank ammunition. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. Service cartridges for the 105-mm howitzer cannons M2A1, M2A2, M4, M4A1, M49 (T96) and T252 are generally packed one per fiber container, one fiber container per metal container, or two fiber containers per wooden box, or three fiber containers per bundle (domestic shipment only). Packing and shipping data appear in SM 9-5-1315. Packing and marking for shipment is described in paragraphs 3 through 14.

130. Cartridge, 105 Millimeter Blank: M395

This cartridge (fig. 35) is for salutes and simulated fire and consists of the cartridge case M15 (brass) or M15B1 (steel), the 100-grain primer M1B1A2, and a 2.0-pound charge of black powder (sodium nitrate). Alternative primer is percussion primer M1A2 and alternative charge is a 1.5-pound charge of black powder (potassium nitrate). The black powder charge is held in a cotton bag which is in the cartridge case surrounding the primer. The charge is held firmly in position by a closing cup or plug assembly. The closing cup assembly consists of two pulboard disks glued one to each surface of a hard felt disk. The assembly is cemented securely in position in the case about 0.50 inch from the mouth of the case. Weight of complete round is 6.24 pounds and the length is 6.02 inches. In future production, this cartridge will be assembled with a loose powder charge (no bags), fiberglass pad, and a plastic closing cup.

131. Cartridge, 105 Millimeter Dummy: M14, w/Fuze, PD, M59, Dummy

This cartridge (fig. 36) is a completely inert assembly designed to permit simulation of all adjustments required in the semifixed service rounds. The cartridge consists of a dummy projectile fitted with an inert or dummy fuze, loosely seated in a dummy cartridge case containing an inert primer and a dummy propelling charge. The dummy projectile is a hollow malleable iron or bronze casting with an open base to facilitate extraction from the weapon. The dummy fuze M59 simulates the PD fuses M48 series and M51 series. The cartridge case consists of a cadmium-plated steel tube threaded at the rear to receive the steel (alternative: malleable iron) base and fitted at the mouth with a manganese or bronze collar which serves as a sleeve to receive the projectile. The dummy propelling charge M8 (par. 235c) consists of a base charge (charge 1) and six increment charges (charges 2, 3, 4, 5, 6, and 7) to simulate the service propelling charge. The base charge is secured to eyebolts (2) in the cartridge case base with twine or sash chain; the first increment (charge 2) is attached to the base charge and each succeeding increment (charges 3, 4, 5, 6, and 7) is attached to the one preceding by twine or snaps on a 16-inch sash chain. This arrangement permits the withdrawal of all increment charges to the mouth of the cartridge.
Figure 34. Comparison of single granulation and dual granulation propelling charges of semifixed rounds of ammunition for 105-mm howitzer cannons M2A1, M2A2, M4, M4A1, and M49 (T96).
c. Cartridge Case. Cartridge case M14 (brass) or M14B1 (steel) is used with all types of ammunition for these howitzers. The cartridge case M14 weighs 5.9 pounds; cartridge case M14B1 weighs 5.4 pounds. Cartridge case M14B2 (M14E1) spiral wrapped steel is used in some 105-mm cartridges. Both the M14 and the M14B2 case have not been type classified as standard B. The steel case M14B1 and the three piece spiral wrapped case M14B3 have been type classified as standard A.

f. Propelling Charge. All 105-mm cartridges of recent manufacture, except HEP-T, HEAT, and TP-T cartridges contain zoned charged of propellant M1 of dual granulation composed of a base charge (charge 1) and six increment charges (charges 2, 3, 4, 5, 6, and 7) (fig. 34) for charge adjustment. The HEAT and TP-T cartridges contain propellant M1 of single granulation (fig. 34), in a single bag charge which is nonadjustable. Some rounds (other than HEAT and TP-T) of older manufacture, containing propellant M1, single granulation, are still in service. The HEP T cartridge uses a single charge of M6, single granulation, and the charge is in a single bag and is not adjustable. See paragraphs 226 through 243 for detailed information.

g. Primer. Percussion primer M28A2 is used for all service and practice ammunition for 105-mm weapons. Alternative primer is percussion primer M28B2 (steel). Percussion primer M1B1A2 or alternative primer M1A2 is used with blank ammunition. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. Service cartridges for the 105-mm howitzer cannons M2A1, M2A2, M4, M4A1, M49 (T96) and T252 are generally packed one per fiber container, one fiber container per metal container, or two fiber containers per wooden box, or three fiber containers per bundle (domestic shipment only). Packing and shipping data appear in SM 9-5-1315. Packing and marking for shipment is described in paragraphs 3 through 14.

130. Cartridge, 105 Millimeter Blank: M395

This cartridge (fig. 351) is for salutes and simulated fire and consists of the cartridge case M15 (brass) or M15B1 (steel), the 100-grain primer M1B1A2, and a 2.0-pound charge of black powder (sodium nitrate). Alternative primer is percussion primer M1A2 and alternative charge is a 1.5-pound charge of black powder (potassium nitrate). The black powder charge is held in a cotton bag which is in the cartridge case surrounding the primer. The charge is held firmly in position by a closing cup or plug assembly. The closing cup assembly consists of two pulpboard disks glued one to each surface of a hard felt disk. The assembly is cemented securely in position in the case about 0.50 inch from the mouth of the case. Weight of complete round is 6.24 pounds and the length is 6.02 inches. In future production, this cartridge will be assembled with a loose powder charge (no bags), fiberglass pad, and a plastic closing cup.

131. Cartridge, 105 Millimeter Dummy: M14, w/Fuze, PD, M59, Dummy

This cartridge (fig. 35) is a completely inert assembly designed to permit simulation of all adjustments required in the semifixed service rounds. The cartridge consists of a dummy projectile fitted with an inert or dummy fuze, loosely seated in a dummy cartridge case containing an inert primer and a dummy propelling charge. The dummy projectile is a hollow malleable iron or bronze casting with an open base to facilitate extraction from the weapon. The dummy fuze M59 simulates the PD fuzes M48 series and M51 series. The cartridge case consists of a cadmium-plated steel tube threaded at the rear to receive the steel (alternate: malleable iron) base and fitted at the mouth with a manganese or bronze collar which serves as a sleeve to receive the projectile. The dummy propelling charge M3 (par. 235c) consists of a base charge (charge 1) and six increment charges (charges 2, 3, 4, 5, 6, and 7) to simulate the service propelling charge. The base charge is secured to eyebolts (2) in the cartridge case base with twine or sash chain; the first increment (charge 2) is attached to the base charge and each succeeding increment (charges 3, 4, 5, 6, and 7) is attached to the one preceding by twine or snaps on a 16-inch sash chain. This arrangement permits the withdrawal of all increment charges to the mouth of the cartridge.
Figure 36. Comparison of single granulation and dual granulation propelling charges of semifixed rounds of ammunition for 105-mm howitzer cannons M2A1, M2A2, M4, M4A1, and M49 (T96).
Figure 35. Cartridge, 105 millimeter blank: M395.

Figure 36. Cartridge, 105 millimeter dummy: M14, w/fuse, PD, M59 dummy.
Figure 35. Cartridge, 105 millimeter blank: M985.

Figure 36. Cartridge, 105 millimeter dummy: M59 dummy.
case for adjusting the charge. Weight of the complete round is 42.06 pounds; length is 31.07 inches. This cartridge is also issued with inert fuze M54.

132. Cartridge, 105 Millimeter: Gas, Persistent, H, M60, Dualgran, w/Fuze, PD, M51A5 0.05-Sec Delay

a. General. This cartridge is assembled with the gas projectile M60 which resembles the high-explosive projectile in outward appearance. The projectile is boat-tailed and the ogival nose is threaded to receive an adapter. The adapter provides a tight seal for the chemical filler of the projectile and is threaded internally to receive a point fuze. The adapter also provides a seal for the forward end of the burster casing assembly M5. This assembly is a thin-walled steel tube extending from the adapter to the rear of the projectile cavity and contains the burster charge M5. The burster charge, when properly functioned by the fuze, ruptures the shell casing and disperses the chemical filler. The filler (H) is distilled (purified) mustard gas, a persistent liquid vesicant which is used as a casualty producing agent and for contaminating habitable areas. The weight of the chemical filler is 3.17 pounds. This cartridge is also issued with a steel case.

b. Data.

<table>
<thead>
<tr>
<th>Weight of cartridge</th>
<th>42.92 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cartridge</td>
<td>31.10 in.(max)</td>
</tr>
<tr>
<td>Weight of projectile, as fired</td>
<td>33.94 lb</td>
</tr>
<tr>
<td>Length of fused projectile</td>
<td>19.51 in.</td>
</tr>
<tr>
<td>Length of cartridge case</td>
<td>14.64 in.</td>
</tr>
<tr>
<td>Width of rotating band</td>
<td>0.81 in.</td>
</tr>
<tr>
<td>Type of base</td>
<td>boat-tailed</td>
</tr>
<tr>
<td>Degree of taper of base</td>
<td>8 deg 45 min</td>
</tr>
<tr>
<td>Radius of ogive</td>
<td>6.18 cal.</td>
</tr>
<tr>
<td>Muzzle velocity, charge 7 (par. 210)</td>
<td>1,550 fps</td>
</tr>
<tr>
<td>Maximum range</td>
<td>12,330 yd</td>
</tr>
</tbody>
</table>

133. Cartridge, 105 Millimeter: Gas, Persistent, HD, M60, Steel Case, Dualgran, w/Fuze, PD, M57, Modified

This cartridge is similar to the cartridge described in paragraph 132, except for the PD fuze M57 assembled thereto and the HD (distilled mustard) filler in the projectile. Data in paragraph 132 are applicable to this cartridge.

134. Cartridge, 105 Millimeter: Gas, Nonpersistent, GB, M360, Dualgran, w/Fuze, PD, M508

This cartridge is assembled with the cartridge case M14 and the gas projectile M360 which resembles the high-explosive projectile in outward appearance. The projectile is boat-tailed and of one-piece construction threaded to receive a point detonating fuze. A thin-walled steel tube extends from the fuze to the rear of the projectile cavity and contains the burster charge T67. The burster charge, when functioned by the fuze, ruptures the shell casing and disperses the chemical filler. Maximum length of cartridge is 31.18 inches. Total weight 43.86 pounds. This cartridge is also issued with a steel case.

135. Cartridge, 105 Millimeter: HE, M1

High-explosive cartridges are used for blast and fragmentation effect. They may have a "normal-cavity" or "deep-cavity" projectile loaded with TNT or composition B. As cartridges are packed, normal-cavity projectiles are with fuze or with closing plug in lieu of fuze. Deep-cavity projectiles may have supplementary charge and fuze, or supplementary charge and closing plug or closing plug only.


(1) Description. See paragraph 10.

(2) Assembly. Normal-cavity projectiles are assembled with the cartridge case M14 or M14E1 fitted with the percussion primer M28A2 or M28B2 (steel), an adjustable propelling charge of dual granulation or single granulation propellant M1, and various models of fuzes to make up the following list of TNT cartridges:

CARTRIDGE, 105 MILLIMETER: HE, M1, w/fuze, MTSQ, M500 or M500A1.

CARTRIDGE, 105 MILLIMETER: HE, M1, steel case, w/fuze, MTSQ, M500 or M500A1.
CARTRIDGE, 105 MILLIMETER: HE, M1, dualgran, w/fuze, MTSQ, M500 or M500A1.

CARTRIDGE, 105 MILLIMETER: HE, M1, w/fuze, PD, M51A4 (M48A2), 0.15-sec delay.

CARTRIDGE, 105 MILLIMETER: HE, M1, steel case, w/fuze, PD, M51A4 (M48A2), 0.15-sec delay.

CARTRIDGE, 105 MILLIMETER: HE, M1, w/fuze, MTSQ, M55A3 (M54).

CARTRIDGE, 105 MILLIMETER: HE, M1, steel case, w/fuze, MTSQ, M55A3 (M54).

(3) Data for cartridges.

(a) Physical data.

Weight of complete round .......................... 42.00 lb
Length of complete round .......................... 31.07 in.
Weight of projectile, as fired ........................ 33.00 lb
Length of fuzed projectile .......................... 19.48 in.
Length of cartridge case .......................... 14.64 in.
Width of rotating band .......................... 0.81 in.
Type of base ............................................ boat-tailed
Degree of taper of base .......................... 8 deg 45 min
Radius of ogive .......................... 6.18 cal.

(b) Ballistic data (maximum ranges with PD fuze to ground impact).

<table>
<thead>
<tr>
<th>Charge</th>
<th>(Maximum range (yd))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>650</td>
</tr>
<tr>
<td>2</td>
<td>710</td>
</tr>
<tr>
<td>3</td>
<td>780</td>
</tr>
<tr>
<td>4</td>
<td>875</td>
</tr>
<tr>
<td>5</td>
<td>1,020</td>
</tr>
<tr>
<td>6</td>
<td>1,235</td>
</tr>
<tr>
<td>7</td>
<td>1,550</td>
</tr>
</tbody>
</table>

Cartridge, 105 Millimeter: HE, M1, dualgran, w/suppl chg and fuze MTSQ, M500.

Cartridge, 105 Millimeter: HE, M1, steel case, dualgran, w/suppl chg and fuze MTSQ, M500 or M500A1.

Cartridge, 105 Millimeter: HE, M1, steel case, spiral wrapped, dualgran, w/suppl chg and fuze, MTSQ, M500 or M500A1.

Cartridge, 105 Millimeter: HE, M1, w/suppl chg and fuze, PD, M51A4 (M48A2), 0.15-sec delay.

Cartridge, 105 Millimeter: HE, M1, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.

1 This weight is for rounds with brass cartridge case and dual granulation propelling charge. Rounds with steel case weigh 0.5 pound less. Rounds with single granulation propelling charge weigh 0.28 pound more.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, dualgran, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, dualgran, w/suppl chg and fuze, PD, M61A5, 0.05-sec delay.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, spiral wrapped, dualgran, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, w/suppl chg and fuze, TSQ, M55A3 (M54).
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, w/suppl chg and fuze, TSQ, M55A3 (M54).
CARTRIDGE, 105 MILLIMETER:  
HE, M1, w/o fuze, adapted for proximity fuzes.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, w/o fuze, adapted for proximity fuzes.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, w/suppl chg, w/o fuze.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, dualgran, w/suppl chg, w/o fuze.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, dualgran, w/suppl chg, w/o fuze.
CARTRIDGE, 105 MILLIMETER:  
HE, M1, steel case, spiral wrapped, dualgran, w/suppl chg, w/o fuze.

(b) Composition B loaded deep-cavity cartridges.
CARTRIDGE, 105 MILLIMETER:  
HE, Comp B, M1, dualgran, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
CARTRIDGE, 105 MILLIMETER:  
HE, Comp B, M1, steel case, dualgran, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.
CARTRIDGE, 105 MILLIMETER:  
HE, Comp B, M1, steel case, spiral wrapped, dualgran, w/suppl chg and fuze, PD, M51A5, 0.05-sec delay.

136. Cartridge, 105 Millimeter: HEAT, M67, w/Fuze, BD, M62 or M62A1

a. General. This cartridge is used against armored targets. The cartridge differs from all other 105-mm ammunition, except TP-T and HEP-T in having a propelling charge consisting of one bag of propellant M1. The projectile is a relatively thin-walled steel bodied shell containing a shaped charge of 3.1 pounds of composition B (some projectiles on hand have a charge consisting of 1.3 pounds 50/50 cast pentolite and 0.6 pounds 10/90 cast pentolite surrounding the fuze). The projectile body is internally threaded at the base to receive the BD fuze M62 or M62A1 and at the nose to receive the ogive assembly which acts as ballistic cap. The BD fuze M62A1 has no tracer. The shaped charge is to the rear of a thin steel cone which is cemented to the interior of the shell. Concentration of blast is obtained by the shape of the charge. The space forward of the steel cone provides the "stand off" necessary for the penetration of target. The projectiles are assembled loosely with cartridge case M14 (brass) or M14B1 (steel) fitted with percussion primer M28A2 or M28B3 (steel). This cartridge is also issued with a steel case.

b. Data.
(1) Physical data.
Weight of cartridge .................................................. 37.06 lb
Length of cartridge .................................................. 31.05 in.
Weight of projectile, as fired ....................................... 28.80 lb
Length of fused projectile ........................................... 20.05 in.
Length of cartridge case ............................................ 14.64 in.
Width of rotating band ................................................ 0.81 in.
Type of base .......................................................... boat-tailed
Degree of taper of base .............................................. 8 deg 45 min
Type of ogive .......................................................... conical
(2) Ballistic data.
Muzzle velocity ........................................ 1,250 fps
Range (8 deg 36 min) .................................... 3,500 yd
Maximum range .......................................... 8,590 yd

137. Cartridge, 105 Millimeter: HEAT-T,
Comp B, M67, w/Fuze, BD, M91A1

This cartridge is used against armored targets. It is similar to cartridge described in paragraph 136, except for the fuze. As the M91A1 fuze has a tracer, the M67 cartridge has a tracer when fitted with this fuze. Data shown in paragraph 211 are applicable. This cartridge is also issued with a steel case.

138. Cartridge, 105 Millimeter: HEP-T, M327,
Steel Case, w/Fuze, BD, M91

This cartridge is used primarily against armored targets. The cartridge, similar to that for the cartridge HEAT-T, has one bag of propellant M1 for its propelling charge. The projectile is internally threaded at the base to receive the BD fuze M91 (some rounds on hand are fitted with BD fuze M61A1). The BD fuze M91 series contain an integral tracer in the base. This cartridge is also issued with a brass case and fuze BD M62A1 which has no tracer. Other data is classified.

139. Cartridge, 105 Millimeter: Illuminating,
M314 or M314A1, Dualgran, w/Fuze,
MTSQ, M501 or M501A1

The illuminating cartridge is intended to provide intense light on a designated point or area. The projectile consists of the illuminating canister M316 or M316A1, a black powder expelling charge adjacent to the fuze, and the parachute unit M8 attached to the canister—all enclosed in a steel casing.

Note. The black powder expelling charge was initially contained in a cloth bag which permitted moisture to deteriorate the charge. Check charges in cloth bags for deterioration before use.

The base of the projectile is closed by a steel plug which in the functioning of the projectile is blown out. The fuze ignites the expelling charge which expels the burning canister and parachute from the projectile, illuminating the target area. Canister M316A1 has an intensity of 600,000 foot candles for approximately 60 seconds. Canister M316 burns for approximately 40 seconds with a light intensity of 240,000 foot candles. The projectile is assembled loosely to the cartridge case M14 or M14B1 steel fitted with percussion primer M28A2 or M28B2 (steel) and an adjustable propelling charge of dualgran propellant M1.

140. Cartridge, 105 Millimeter: Illuminating,
M314A1, Steel Case, Spiral Wrapped,
Dualgran, w/Fuze, MTSQ, M501A1

This cartridge is generally similar to that described in paragraph 139, except that it has a spiral wrapped steel cartridge case M14E1.

Note. The mouth of this case can expand slightly by uncoiling. This makes it easier to insert the projectile in the mouth of the case. However, if the loader is not careful to grasp the projectile at its balance, the complete round may sag in the center more than normal. If the lip of the mouth of the case is on the bottom, it may protrude enough to catch on the lip of the lower extractor recess in the chamber. The mouth will then bend back making it impossible to chamber the round. The projectile must be grasped at its balance to keep the complete round from sagging while being loaded.

141. Cartridge, 105 Millimeter: Leaflet, BE,
M84 or M84B1, w/Fuze, MTSQ, M501

This cartridge, which is used to distribute leaflets, is similar to an M84 or M84B1 cartridge with the smoke canister removed and the cartridge suitably repainted. Field addition of printed leaflets take place in the space normally occupied by the smoke canister. The data applicable to the smoke projectile M84 applies also to this projectile. The projectile is assembled loosely with the cartridge case M14 fitted with primer M28A2 or M28B2 (steel) and an adjustable, propelling charge of single granulation propellant M1 and the MTSQ fuze M501. This cartridge is an improvisation and its firing will result in a large percentage of damaged leaflets.

142. Cartridge, 105 Millimeter: Smoke, Green,
BE, M84 or M84B1, w/Fuze, MTSQ, M501
or M501A1

a. General. This cartridge is a base ejecting type similar to the illuminating projectile M314 or M314A1 (par. 139) used to produce screening smoke of various colors for spotting and screening purposes. The projectile contains an expelling charge of black powder adjacent
to the fuze and three smoke canisters — all enclosed in a steel casing. The base of the projectile is closed by a steel plug which in the functioning of the projectile is blown out. The fuze ignites the black powder expelling charge which ignites the smoke mixture and the burning smoke canisters. The projectile is provided with one of five types of smoke producing canisters — HC (white), yellow, red, violet, and green. The projectile is assembled loosely to the cartridge case M14 (brass) or M14B1 (steel) fitted with percussion primer M28A2 or M28B2 (steel), an adjustable propelling charge of dual granulation or single granulation propellant M1, and various models of fuzes to make up the following list of cartridges:

**CARTRIDGE, 105 MILLIMETER:** smoke, green, BE, M84 or M84B1, dualgran, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, green, BE, M84 or M84B1, steel case, dualgran, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, green, BE, M84 or M84B1, steel case, dualgran, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, HC, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, HC, BE, M84 or M84B1, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, HC, BE, M84 or M84B1, steel case, dualgran, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, HC, BE, M84 or M84B1, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, HC, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, dualgran, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, steel case, dualgran, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, steel case, dualgran, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, w/fuze, TSQ, M54.

**CARTRIDGE, 105 MILLIMETER:** smoke, red, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, violet, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, violet, BE, M84 or M84B1, w/fuze, TSQ, M54.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, w/fuze, TSQ, M54.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, dualgran, w/fuze, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, dualgran, w/fuze, MTSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, dualgran, w/fuze, TSQ, M501 or M501A1.

**CARTRIDGE, 105 MILLIMETER:** smoke, yellow, BE, M84 or M84B1, w/fuze, TSQ, M54.

b. Data.

**Weight of cartridge:**

- Green ........................................... 33.58 lb
- HC ............................................. 41.93 lb
- Red ........................................... 33.78 lb
- Violet ........................................ 33.58 lb
- Yellow ....................................... 39.38 lb

**Length of projectile** .................................. 30.49 in.

**Weight of projectile, as fired:**

- Green ........................................... 30.48 lb
- HC ............................................. 32.86 lb
- Red ........................................... 30.68 lb
- Violet ........................................ 30.48 lb
- Yellow ....................................... 30.29 lb

**Weight of smoke charge:**

- Green ........................................... 5.12 lb
- HC ............................................. 7.59 lb
- Red ........................................... 5.32 lb
- Violet ........................................ 5.12 lb
- Yellow ....................................... 4.92 lb

**Length of fused projectile** .................. 18.84 in.

**Length of cartridge case** .................. 14.64 in.

**Width of rotating band** ................... 0.81 in.

**Type of base** ..................................... boat-tailed

**Degree of taper of base** ................... 8 deg 45 min

**Radius of ogive** ................................ 6.18 cal.
143. Cartridge, 105 Millimeter: Smoke, WP, M60, w/Fuze, PD, M51A4, 0.15-sec Delay

a. General. This cartridge is similar in appearance and functioning to the "H" gas cartridge M60 (par. 132). It differs from the "H" gas projectile in that its filler is WP (white phosphorous), a smoke-producing chemical which also has a slight incendiary effect. The cartridge is used for spotting and screening purposes. The projectile is assembled loosely to the cartridge cases M14 (brass), M14B1 (steel), or M14E1 (steel, spiral, wrapped) fitted with percussion primer M28A2 or M28B1 (steel), an adjustable propelling charge of dual granulation, and PD fuze M51A5 or M57 modified.

b. Data. Physical and ballistic data is the same as that for the "H" gas cartridge M60 (par. 132), except for the weight of cartridge which is 43.81 pounds and the weight of projectile, as fired, which is 34.83 pounds.

c. Similar Cartridges. Other cartridges are issued similar to that in paragraph 142a except for the type of fuze and granulation of propelling charge; see SM 9–5–1315.

Section XII. PROJECTILES FOR 120-MM GUN CANNONS M1, M1A1, M1A2, AND M1A3 (AA)

144. Cartridge, 105 Millimeter: TP–T, M67

a. General. This cartridge is for target practice to simulate firing the HEAT cartridge M67 (par. 136). It is an inert HEAT projectile M67 loaded to weigh with an inert mixture either of barium carbonate and stearic acid or plaster of paris. A base plug, containing the tracer element, is used instead of the BD fuze. The tracer in flight has an average visibility of 3 seconds at night and 5 seconds by day.

b. Data.

1. Physical. Physical data is the same as paragraph 136, except for length of projectile which is 19.46 inches.

2. Ballistic. Ballistic data for the HEAT cartridge (par. 136) apply.

c. Similar Cartridges. The following cartridges are similar to that described in a and b above, except for type of cartridge case:

CARTRIDGE, 105 MILLIMETER: TP–T, M67, steel case.
CARTRIDGE, 105 MILLIMETER: TP–T, M67, steel case, spiral wrapped.

145. General

a. General Discussion. These guns are antiaircraft weapons intended for protection of large areas against aircraft at altitudes up to 30,000 feet. Ammunition used in these weapons is "separated" ammunition. The projectile and the propelling charge assembly are shipped separately. In separated ammunition, unlike separate-loading ammunition, a cartridge case protects the nonadjustable propelling charge against moisture and foreign matter and prevents the loss of propellant. In firing, the projectile and the propelling charge are placed on a tray and then loaded into the weapon as a unit by a power rammer. Firing data for 120–mm ammunition are in TD 47.7 AA–C–1 FT 4.7 AA–C–1 with charge 3 and FT 120–AA–A–1.

b. Identification. The ammunition is identified by means of the painting and marking as illustrated in figure 38 and in accordance with basic color scheme as prescribed in TM 9–1900.

c. Projectiles. Projectiles for 120-mm ammunition are the high-explosive projectile M73 with normal cavity, the high-explosive projectile M73 with deep cavity, and the dummy projectile M15. The high-explosive projectile differs only in the depth of fuze cavity and weight of TNT bursting charge. The "normal" cavity projectile has a 0.81-inch deep fuze cavity and contains 5.26 pounds of TNT while the "deep" cavity projectile has a 3.59-inch deep cavity and contains 4.83 pounds of TNT. The deeper cavity of the "deep" cavity projectile permits it to accommodate proximity fuzes for either antiaircraft or terrestrial fire. The insertion of a 0.33-pound supplementary charge of TNT into the deep cavity adapts this type of projectile for use with authorized PD and MT fuzes. The dummy projectile M15 uses the projectile M73 metal parts but differs from the other projectiles in its inert filler and in that its rotating band is machined flush with the rear bourrelet. Weight zones (sec II, ch 1) are indicated on 120 mm projectile M73 by
Figure 38. Projectile, 120 millimeter: HE, M73, w/ fuze, MT, M61A2 and charge, propelling, 120 millimeter, M15.
Section XIII. PROJECTILES FOR 120-MM GUN CANNON M58

150. General

a. General Discussion. The 120-mm gun cannon M58 is used as a tank and antitank weapon. Ammunition for this cannon is of the "separated" type. Separated ammunition consists of the projectile and the propelling charge as separate units, although they are loaded into the weapon as a unit by the automatic loading mechanism in the tank. A complete round consists of all the ammunition components required to fire the weapon once.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9-1900.

c. Projectile. Dependent upon the type of projectile, ammunition authorized for these weapons only, is classified as armor-piercing with tracer (AP-T), high-explosive (HE), high-explosive with tracer (HE-T), smoke (WP), smoke with tracer (WP-T), and target-practice with tracer (TP-T). The weight zones are indicated on the ogive of the projectile by means of ¼-inch squares of the same color as the marking. On the 120-mm projectile, there are from three to five squares depending upon the weight of the projectile. Four squares indicate "standard" or "normal" weight for which no weight corrections are necessary when computing firing data.

d. Fuze. Fuzes used with ammunition for these weapons are of the terrestrial-target type. The PD fuzes M48A3 and M51A5 are impact-type fuzes and are used with smoke and HE rounds respectively. The point detonating (PD) concrete-piercing fuzes M78 and M78A1 (w/booster M25) are used with HE projectiles against concrete targets. See paragraphs 184 through 225 for complete description of these fuzes.

e. Tracer. The tracer M5 series is used in the AP-T, M358 (T116E7); HE-T, M356 (T15E3); WP-T, T16E3; and TP-T, M359 (T147E7) projectiles. The tracer M6 is a lightweight capsule replaceable type. This tracer assembly, which has an improved moisture-proof closure and contains igniter composition K29 and tracer composition R45, is screwed into the boss on the base or into the base of the projectile.

151. Projectile, 120 Millimeter: HE, Comp B, T15E1, w/Fuze, PD, M51A5, 0.05-Sec Delay and Charge, Propelling (Case), T21

a. General. This projectile (fig. 39) is provided for use when fragmentation blast or mining effect is desired. It contains a bursting charge of 7.84 pounds of composition B. When assembled with point detonating (PD) concrete-piercing fuze M78 or M78A1, the projectile is effective against concrete and will destroy reinforcing bars and remove debris from within the impact area. The projectile which has a long ogive, has a square base near which two gilding metal rotating bands are fitted. The complete round consists of the fuzed projectile and the cased propelling charge T21.

b. Data.

Weight of projectile, as fired ..................................50.41 lb
Length of projectile, as fired ................................23.19 in.
Weight of cased propelling charge ..........................38.74 lb
Length of cased propelling charge ..........................34.75 in.
Double rotating bands, width of each .....................0.94 in.
Type of base..............................................square
Radius of ogive ........................................12.75 cal
Muzzle velocity ........................................2,500 fps
Maximum range .........................................19,910 yd
Figure 38. Projectile, 120 millimeter: HE, M 7, w/size, MT, M61A2 and charge, propelling, 120 millimeter, M15.
Section XIII. PROJECTILES FOR 120-MM GUN CANNON M58

150. General

a. General Discussion. The 120-mm gun cannon M58 is used as a tank and antitank weapon. Ammunition for this cannon is of the "separat-ed" type. Separated ammunition consists of the projectile and the propelling charge as separate units, although they are loaded into the weapon as a unit by the automatic loading mechanism in the tank. A complete round consists of all the ammunition components required to fire the weapon once.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.

c. Projectile. Dependent upon the type of projectile, ammunition authorized for these weapons only, is classified as armor-piercing with tracer (AP–T), high-explosive (HE), high-explosive with tracer (HE–T), smoke (WP), smoke with tracer (WP–T), and target-practice with tracer (TP–T). The weight zones are indicated on the nose of the projectile by means of 1/2-inch squares of the same color as the marking. On the 120-mm projectile, there are from three to five squares depending upon the weight of the projectile. Four squares indicate "standard" or "normal" weight for which no weight corrections are necessary when computing firing data.

d. Fuze. Fuzes used with ammunition for these weapons are of the terrestrial-target type. The PD fuzes M48A3 and M51A5 are impact-type fuzes and are used with smoke and HE rounds respectively. The point detonating (PD) concrete-piercing fuzes M78 and M78A1 (w/booster M25) are used with HE projectiles against concrete targets. See paragraphs 184 through 225 for complete description of these fuzes.

e. Tracer. The tracer M5 series is used in the AP–T, M358 (T116E7); HE–T, M356 (T15E3); WP–T, T16E3; and TP–T, M359 (T147E7) projectiles. The tracer M6 is a lightweight capsule replaceable type. This tracer assembly, which has an improved moisture-proof closure and contains igniter composition K29 and tracer composition R15, is screwed into the boss on the base or into the base of the projectile.

f. Cartridge Case. Cartridge case M34 (brass) weighing 24.70 pounds, M109 (T25) (brass) weighing 24.80 pounds, or T25E3 (steel spiral wrapped) weighing 20.34 pounds, is used with ammunition for this cannon.

g. Propelling Charge. The propelling charge assemblies M45 (T21E1), M46 (T38E1) and T38E2 are used with ammunition for this cannon. See paragraphs 226 through 243 for detailed information.

h. Primer. The primers used with ammunition for this cannon are the percussion primer M67 (T36E6) and the percussion electric primes M67 (T85E3) and T85E2. See paragraphs 244 through 268 for detailed information.

i. Packing and Shipping Data. Projectiles and propelling charges for 120-mm gun cannon M58 are packed individually in fiber containers, two fiber containers (one round) per wooden box. Packing and shipping data appear in SM 9–5–1815.

151. Projectile, 120 Millimeter: HE, Comp B, T15E1, w/Fuze, PD, M51A5, 0.05-Sec Delay and Charge, Propelling [Case], T21

a. General. This projectile (fig. 39) is provided for use when fragmentation blast or mining effect is desired. It contains a bursting charge of 7.84 pounds of composition B. When assembled with point detonating (PD) concrete-piercing fuze M78 or M78A1, the projectile is effective against concrete and will destroy reinforcing bars and remove debris from within the impact area. The projectile which has a long ogive, has a square base near with which two gilding metal rotating bands are fitted. The complete round consists of the fuzed projectile and the cased propelling charge T21.

b. Data.

Weight of projectile, as fired .......... 50.41 lb
Length of projectile, as fired .......... 23.19 in.
Weight of cased propelling charge ...... 38.74 lb
Length of cased propelling charge..... 34.78 in.
Type of base ..................... square
Radius of ogive ................... 2.546 in.
Muzzle velocity .......................... 2,500 fps
Maximum range .................. 19,910 yd
152. Projectile and Charge, Propelling, 120 Millimeter: Consisting of Projectile, HE-T, Comp B, M356, w/Fuze, PD, M51A5, 0.05-Sec Delay and Charge, Propelling (Case), M45

This projectile (fig. 40) which is an HE projectile of later design, differs from the projectile T15E1 in that it has a boss on the bottom of the projectile into which a tracer assembly of the M5 series is screwed. By a slight alteration of the projectile M356 both projectiles maintain the same "as fired" weight. The propelling charge used is the M45 (T21E1). The tracer is ignited by the propelling charge and burns with a visible tracer for a minimum of 3 seconds when the round is fired. All data pertaining to projectile T15E1 in paragraph 151 also pertains to this projectile with the exception that the length of the projectile as fired is 24.02 inches.
153. Projectile and Charge, Propelling, 120 Millimeter: Consisting of Projectile, Smoke WP, T16E1, w/Fuze, PD, M48A3 and Charge, Propelling (Case), M45

This projectile is similar in size, shape, weight, and ballistics to the HE projectile described in paragraph 151. The projectile is a white phosphorous-filled bursting-type projectile containing 7.51 pounds of WP. It has a central tube or burster casing. The lower end of the burster casing is seated in a well at the base of the projectile cavity. The burster casing contains a burster with a bursting charge of approximately 0.55 pounds of tetrytol, as well as the burster initiator M2, which contains 106 grains of tetryl. The propelling charge used is the M45 (T21E1). All data pertaining to PROJECTILE, HE, COMP B, T15E1 in paragraph 151 also pertains to this projectile.

154. Projectile and Charge, Propelling, 120 Millimeter: Consisting of Projectile, Smoke WP-T, T16E3, w/Fuze, PD, M51A5, 0.05-Sec Delay and Charge, Propelling (Case), M45

This projectile (fig. 41) which is a WP projectile of later design, is similar in size, shape, weight, and ballistics to the projectile described in paragraph 151 with the exception that it has a boss on the bottom of the projectile into which a tracer assembly of the M5 series is screwed. By a slight alteration on the projectile T16E3, the "as fired" weight is the same as the projectile T16E1. The tracer is ignited by the propelling charge and burns with a visible tracer for a minimum of 3 seconds when the round is fired. The propelling charge used is the M45 (T21E1). All data pertaining to PROJECTILE, HE, COMP B, T16E1 in paragraph 151 also pertains to this projectile with the exception that the length of the projectile as fired is 24.02 inches.

Figure 41. Projectile, 120 millimeter: smoke, WP-T, T16E3, w/fuze, PD, M51A5, 0.05-sec delay.
155. Projectile and Charge, Propelling, 120 Millimeter: Consisting of Projectile, AP-T, M358 and Charge, Propelling (Case), M46

a. General. This high velocity projectile (fig. 42) is used against armored targets. This projectile, which is of conventional monobloc design, consists of a hardened steel projectile body, a forged-aluminum windshield, two separate gilding metal rotating bands fitted near the base of the projectile, and a tracer of the M5 series, which is screwed into the base of the projectile. The complete round consists of the projectile and the cased propelling charge M46 (T38E1).

b. Data.

Weight of projectile, as fired .................. 50.85 lb
Length of projectile, as fired .................. 17.82 in.
Weight of cased propelling charge .......... 56.46 lb
Length of cased propelling charge .......... 34.69 in.

Double rotating bands, width of each .... 0.94 in.
Type of base ..................................... square
Radius of ogive .................................. 1.42 cal.
Muzzle velocity .................................. 3,500 fps
Maximum range .................................. 25,290 yd

156. Projectile, 120 Millimeter: TP-T, M359, w/Charge, Propelling (Case), M46 (T38E1)

This projectile is provided for training in marksmanship. This projectile is identical in design to PROJECTILE, AP-T, M358 described in paragraph 155 with the exception of the materiel used in the projectile body, which is low strength carbon steel and is for target practice use. The complete round consists of the projectile and the cased propelling charge M46 (fig. 43). All data pertaining to PROJECTILE, AP-T, M358 in paragraph 155 also pertains to this projectile.

![Figure 12. Projectile, 120 millimeter: AP-T, M358.](image-url)
Figure 4.3. Charge, propelling (excr.), 120 millimeter, M46.
155. Projectile and Charge, Propelling, 120 Millimeter: Consisting of Projectile, AP-T, M358 and Charge, Propelling (Case), M46

a. General. This high velocity projectile (fig. 42) is used against armored targets. This projectile, which is of conventional monobloc design, consists of a hardened steel projectile body, a forged-aluminum windshield, two separate gilding metal rotating bands fitted near the base of the projectile, and a tracer of the M5 series, which is screwed into the base of the projectile. The complete round consists of the projectile and the cased propelling charge M46 (T38E1).

b. Data.

Weight of projectile, as fired .................. 50.85 lb
Length of projectile, as fired .............. 17.82 in.
Weight of cased propelling charge ........... 56.46 lb
Length of cased propelling charge .......... 34.69 in.

Double rotating bands, width of each .... 0.94 in.
Type of base .................................... square
Radius of ogive ................................ 1.42 cal.
Muzzle velocity ................................. 3,500 fps
Maximum range ................................ 25,290 yd

156. Projectile, 120 Millimeter: TP-T, M359, w/Charge, Propelling (Case), M46 (T38E1)

This projectile is provided for training in marksmanship. This projectile is identical in design to PROJECTILE, AP-T, M358 described in paragraph 155 with the exception of the materiel used in the projectile body, which is low strength carbon steel and is for target practice use. The complete round consists of the projectile and the cased propelling charge M46 (fig. 43). All data pertaining to PROJECTILE, AP-T, M358 in paragraph 155 also pertains to this projectile.

Figure 42. Projectile, 120 millimeter: AP-T, M358.
Figure 43. Charge, propelling (120 mm) millimeter, M46.
Section XIV. PROJECTILES FOR 155-MM GUN CANNONS MT AND M46 (T80)

157. General

a. General Discussion. The 155-mm gun cannon M2 is used as a field piece. The M46 (T80) is used on self-propelled 155-mm gun cannon M53. Ammunition for the 155-mm gun cannons M2 and M46 (T80) is of the separate-loading type. The loading of each complete round into the cannon requires three separate operations: loading the projectile, the propelling charge, and the primer. The projectiles, either deep-cavity with supplementary charge or normal cavity, are issued unfuzed with eyebolt lifting plug in the nose of the projectile. Projectiles used in these 155-mm gun cannons are the same size and shape as those fired from the 155-mm howitzer cannons M1, M1A1, and M45. They are not fully interchangeable except for the dummy and the illuminating projectiles. They differ in the width of the rotating band and the marking. The 2.02-inch wide rotating band of the gun projectile is wider than the rotating band of the howitzer projectile. However, the howitzer projectile may be used in the gun with the base charge only (c below).

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9-1900.

c. Projectile. Dependent upon type of filler, projectiles for these weapons are classified as dummy, gas (HD), high-explosive (HE), illuminating, and smoke (WP) or white or colored (BE).

d. Fuze. All projectiles for these weapons are issued unfuzed. Point detonating, concrete-piercing (CP), mechanical time (MT), mechanical time superquick (MTSQ), point-detonating (PD), proximity type (VT), and time superquick (TSQ) fuzes are authorized for use with ammunition for these weapons. A brief description of the fuzes for these guns is given in (1) through (4) below. See paragraphs 184 through 225 for complete descriptions of these fuzes.

(1) Fuze used with HE projectiles. The point detonating concrete-piercing (CP) fuze M78A1 (or M78) (w/ booster M25) an impact-type fuze, is used against concrete targets. The MTSQ fuze M500A1 (or M500) and MT fuze M67A3 are mechanical time fuzes that permit adjustment of time setting. The MTSQ fuze M500A1 (or M500) also incorporates an impact element. The PD fuzes M51A5 or M51A4) and M535 (T177E3) are impact-type fuzes with superquick or 0.05-second delay action. The proximity fuze M514 (T227), incorporates an impact element and has a "delay arming" feature. The proximity fuze M514 can be used with the deep-cavity projectile only.

(2) Fuze used with illuminating projectiles. The MTSQ fuze M501A1 (or M501) and TSQ fuze M54 are time fuzes that permit adjustment of time settings. These fuzes also incorporate impact elements.

(3) Fuze with gas (HD) or smoke (WP) projectiles. The PD fuzes M51A5 or M51A4 and T177E3 (M535) are impact-type fuzes with superquick or 0.05-second delay action.

(4) Fuze used with GB gas projectile M122. The PD fuze M508 (T234E1) is an impact-type fuze with superquick action and a delayed arming mechanism in the booster.

e. Propelling charge. The propelling charge M19 used with all service rounds in the 155-mm cannon consists of a base and one increment and is approximately 37½ inches long by 6¼ inches in diameter. The charge consists of propellant M6 loaded in cloth bags. The full charge of base and increment is sometimes called SUPERCHARGE, and the base only, reduced charge is sometimes called NORMAL CHARGE. The igniter charge consists of 10 ounces of black powder, contained in a red dyed cloth cartridge bag. The igniter bag is sewed to the rear end of the base section. The dummy propelling charge M100 which simulates the service propelling charge, is provided for use with the dummy projectile. See paragraphs 226 through 243 for detailed information.

f. Flash Reducer. The flash reducer M1 is used with the base section (normal charge) of the propelling charge. Its use greatly reduces the flash and is intended primarily for use in night firing. See paragraphs 226 through 243 for detailed information.
g. Primer. Only the percussion primer Mk 2A4 is used in the 155-mm cannon M2. The combination lock electric and percussion primer Mk 15 Mod 1 or the lock electric primer Mk 34 Mod 0 is used in the 155-mm cannon M46 (T80). See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. The projectiles for the 155-mm gun cannon M2 and M46 (T80) are shipped unfuzed with eyebolt lifting plug fitted to the projectile in the fuze opening. Grommets (par. 287) protect the rotating band. Pallets are wooden skids with a separate wooden top. See TM 9–1900 for palletized shell. Packing and shipping data for projectiles and propelling charges appear in SM 9–5–1320. Packing and shipping data for fuzes and primers appear in SM 9–5–1390. Packing and marking for shipment is described in paragraphs 3 through 14.

158. Projectile, 155 Millimeter, Dummy: M7

This dummy projectile (fig. 44) is intended for training in handling and service of the 155-mm cannon. Projectile of earlier manufacture are for use in the 155-mm guns only, because of the greater diameter of the rear band (6.3 in.). It is of the type having a fully inclosed spring-operated plunger, which kicks the projectile loose from the forcing cone of the weapon on rebound resulting from ramming. It has bronze cap, steel body, bronze front band, steel base, and manganese bronze rear band. The bronze front band simulates the bourrelet of a service projectile. The manganese bronze rear band simulates the rotating band of a service projectile. The several parts of this dummy projectile are replaceable. The projectile is 27.56 inches long and weighs 95 pounds. Some projectiles, marked M7B1, differ from the M7 only in the cap which, in the M7B1, is made of malleable iron.

159. Projectile, 155 Millimeter: Persistent, Gas, HD, M104

a. General. The HD persistent gas projectile M104 (fig. 45) is intended for producing a toxic effect on personnel. The projectile has the same contour as the HE projectile M101 described in paragraph 160. The projectile filler consists of 11.70 pounds of HD (distilled mustard gas) and burster charge M6 consisting of 0.83-pound tetrytol. The burster charge M6 is contained in a thin aluminum or steel tube. The burster casing M1 extends into the projectile. It is applied after the projectile is filled with chemical agent and it seals the cavity by means of press-fit surfaces on the open end of the burster and an adapter sealed into the nose end of the projectile body. The adapter is threaded for assembly of a fuze. The projectile is issued unfuzed, but with an eyebolt-lifting plug assembled in the nose.

![Figure 44. Projectile, 155 millimeter, dummy: M7.](image-url)
b. Data.

Weight of projectile, as fired .......... 94.60 lb
Length of projectile (w/eyebolt lifting plug) .......................... 26.78 in.
Width of rotating band .......................... 2.02 in.
Type of base ...................................... boat-tailed
Degree of taper .................................. 8.0 deg
Radius of ogive .................................. 10.75 cal.
Muzzle velocity, maximum charge .... 2,800 fps
Maximum range, supercharge ......... 25,715 yd

160. Projectile, 155 Millimeter: HE, M101

a. General. This projectile (fig. 46) is intended principally for fragmentation, mining, or blast effect. The projectile comprises a steel shell body containing a high-explosive bursting charge of approximately 15.48-pounds TNT. The projectile has a single rotating band which is located approximately 3.5 inches forward of the base. The projectile is fitted with a base cover which assures that hot gases generated by the burning propelling charge do not come in contact with the bursting charge.

b. Data.

Weight of projectile, as fired .......... 95.73 lb
Length of projectile (w/eyebolt lifting plug) .......................... 26.79 in.
Width of rotating band .......................... 2.02 in.
Type of base ...................................... boat-tailed
Degree of taper .................................. 8.0 deg
Radius of ogive .................................. 10.75 cal.
Muzzle velocity, maximum charge .... 2,800 fps
Maximum range, supercharge ......... 25,715 yd

161. Projectile, 155 Millimeter: HE, M101, w/ Suppl Chg

a. General. This projectile is similar to that described in paragraph 160, except that it has a deep fuze cavity 4.94 inches long. The projectile contains a high-explosive bursting charge of 14.61 pounds of TNT and a supplementary bursting charge of 0.30 pound of TNT contained in an aluminum sheet liner. This projectile is adaptable for use with proximity fuzes or mechanical-type fuzes and boosters. The supplementary bursting charge must be removed before insertion of a proximity fuze.

b. Data. The data listed in paragraph 160, also applies to this projectile except for the following:

Weight of projectile, as fired .......... 95.10 lb
Length of projectile (w/eyebolt lifting plug) .......................... 26.81 in.

162. Projectile, 155 Millimeter: Smoke, WP, M104

a. General. The WP smoke projectile M104 (fig. 47) although it also has a slight incendiary effect is intended for producing a screening smoke. This projectile except for the 15.60-pounds WP smoke filler is similar to the HD persistent gas projectile described in paragraph 159.
Figure 46. Projectile, 155 millimeter: HE, M101.

Figure 47. Projectile, 155 millimeter: smoke, WP, M104.
b. Data. The data listed in paragraph 159 also applies to this projectile except for the following:

Weight of projectile, as fired .......................... 97.90 lb

163. Projectile, 155 Millimeter:

The following projectiles, listed under “For 155-mm howitzer cannon M1, M1A1, and M45” are authorized for use in the 155-mm gun cannon M2 when fired with Normal charge only. PROJECTILE, 155 MILLIMETER: HE, M107 (w/o suppl charge).

PROJECTILE, 155 MILLIMETER: smoke, green, BE, M116.

PROJECTILE, 155 MILLIMETER: smoke, HC, BE, M116.

PROJECTILE, 155 MILLIMETER: smoke, red, BE, M116.

PROJECTILE, 155 MILLIMETER: smoke, WP, M110.

PROJECTILE, 155 MILLIMETER: smoke, yellow, BE, M116.

PROJECTILE, 155 MILLIMETER: illuminating, M118A1.

164. Projectile, 155 Millimeter: Gas, Nonpersistent, GB, M122
a. General. The GB gas projectile M122 is intended for use against personnel to produce a toxic effect on personnel. The projectile has the same contour and ballistics as the HE projectile M101 described in paragraph 161. The projectile contains 6.5 pounds of chemical filler which produces a nonpersistent nerve poison. The burster casing M15 is press fitted into the nose of the projectile providing an airtight compartment in the projectile for the chemical filler. The burster charge assembly M37, which contains 2.72 pounds of tetrytol, fits into the burster casing. A steel fuze adapter in the nose of the projectile equips the projectile for receiving artillery fuzes with 2-inch threads. The filler is released when the burster charge functions rupturing the projectile.

b. Data.

Weight of projectile w/o fuze ......................... 99.70 lb

Length of projectile (w/eyebolt lifting plug) ............................................. 26.73 in.

Width of rotating band .................................. 2.02 in.

Type of base ..................................................... boat-tailed

Degree of taper .................................................... 8.0 deg

Radius of ogive ..................................................... 10.75 cal.

Muzzle velocity:

M19 normal charge ........................................... 2,100 fps

M19 supercharge ................................................ 2,800 fps

Maximum range:

M19 normal charge ........................................... 18,500 yd

M19 supercharge ................................................ 24,970 yd

Section XV. PROJECTILES FOR 155-MM HOWITZER CANNONS M1, M1A1, AND M45

165. General

a. General Discussion. The 155-mm howitzer cannons M1, M1A1, and M45 are used as field pieces. The M1 and M1A1 are towed weapons and the M45 is a self-propelled weapon. Ammunition for the 155-mm howitzer cannons M1, M1A1, and M45 is of the separate-loading type. The loading of each complete round into the weapon requires three separate operations: loading the projectile, the propelling charge, and the primer. The projectiles, either deep-cavity with or without supplementary charge or normal cavity, are issued unfused with eyebolt lifting plug assembled in the nose of the projectile. Projectiles used in these 155-mm howitzer cannons are the same size and shape as those fired from the 155-mm gun cannon M2. They differ in the width of the rotating band and the marking. The rotating band of the howitzer projectile is narrower than the rotating band of the gun projectile, except for the illuminating projectile which is provided only with a narrow band. The projectiles with narrow bands are designed primarily for use in the howitzers, but may be used in the gun with reduced (normal) propelling charge (par. 157e). The wide band projectiles may be fired only in the gun. The dummy projectile is interchangeable in the howitzers and gun.

b. Identification. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900.

c. Projectile. Dependent upon type of projectile, ammunition for these howitzers is classified as dummy, gas (GB, H, HD), high-explosive (HE), illuminating, smoke (WP), and BE smoke (colored or HC).
d. Fuze. All projectiles for these weapons are issued unfuzed with eyebolt lifting plug assembled. Mechanical time (MT), mechanical time superquick (MTSQ), point detonating (PD), and point detonating concrete-piercing (CP) proximity type (VT), and time superquick (TSQ) fuzes are authorized for use with ammunition for these howitzers. A brief description of the fuze for these howitzers is given in (1) through (4) below. See paragraphs 184 through 225 and SM 9–5–1390 for complete description of these fuzes.

1. Fuze used with HE projectiles. The point detonating concrete-piercing (CP) fuze M78A1 (or M78) (w/ booster M25) an impact-type fuze with 0.05-second delay action, is used against concrete targets. The MTSQ fuze M600A1 (or M500) and MT fuze M67A3 are mechanical time fuzes that permit adjustment of time setting to 75 seconds. The MTSQ fuze M500A1 (or M500) also incorporates an impact element. The PD fuzes M51A5 (or M51A4) and T177E3 are impact-type fuzes with superquick or 0.05-second delay action. The TSQ fuze M55A3 is a time fuze that permits adjustment of time setting. The fuze also incorporates an impact element. The proximity fuze M514 (T227) is a proximity type that incorporates an impact element and has a “delay arming” feature. This proximity fuze can be used only with deep cavity projectile.

2. Fuze used with gas (H, HD) and smoke (WP) projectiles. Only PD fuzes, set SQ, are properly used with HD or WP projectiles. The PD fuzes M51A5 or M51A4 and M535 (T177E3) are impact-type fuzes with superquick or delay action.

3. Fuze used with illuminating and BE smoke projectiles. The MTSQ fuze M501A1 (or M501) and TSQ fuze M54 and M55A3 are time fuzes that permit adjustment of time settings. These fuzes also incorporate impact elements.

4. Fuze used with GB gas projectiles M181 (T77). The PD fuze M508 (T234E1) is an impact-type fuze with superquick action and a delayed arming mechanism in the booster.

e. Propelling Charge. The propelling charge M3 (green bag), M4 (white bag), or M4A1 (white bag) (par. 239) used with the service rounds in the 155-mm weapons is divided into a base section and unequally sized increments to provide for zone firing. The propelling charge M3 which is approximately 16 inches long by 5.0 inches in diameter consists of 5.50 pounds of propellant loaded in a cloth bag. The propelling charge M4 or M4A1 which is approximately 21 inches long by 5.8 inches in diameter consists of 13.65 pounds of propellant loaded in a metal or fiber container. The igniter charge consists of 3 ounces of black powder contained in a red dyed cloth cartridge bag. The dummy bag is sewed to the rear of the base section. The dummy propelling charge Mk 1 or M2, which simulates the service propelling charges, is provided for use with the dummy projectiles. See paragraphs 226 through 243 for detailed information.

f. Flash Reducer. The flash reducer M2 is used with the propelling charge M4 or M4A1. Its use greatly reduces the flash and is intended primarily for use in night firing. See paragraphs 226 through 243 for detailed information.

g. Primer. Only the percussion primer Mk 2A4 is used in the 155-mm howitzer cannon M1 or M1A1. The combination lock electric and percussion primer Mk 15 Mod 1 or the lock electric primer Mk 34 Mod 0 is used in the 155-mm howitzer cannon M45.

Note. The Mk 34 Mod 0 can be used in electric firing only. See paragraphs 244 through 268 for detailed information.

h. Packing and Shipping Data. The projectiles for the 155-mm howitzer cannons M1, M1A1, and M45 are shipped unfused with eyebolt lifting plug threaded in the fuze opening and the rotating band protected by a grommet. Packing and shipping data appear in SM 9–5–1320 and SM 9–5–1390 for primers. Packing and marking for shipment is described in paragraphs 3 through 14.
166. Projectile, 155 Millimeter Dummy: M7

This dummy projectile is intended for training in handling and service of the 155-mm gun or howitzer cannon. The dummy projectile is described in paragraph 158 and figure 44.

167. Projectile, 155 Millimeter Dummy: Mk I

This dummy projectile is intended for training in handling and service of the 155-mm weapons. The principal parts of the dummy projectile are a cast-iron body, a steel base, a bronze front band, and steel rear ring on which is mounted a bronze band. The cast-iron body is ogival in shape and screws onto the steel base at about the center of gravity of the projectile. The bronze front band simulates the bourrelet of a service projectile. The bronze rear band simulates the rotating band (6.1 inches diameter) of a service projectile. The steel ring on which it is mounted slides freely along the cylindrical portion of the steel base.

The projectile, fitted with a 45-second inert fuze M1907M, is 21.14 inches and weighs 95 pounds.

168. Projectile, 155 Millimeter: Gas, Persistent, H or HD, M110

a. General. The persistent gas projectile M110 (fig. 48) is intended for producing a toxic effect on personnel. The projectile filler consists of approximately 11.70 pounds of H gas or 9.7 pounds of HD gas. The burster charge M6 (0.83 pounds of tetrytol) contained in a thin aluminum or steel tube fits in the burster casing M1 which seats in the shell cavity. An adapter in the nose of the projectile is threaded for assembly of a fuze. The filler is contained in the annular space between the outside wall of the burster casing and inner shell body. The filler is released when the burster charge functions rupturing the projectile. The propelling charge M3, M4, or M4A1 are authorized for use with this projectile.
b. Data.

Weight of projectile, as fired (max.) ... 98.49 lb
Length of projectile (w/eyebolt lifting plug) ........................................... 26.78 in.
Width of rotating band ................................................................. 1.02 in.
Type of base ....................................................................................... h-tailed
Degree of taper .................................................................................. 8.0 deg
Radius of ogive .................................................................................. 10.75 cal.
Muzzle velocity:
  M3 charge ....................................................................................... 1,220 fps
  M4 or M4A1 charge .......................................................................... 1,850 fps
Maximum range:
  M3 charge ....................................................................................... 16,780 yd
  M4 or M4A1 charge .......................................................................... 16,355 yd

169. Projectile, 155 Millimeter: HE, M107

This projectile (fig. 49) is similar to that described in paragraph 170, except that it has a normal cavity. The projectile contains a high-explosive bursting charge of 15.34-pounds TNT.

170. Projectile, 155 Millimeter: HE, M107, w/ Suppl Chg or w/o Suppl Chg

a. General. The HE projectile M107 (fig. 50) is intended principally for fragmentation, mining, or blast effect. The projectile comprises a steel walled shell containing a high-explosive charge of 14.61 pounds of TNT and a supplementary charge which has 0.36 pound of TNT. The supplementary bursting charge contained in an aluminum sheet liner, is assembled in the projectile in the deep cavity. The projectile has a single rotating band located approximately 3.5 inches forward of the base. The projectile is fitted with a base cover which assures that hot gases generated by the burning propelling charge do not come in contact with the bursting charge. The projectile is adaptable for use with proximity fuzes or mechanical-type fuzes and boosters due to the deep cavity and the supplementary charge.

Figure 49. Projectile, 155 millimeter: HE, M107.
166. Projectile, 155 Millimeter Dummy: M7

This dummy projectile is intended for training in handling and service of the 155-mm gun or howitzer cannon. The dummy projectile is described in paragraph 158 and figure 44.

167. Projectile, 155 Millimeter Dummy: Mk I

This dummy projectile is intended for training in handling and service of the 155-mm weapons. The principal parts of the dummy projectile are a cast-iron body, a steel base, a bronze front band, and steel rear ring on which is mounted a bronze band. The cast-iron body is ogival in shape and screws onto the steel base at about the center of gravity of the projectile. The bronze front band simulates the bourrelet of a service projectile. The bronze rear band simulates the rotating band (6.1 inches diameter) of a service projectile. The steel ring on which it is mounted slides freely along the cylindrical portion of the steel base.

The projectile, fitted with a 45-second inert fuze M1907M, is 21.14 inches and weighs 95 pounds.

168. Projectile, 155 Millimeter: Gas, Persistent, H or HD, M110

a. General. The persistent gas projectile M110 (fig. 48) is intended for producing a toxic effect on personnel. The projectile filler consists of approximately 11.70 pounds of H gas or 9.7 pounds of HD gas. The burster charge M6 (0.83 pounds of tetrytol) contained in a thin aluminum or steel tube fits in the burster casing M1 which seats in the shell cavity. An adapter in the nose of the projectile is threaded for assembly of a fuze. The filler is contained in the annular space between the outside wall of the burster casing and inner shell body. The filler is released when the burster charge functions rupturing the projectile. The propelling charge M3, M4, or M4A1 are authorized for use with this projectile.
b. Data.

Weight of projectile, as fired (max.) .... 98.49 lb
Length of projectile (w/eyebolt
lifting plug) ........................................ 26.78 in.
Width of rotating band ......................................... 1.02 in.
Type of base .......................................................... 6-90, 6-70, or TA-70
Degree of taper .......................................................... 8.0 deg
Radius of ogive .......................................................... 10.75 cal.
Muzzle velocity:
  M3 charge .......................................................... 1,220 fps
  M4 or M4A1 charge ............................................... 1,350 fps
Maximum range:
  M3 charge .......................................................... 10,780 yd
  M4 or M4A1 charge ............................................... 16,355 yd

169. Projectile, 155 Millimeter: HE, M107

This projectile (fig. 49) is similar to that described in paragraph 170, except that it has a normal cavity. The projectile contains a high-explosive bursting charge of 15.34-pounds TNT.

170. Projectile, 155 Millimeter: HE, M107, w/ Suppl Chg or w/o Suppl Chg

a. General. The HE projectile M107 (fig. 50) is intended principally for fragmentation, mining, or blast effect. The projectile comprises a steel walled shell containing a high-explosive charge of 14.61 pounds of TNT and a supplementary charge which has 0.36 pound of TNT. The supplementary bursting charge contained in an aluminum sheet liner, is assembled in the projectile in the deep cavity. The projectile has a single rotating band located approximately 3.5 inches forward of the base. The projectile is fitted with a base cover which assures that hot gases generated by the burning propelling charge do not come in contact with the bursting charge. The projectile is adaptable for use with proximity fuzes or mechanical-type fuzes and boosters due to the deep cavity and the supplementary charge.
Figure 50. Projectile, 155 millimeter: HE, M107, w/suppl chg.
b. Data.

Weight of projectile, as fired
(w/PD fuse M51A5) .......................... 96.75 lb
Length of projectile, as fired
(w/PD fuse M51A5) .......................... 27.57 in.
Width of rotating band ........................ 3.02 in.
Type of base .................................. boat-tailed
Degree of taper ................................ 8.0 deg
Radius of ogive ................................. 10.75 cal.
Muzzle velocity:
M3 charge ..................................... 1,220 fps
M4 or M4A1 charge .............................. 1,850 fps
Maximum range:
M3 charge ..................................... 10,780 yd
M4 or M4A1 charge .............................. 16,355 yd

171. Projectile, 155 Millimeter: Gas, Nonpersistent, GB, M121 (T77)

The GB gas projectile M121 (T77) (fig. 51) is intended for use against personnel to produce a toxic effect on personnel. This projectile is similar to that described in paragraph 164, except that the width of rotating band is 1.02 inches instead of 2.02 inches. Other data shown in paragraph 164 is applicable.

172. Projectile, 155 Millimeter: Smoke (HC, green, red, violet, or yellow), BE, M116 or M116B1

a. General. The BE smoke projectile M116 (fig. 52) is intended for target and battery identification purposes. The projectile is a base-ejection type, in which the nose, body, and base are manufactured as separate parts and assembled by screwing together. An expelling charge of 0.28-pound black powder positioned against a baffle plate is located in the nose end of the projectile. The remainder of the cavity holds four canisters of smoke mixture weighing 17.19 pounds for the colored smoke projectiles, one behind the other. The four canisters for the HC, white smoke projectile weigh about 25.84 pounds. Dependent upon the type of smoke canisters used, the projectile can produce green, HC (white), red, violet, or yellow smoke. The forward canister is conical to conform with the taper of the cavity. A hole passes through the baffle plate and the longitudinal axis of each canister, thus forming a flash tube. The base of the projectile is closed by a base plug which, in the functioning of the shell, is blown out, as are the four smoke canisters. The flash from the expelling charge passes through the flash tube and ignites the “burning” smoke mixture in each of the canisters prior to ejecting them. Maximum emission of smoke occurs in about 1 minute although an effective smoke develops in 30 seconds. The smoke cloud emitted from each canister is approximately two or three times greater in volume than that from a 105-mm BE smoke canister. A manufacturing alternative is the BE smoke projectile M116B1, in which the body and nose sections are integral. Propelling charges M3, M4, or M4A1 are authorized for use with the BE smoke projectile. The following is a list of smoke projectiles issued for use:

PROJECTILE, 155 MILLIMETER; smoke, green, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, HC, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, red, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, violet, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, yellow, BE, M116.

b. Data.

Weight of projectile, as fired .................. 86.43 lb
Length of projectile (w/eyebolt lifting plug) .................. 26.41 in.
Width of rotating band ........................ 1.02 in.
Type of base .................................. boat-tailed
Degree of taper ................................ 8.0 deg
Radius of ogive ................................ 10.75 cal.
Muzzle velocity:
M4 or M4A1 charge .............................. 1,922 fps
M3 charge ..................................... 1,260 fps
Maximum range:
M3 charge ..................................... 7,800 yd
M4 or M4A1 charge .............................. 9,700 yd
Burning time, maximum ......................... 4 min

173. Projectile, 155 Millimeter: Smoke, WP, M105

The WP projectile M105, although it also has a slight incendiary effect, is intended for producing a screening smoke. This projectile, except for the 15.60 pounds of WP smoke filler and a 0.60-inch (narrower) rotating band, is similar to the smoke projectile described in paragraph 174. This projectile is authorized for use only with propelling charge M3, and then, only for training purposes. Weight of projectile, as fired 98.22 pounds.
Figure 30. Projectile, 155 millimeter: HE, M107, w/suppchg.
b. Data.

Weight of projectile, as fired (w/PD) fuse M51A5 .......................... 96.75 lb
Length of projectile, as fired (w/PD) fuse M51A5 .......................... 27.57 in.
Width of rotating band .......................... 1.05 in.
Type of base .......................... boat-tailed
Degree of taper .......................... 8.0 deg
Radius of ogive .......................... 10.75 cal.

Muzzle velocity:
- M3 charge .......................... 1,220 fps
- M4 or M4A1 charge .......................... 1,850 fps

Maximum range:
- M3 charge .......................... 10,780 yd
- M4 or M4A1 charge .......................... 16,385 yd

171. Projectile, 155 Millimeter: Gas, Nonpersistent, G8, M121 (T77)

The GB gas projectile M121 (T77) (fig. 51) is intended for use against personnel to produce a toxic effect on personnel. This projectile is similar to that described in paragraph 164, except that the width of rotating band is 1.62 inches instead of 2.02 inches. Other data shown in paragraph 164 is applicable.

172. Projectile 155 Millimeter: Smoke (HC green, red, violet, or yellow), BE, M116 or M116B1

a. General. The BE smoke projectile M116 (fig. 52) is intended for target and battery identification purposes. The projectile is a base-ejection type, in which the nose, body, and base are manufactured as separate parts and assembled by screwing together. An expelling charge of 0.28-pound black powder positioned against a baffle plate is located in the nose end of the projectile. The remainder of the cavity holds four canisters of smoke mixture weighing 17.19 pounds for the colored smoke projectiles, one behind the other. The four canisters for the HC, white smoke projectile weigh about 25.84 pounds. Dependent upon the type of smoke canisters used, the projectile can produce green, HC (white), red, violet, or yellow smoke. The forward canister is conical to conform with the taper of the cavity. A hole passes through the baffle plate and the longitudinal axis of each canister, thus forming a flash tube. The base of the projectile is closed by a base plug which, in the functioning of the shell, is blown off, etc., as are the four smoke canisters. The flash from the expelling charge passes through the flash tube and ignites the "burning" smoke mixture in each of the canisters prior to ejecting them. Maximum emission of smoke occurs in about 1 minute although an effective smoke develops in 30 seconds. The smoke cloud emitted from each canister is approximately two or three times greater in volume than that from a 105-mm BE smoke canister. A manufacturing alternative is the BE smoke projectile M116B1, in which the body and nose sections are integral. Propelling charges M3, M4, or M4A1 are authorized for use with the BE smoke projectile. The following is a list of smoke projectiles issued for use:

PROJECTILE, 155 MILLIMETER; smoke, green, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, HC, BE, M116.
PROJECTILE, 155 MILLIMETER; smoke, red, BE, M116.
PROJECTILE, 155 MILLIMETER: smoke, violet, BE, M116.
PROJECTILE 155 MILLIMETER: smoke, yellow, BE, M116.

b. Data.

Weight of projectile, as fired .......... 86.43 lb
Length of projectile (w/eyebolt lifting plug) .......................... 26.41 in.
Width of rotating band .......................... 1.02 in.
Type of base .......................... boat-tailed
Degree of taper .......................... 8.0 deg
Radius of ogive .......................... 10.75 cal.

Muzzle velocity:
- M4 or M4A1 charge .......................... 1,600 fps
- M3 charge .......................... 1,280 fps

Maximum range:
- M3 charge .......................... 7,800 yd
- M4 or M4A1 charge .......................... 9,700 yd

Burning time, maximum .................... 4 min

173. Projectile, 155 Millimeter: Smoke, WP, M105

The WP projectile M105, although it also has a slight incendiary effect, is intended for producing a screening smoke. This projectile, except for the 15.60 pounds of WP smoke filler and a 0.60-inch (narrower) rotating band, is similar to the smoke projectile described in paragraph 171. This projectile is authorized for use only with propelling charge M3, and then, only for training purposes. Weight of projectile, as fired 98.22 pounds.
Figure 51. Projectile, 155 millimeter: gas, nonpersistent, GB, M121 (T77).

Figure 52. Projectile, 155 millimeter: smoke, HC, BE, M116.
174. Projectile, Smoke, WP, M110

The WP smoke projectile M110 (fig. 53) has a slight incendiary effect, but is intended for producing a screening smoke. This projectile has 15.6 pounds of WP smoke filler. Weight of projectile, as fired 97.50 pounds.

The gas and smoke projectiles M110 use the fuze PD, M51A4 and M51A5 and primer Mk 2A4. This smoke projectile has the same ballistic shape and properties and external dimensions as the HE projectile M107 described in paragraph 170.

175. General

a. General Discussion. There are two models of 8-inch howitzer cannons, the M2 and M47. Both models use the same ammunition, except for the primer, which is the percussion type for the M2, the combination electric and percussion lock type or the electric lock type for the M47. The ammunition authorized for 8-inch cannon is of the separate-loading type. The loading of each complete round requires three separate operations: loading the projectile, the propelling charge, and the primer.

b. Identification. The ammunition and components are identified by means of the painting and marking in accordance with the basic color scheme prescribed in TM 9–1900. The pallets are marked in accordance with Ordnance Department drawings and specifications.

c. Projectile. One model of high-explosive projectile and two models of dummy projectile are authorized for use in the 8-inch cannons. Three types of high-explosive projectiles are provided: the normal-cavity type; the deep-cavity type with supplementary charge; and the deep-cavity type without supplementary charge, for use with a proximity fuze.

d. Fuzes. The MTSQ fuze M500A1 (or M500), PD fuzes M51A5 (or M51A4) and M535 (T177E3), mechanical time fuze M67A3, point detonating concrete-piercing (CP) fuze M78A1 (or M78), and proximity fuze VT 514 are authorized for use with HE projectile for the 8-inch howitzers. See paragraphs 184 through 225 for detailed information.
GAS CHARGE

BURSTER CASING
BURSTER

GRAY (MARKING IN GREEN)
26.71 MAX

LOT NUMBER AND LOADER'S INITIALS
MODEL OF PROJECTILE
YELLOW BAND
DOD IDENTIFICATION CODE

CALIBER AND TYPE OF CANNON
KIND OF FILLER

GRAY (MARKING IN YELLOW)
26.81 MAX

Figure 51. Projectile, 155 millimeter: gas, nonpersistent, GB, M161 (T71).

Figure 52. Projectile, 155 millimeter: smoke, HC, BE, M116.
174. Projectile, Smoke, WP, M110

The WP smoke projectile M110 (fig. 53) has a slight incendiary effect, but is intended for producing a screening smoke. This projectile has 15.6 pounds of WP smoke filler. Weight of projectile, as fired 97.50 pounds.

The MHO and smoke projectiles M110 use the fuze PD, M51A4 and M51A5 and primer Mk 2A4. This smoke projectile has the same ballistic shape and properties and external dimensions as the HE projectile M107 described in paragraph 170.

175. General

a. General Discussion. There are two models of 8-inch howitzer cannons, the M2 and M47. Both models use the same ammunition, except for the primer, which is the percussion type for the M2, the combination electric and percussion lock type or the electric lock type for the M47. The ammunition authorized for 8-inch cannon is of the separate-loading type. The loading of each complete round requires three separate operations: loading the projectile, the propelling charge, and the primer.

b. Identification. The ammunition and components are identified by means of the painting and marking in accordance with the basic color scheme prescribed in TM 9–1900. The pallets are marked in accordance with Ordnance Department drawings and specifications.

c. Projectile. One model of high-explosive projectile and two models of dummy projectile are authorized for use in the 8-inch cannons. Three types of high-explosive projectiles are provided: the normal-cavity type; the deep-cavity type with supplementary charge; and the deep-cavity type without supplementary charge, for use with a proximity fuze.

d. Fuzes. The MTSQ fuze M500A1 (or M500), PD fuzes M51A5 (or M51A4) and M535 (T177E3), mechanical time fuze M67A3, point detonating concrete-piercing (CP) fuze M78A1 (or M78), and proximity fuze VT 511 are authorized for use with HE projectile for the 8-inch howitzers. See paragraphs 184 through 225 for detailed information.
e. Propelling Charges. Two types of service charges are provided, the green bag M1 and white bag M2 (par. 240). A flash reducer M3 (T3) is provided for optional use with the M2 charge. The dummy charge M4 is provided for use with both models of dummy projectile. See paragraphs 226 through 243.

f. Primers. The percussion primer Mk 2A4 is used in the 8-inch howitzer cannon M2. The Mk Mod 1 electric and percussion combination lock primer or the Mk 34 Mod 0 electric lock primer are used in the 8-inch howitzer cannon M47. See paragraphs 244 through 268 for detailed information.

g. Packing and Shipping Data. The projectiles are shipped three to a pallet unfuzed with eyebolt lifting plug fitted to the projectile in the fuze opening. The rotating band is covered with a grommet (par. 287) for protection. The dummy projectile is packed one per wooden crate. The propelling charges M1 and M2 are packed one per fiber container, three containers per bundle for domestic shipment or one bundle per wooden crate for overseas shipment. Also one charge per metal container or one charge per fiber container, two containers per wooden box. Also one charge per waterproof bag, one bag per fiber container, two containers per wooden box. The propelling charge M2 may also be packed two charges per metal container. Packing and shipping data appear in SM 9-5-1320.

176. Projectile, 8-Inch Dummy: M14

This projectile (fig. 54) simulates the HE projectile M106 described in paragraph 178. It is of the conventional type having a fully enclosed spring-operated plunger, which loosens the projectile in the forcing cone of the weapon on rebound resulting from ramming. It has an ogival bronze cap, a steel body, and a steel base, each screwing into the next neighboring part when assembled. Some projectiles have steel caps. The rotating band and bourrelet of the service projectile are simulated by bronze bands. The several parts are replaceable. Projectile is 34.40 inches long and weighs 200 pounds.

177. Projectile, 8-Inch Dummy: Mk I

This projectile is provided for training in handling and the service of the 8-inch cannon. Its principal parts are a bronze cap, a steel body, bronze front band, steel base, and a steel rear ring with bronze rear band. The bronze cap is ogival in shape and is attached to the forward end of the body. The bronze front band simulates the bourrelet of a service projectile. The steel rear ring is mounted on the cylindrical portion of the base and can slide freely upon it. The bronze rear band mounted on the rear ring simulates the rotating band of the service projectile. The several parts are replaceable. The projectile is 29 inches long and weighs 188.6 pounds.
178. Projectile, 8-Inch: HE, M106

a. General. This projectile (fig. 55) has a normal cavity in which an aluminum fuze well cup is assembled. The rotating band, made of copper or gilding metal, is located 6.06 inches from the base end and has two cannelures or grooves. The projectile is adapted to receive the following fuzes: point-detonating concrete-piercing (CP) M78A1 (or M78), MTSC M500A1 (or M500), M51A5 PD (or M51A4) PD M535 (T177E3), or mechanical time M67A3. The projectile is fitted with a base cover which assures that hot gases generated by the burning propelling charge do not come in contact with the bursting charge. The bursting charge consists of 36.75 pounds of TNT.

Figure 55. Projectile, 8-inch: HE, M106.

b. Data.

Weight of projectile, as fired (max.) ........... 200 lb
Length of projectile ......................... 34.35 in.
Width of rotating band ....................... 2.02 in.
Type of base ........................................... boat-tailed
Degree of taper ....................................... 9.0 deg
Radius of ogive ..................................... 8.0 cal.
Muzzle velocity (charge 7) .................... 1,950 fps
Maximum range (charge 7) .................... 18,510 yd

1 With eyebolt-lifting plug.

179. Projectile, 8-Inch: HE, M106, w/Suppl Chg

This projectile (fig. 56) is similar to the HE projectile M106 described in paragraph 178, except that it has a deep-fuze cavity so that proximity fuzes can be used. The projectile, as issued with a supplementary charge, is adapted for use with mechanical time, mechanical time superquick, impact, or concrete-piercing fuzes.

180. Projectile, 8-Inch: HE, M106, Adapted for Proximity Fuze

This projectile is similar to the HE projectile M106 described in paragraph 178, except that it has a deep-fuze cavity for proximity fuzes. The projectile, as issued, requires the addition of a supplementary charge for use with mechanical time, mechanical time superquick, impact, or concrete-piercing fuzes.
Figure 56. Projectile, 8-inch: HE, M106, w/suppl chg.
Section XVII. PROJECTILES FOR 280-MM GUN CANNON M66 (T131)

181. General

a. Discussion. Ammunition for the 280-mm gun cannon M66 (T131) is of the separate-loading type. The complete round is loaded into the weapon in three operations: loading the projectile, the propelling charge, and the primer. The components of a complete round (projectile, propelling charge, primer, and fuze) are shipped separately. As issued, the projectile is fitted with an eyebolt-lifting plug. The fuze is assembled to the projectile just prior to loading and firing. The conventional high-explosive projectile is used for fragmentation or mining effect.

b. Identification. The ammunition and ammunition components are identified by the painting and markings in accordance with the color scheme prescribed in TM 9-1900.

c. Projectile. The projectiles for the M66 (T131) gun cannon are of the conventional high-explosive type, and certain special types.

d. Fuzes. The high-explosive projectile is used with the MTSQ fuze M520 with booster M125, PD fuze M535 (T177E3), with booster T35E7 and proximity fuze VT M514 or VT M514B1. The following fuzes may also be used: PD, M51A4 or M51A5 with booster M21A4. CP, M78 or M78A1 with booster M25. See paragraphs 184 through 225 for a detailed description of these fuzes.

e. Propelling Charges. Dualgran propelling charge M43 (T44) is used with the HE projectile. See paragraphs 226 through 243 for additional information on these propelling charges.

f. Primers. The combination electric and percussion primer Mk 15 Mod 1 is utilized in firing the high-explosive projectiles. Another primer is under test. See paragraphs 244 through 268 for detailed description of this primer.

g. Packing and Shipping Data. The projectiles are shipped uncrated.

182. Projectile, 280 Millimeter: HE, M124 (T122E4) w/Suppl Chg

a. General. This projectile (fig. 57) has a deep-fuze cavity with supplementary charge which makes the projectile adaptable for use with either the proximity fuze or conventional fuzes with boosters. It is shipped unfuzed with eyebolt-lifting plug. The supplementary charge, which remains in the fuze cavity when a conventional fuze is used, is removed from this cavity when a proximity fuze is inserted in the projectile. The M124 (T122E4) projectile has a two-piece body which consists of a forged steel main body portion and a nose adapter which completes the forward end of the ogive. The total length of the ogive is approximately 26 inches, of which approximately 6 inches is at the forward end in the adapter. The adapter is threaded externally at the larger end and screws into a female thread on the main body portion. It is threaded internally at the smaller end to receive the fuze. The loaded projectile contains approximately 101.7 pounds of cast TNT. The projectile is provided with a caulked base cover.

b. Data.

Weight of projectile, as fired ................................ 600 lb
(approx.)

Length of projectile ........................................ 5,243 in. max.

Width of rotating band ........................................ 660 in.

Divided into two sections each ............................ 330 in.

Type of base ................................................................ square

Radius of ogive ......................................................... 10 cal.

Muzzle velocity (maximum charge) .................... 2,500 fps

Maximum range (maximum charge) ............... 31,400 yd

1 With eyebolt-lifting plug.

183. Projectile, 280 Millimeter: HE, M124A1 (T122E3), w/Suppl Chg

The M124A1 (T122E3) projectile differs from the M124 (T122E4) projectile (par. 182) in that the main projectile body is cast steel instead of forged steel.
Figure 57. Projectile, 280 millimeter: HE, M 121 (T122El) w/suppl chg (T122 shown).
CHAPTER 3
FUZES, PROPELLING CHARGES, PRIMERS, AND OTHER COMPONENTS

Section I. FUZES

184. General

a. Definition. An artillery fuze is a mechanical device used with a projectile to cause it to function at the time and under the circumstances desired.

b. Classification. Artillery fuzes are classified according to their position on the projectile as base detonating (BD), point-initiating base-detonating (PI BD), point detonating (PD), and point detonating (PD) concrete-piercing (formerly concrete-piercing). Base detonating fuzes are used with some types of armor-piercing projectiles and a few types of high-explosive projectiles. PI BD fuzes are generally used with high explosive-antitank (HEAT) projectiles. Artillery fuzes are also classified according to their method of functioning as impact, time, or proximity, or a combination of these. Impact fuzes are classified, according to type of action, as super-quick, delay, or nondelay. For additional information on artillery fuzes, see TM 9-1900.

c. Description. In general, fuzes contain at least one series of small explosive charges, called an explosive train. The fuze provides a means for initiating the action of the first charge of the explosive train. This action may be by a striker or firing pin or by an electrical impulse. For convenience and safety, the explosive train is composed of distinct units containing one or more preliminary and/or secondary high explosives. Such components are called—primers, relays, detonators, leads, and boosters and are used in approximately that order. (Use of all these components is not necessary for each explosive train.) If delay action is desired, a delay composition such as black powder or some pyrotechnic composition is used between the primer charge and the detonator. When a fuze functions, the first explosive train component, which may be either a primer or a detonator, is activated. In either case a very sensitive primer composition is ignited. The output from this charge in almost all cases initiates a charge of lead azide. The characteristics of lead azide are such that it very rapidly proceeds from burning to detonation. This charge separates the zones of burning and detonation. From this charge to the main bursting charge, the intermediate explosive components are used principally for transmission and amplification of the detonation wave.

d. Boresafety.

(1) Artillery fuzes contain safety devices that tend to prevent functioning until after the fuze has been subjected to centrifugal and setback forces, which take place after the round is fired.

(2) Certain fuzes are said to be “bore-safe.” A boresafe (detonator-safe) fuze is one in which the path of the explosive train is interrupted so that, while the projectile is still in the bore of the gun, premature explosion of the shell is prevented if any of the more sensitive elements, primer, detonator, or both, should function. Interruption is most generally obtained by out-of-line components or interrupter blocks or slides.

(3) Certain internal parts of an impact fuze are in “unarmed” position prior to firing. Upon firing and while the projectile is being rotated and accelerated, centrifugal and setback forces act upon those parts. As the projectile leaves the muzzle of the weapon, acceleration ceases and hence setback ceases. The combination of centrifugal force and setback in the bore of the weapon together with cessation of setback after the projectile has left the bore of the weapon arms the fuze.
Figure 57. Projectile, 280 mm, with supplementary charge (T1).
CHAPTER 3
FUZES, PROPPELLING CHARGES, PRIMERS, AND OTHER COMPONENTS

Section I. FUZES

184. General

a. Definition. An artillery fuze is a mechanical device used with a projectile to cause it to function at the time and under the circumstances desired.

b. Classification. Artillery fuzes are classified according to their position on the projectile as base detonating (BD), point-initiating base-detonating (PI BD), point detonating (PD), and point detonating (PD) concrete-piercing (formerly concrete-piercing). Base detonating fuzes are used with some types of concrete-piercing projectiles and a few types of high-explosive penetrators. PI BDs and PDs are classified, according to their method of functioning as impact, time, or proximity, or a combination of these. Impact fuzes are classified, according to type of action, as superfuse, quick, delay, or nondelay. For additional information on artillery fuzes, see TM 9-1900.

c. Description. In general, fuzes contain at least one series of small explosive charges, called an explosive train. The fuze provides a means for initiating the action of the first charge of the explosive train. This action may be by a striker or firing pin by an electrical impulse. For convenience and safety, the explosive train is composed of distinct units containing one or more preliminary and or secondary high explosives. Such components are called—primers, relays, detonators, leads, and boosters and are used in approximately that order. (Use of all these components is not necessary for each explosive train.) If delay action is desired, a delay composition such as black powder or some pyrotechnic composition is used between the primer and the detonator. When a fuze functions as the explosive train component, which may be either a primer or a detonator, is activated. In either case a very sensitive primer composition is ignited. The output from this charge in almost all cases initiates a charge of lead azide. The characteristics of lead azide are such that it very rapidly proceeds from burning to detonation. This charge separates the zones of burning and detonation. From this charge to the main bursting charge, the intermediate explosive components are used principally for transmission and amplification of the detonation wave.

d. Boresafety.

1. Artillery fuzes contain safety devices that prevent premature detonation of the charge and the bore, if firing is interrupted.

2. Certain fuzes are said to be “boresafe.” A boresafe (detonator-safe) fuze is one in which the path of the explosive train is interrupted so that, while the projectile is still in the bore of the gun, premature explosion of the shell is prevented if any of the more sensitive elements, primer, detonator, or both, should function. Interruption is most generally obtained by out-of-line components or interrupter blocks or slides.

3. Certain internal parts of an impact fuze are in “unarmed” position prior to firing. Upon firing and while the projectile is being rotated and accelerated, centrifugal and setback forces act upon those parts. As the projectile leaves the muzzle of the weapon, acceleration ceases and hence setback ceases. The combination of centrifugal forces and setback in the bore of the weapon together set the component of setback after the projectile has left the bore of the weapon arms the fuze.
The time train of time fuzes is initiated at the instant of firing by setback. To prevent accidental arming in handling and shipping, safety devices such as safety wire or cotter pin are used on some fuzes; on others, delayed arming occurs so that they do not arm until some distance away from the weapon. Wire and cotter pins must be manually removed before firing.

(4) Arming of VT fuzes is delayed by a series of internal safety devices. The fuze becomes automatically armed a specified length of time after the projectile is fired.

e. Methods of Arming.

(1) A fuze is armed when it is ready to detonate the projectile, that is, when all parts are in position, or free to move to a position, that will allow the fuze to operate in its intended manner. The principal forces used in arming fuzes are inertia and centrifugal force. In some fuzes both of these forces are used to activate safety devices; in other fuzes, only one of these forces is used.

(2) Inertia may be exhibited in several ways, each of which may be used to advantage, or each of which must be guarded against. Setback occurs when the projectile accelerates on being fired. It may be used to unlock safety devices. Setforward occurs at impact or sudden deceleration. This effect may be used to drive firing pins into primers or to drive primers against stationary firing pins.

(3) Centrifugal force due to the spinning of projectiles may be utilized to actuate gear trains and to move safety devices into their operating positions in fuzes and boosters. Such fuzes and boosters are designed to operate in the rotational velocity range of the projectile-weapon combination in which they are used. Rotational speed is dependent upon the twist of the rifling and the muzzle velocity. Fuzes for projectiles fired in these weapons, then, would have different arming characteristics based on rate of rotation. Fuzes utilizing centrifugal force also must be fashioned so that they will not become disarmed as the rotational velocity decreases during flight.

f. Detonators.

(1) General. A detonator (fig. 58) is used in the explosive train to create a detonation wave and then transmit it to the next component and the explosive train. Detonators may be divided into three types, depending on how they are initiated. They are known as flash, stab, or electric detonators. Each of these types has a secondary explosive base charge (PETN, tetryl, or RDX) and a primary explosive intermediate charge (lead azide), most flash detonators contain only these two charges consolidated into a metal container (aluminum, gilding metal, or stainless steel). Flash detonators are usually initiated by the output from a separate primer, delay column, or relay acting on the lead azide in the detonator. Stab detonators normally consist of the aforementioned base and intermediate charges plus a third charge, known as the upper charge, all consolidated in the metal cup. The upper charge is a mixture of fuels and oxidizers with various sensitizing materials. These detonators are activated by the action of a stab-type firing pin on the stab sensitive upper charge. The electric detonator has in addition to the consolidated base and intermediate charges, a spot charge, usually of milled lead styphnate or colloidal lead azide plus a nitrocellulose binder which adheres the spot charge to the bridge of the electric detonator. This bridge is either a very small diameter wire or a carbon film, connected to exterior terminals on the detonator. Application of a potential across these terminals will cause an electric current to flow through the bridge where electrical energy is converted into suf-
sufficient heat energy to ignite the spot charge. The output from the spot charge in turn activates the intermediate lead azide.

(2) **Identification.** Detonators are colored to mark the insensitive end. Yellow is used on detonators which do not contain primer mixture or igniting mixture; green on detonators containing primer mixture; and black on detonators having a heavy disk (0.02 inch instead of 0.002 inch) on the primer mixture end. Detonators usually are not colored externally at the sensitive end. However, due to the method of sealing the disk in place and the red color specified for the sealing lacquer, a color (red) identification is provided for the sensitive end. Coating of the end of the detonator and the entire detonator disk with the red sealing lacquer is optional, depending on the detonator manufacturer. The color scheme described above applies to the latest detonator construction; differences may be found on detonators of older manufacture.

g. **Torque Testing and Torque Readjustment of MT Fuzes, M43 Series, M61 Series, and M67 Series and MTSQ Fuzes M500, M500A1, M501, M501A1, and M502 (See ORDM 3–4).**

(1) **Torque testing and effects of improper torque.**

(a) **General.** At the time of manufacture, these fuzes are subject to torque tests and are so adjusted that the torque required to set the fuze (turn the lower cap) falls within the narrow range of the “readjustment limit of torque” as shown in table II. After short periods of storage, it has been noted that in a large percentage of fuzes, there is a change in the torque required to set the fuzes. Often, the torque required to set the fuze falls above or below the relatively wider range of the “acceptable range of torque” as shown in table II.

(b) **Excessive torque.** If the torque required to set the fuze is greater than the specified upper limit of “acceptable range of torque” shown in the table, difficulties may result at the time of use. These difficulties are as follows:

1. When an automatic fuze setter is used, the settings may be inaccurate due to the slipping or scraping of the knives on the soft metal of the lower cap or the setter may stall.

2. When a hand-type fuze setter or hand-wrench-type fuze setter is used, personnel may find it difficult to turn the fuze setter handle.

(c) **Insufficient torque.** If the setting torque is below the specified lower limit of the “acceptable range of torque” shown in the table, inaccuracies may result from movement of the lower cap after the fuze has been set.

(2) **Torque requirements.** The torque requirements for testing and for readjusting the fuzes listed are tabulated in table II. The “acceptable range of torque” column gives the range of acceptable torque readings for each model of fuze when torque is being tested. The “readjustment limits of torque” column gives the upper and lower limits of torque readings that are required when torque is being readjusted.

<table>
<thead>
<tr>
<th>Model of fuze</th>
<th>Acceptable range of torque (lb-in.)</th>
<th>Readjustment limits of torque (lb-in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M67 series, M500, M500A1, M501, and M501A1.</td>
<td>50 to 140</td>
<td>90 min 100 max.</td>
</tr>
<tr>
<td>M43 series and M502</td>
<td>50 to 200</td>
<td>90 min 160 max.</td>
</tr>
<tr>
<td>M61 series</td>
<td>50 to 150</td>
<td>98 min 162 max.</td>
</tr>
</tbody>
</table>
(3) Application of torque testing and torque readjustment procedures by types and lots. Outer containers of MT and MTSQ fuzes listed or of complete rounds assembled with these fuzes may be marked to indicate that torque testing and torque readjustment have already been accomplished (at manufacture or depot) prior to shipment to ammunition supply points. The testing and readjustment of fuzes in containers so marked, ordinarily will not be required at ammunition supply points. Fuzes of lots lower in the series than those shown in table III will require torque testing and readjustment unless outer containers are marked as above.

Table III. Lots Requiring Testing and Readjustment

<table>
<thead>
<tr>
<th>Model of fuse</th>
<th>Lot No. of fuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT, M61 and M61A1</td>
<td>A11</td>
</tr>
<tr>
<td>MT, M61A2</td>
<td>BPX-1-120</td>
</tr>
<tr>
<td>MTSQ, M500</td>
<td>GXW-1-11, ING-1-36, KS-1-223</td>
</tr>
<tr>
<td>MTSQ, M500A1</td>
<td>FA-7-5, GWX-2-1, HAM-2-21, UST-5-21, WGT-C-1-12, ING-2 series, and subsequent lots.</td>
</tr>
<tr>
<td>MTSQ, M501A1</td>
<td>EK-2-45</td>
</tr>
<tr>
<td>MTSQ, M502</td>
<td>BPX-1-1, UST-1-354, UST-2-100, UST-4-54, FA-7-5.</td>
</tr>
<tr>
<td>MTSQ, M502A1</td>
<td>None require testing.</td>
</tr>
</tbody>
</table>

(4) Procedure for readjusting torque greater than the upper limit of the acceptable range (table II) at ammunition supply points.

(a) Partially disengage the safety wire by slipping its coils over the head of the fuze. Do not completely remove the wire but lower it so that it will not interfere with procedure.

(b) Using a suitable screwdriver, equally turn the locking wire screws in the lower part of the lower cap counterclockwise in stages of one-eighth turns until the torque reading is approximately 50 pound-inches. Reduction below this is undesirable since it may permit disengagement of the inner mechanism.

(c) Increase the torque by turning locking wire screws clockwise in stages of one-eighth turns. It is essential that each locking wire screw applies equal pressure against the locking wire. Gradually increase the torque reading until it falls within the torque limits for the particular fuze (refer to table II “readjustment limits of torque”). Normally, readjustment of the torque and reset to the safe position may be accomplished during the course of one complete counterclockwise revolution of the lower cap. If this is impossible, readjustment and reset to safe position should be made within the second revolution. However, isolated cases may occur where the torque readings cannot be brought within the “readjustment limits of torque” in the course of two revolutions. In this case, the fuze is acceptable if the torque falls within the “acceptable range of torque.”

(d) Replace coils of safety wire over head of fuze.

(e) If the readjusted fuzes are not to be fired within a short time, apply an approved waterproofing compound to the locking wire screws. This will prevent moisture entering the timing mechanism. Do not allow compound to enter opening between lower cap and the body.

(f) Packing containers should be marked to show that these fuzes have been torque tested and readjusted. The markings should show the initials of the organization and the date of performance.

(g) Report for disposition any fuze that cannot be readjusted by above procedure.
(5) Procedure for readjusting torque less than the lower limit of the acceptable range (Table II). Normally, only a few fuzes would fall in this group. However, if they are found, they should be readjusted as outlined in (4) (c) through (g) above.

(6) Precautions.

(a) Avoid striking the impact element of MTSQ fuzes and primers of fixed and semifixed cartridge during torque testing and readjusting operations.

(b) Use an appropriate type torque wrench for all testing and readjusting.

(c) Always turn the torque wrench counterclockwise (direction of increasing time on fuze scale) while looking down on the nose of the fuze. The lower cap must never be turned clockwise (backed up) because faulty readings will be obtained.

(d) When lowering torque during readjustment, do not reduce the torque below the 50 pound-inches minimum since this may permit disengagement of the inner mechanism.

(e) If an opening in excess of 0.014 inch exists between the lower cap and the body, the fuze should be carefully removed and destroyed, since there is a possibility that the setting pin has become disengaged from the timing mechanism.

(f) If ticking sounds come from the fuze during readjustment, stop the operation and carefully remove it and destroy it. This ticking is an indication that partial gear train activation is occurring. If such a fuze is fired when set safe ("S"), premature functioning may occur.

(g) If the safety line ("S") is passed during readjustment, continue turning the torque wrench counterclockwise until the set line on the lower cap is in line with the safety line ("S") on the body.

(h) Do not allow waterproofing compound to enter the opening between the lower cap and the body when applying it to locking wire screws. If it enters the opening and then sets, it may become impossible to move the lower cap in order to set the fuze.

(7) Fuze setting at the gun position. Normally, the fuzes being used at gun position have already been torque tested and readjusted and require only that the fuze be set to the desired time of flight. However, if difficulty in setting is encountered due to excessive torque or if setting torque is insufficient, the fuze (or fuze-round) should be returned to ordnance ammunition personnel for readjustment.

(8) Procedure for assembling separately issued fuze to projectile. See paragraph 11r.

Table IV. Detonators.

<table>
<thead>
<tr>
<th>Model</th>
<th>Used in</th>
<th>Dimensions</th>
<th>Color identification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length (in.)</td>
<td>Dia. (in.)</td>
</tr>
<tr>
<td>M17</td>
<td>Fuze, BD, M66A1, M66A2, M68, M68A1; Booster, M21A4, M25, M125 (T23); Fuse, MTSQ M506.</td>
<td>0.342</td>
<td>0.241</td>
</tr>
<tr>
<td>M18</td>
<td>Fuze, PD, M507, M508, T177E3; Fuze, BD, M58 Practice.</td>
<td>0.342</td>
<td>0.241</td>
</tr>
<tr>
<td>M19A2</td>
<td>Booster, T35E8</td>
<td>0.370</td>
<td>0.241</td>
</tr>
<tr>
<td>M22</td>
<td>Fuze, BD, M62A1, M91, M91A1; Fuze, MTSQ, M500, M501, M500A1.</td>
<td>0.395</td>
<td>0.192</td>
</tr>
</tbody>
</table>
### Table IV. Detonators—Continued.

<table>
<thead>
<tr>
<th>Model</th>
<th>Used in</th>
<th>Dimensions</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length (in.)</td>
<td>Dia (m.)</td>
</tr>
<tr>
<td>M23</td>
<td>Fuze, PD, M56; Fuze, MTSQ, M502, M502A1, M506, M518.</td>
<td>0.395</td>
<td>0.192</td>
</tr>
<tr>
<td>M24</td>
<td>Fuze, PD, M48A3, M48A2, M51A5, M51A4, M51A5-Mod 3, M51A4-Mod 3, M37; Fuze, TSQ, M54, M55A3.</td>
<td>0.370</td>
<td>0.241</td>
</tr>
<tr>
<td>M29</td>
<td>Fuze, PD, M74</td>
<td>0.390</td>
<td>0.145</td>
</tr>
<tr>
<td>M30</td>
<td>Booster, M24</td>
<td>0.390</td>
<td>0.145</td>
</tr>
<tr>
<td>M48 Elec</td>
<td>Fuze, PIBD, M509</td>
<td>0.353</td>
<td>0.266</td>
</tr>
</tbody>
</table>

Significance of colors:
- Yellow — Detonator does not contain primer mixture or igniting mixture.
- Green — Detonator contains primer mixture (stab-type detonator).
- Black — Detonator contains heavy disk on primer mixture end (0.02 inch instead of 0.002 inch).
- Red — Used for sealing purposes only (when present indicates sensitive end of detonator).

185. Fuze, Base Detonating: M58 Practice

a. Description and Functioning. The practice BD fuze M5T is the service fuze M58 with the booster assembly omitted. A closing cap with a center hole and an aluminum washer replace the booster assembly. A booster is unnecessary with the cartridge, since the flame from the detonator is sufficient to ignite the black powder filler in the projectile. Except for this difference it functions like the service model. This fuze is used with target practice cartridge M63 Mod 1 for 37-mm subcaliber guns.

b. Data. Overall length, 3.46 inches; weight, 1.27 pounds; thread size, 1.5–12NS–1 LH.

186. Fuze, Base Detonating: M62A1 and M62

a. Description. The fuze M62A1 is a non-delay base-detonating fuze formerly provided for use with 75-mm pack howitzer cannon M1A1 and 105-mm howitzer cannons M2A1, M2A2, M4, and M4A1, HEAT projectiles. It is superseded in use in some rounds by the BD fuze M91 (par. 189) which is essentially the same as the fuze M62A1 except for a tracer in its conical base end. The fuze M62A1 differs from the earlier fuze M62 in the firing pin plunger assembly. In the fuze M62, the steel plunger housing is omitted and two small springs held in light brass housings are used to restrain the plunger and firing pin assembly during the flight prior to impact. In the fuze M62A1, one large spring is used as in the fuze M91. See figure 60 and paragraph 189.

b. Data. Overall length, 3.46 inches; weight, 1.27 pounds; thread size, 1.5–12NS–1 LH.

187. Fuze, Base Detonating: M66A1 and M66A2

a. General. The fuze M66A2 (fig. 59) is a delay-action base-detonating fuze which is used with the APC–T projectile M62A1 in the 76-mm guns. The fuze M66A1 model is used with this round and also with the APC–T projectiles M61 and M61A1 in the 75-mm guns. Both fuzes are of the simple inertia type, without boresafety provision. Firing pin is held at rest by a soft steel washer prior to impact at the target. Upon impact, the weight of the firing pin forces it past the washer.

b. Data.

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Length</th>
<th>Weight</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>M66A1</td>
<td>3.458</td>
<td>1 lb</td>
<td>1.65–1ONS–16H</td>
</tr>
<tr>
<td>M66A2</td>
<td>3.327</td>
<td>1.04 lb</td>
<td>1.65–1ONS–16H</td>
</tr>
</tbody>
</table>
Figure 58. Typical detonators.
Significance of colors:

Yellow — Detonator does not contain primer mixture or igniting mixture.

Green — Detonator contains primer mixture (stab-type detonator).

Black — Detonator contains heavy disk on primer mixture (non-igniting mixture 0.002 inch).

Red — Used for sealing purposes only (when present indicates sensitive end of detonator).

185. Fuze, Base Detonating: M58 Practice

a. Description and Functioning. The practice BD fuze M5T is the service fuze M58 with the booster assembly omitted. A closing cap with a center hole and an aluminum washer replace the booster assembly. A booster is unnecessary with the cartridge, since the flame from the detonator is sufficient to ignite the black powder filler in the projectile. Except for this difference it functions like the service model. This fuze is used with target practice cartridge M63 Mod 1 for 37-mm subcaliber guns.

b. Data. Overall length, 1.61 inches; weight, 0.29 pound; thread size, 1.02-18NS-3LH.

186. Fuze, Base Detonating: M62A1 and M62

Description. The fuze M62A1 is a non-igniting base-detonating fuze formerly provided for use with 75-mm pack howitzer cannon M1A1 and 105-mm howitzer cannons M2A1, M2A2, M4, and M4A1, HEAT projectiles. It is superseded in use in some rounds by the BD fuze M91 (par. 189) which is essentially the same as the fuze M62A1 except for a tracer in its conical base end. The fuze M62A1 differs from the earlier fuze M62 in the firing pin plunger assembly. In the fuze M62, the steel plunger housing is omitted and two small springs are used to restrain the plunger and firing pin assembly during the flight prior to impact. In the fuze M62A1, one large spring is used as in the fuze M91. See figure 60 and paragraph 189.

b. Data. Overall length, 3.46 inches; weight, 1.27 pounds; thread size, 1.5-12NS-1 LH.

187. Fuze, Base Detonating: M66A1 and M66A2

a. General. The fuze M66A2 (fig. 59) is a delay-action base-detonating fuze which is used with the APC-T projectile M62A1 in the 76-mm guns. The fuze M66A1 model is used with this round and also with the APC-T projectiles M61 and M61A1 in the 75-mm guns. Both fuzes are of the simple inertia type, without boresafety provision. Firing pin is held at rest by a soft steel washer prior to impact at the target. Upon impact, the weight of the firing pin forces it past the washer.

b. Data.
Figure 58. Typical detonators.
c. Description.

(1) Both models of this fuze are essentially the same in their method of functioning. Some differences exist in the structure of their parts. Also, the fuze M66A2 is slightly longer and heavier than the fuze M66A1.

(2) The fuzes are made up of three main parts: a body assembly, a booster holder assembly, and a primer holder assembly. The body assembly contains the firing pin and, in a cavity of the boat-tailed rear portion, a red tracer composition which operates independently of the fuze mechanism. The booster holder assembly holds a tetral booster pellet and a detonator. The primer holder assembly contains primer No. 26 in the fuze M66A1 and primer No. 31 in the fuze M66A2, and a black powder delay pellet.

d. Functioning. The tracer composition is ignited by the flash of the propelling charge, and burns thereafter for a prescribed time (a minimum of 3 seconds), providing a visible trace. The firing pin remains at rest upon firing and during the flight of the projectile. Upon impact, the forward force of the firing pin breaks the soft steel washer and the point of the pin strikes the primer. Action of the primer ignites the delay pellet. After burning a prescribed time (0.01 second), the black powder pellet initiates detonation of the detonating elements in the explosive train. The final charge (the booster pellet) in turn causes the filler of the projectile to explode.

188. Fuze, Base Detonating: M68A1 and M68

a. General. These fuzes are provided for use with the APC-T M82 projectiles used in the 90-mm weapons. The fuze M68 is similar to the fuze M66A1 (par. 187 and fig. 59) and the fuze M68A1 to the fuze M66A2 in construction and functioning. Fuzes M68 and M68A1 are larger in body and thread diameter in order for accommodation in the larger 90-mm projectile.

b. Description. The fuzes M68 and M68A1 are respectively 2 inches and 2.28 inches in diameter as compared with the fuzes M66A1 and M66A2, which are respectively 1.65 inches and 1.79 inches.

c. Data.

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Length</th>
<th>Weight</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>M68A1</td>
<td>3.52</td>
<td>1.44</td>
<td>2-10NS-1-LH</td>
</tr>
<tr>
<td>M68</td>
<td>3.46</td>
<td>1.56</td>
<td>2-10NS-1-LH</td>
</tr>
</tbody>
</table>

189. Fuze, Base Detonating: M91 and M91A1

Note. The key letters shown below in parentheses refer to figure 60.

a. General. The fuze M91A1 (fig. 60) is used with the HEAT-T projectiles in 75-mm pack howitzer cannon M1A1, 90-mm cannon firing HE Aberdeen Projected Ammunition, and 105-mm howitzer canons M2A1 and M4. The fuze M91A1 is a nondelay base-detonating fuze similar in construction and functioning to the fuze M62A1. It differs from the fuze M62A1 only in having a tracer element in its conical base end. The principle difference between the fuzes M91A1 and M91 is in the assembly of the tracer to the fuze body. In the latter fuze, the tracer charge is contained in a cast aluminum cup which is press fitted into a well in the body of the fuze and sealed with a gilding metal closing cup. In the former fuze, the tracer charge and an igniter charge are contained in a threaded steel or aluminum-alloy housing which screws into the fuze body and is sealed with a crimped gilding metal closing disk.

b. Data.

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Length</th>
<th>Weight</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>M91A1</td>
<td>4.211</td>
<td>1.40</td>
<td>1.5-12NS-LH</td>
</tr>
<tr>
<td>M91</td>
<td>4.11</td>
<td>1.38</td>
<td>1.5-12NS-LH</td>
</tr>
</tbody>
</table>

c. Description. The fuze consists of four parts: a steel head (N), a steel body (C), a brass booster cup (A), and a tracer (P). The head holds a rotor firing pin (L) and inertia plunger (K). The body contains a detonator (H), a slider assembly (E) with a slider charge (F), a booster pellet (B), and a booster lead (D). The booster cup seals the booster pellet in its cavity in the fuze body when screwed to the body. The tracer is screwed in the base. Boresafety is provided for by the slider assembly.
Figure 59. Fuze, base detonating: M66A2.
c. Description.

(1) Both models of this fuze are essentially the same in their method of functioning. Some differences exist in the structure of their parts. Also, the fuze M66A2 is slightly longer and heavier than the fuze M66A1.

(2) The fuzes are made up of three main parts: a body assembly, a booster holder assembly, and a primer holder assembly. The body assembly contains the firing pin and, in a cavity of the boat-tailed rear portion, a red tracer composition which operates independently of the fuze mechanism. The booster holder assembly holds a tetryl booster pellet and a detonator. The primer holder assembly contains primer No. 26 in the fuze M66A1 and primer No. 31 in the fuze M66A2, and a black powder delay pellet.

Functioning. The tracer composition is ignited by the clash of the propelling charge, minimum of 5 seconds), providing a visible trace. The firing pin remains at rest upon firing and during the flight of the projectile. Upon impact, the forward force of the firing pin breaks the soft steel washer and the point of the pin strikes the primer. Action of the primer ignites the delay pellet. After burning a prescribed time (0.01 second), the black powder pellet initiates denotation of the detonating elements in the explosive train. The final charge (the booster pellet) in turn causes the filler of the projectile to explode.

188. Fuze, Base Detonating: M68A1 and M68

a. General. These fuzes are provided for use with the APC-T M82 projectiles used in the 90-mm weapons. The fuze M68 is similar to the fuze M66A1 (par. 187 and fig. 59) and the fuze M68A1 to the fuze M66A2 in construction and functioning. Fuzes M68 and M68A1 are larger in body and thread diameter in order for accommodation in the larger 90-mm projectile.

b. Description. The fuzes M68 and M68A1 are respectively 2 inches and 2.28 inches in diameter as compared with the fuzes M66A1 and M66A2, which are respectively 1.65 inches and 1.79 inches.

c. Data.

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Length</th>
<th>Weight</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>M68A1</td>
<td>3.52</td>
<td>1.44</td>
<td>2-10NS-1-LH</td>
</tr>
<tr>
<td>M68</td>
<td>3.46</td>
<td>1.56</td>
<td>2-10NS 1-LH</td>
</tr>
</tbody>
</table>

189. Fuze, Base Detonating: M91 and M91A1

Note. The key letters shown below in parentheses refer to figure 60.

a. General. The fuze M91A1 (fig. 60) is used with the HEAT-T projectiles in 75-mm pack howitzer cannon M1A1, 90-mm cannon firing HEP ammunition, and 105-mm howitzer cannons M2A1 and M4. The fuze M91A1 is a nondelay base-detonating fuze similar in construction and functioning to the fuze M62A1. It differs from the fuze M62A1 only in having a tracer element in its conical base end. The principle difference between the fuzes M91A1 and M91 is in the assembly of the tracer to the fuze body. In the latter fuze, the two fuzes are assembled to the fuze body, which is press fitted into a well in the body of the fuze and sealed with a gilding metal closing cup. In the former fuze, the tracer charge and an igniter charge are contained in a threaded steel or aluminum-alloy housing which screws into the fuze body and is sealed with a crimped gilding metal closing disk.

b. Data.

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Length</th>
<th>Weight</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>M91A1</td>
<td>4.211</td>
<td>1.40</td>
<td>1-5/12NS-LH</td>
</tr>
<tr>
<td>M91</td>
<td>4.11</td>
<td>1.38</td>
<td>1-5/12NS-LH</td>
</tr>
</tbody>
</table>

c. Description. The fuze consists of four parts: a steel head (N), a steel body (C), a brass booster cup (A), and a tracer (P). The head holds a rotor firing pin (L) and inertia plunger (K). The body contains a detonator (H), a slider assembly (E) with a slider charge (F), a booster pellet (B), and a booster lead (D). The booster cup seals the booster pellet in its cavity in the fuze body when screwed to the body. The tracer is screwed in the base. Boresafety is provided for by the slider assembly.
Figure 59. Fuze, base detonating: M60A2.
d. Functioning. The rotor firing pin (L) is held in the unarmed position in the plunger by spring-held safety pins (M) which release the rotor firing pin under the action of centrifugal force. The plunger assembly will not arm at 1,700 revolutions per minute or less. The slider assembly normally is positioned under spring pressure in its recess in the fuze body so that the slider charge of the slider is out of alinement with the other explosive elements. When sufficient centrifugal force has been set up, the slider overcomes the resistance of the spring (G) and moves outward, bringing the slider charge into alinement. The slider will not arm when the fuze revolves at 2,400 revolutions per minute or less, but must arm at 3,600 revolutions per minute. Upon firing and after sufficient rotational force has been created, the firing pin and slider move into the armed position. However, the plunger assembly is held to the rear during the flight of the projectile by the restraining spring (J). Upon impact, the plunger overcomes the resistance of the spring and carries the firing pin forward against the detonator, initiating the action of the explosive train. The booster pellet, in its turn, causes detonation of the shell bursting charge. The tracer, which is ignited by propellant gases, creates a luminous trace during the flight of the projectile.

190. Dummy Fuzes

a. General. Dummy fuzes (figs. 61 through 63) are for use with ammunition, such as target practice and drill, which does not require a normal full-functioning fuze. Fuzes may be manufactured especially for the purpose (dummy fuzes), or may be assembled from burned out or rejected inert parts of service fuzes (inert fuzes). Whether assembled from service parts or especially manufactured for the purpose, the assemblies are completely inert. In general, the fuzes are intended to simulate a specific model or one type of service fuze. Contour and weight of the service fuze which is simulated are approximated in the dummy fuze for use with practice ammunition, and to give the proper “feel” when used with dummy ammunition. This policy also permits the use of dummy ammunition in conjunction with fuze setters for training in preparing ammunition for firing and in “servicing the piece.” Most dummy fuzes are simple in construction but essential features of the simulated service fuze are incorporated in some types. Instances are dummy fuzes, M59 and M73, which have a setting screw and registration similar to that in M48 series and M51 series type fuzes.

b. Data. Dummy fuzes are listed in table V together with essential information thereon.
Figure 60. Fuse, base detonating: M91A1.
d. Functioning. The rotor firing pin (L) is held in the unarmed position in the plunger by spring-held safety pins (M) which release the rotor firing pin under the action of centrifugal force. The plunger assembly will not arm at 1,700 revolutions per minute or less. The slider assembly normally is positioned under spring pressure in its recess in the fuze body so that the slider charge of the slider is out of alinement with the other explosive elements. When sufficient centrifugal force has been set up, the slider overcomes the resistance of the spring (G) and moves outward, bringing the slider charge into alinement. The slider will not arm when the fuze revolves at 2,400 revolutions per minute or less, but must arm at 3,600 revolutions per minute. Upon firing and after sufficient rotational force has been created, the firing pin and slider move into the armed position. However, the plunger assembly is held to the rear during the flight of the projectile by the restraining spring (J). Upon impact, the booster overcomes the resistance of the spring and carries the firing pin forward against the force of the action of the explosive train. The booster pellet, in its turn, causes detonation of the shell bursting charge. The tracer, which is ignited by propellant gases, creates a luminous trace during the flight of the projectile.

190. Dummy Fuzes

a. General. Dummy fuzes (figs. 61 through 63) are for use with ammunition, such as target practice and drill, which does not require a normal full-functioning fuze. Fuzes may be manufactured especially for the purpose (dummy fuzes), or may be assembled from burned out or rejected inert parts of service fuzes (inert fuzes). Whether assembled from service parts or especially manufactured for the purpose, the assemblies are completely inert. In general, the fuzes are intended to simulate a specific model or one type of service fuze. Contour and weight of the service fuze which is simulated are approximated in the dummy fuze for use with practice ammunition, and to give the proper "feel" when used with dummy ammunition. This policy also permits the use of dummy ammunition in conjunction with fuze setters for training in preparing ammunition for firing and in "servicing the piece." Most dummy fuzes are simple in construction but essential features of the simulated service fuze are incorporated in some types. Instances are dummy fuzes, M59 and M73, which have a setting screw and registration similar to that in M18 series and M51 series type fuzes.

b. Data. Dummy fuzes are listed in table V together with essential information thereon.
Figure 60. Fuze, base detonating: M91A1.
Figure 61. Dummy fuzes — simulated time fuzes.

Figure 62. Dummy fuzes — simulated small caliber fuzes.
Figure 61. Dummy fuze, unserrated time fuzes.

Figure 62. Dummy fuzes, unserrated wall caliber fuzes.
Figure 63. Dummy fuses — simulated M48 and M51 series fuses.

Table V. Dummy Fun Data

<table>
<thead>
<tr>
<th>Fuze, Point Detonating, Dummy:</th>
<th>Length (in.)</th>
<th>Wt (lb)</th>
<th>Thread size</th>
<th>Ammunition with which used</th>
<th>Service Fuse simulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>M44A2</td>
<td>Manganese bronze; or naval brass; or aluminum alloy; or copper-silicon alloy; or sintered iron.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M50B1</td>
<td>Steel</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>M50B2</td>
<td>Steel</td>
<td></td>
<td></td>
<td></td>
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</tr>
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<td>M50B3</td>
<td>Steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M59</td>
<td>Steel</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>M69</td>
<td>Steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M73</td>
<td>Steel</td>
<td></td>
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<td>M80</td>
<td>Steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12 drill cartridge for 90-mm gun.</td>
<td>M12 drill cartridge for 90-mm gun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M71 TP cartridge for 90-mm gun.</td>
<td>M71 TP cartridge for 90-mm gun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M50 TP-T cartridge for 40-mm gun.</td>
<td>M50 TP-T cartridge for 40-mm gun.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>M27 drill cartridge for 40-mm gun.</td>
<td>M27 drill cartridge for 40-mm gun.</td>
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<td></td>
</tr>
<tr>
<td>M15 dummy projectile for 120-mm gun.</td>
<td>M15 dummy projectile for 120-mm gun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12 drill cartridge for 90-mm gun.</td>
<td>M12 drill cartridge for 90-mm gun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See footnotes on following page.
Figure 63. Dummy fuzes — simulating M48 and M51 series fuzes.

Table 1. Dummy Fuze Specifications

<table>
<thead>
<tr>
<th>Fuze, Point Detonating, Dummy: M48</th>
<th>Length (in.)</th>
<th>Overall</th>
<th>Visible</th>
<th>Thread</th>
<th>Nomination with Shortened Stand</th>
<th>Service Life Modeled</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 drill cartridge for 90-mm guns</td>
<td>4.55</td>
<td>3.72</td>
<td>1.7-14 NS 1</td>
<td>M12 drill cartridge for 90-mm guns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M7 TP cartridge for 90-mm guns</td>
<td>2.18</td>
<td>1.74</td>
<td>2.50</td>
<td>1.125-20 NS 1</td>
<td>M7 TP cartridge for 90-mm guns</td>
<td></td>
</tr>
<tr>
<td>M21 drill cartridge for 37-mm gun M1A2</td>
<td>2.18</td>
<td>1.74</td>
<td>2.50</td>
<td>1.125-20 NS 1</td>
<td>M21 drill cartridge for 37-mm gun M1A2</td>
<td></td>
</tr>
<tr>
<td>M55A1 TP cartridge for 37-mm gun M1A2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M14 dummy cartridge for 105-mm how.</td>
<td>4.55</td>
<td>3.73</td>
<td>1.7-14 NS 1</td>
<td>M14 dummy cartridge for 105-mm how.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M15 dummy cartridge for 75-mm gun.</td>
<td>2.375</td>
<td>1.90</td>
<td>0.225</td>
<td>1.18-14 NS 1</td>
<td>M15 dummy cartridge for 75-mm gun.</td>
<td></td>
</tr>
<tr>
<td>M19 dummy cartridge for 75-mm how.</td>
<td>5.71</td>
<td>3.77</td>
<td>2.15</td>
<td>2-12NS 1</td>
<td>M19 dummy cartridge for 75-mm how.</td>
<td></td>
</tr>
<tr>
<td>M20 dummy cartridge for 76-mm gun.</td>
<td>0.625</td>
<td>4.750</td>
<td>3.37</td>
<td>1.7-14 NS 1</td>
<td>M20 dummy cartridge for 76-mm gun.</td>
<td></td>
</tr>
<tr>
<td>M71 TP cartridge for 90-mm gun.</td>
<td>7.677</td>
<td>6.867</td>
<td>2.72</td>
<td>2-12NS 1</td>
<td>M71 TP cartridge for 90-mm gun.</td>
<td></td>
</tr>
<tr>
<td>M48 TP cartridge for 75-mm sub-caliber gun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M15 dummy projectile for 120-mm gun.</td>
<td>4.55</td>
<td>3.72</td>
<td>2.50</td>
<td>1.125-20 NS 1</td>
<td>M15 dummy projectile for 120-mm gun.</td>
<td></td>
</tr>
<tr>
<td>M12 drill cartridge for 90-mm guns</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

See footnotes on following page.
191. Inert Fuzes

*a. General.* Inert fuzes are assembled from burned out or rejected parts of service fuzes. They are provided for dummy ammunition when it is not supplied with a dummy fuze. The fuzes are a specific model or type of service fuze but are completely inert.

*b. Data.* Inert fuzes now in use are listed in table VI.

### Table VI. Inert Fuze Data

<table>
<thead>
<tr>
<th>Fuze</th>
<th>Ammunition with which used</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUZE, MT, INERT: M43A2</td>
<td>CARTRIDGE, 90-MM, DUMMY: M12B1 or M12B2</td>
</tr>
<tr>
<td>FUZE, MT, INERT: M61 or M61A1</td>
<td>PROJECTILE, 120-MM: HE, 73, w/suppl chg</td>
</tr>
<tr>
<td>FUZE, MT, INERT: M67 (all mods) w/Booster, M21 (all mods).</td>
<td>PROJECTILE, 155-MM: HE, M107</td>
</tr>
<tr>
<td>FUZE, MTSQ, INERT: M500 series</td>
<td>PROJECTILE, 155-MM: HE, M101</td>
</tr>
<tr>
<td>FUZE, MTSQ, INERT: M500 series</td>
<td>PROJECTILE, 8-INCH: HE, M106</td>
</tr>
<tr>
<td>FUZE, PD, INERT: M48A2</td>
<td>CARTRIDGE, 90-MM: HE, M71</td>
</tr>
<tr>
<td>FUZE, PD, INERT: M51 (all mods) w/Booster, M20 (all mods).</td>
<td>CARTRIDGE, 75-MM: HE, M48</td>
</tr>
<tr>
<td>FUZE, PD, INERT: M51 (all mods) w/Booster, M21 (all mods).</td>
<td>CARTRIDGE, 90-MM: HE, M71</td>
</tr>
<tr>
<td>FUZE, PD, INERT: M51A5</td>
<td>PROJECTILE, 155-MM: GAS, M110</td>
</tr>
<tr>
<td>FUZE, TSQ, INERT: M54</td>
<td>PROJECTILE, 155-MM: SMOKE, M110</td>
</tr>
<tr>
<td>FUZE, TSQ, INERT: M55 series</td>
<td>PROJECTILE, 8-INCH: HE, M106</td>
</tr>
<tr>
<td>FUZE, PD, INERT: M56</td>
<td>CARTRIDGE, 75-MM: empty, M384</td>
</tr>
<tr>
<td>FUZE, TSQ, INERT: M1907M, 21-sec delay.</td>
<td>CARTRIDGE, 105-MM, DUMMY: M14</td>
</tr>
<tr>
<td>FUZE, TSQ, INERT: M1907M, 0.45-sec delay.</td>
<td>CARTRIDGE, 75-MM: HE, M48</td>
</tr>
<tr>
<td></td>
<td>CARTRIDGE, 75-MM DUMMY: M7</td>
</tr>
<tr>
<td></td>
<td>CARTRIDGE, 75-MM DUMMY: M2A2</td>
</tr>
</tbody>
</table>
192. Fuze, Mechanical Time: M43 (All Modifications)

Note. The key letters shown below in parentheses refer to figure 64.

a. General. The fuze M43 is a mechanical time type. All modifications provide for time setting to 30 seconds, and are without impact element. The fuze originally was adopted for antiaircraft use with medium caliber shell fitted with a suitable booster (the M20 type) but now is assembled with the M21 type booster as a fixed component. Differences in the various models are described in g below; basic features are described in b through g below.

b. Data. Length, visible, 3.70 inches; overall, 4.51 inches; weight, 1.41 pounds; thread size, 1.7-14NS-1.

c. External Details. The fuze body for the fuzes M43 to M43A4 (fig. 64) is in three parts: an upper cap, a movable lower cap, and a fixed base (W). The lower cap holds the setting pin (B) and a hammer (D) device which releases the timing disk (G) upon firing. The lower cap and base house the other mechanical parts and explosive elements. The upper cap is staked to the lower cap and turns as a unit with it during fuze setting. The base is engraved circumferentially with 0.2-second graduations up to 30 seconds, full seconds being numbered. A safety line with "S" below it, also is stamped on the base, and indicates a point in the setting at which the fuze cannot function. As shipped, the fuze is set "safe," that is with "S" line alined with the register line of the lower cap. Timing is regulated by the angular distance which the timing disk must turn before the firing arm is released for functioning. This distance is increased by turning the lower cap counterclockwise as viewed from the point of fuze and reduced by turning in a clockwise direction. The desired time has been set when the register line on the lower cap is alined with the appropriate graduation on the base. The lower cap may be turned in either direction and through the zero and safety graduations. For accuracy in time of functioning, the time setting should always be approached from the same direction. Two setting grooves, one each in the lower cap and base, are provided for fuze setting.

d. Internal Details. The driving mechanism is based on the same principles as clockwork but differs in that it is driven by a pair of weighted gear segments actuated by centrifugal force. Also, the escapement (R) beats at a much higher frequency and makes use of a straight spring (Q). A timing disk with protruding lug and a notch is connected with the main gear pinion at the upper end of the mechanism by means of a washer and Belleville spring device (F). This allows slippage during fuze setting but provides sufficient friction for the main pinion to rotate the disk when the disk is released from the setting pin (B). In recent models, there is a safety leaf (H) immediately below the timing disk which prevents functioning should the fuze be set for dangerously short periods; in earlier models, the safety leaf was attached to the hammer. A striker assembly, consisting of a firing arm (J) and firing pin (M), is assembled in the mechanism so that it is released for functioning when the notch in the timing disk becomes alined with the finger on the upper portion of the firing arm. Explosive elements comprise a percussion primer (S), a black powder pellet (T) (omitted in earlier models), and a magazine charge (U) of black powder. Three main safety features make for boresafety: hammer (D) which acts on timing disk on setback, setback pin (K) which releases striker assembly on setback, and safety lock (P) which releases escapement on centrifugal action. Earliest models were fitted with a pull wire to prevent accidental rotation of the lower cap during shipment, but this has been omitted on more recent models.

e. Functioning. When setting the fuze, the turning of the lower cap rotates the timing disk by means of the setting pin and upraised lug on the timing disk, causing the desired change in angular distance between the firing arm and the notch in the timing disk. All other parts of the mechanism remain in position, since the gear train (N) and escapement are locked by the centrifugal safety device. Upon firing, setback causes the hammer on the cantilever spring (E) to strike the upraised lug on the timing disk, flattening the lug and releasing the disk from the setting pin. The ham-
mer returns to its original position as soon as setback ceases. At the same time, the setback pin which locks the firing arm moves backward, leaving the firing arm free to turn when the notch in the timing disk comes opposite the finger on the firing arm. When sufficient centripetal force has developed, the safety lock holding the escapement rotates and releases the escapement, leaving the movement free to run. The weighted gear segments (V) in mesh with the main driving pinion then drive the movement, the rate of rotation of the pinion, and therefore of the timing disk, being governed by the escapement through a series of gears. When the notch in the timing disk reaches the finger of the firing arm, the firing arm turns, permitting the firing pin safety plate (L) to swing from under the firing pin flange, and allowing the firing pin to strike the primer under the action of its spring. This initiates the action of the powder train, which action is transmitted to the booster and projectile bursting charge.

f. Preparation for Firing. The fuze is set by means of a fuze setter, the lower cap being turned in a counterclockwise direction as viewed from the point of the fuze to increase the setting, and clockwise to reduce it. In the case of early fuzes M43A1, it is necessary to remove the pull wire before setting the fuze. This can be done readily by pulling the end of the wire from the hole in the lower cap and sliding the wire off the end of the fuze.

g. Modifications. There are several modifications of the fuze M43, and these differ as follows: The change from the fuze M43A1 to the M43A2 consisted of a bevel in the shoulder so that the fuze could be screwed into the booster M23. The change from the fuze M43A2 to M43A3 resulted from a change in the method of regulating movements. The change from the fuze M43A3 to M43A4 resulted from the decrease in minimum functioning time from 1.67 to 0.6 second. Since safe setting and torque required to turn the lower cap may be critical, these data are presented for the various modifications, as follows:

<table>
<thead>
<tr>
<th>Modification</th>
<th>Minimum functioning time (sec)</th>
<th>Torque required to turn lower cap (lb-in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M43A4</td>
<td>0.6</td>
<td>80 to 100</td>
</tr>
<tr>
<td>M43A3</td>
<td>1.67</td>
<td>80 to 100</td>
</tr>
<tr>
<td>M43A2</td>
<td>1.67</td>
<td>60 to 80</td>
</tr>
<tr>
<td>M43A1 ' (late)</td>
<td>1.67</td>
<td>60 to 80</td>
</tr>
<tr>
<td>M43A1 ' (early)</td>
<td>1.4</td>
<td>40 to 60</td>
</tr>
</tbody>
</table>

1 Fuze will not function if set below this figure.
2 Upper cap painted red.
3 Fuzes of late manufacture without pull wire.
4 Fuzes of earlier manufacture with pull wire.

193. Fuze, Mechanical Time: M61A2

The mechanical time fuze M61A2 is essentially the fuze M61A1 (par. 194) without the magazine charge and bottom closing screw assembly. The bottom closing screw assembly is replaced by a closing plug, “O” ring, and retainer. The closing plug has a flash hole to connect the primer to the relay M7. This fuze is being replaced by the MTSQ fuze M506 (T176E3) (w/booster M124). Other data shown in paragraph 194 for the fuze M61A1 is applicable to this fuze.

194. Fuze, Mechanical Time: M61A1 and Fuze, Mechanical Time: M61

a. Description. The fuze M61A1 (fig. 65) is essentially the fuze M43A4 with an extended conical nose. The long-pointed shape is required to adapt the fuze to the ogive of the 120-mm antiaircraft projectile M73 for which the fuze is provided. Aside from the difference in contour, the fuzes M61A1 and M43A4 are alike in construction and in functioning (par. 192 for details of arrangement and functioning), including safety devices and the minimum safe setting time of 0.6 second, as well as the torque required to turn the movable cap. Similarly, the fuze M61 is the same as the fuze M43A3 except for the difference in shape and weight.

b. Data. Length, visible, 6,867 inches; overall, 7,677 inches; weight, 1.62 pounds; thread size, 1.7–14NS–1.

c. Preparation for Firing. The fuze is prepared for firing in the same manner as described for the fuzes M43 in paragraph 192.
Figure 64. Fuze, mechanical time, M43A4 and fuze mechanism.
mer returns to its original position as soon as setback ceases. At the same time, the setback pin which locks the firing arm moves backward, leaving the firing arm free to turn when the notch in the timing disk comes opposite the finger on the firing arm. When sufficient centrifugal force has developed, the safety lock holding the escapement rotates and releases the escapement, leaving the movement free to run. The weighted gear segments (V) in mesh with the main driving pinion then drive the movement, the rate of rotation of the pinion, and therefore of the timing disk, being governed by the escapement through a series of gears. When the notch in the timing disk reaches the finger of the firing arm, the firing arm turns, permitting the firing pin safety plate (L) to swing from under the firing pin flange, and allowing the firing pin to strike the primer under the action of its spring. This initiates the action of the powder train, which action is transmitted to the booster and projectile bursting charge.

*Footnotes*

1. Fuze will not function if set below this figure.
2. Upper cap painted red.
3. Fuzes of later manufacture without pull wire.
4. Fuzes of earlier manufacture with pull wire.

### Table: Fuze, Mechanical Time: M61A2

<table>
<thead>
<tr>
<th>Modification</th>
<th>Minimum functioning time (sec)</th>
<th>Torque required to turn lower cap (lb-in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M43A4</td>
<td>0.6</td>
<td>80 to 100</td>
</tr>
<tr>
<td>M43A3</td>
<td>1.67</td>
<td>80 to 100</td>
</tr>
<tr>
<td>M43A2</td>
<td>1.67</td>
<td>60 to 80</td>
</tr>
<tr>
<td>M43A1</td>
<td>1.67 (late)</td>
<td>60 to 80</td>
</tr>
<tr>
<td>M43A1</td>
<td>(early)</td>
<td>1.4</td>
</tr>
</tbody>
</table>

#### 193. Fuze, Mechanical Time: M61A2

The mechanical time fuze M61A2 is essentially the fuze M61A1 (par. 194) without the magazine charge and bottom closing screw assembly. The bottom closing screw assembly is replaced by a closing plug, "O" ring, and retainer. The closing plug has a flash hole to connect the primer to the relay M7. This fuze is being replaced by the MTSQ fuze M506 (T176E3) (w booster M121). Other data shown in paragraph 191 for the fuze M61A1 is applicable to this fuze.

#### 194. Fuze, Mechanical Time: M61A1 and Fuze, Mechanical Time: M61

**a. Description.** The fuze M61A1 (fig. 65) is essentially the fuze M43A4 with an extended conical nose. The long-pointed shape is required to adapt the fuze to the ogive of the 120-mm antiaircraft projectile M73 for which the fuze is provided. Aside from the difference in contour, the fuzes M61A1 and M43A4 are alike in construction and in functioning (par. 192 for details of arrangement and functioning), including safety devices and the minimum safe setting time of 0.6 second, as well as the torque required to turn the movable cap. Similarly, the fuze M61 is the same as the fuze M43A3 except for the difference in shape and weight.

**b. Data.** Length, visible, 6.867 inches; overall, 7.677 inches; weight, 1.62 pounds; thread size, 1.7-14NS-1.

**c. Preparation for Firing.** The fuze is prepared for firing in the same manner as described for the fuzes M43 in paragraph 192.
Figure 64. Fuze, mechanical timer, M. A.; and fuze mechanism.
Figure 65. Fuze, mechanical time: M61A1.
195. Fuze, Mechanical Time: M67A3

a. General. The fuze M67A3 (fig. 66) is a mechanical time fuze used with high-explosive projectile in calibers from 105- to 280-mm (field weapons only) and with 90-mm high-explosive cartridge M71. Due to its longer time range, the fuze also has replaced the fuzes M55, M55A1, M55A2, and M55A3 for use for high-burst ranging with these calibers.

b. Data. Length, visible, 3.74 inches; overall, 5.93 inches (including booster); weight, 2.14 pounds (including booster); thread size, 2-12NS-1.

c. Description. The fuze M67A3 without booster has the same size, weight and shape as the fuze M43A4 and, like it, has no impact element. The time action is based on the same clockwork principle. It has “kick off” springs and a 30-tooth gear meshing with the escapement and functions similarly to the fuze M43A4 except that the escapement and gears of the fuze M67A3 are set to give a functioning time up to 75 seconds, and the safety leaf prevents functioning when the fuze is set for less than 1.5 seconds. The body is engraved with 0.5-second graduations up to 75 seconds, and a safety (S) line. The fuze is set safe as shipped. A safety wire extends through the fuze body and the movement firing pin, providing positive safety during the handling prior to firing. This wire must be removed when preparing the fuze for firing.

d. Preparation for Firing. Assemble the fuze and booster assembly to the projectile as indicated in (1) through (4) below.

(1) Remove the shipping plug from the projectile.

(2) Inspect the fuze hole threads to make certain that no foreign matter is present which may interfere with proper assembly.

(3) Screw the fuze and booster assembly into the projectile by hand and tighten with the fuze wrench M18.

(4) When the fuze is assembled to the projectile, it is necessary only to remove the safety wire (pull end of wire from hole and slip the wire off the head) and then set the fuze for the desired time of action by turning the lower cap to complete the preparation for firing.

196. Fuze, Mechanical Time and Superquick: M500 and M501

a. Description. The fuze M500 is replacing TSQ fuze M55A3 and mechanical time fuze M67 series (par. 195). The fuze M501 is replacing TSQ fuze M54. The fuze M500 has a booster attached; the fuze M501 has no booster. The fuzes M500 and M501 are designed for time settings up to 75 seconds. The fuze M500 is authorized for issue for all applications where the mechanical time M67 series and time and superquick M55 series fuzes were authorized. The fuze M501 is authorized for issue for all applications where the TSQ fuze M54 was authorized.

b. Setting. First, remove the safety pull wire from the fuze. If time action is desired, set the fuze at the desired time-of-flight, using fuze setter M27, M26, M14, or M23. The fuze must be set by turning the lower cap in a counterclockwise direction. If superquick action is required, the lower cap may be left as shipped (set at “S”) or set at a time greater than the expected time-of-flight.

Note. If a fuze has been set in preparation for firing but is not fired, reset the fuze to safe (“S”) and replace the safety pull wire in proper position.

c. Precautions in Firing.

(1) When MTSQ fuze M500 or M501 is set for air burst and fired in the 155-mm howitzer M1, M1A1, or M45, failures may occur when firing charges 1 or 2. Failures may be expected in the order of 20 percent when fired with charge 1, and 10 percent when fired with charge 2. Such failures occur because the setback forces attained with charges 1 and 2 are not always adequate to release the timing mechanism. However, projectiles so fuzed and set will function on ground impact.

(2) Firing during heavy rain may cause premature functioning of the fuze. Heavy rain that would cause premature functioning is comparable to that which occurs during summer thunderstorms.

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Figure 65. Fuze, mechanical time: M61A1.
195. Fuze, Mechanical Time: M67A3

a. General. The fuze M67A3 (fig. 66) is a mechanical time fuze used with high-explosive projectile in calibers from 105- to 280-mm (field weapons only) and with 90-mm high-explosive cartridge M71. Due to its longer time range, the fuze also has replaced the fuzes M55, M55A1, M55A2, and M55A3 for use for high-burst ranging with these calibers.

b. Data. Length, visible, 3.74 inches; overall, 5.93 inches (including booster); weight, 2.14 pounds (including booster); thread size, 2-12NS-1.

c. Description. The fuze M67A3 without booster has the same size, weight and shape as the fuze M43A4 and, like it, has no impact element. The time action is based on the same clockwork principle. It has “kick off” springs and a 30-tooth gear meshing with the escapement and functions similarly to the fuze M43A4 except that the escapement and gears of the fuze M67A3 are set to give a functioning time up to 75 seconds, and the safety leaf prevents action after the fuze is set for less than 1.5 seconds. The body is engraved with 0.5-second graduations up to 75 seconds, and a safety (S) line. The fuze is set safe as shipped. A safety wire extends through the fuze body and the movement firing pin, providing positive safety during the handling prior to firing. This wire must be removed when preparing the fuze for firing.

d. Preparation for Firing. Assemble the fuze and booster assembly to the projectile as indicated in (1) through (4) below.

(1) Remove the shipping plug from the projectile.

(2) Inspect the fuze hole threads to make certain that no foreign matter is present which may interfere with proper assembly.

(3) Screw the fuze and booster assembly into the projectile by hand and tighten with the fuze wrench M18.

(4) When the fuze is assembled to the projectile, it is necessary only to remove the safety wire (pull end of wire from hole and slip the wire off the head) and then set the fuze for the desired time of action by turning the lower cap to complete the preparation for firing.

196. Fuze, Mechanical Time and Superquick: M500 and M501

a. Description. The fuze M500 is replacing TSQ fuze M55A3 and mechanical time fuze M67 series (par. 195). The fuze M501 is replacing TSQ fuze M54. The fuze M500 has a booster attached; the fuze M501 has no booster. The fuzes M500 and M501 are designed for time settings up to 75 seconds. The fuze M500 is authorized for issue for all applications where the mechanical time M67 series and time and superquick M55 series fuzes were authorized. The fuze M501 is authorized for issue for all applications where the TSQ fuze M54 was authorized.

b. Setting. First, remove the safety pull wire from the fuze. If time action is desired, set the fuze at the desired time-of-flight, using fuze setter M27, M26, M14, or M23. The fuze must be set by turning the lower cap in a counterclockwise direction. If superquick action is required, the fuze must be set at “S” (set at “S”) or set at a time greater than the expected time-of-flight.

Note. If a fuze has been set in preparation for firing but is not fired, reset the fuze to safe (“S”) and replace the safety pull wire in proper position.

c. Precautions in Firing.

(1) When MTSQ fuze M500 or M501 is set for air burst and fired in the 155-mm howitzer M1, M1A1, or M45, failures may occur when firing charges 1 or 2. Failures may be expected in the order of 20 percent when fired with charge 1, and 10 percent when fired with charge 2. Such failures occur because the setback forces attained with charges 1 and 2 are not always adequate to release the timing mechanism. However, projectiles so fused and set will function on ground impact.

(2) Firing during heavy rain may cause premature functioning of the fuze. Heavy rain that would cause premature functioning is comparable to that which occurs during summer thunderstorms.
Figure 66. Fuze, mechanical time, M67AS.
197. Fuze, Mechanical Time and Superquick: M500A1 and M501A1

The fuzes M500A1 and M501A1 (fig. 67) are designed for time settings up to 75 seconds. The fuze M500A1 has the booster M21A4 attached; the fuze M501A1 has no booster, otherwise they are exactly alike. These fuzes are modifications of the fuzes M500 and M501 (par. 196) to improve reliability and timing accuracy.

198. Fuze, Mechanical Time and Superquick: M502

a. Description. This fuze is a mechanical time superquick (MTSQ) type for use with HE cartridge M71 in 90-mm weapons. The impact element of this fuze is a supersensitive type designed to function on impact with thin aircraft surfaces that usually would not offer enough resistance to cause functioning of the more ordinary-type impact elements. The firing pin in the impact element is held in an unarmèd position prior to firing by two half blocks, which in turn, are held in place by a coil of spring wire. Upon firing, centrifugal force causes the spring to open and the half blocks to separate, thus freeing the firing pin to function on impact. This fuze also contains a 30-second clockwork-type timing mechanism that, except for its main pinion shaft, is fundamentally similar to that used in the MT fuze M43A4. The main pinion shaft, made tubular, serves as a flash tube to carry the flame initiated on impact through the clockwork mechanism. The fuze M502 is ballistically interchangeable with the MT fuze M43A4. The 30-second clockwork timing mechanism makes the fuze boresafe.

b. Setting. The fuze is set to the desired time-of-flight by the automatic fuze setter rammer M20 or fuze setter M13A1 or M13.

c. Use. This fuse is used for the purposes indicated in (1) through (3) below.

(1) As a mechanical time and superquick (MTSQ) fuze, in lieu of the mechanical time (MT) fuze M43 series in a normal antiaircraft role.

(2) As a substitute for point detonating self-destroying (PDSD) fuzes, pending availability of the latter. In this role, the fuze should be set for a time somewhat beyond the calculated “time of flight to impact target.” Thus, any projectile that fails to impact the intended target will destroy itself in the air.

(3) In a trial fire role for adjusting the antiaircraft fire control systems M33/T33 series.

d. Precaution in Firing. Firing during heavy rain may cause premature functioning of the fuze. Heavy rain that would cause premature functioning is comparable to that which occurs during summer thundershowers.

199. Fuze, Mechanical Time and Superquick: M502A1

The fuze M502A1 (fig. 68) is a mechanical time and impact fuze with superquick action for antiaircraft use. Because of additional safety features, it is superseding the fuze M502. The impact element is designed to function on impact with thin aircraft surfaces that usually would not offer enough resistance to cause functioning of the usual impact elements. The superquick impact element becomes armed when the half blocks holding the firing pin in the unarmèd position move outward under centrifugal force caused by rotation of the projectile. The firing pin is left in a “floating” position with unobstructed passage to the detonator. Action of the detonator is augmented by the lead charge and is transmitted through the uninterrupted flash tube to the relay in the closing plug and thence to the booster which explodes and sets off the cartridge charge.
Figure 66. Fuze, mechanical time, M67AS.
197. Fuze, Mechanical Time and Superquick: M500A1 and M501A1

The fuzes M500A1 and M501A1 (fig. 67) are designed for time settings up to 75 seconds. The fuze M500A1 has the booster M21A4 attached; the fuze M501A1 has no booster, otherwise they are exactly alike. These fuzes are modifications of the fuzes M500 and M501 (par. 196) to improve reliability and timing accuracy.

198. Fuze, Mechanical Time and Superquick: M502

a. Description. This fuze is a mechanical time superquick (MTSQ) type for use with HE cartridge M71 in 90-mm weapons. The impact element of this fuze is a supersensitive type designed to function on impact with thin aircraft surfaces that usually would not offer enough resistance to cause functioning of the more ordinary-type impact elements. The firing pin in the impact element is held in an unaltered position prior to firing by two half coils of spring wire. Upon firing, centrifugal force causes the spring to open and the half blocks to separate, thus freeing the firing pin to function on impact. This fuze also contains a 30-second clockwork-type timing mechanism that, except for its main pinion shaft, is fundamentally similar to that used in the MT fuze M43A4. The main pinion shaft, made tubular, serves as a flash tube to carry the flame initiated on impact through the clockwork mechanism. The fuze M502 is ballistically interchangeable with the MT fuze M43A4. The 30-second clockwork timing mechanism makes the fuze boresafe.

b. Setting. The fuze is set to the desired time-of-flight by the automatic fuze setter rammer M20 or fuze setter M13A1 or M13.

c. Use. This fuse is used for the purposes indicated in (1) through (3) below.

1) As a mechanical time and superquick (MTSQ) fuze, in lieu of the mechanical time (MT) fuze M43 series in a normal antiaircraft role.

2) As a substitute for point detonating self-destructing (PDSD) fuzes, pending availability of the latter. In this role, the fuze should be set for a time somewhat beyond the calculated "time - of - flight - to - impact - target." Thus, any projectile that fails to impact the intended target will destroy itself in the air.

3) In a trial fire role for adjusting the antiaircraft fire control systems M33/ T33 series.

d. Precaution in Firing. Firing during heavy rain may cause premature functioning of the fuze. Heavy rain that would cause premature functioning is comparable to that which occurs during summer thundershowers.

199. Fuze, Mechanical Time and Superquick: M502A1

The fuze M502A1 (fig. 68) is a mechanical time and impact fuze with superquick action for antiaircraft use. Because of additional safety features, it is superseding the fuze M502. The impact element is designed to function on impact with thin aircraft surfaces that usually would not offer enough resistance to cause functioning of the usual impact elements. The superquick impact element becomes armed when the half blocks holding the firing pin in the unarmed position move outward under centrifugal force caused by rotation of the projectile. The firing pin is left in a "floating" position with unobstructed passage to the detonator. Action of the detonator is augmented by the lead charge and is transmitted through the uninterrupted flash tube to the relay in the closing plug and thence to the booster which explodes and sets off the cartridge charge.
Figure 67. Fuze, mechanical time and superquick: M500A1 and M501A1.

Figure 68. Fuze, mechanical time and superquick: M502A1.
200. Fuze, Mechanical Time and Superquick: M506 [T175E3] (w/Booster M124 [T35E8])

a. General. This fuze is a dual action mechanical time and impact fuze with superquick action. It is designated to replace FUZE, MECHANICAL TIME: M61A2 (w/booster M21A4), for use with the 120-mm high-explosive projectile M73. The fuze M61A2 functions only by time action but the fuze M506 combines impact and time actions. The time action of the M506 is the same as that of the M61A2. The superquick impact action of the M506 is patterned in general after that of the M502 except that the M506 has no interrupter. Because the fuze M506 includes the booster M124 it is considered boresafe. The M506 has another detonator in the adapter for strengthening the flash of the point detonator. Because the fuze M506 has both time and impact action, it is suitable for firing at either aircraft or ground targets.

b. Description.

(1) General. The fuze, with principal parts or subassemblies indicated (movement assembly, body, lower cap, adapter assembly, windshield, point detonator assembly, and booster M124) is shown in figure 69. The movement assembly is attached to the inside of the body by three holding screws and contains a firing pin and the timing mechanism which eventually releases it. The aluminum body forms the base of the fuze and contains explosive elements consisting of a primer and a relay. The body is inscribed with a scale graduated in seconds for setting the fuze. The movable lower cap houses the major portion of the movement assembly and contains the setting pin and hammer spring. The lower cap is attached to the body by two locking wires which are adjusted during manufacture to provide resistance to rotation. Setting slots are located on the lower cap and lower body for engagement of the lugs of a fuze setter — automatic or hand wrench type. The adapter assembly is provided because of the long pointed contour of the fuze which requires the use of a relatively long flash tube to connect the point detonator with the explosive elements in the lower portion of the fuze. The adapter, which screws into the lower cap, secures one end of the flash tube while the other end screws into the point detonator assembly. The point detonator assembly houses the superquick impact element consisting essentially of a firing pin and detonator. This detonator is augmented by another detonator in the adapter. The windshield completes the contour of the fuze.

(2) Movement assembly.

(a) The timing movement of the fuze is based on the same principles as clockwork, but utilizes centrifugal force acting on two weighted gear segments for the primary driving force.

(b) A timing disk with a protruding forked lug and a firing notch is connected with the main gear pinion at the upper end of the mechanism by means of a Belleville spring. This device allows slippage during fuze setting, but provides sufficient friction for the main pinion to rotate the disk, when the disk is released from the setting pin by setback. A safety disk immediately below the timing disk prevents functioning should the fuze be set for dangerously short periods.

(c) The entire gear train including the escapement mechanism is unlocked by the safety lever assembly which is centrifugally controlled. The escapement mechanism frequency governs the speed of the fuze movement. The accuracy of the time interval for which the fuze has been preset depends essentially, therefore, upon the accuracy of the escapement mechanism, which is adjusted statically prior to dynamic regulation of the complete movement assembly, before it is attached to the inside of the fuze body.
Figure 69. Fuse, mechanical time and superquick: M506 (T176E3), w/booster M124 (T55E8).
(d) The setback pin is kept in position by a holding spring. When setback occurs, the spring releases the setback pin, which falls towards the base of the fuze, allowing the firing arm shaft to rotate when the firing arm upright meets the notch in the timing disk. The flat on the firing arm shaft provides clearance for the firing pin safety plate to swing out from under the flange of the firing pin. The firing pin spring then drives the firing pins into the primer in the body.

e. Body.
(1) The aluminum body forms the base of the fuze and houses explosive elements consisting of percussion primer M29A1 and relay M7. The body is engraved circumferentially with 0.2 second graduations up to 30 seconds, full seconds being numbered. A safety line on the body with “S” stamped below it in the setting slot indicates a point in the setting at which the timing mechanism of the fuze cannot function. The fuze is set “Safe” when shipped, that is, with the “S” line on the body alined with the indicator line on the lower cap. A setting slot is provided for fuze setting, and wrench slots are located on the side for assembly of the fuze into the projectile.

(2) A closing plug containing two desiccator pellets for moisture absorption is inserted into the bottom of the body and attached by a threaded retainer. The closing plug holds relay M7 which is positioned at the junction of two flash holes. One transmits the flash from the point detonator to the relay, the other transmits the flash from the primer to the relay.

d. Lower Cap.
(1) The aluminum lower cap holds devices which set the timing disk and release it. The devices which perform these functions are the setting pin and the hammer spring assembly. The setting pin is fixed in the top inside shoulder of the lower cap, parallel to the longitudinal axis of the fuze. The free end of the pin engages the forked uprising lug of the timing disk which causes the timing disk to turn when the lower cap is rotated counterclockwise (as viewed from the point of the fuze). The functioning time is determined by the angular distance between the firing arm and the notch in the timing disk.

(2) Disengagement of the setting pin from the uprising lug of the timing disk is effected by two small weights on the hammer spring assembly, which depress the uprising lug under the force of setback when firing occurs. As setback ceases, the hammer spring returns to its original position. The uprising lug remains bent down, thus unlocking the timing disk.

(3) The upper end of the cap is threaded internally for assembly with the adapter.

(4) Two locking wires are inserted inside the lower cap to provide resistance to rotation between the lower cap and body when assembled. The tension is adjusted by eight screws during assembly at the manufacturing plant.

(5) A setting slot is provided on the lower cap for fuze setting.

e. Adapter Assembly. The long pointed contour of fuze M506 and the incorporation of a superquick impact feature together necessitates the use of the adapter assembly, which connects the point detonator to the explosive elements in the lower portion of the fuze. The adapter assembly consists of an aluminum adapter and a steel flash tube. The flash tube is threaded externally at both ends for assembly into the adapter at the lower end and into the point detonator at the upper end. The adapter houses the detonator (M17) assembly, which is provided to augment the flash of the point detonator. The complete adapter assembly screws into the upper portion of the lower cap.
Figure 69. Fuze, mechanical time and superquick: M506 (T176E3), w/booster M124 (T35E8).
(d) The setback pin is kept in position by a holding spring. When setback occurs, the spring releases the setback pin, which falls towards the base of the fuze, allowing the firing arm shaft to rotate when the firing arm upright meets the notch in the timing disk. The flat on the firing arm shaft provides clearance for the firing pin safety plate to swing out from under the flange of the firing pin. The firing pin spring then drives the firing pin into the primer in the body.

e. Body.

(1) The aluminum body forms the base of the fuze and houses explosive elements consisting of percussion primer M29A1 and relay M7. The body is engraved circumferentially with 0.2 second graduations up to 30 seconds, full seconds being numbered. A safety line on the body with "S" stamped below it at the setback set indicates a point in the setting at which the timing mechanism of the fuze cannot function. The fuze is set "Safe" when shipped, that is, with the "S" line on the body aligned with the indicator line on the lower cap. A setting slot is provided for fuze setting, and wrench slots are located on the side for assembly of the body into the projectile.

(2) A closing plug containing two desiccator pellets for moisture absorption is inserted into the bottom of the body and attached by a threaded retainer. The closing plug holds relay M7 which is positioned at the junction of two flash holes. One transmits the flash from the point detonator to the relay, the other transmits the flash from the primer to the relay.

d. Lower Cap.

(1) The aluminum lower cap holds devices which set the timing disk and release it. The devices which perform these functions are the setting pin and the hammer spring assembly. The setting pin is fixed in the top inside shoulder of the lower cap, parallel to the longitudinal axis of the lower cap. The free end of the pin engages the forked upraised lug of the timing disk which causes the timing disk to turn when the lower cap is rotated counterclockwise (as viewed from the point of the fuze). The functioning time is determined by the angular distance between the firing arm and the notch in the timing disk.

(2) Disengagement of the setting pin from the upraised lug of the timing disk is effected by two small weights on the hammer spring assembly, which depress the upraised lug under the force of setback when firing occurs. As setback ceases, the hammer spring returns to its original position. The upraised lug remains bent down, thus unlocking the timing disk.

(3) The upper end of the cap is threaded internally for assembly with the adapter.

(4) Two locking wires are inserted inside the lower cap to provide resistance to rotation between the lower cap and body when assembled. The tension is adjusted by eight screws during assembly at the manufacturing plant.

(5) A setting slot is provided on the lower cap for fuze setting.

e. Adapter Assembly. The long pointed contour of fuze M506 and the incorporation of a superquick impact feature together necessitates the use of the adapter assembly, which connects the point detonator to the explosive elements in the lower portion of the fuze. The adapter assembly consists of an aluminum adapter and a steel flash tube. The flash tube is threaded externally at both ends for assembly into the adapter at the lower end and into the point detonator at the upper end. The adapter houses the detonator (M17) assembly, which is provided to augment the flash of the point detonator. The complete adapter assembly screws into the upper portion of the lower cap.
f. Point Detonator Assembly. The point detonator assembly which houses the superquick impact element consists of three subassemblies: the head proper, the detonator (M23) assembly (which is secured in the base of the head proper), and a nose. The nose holds the firing pin, and screws into the upper end of the head in such a manner as to leave a recess below the firing pin. Half-blocks and a coiled spring are positioned in the recess to hold the firing pin in an unarmed position prior to firing. The front end of the nose is closed by a thin aluminum disk for protection against foreign matter or air resistance. The head is threaded internally at the lower end for assembly with the flash tube. The complete point detonator assembly is secured to the windshield by staking.

g. Windshield. The long pointed contour of the fuze is formed by the conical shaped steel windshield, which is secured in place by being staked to the lower cap and point detonator assembly.

h. Booster. This fuze incorporates BOOSTER: M124, which employs a ball rotor, giving an arming delay which prevents functioning of the booster explosive until the fired projectile has reached a point 40 to 150 feet from the muzzle of the weapons.

i. Functioning.

(1) Movement assembly. As issued, the fuze is in the unarmed (SAFE) condition and remains in this condition during transportation and storage. When the fuse is set, the turning of the lower cap rotates the timing disk by means of the setting pin which is engaged in the upraised lug. All other parts of the mechanism remain in position, since the gear train and escape ment are locked by the safety lever assembly. Upon firing, setback causes a hammer spring to strike the upraised lug on the timing disk, flattening the lug and releasing the disk from the setting pin. The hammer returns to its original position as setback ceases. Setback also moves the setback pin towards the base of the fuze, leaving the firing arm free to turn when the notch in the timing disk comes opposite the upright on the firing arm. When sufficient centrifugal force has developed, the safety lever holding the escapement moves outward and releases the escapement, leaving the movement free to run. Simultaneously, centrifugal force augmented by backlash actuates the weighted gear segments, which, being in mesh with the main driving pinion, drives the movement. The rate of rotation of the pinion, and therefore of the timing disk, is governed by the escapement through a series of gears. When the notch in the timing disk reaches the upright of the firing arm, the firing arm turns, permitting the firing pin safety plate to swing out from under the firing pin flange. The firing pin then strikes the primer under the action of its spring. This initiates the action of the explosive train which action is transmitted to the booster and the bursting charge of the projectile.

(2) Point detonator assembly. The superquick impact element becomes armed when the half-blocks holding the firing pin in the armed position move outward under centrifugal force caused by rotation of the projectile. The firing pin is then left in a “floating” position with unobstructed passage to the detonator. Upon impact, the thin closing disk is perforated or the head is crushed, depending on the force of impact. In either case, the firing pin is crushed against the detonator. Action of the detonator is transmitted through the uninter rupted flash tube to the detonator in the adapter and thence to the booster. When use of the superquick impact element is required, the time setting can be left as shipped; that is, set at safe (S) or be set for a time greater than the anticipated time of flight.
j. Comparison with Fuze, Mechanical Time: M61A2 (w/Booster M21A4). The contour of fuze M506 is similar to that of the M61A2 except that the nose of the M506, which embodies the point detonator assembly, has a flat tip whereas the hollow nose of the M61A2 has a rounded tip. That portion (intrusion) of fuze M506 and booster assembly which screws into the projectile differs from that of the M61A2 as follows: the threaded portion of the M506 has a 2-inch external thread for making a joint with the projectile and a 1.7-inch internal thread for receiving externally threaded booster M124; the M61A2 has a 1.7-inch external thread which screws into the booster (M21A4) which also has an external thread which screws into the projectile. The depth of intrusion of fuze M506 and booster M124 assembly is the same as in the case of the fuze M61A2 and booster M21A4 assembly. The larger engagement (2-inch thread) of fuze-to-projectile in the case of the M506 makes for greater strength than in the case of the M61A2. Thus, the M506 is less liable to break off on impact before functioning at the target than in the case of the M61A2.

k. Data. Length, visible, 7.31 inches; intrusion, 2.21 inches; length, overall 9.52 inches; weight 2.61 pounds (including booster); thread size of fuze, 2-12NS-1; thread size of booster 1.7-14NS-1.

l. Safety Features. A setback pin prevents rotation of the firing arm and hence tripping of the spring-loaded firing pin until the setback pin is forced downward by setback. A spring-loaded safety lever prevents oscillation of the escapement until centrifugal force slides the safety lever out of engagement. The firing notch in the timing disk is covered by a safety disk when the fuze is set “safe” or anything less than the prescribed minimum setting. This prevents release of the firing arm and subsequent tripping of the firing pin should the timing disk be rotated into firing position. A setting pin which engages the raised forked lug of the timing disk prevents the timing disk from rotating. The timing disk is released from the setting pin by the hammer spring in the lower cap which flattens the lug when setback occurs. Disengagement of the timing disk is prevented when the fuze is set “SAFE.”

m. Authorized Use. FUZE, MECHANICAL TIME AND SUPERQUICK: M506 (w/booster M124) is authorized for use in the 120-mm high-explosive projectile M73.

n. Care, Handling, and Preservation. Special care should be exercised when handling the complete round since fuze M506 is extremely sensitive to shock and friction due to its extended contour. Care should also be taken in packing to see that the fuzes are properly supported in racks or trays and protected against shock or rough handling. No attempt will be made to disassemble any fuze at any time without specific instructions from the Chief of Ordnance. Mechanical time fuzes contain many delicate moving parts and have several joints and openings vulnerable to entrance of moisture. The fuze is sealed at assembly with a sealing compound in all external joints and openings. Plastic O-rings are also used as seals at several internal joints and two desiccator pellets are placed inside the closing plug at the base of the fuze for moisture absorption. Fuzes are packed in containers which are in accordance with ordnance specifications.

o. Preparation for Firing. The fuze is set by turning the lower cap to the desired setting in the direction of the arrow on the fuze body, by means of a fuze setter or hand setting wrench. No other preparation is required.

p. Precautions in Firing. Fuzes will be examined carefully before firing for any imperfection, dents, bruises, and particularly for any perforation or other imperfection in the point detonator assembly closing disk. Any such fuzes will not be fired. Fuzes will always be set in one direction only as indicated by the arrow immediately above the index mark on the lower cap.

q. Marking. The external surface of the fuze is stamped with the type and model number, manufacturer’s initials, lot number, year of manufacture, and time in seconds in the graduated time ring.

r. Packing. Packing data for separately issued fuzes of this model number (M506) are published in SM 9-5-1390.
201. Fuze, Mechanical Time and Superquick: M518 (T286E1)

a. General. The fuze M518 (T286E1) is a dual purpose mechanical time and impact fuze with superquick action for use with HE 90-mm cartridge M71 and HE 75-mm cartridge M334. It is essentially MTSQ fuze M502A1 less booster M21A4 plus booster M125. This booster delays arming of the fuze prior to 90 feet from the weapon muzzle.

b. Description. As assembled the fuze less booster is comprised of four subassemblies: the movement (clockwork) assembly, the body, the lower cap, and the point detonator assembly. The movement assembly contains a firing pin and the timing mechanism which eventually releases it. The movement is attached to the body by three holding screws. The aluminum body forms the base of the fuze and contains explosive elements consisting of a primer and delay. The body is inscribed with a 30-second graduated scale for setting the fuze. The brass lower cap houses the major portion of the movement assembly and contains the setting pin and hammer spring. It is attached to the body by a tensioning joint which is adjusted by four screws during manufacture to provide resistance to rotation between the lower cap and body. Setting slots are provided on the lower cap and body for engagement of a fuze setter or hand setting wrench. The point detonator assembly screws into the lower cap and completes the contour of the assembled fuze. It houses the superquick impact element consisting of a firing pin and support, and a detonator and lead charge.

c. Data. Length, visible, 3.74 inches; overall, 5.95 inches; weight (including booster), 2.06 pounds; thread size, 2-12NS-1.

d. Preparation for Firing. The fuze is set by turning the lower cap to the desired setting in a counterclockwise direction. When use of the superquick element is required, the time setting can be left as shipped, that is, set at safe (S) or be set for a time greater than the time of flight. This fuze is adjustable to 30 seconds.

202. Fuze, MTSQ, T197

MTSQ fuze T197 is used against ground targets and for high burst ranging. This fuze is authorized for use with high-explosive rounds for the M35 series “Skysweeper” guns. Fuze T197 is a combination mechanical time and impact fuze with settings for time action (0 to 100 sec) and an impact element for superquick action. The time action of this fuze is based on a clockwork principle. The fuze is graduated in 1/2-second intervals up to 100 seconds. The fuze contains an impact element similar to the M51A5 fuze. Booster M124 (T35E7) is used with this fuze. The fuze is set safe as shipped. A safety wire extends through the fuze body and the firing pin, providing positive safety during shipment and handling. The wire is removed just before setting the fuze. Fuze setter M28 (T46) is used to set the fuze to the desired time. If this fuze is fired during extremely heavy rainfalls, premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to the exceedingly heavy downpours that occur during summer thundershower.

203. Fuze, Mechanical Time and Superquick: M520

a. Description. Fuze M520 is a dual purpose fuze, mechanical time and superquick for use with rotated ammunition calibers 75-mm through 280-mm. It is composed of fuze M501A1 with booster M125. It has a 75-second timing mechanism which is set in a counterclockwise direction, a point detonator with superquick action on impact, and a booster which has a delay arming mechanism for additional safety. The fuze is fitted with a pull wire to prevent accidental arming of the setback pin during shipment.

b. Data. Length 5.95 inch, including booster; weight, 2.06 pounds, including booster; thread size, 2-12NS-1.

c. Preparation for Firing.

(1) Screw the fuze and booster assembly into the projectile by hand and tighten with fuze wrench.

(2) Remove the safety wire (pull end of wire from hole and slip other end off the head). Set the fuze by turning the lower cap to the desired setting in a counterclockwise direction, with a fuze setter or hand setting wrench.
204. Fuze, Point Initiating, Base Detonating: M509

a. General. The fuze M509 (fig. 70) is a single purpose, point initiating, base detonating fuze, for use in 90-mm and larger caliber fin-stabilized HEAT projectiles. The fuze contains the electric detonator T18E4. The fuze power source is a polarized ceramic disk with piezoelectric characteristics (code name "Lucky") which is positioned in the nose of the projectile. When the projectile strikes the target the ceramic disk is deformed, generating an electric impulse, which initiates the electric detonator in the fuze. Boresafety and drop safety are accomplished with a sequential-leaf arming mechanism which is activated by the sustained acceleration encountered during firing of the projectile from the cannon.

Note. The key letters shown in parentheses in b below refer to figure 70.

b. Description. The fuze consists of a rotor housing (A) which contains a rotor (B) with an electric detonator, a bleeder resistor (C), sequential leaves (D), and a rotor spring (E). Forward of the rotor housing is a booster lead cup assembly (F) with booster lead charge and a booster (G). Electrical contact between the rotor housing and rotor is made through the contact spring (H) and wiper contact (J) when the rotor is in the armed position.

c. Boresafety and Electrical Safety.

1) Mechanical boresafety is provided in the fuze by maintaining the electrical detonator in an out-of-line position in relation to the lead cup assembly.

2) Electrical safety is provided in the fuze in case the power source disk is inadvertently activated prior to or while placing the projectile in the cannon, by virtue of the detonator leads being disconnected from the disk and being shorted while the fuze is in the unarmed position. A secondary safety feature prevents premature bursts by preventing a build-up charge on the disk during the time that the fuze is being accelerated in the cannon. This is possible by using a bleeder resistor across the power circuit. The resistor drains off and neutralizes any electrical energy in the circuit. This prevents ignition of the electrical detonator when the rotor rotates into the in-line or armed position and contacts the contact bushing.

d. Functioning. When the projectile is fired, sustained acceleration creates setback forces which act upon the sequential-leaf arming mechanism located in the release mechanism assembly. The leaves are sequentially displaced by setback forces until leaf number 3 is locked in its rear or armed position. The preloaded rotor spring then rotates the rotor approximately 90 degrees until the rotor is in the in-line or armed position. A stop pin protruding from the rotor, butts against a stop slot in the bearing plate to assure positive alinement of the electric detonator in the in-line position. After rotor rotation, the contact wiper, which is secured to the rotor, makes contact with the contact spring, located in the rotor housing, and completes the electrical circuit for arming the fuze. The fuze is now armed and ready to initiate the explosive train when the projectile impacts against the target.

e. Preparation for Use. The fuze is assembled to the projectile prior to shipping for field use. No preparation is necessary.

f. Ballistic Data. The fuze has no built-in arming delay mechanism. The inherent delay involved in rotor displacement of 90 degrees amounts to approximately 0.008 second.

205. Fuze, Point Detonating: M48A3 and M48A2

a. General. The fuzes M48A3 and M48A2 are essentially the same as the fuzes M51A5 and M51A4 (par. 206 and fig. 71), except that the M48 series does not include the booster. Like the M51 series, the M48 series fuzes are selective superquick-delay types. Either action can be obtained, prior to firing, by turning a setting sleeve in the side of the fuze. The fuze M48A2 has two variations, one having a delay of 0.05 second, the other a delay of 0.15 second; the time of delay is stamped on the fuze body. The fuze M48A3, however, is made with only one delay of 0.05 second. The fuze M48 with 0.05-second delay is used with INITIATOR, burster, M1 in 75-mm chemical projectile. The fuze M48A3 has the new delay plunger assembly M1 (0.05-sec delay) which also is used in the fuze M51A5 and is standard for all ammunition employing fuzes of the M48 series.
Figure 70. Fuze, point initiating, base detonating: M509.

b. Data. Length, visible, 3.74 inches; overall, 4.55 inches; weight, 1.41 pounds; thread size, 1.7–14NS–1.

c. Description. For detailed explanation of operation, setting, safety devices, and preparation for firing, see paragraph 206.

206. Fuze, Point Detonating: M51A5 and M51A4

Note. The key letters shown below in parentheses refer to figure 71.

a. General. The fuze M51A5 is essentially the fuze M48A3 (par. 205) with the booster M21A4 (U) attached and replaces earlier modifications of the M51 series. The fuze M51A5 has a 0.05-second delay and is used as a point initiating fuze for all HE ammunition for field artillery weapons. The fuzes M51A4 and M51A5 and booster assemblies have the firing pin of the delay plunger assembly housing secured against movement prior to impact, and the booster has an additional lockpin. The fuze M51A4 was manufactured in lots having either 0.05- or 0.15-second delay, the length of delay being indicated by marking on the fuze. The fuze M51A5 uses the improved delay plunger assembly M1 (0.05-sec delay) which is more sensitive than the delay plunger assembly used in the fuze M51A4. The delay plunger assembly M1 includes a new delay element consisting of a primer, delay charge, and relay. This element shows a marked improvement in sensitivity and uniformity of burning time, over the element used in earlier models of the M51 series. This element can be loaded, tested, and stored as a unit, similar to the current practice with detonators and primers. A minor dimensional change has been made in delay plunger body and the rigidly fixed firing pin has been given a sharper point.

b. Data. Length, visible, 3.74 inches; overall, 5.93 inches (including booster); weight, 2.15 pounds (including booster); thread size, of fuze, 1.7–14NS–1, of booster, 2–12NS–1.

c. Description. With reference to figure 71, which depicts essentially either the fuze M51A5 or the M51A4 with the exception of the delay plunger assembly and the shape of the delay firing pin, the fuze consists of a head (A) which holds a superquick element (B), a body
(H) which holds a delay plunger assembly (M) and its housing, and a selective setting device. These main assemblies are connected by a flash tube (G) which holds the parts firmly in position, and are supported further by a thin-walled ogive (F). The superquick element comprises a firing pin (D) supported by a firing pin support (C) and a detonator (E). The firing pin support is strong enough to withstand ordinary blows on the firing pin as well as setback forces upon firing, but collapses under the force of impact at the target. The delay assembly is an inertia plunger type and includes a firing pin (N), the point of which is less sharp in the fuze M51A4 than in the fuze M51A5, primer (P), black powder delay pellet (Q), and a relay charge (T).

d. Setting. The setting device is an eccentrically positioned interrupter (K) and interrupter spring (L), the functioning of which is regulated by a setting sleeve (J). The head of the sleeve is slotted to facilitate turning when adjusting the setting. To enable exact alignment, two register lines and the marking “SQ” and “DELAY” are stamped on the ogive of the fuze. When the slot in the sleeve head is alined with the “SQ” line (parallel to the fuze axis), or within 15 degrees thereto, the sleeve, which is thicker on one side than on the other, is turned so that it does not interfere with movement of the plunger. The plunger is free, therefore, to move outward under centrifugal force, and thereby opens the passage for superquick action. When the slot is alined with the “DELAY” line (at right angles to the fuze axis) or within 15 degrees thereto, a section on the setting sleeve rests against the plunger, securing it in the lower extremity of the recess, across the superquick passage.

e. Safety Devices. Boresafe superquick action is provided by the interrupter (K). Boresafe delay action is provided by arrangement of mechanism within the booster.

f. Functioning. (Functioning described here-in refers to the fuze; for booster functioning, see paragraph 271). No action takes place in the fuze upon firing until sufficient rotational speed has been established to overcome the resistance of springs and setback force on the several safety devices. When set for super-

quick action, after the projectile leaves the muzzle of the weapon, centrifugal force causes the interrupter (K) to move outward, opening the passage. At the same time, the plunger pins (S) locking the delay plunger assembly in unarmed position also move outward, releasing that assembly in preparation for impact. The plunger pin lock (R) then swings on its pivot under centrifugal force placing an arm against the inner end of each plunger pin and thereby preventing the return of the pins to the unarmed position. Upon impact, the firing pin of the superquick action is driven against the detonator, initiating the superquick action. Inertia causes the delay plunger to move forward, driving the primer against the delay firing pin and initiating the delay action. In normal functioning with superquick action, the delay action has no effect since the superquick train will have caused the projectile to explode before the delay train can burn for its prescribed time. However, should the superquick action fail, the projectile will function with delay action rather than become a dud. When set for delay action, the interrupter which interrupts the superquick passage is restrained from moving. Upon impact, the superquick firing pin and detonator function but the effect is prevented from being transmitted to the projectile.

g. Preparation for Firing. The fuze need be adjusted only for the desired action, as described above. The setting can be adjusted at will, prior to firing, with a screwdriver or fuze wrench M18. The adjustment can be made in the dark by noting the position of the slot, parallel to the fuze axis (or within 15 degrees either side) for superquick (“SQ”) action and at right angles thereto (or within 15 degrees either side) for delay (“DELAY”) action.

h. Limitations and Precautions (Earlier Models). The fuze M51A4, when set “SQ,” generally functions under all firing conditions. However, when set “DELAY,” a small percentage of duds may result when fired in zone 1 of 155-mm and 8-inch howitzers, due to the low striking velocity obtained especially at low angles of fall or on soft ground.

i. Safety Pin (Cotter). This pin, formerly used in booster M21A4, has been found unnecessary and is no longer used in this booster.
Figure 71. Fuze, PD, M51A5 0.05-sec delay.
j. Duds.

(1) An appreciable percentage of duds may be expected when firing ammunition fitted with FUZE, PD, M51A5, 0.05-second delay (w/booster M21A4), set delay (DEL), in low zones of fire in howitzers. This is due to the inherent insensitivity of the delay action of this fuze to conditions of low-striking velocity or impact on soft ground. Under these conditions, the set forward force, resulting from the low rate of retardation, is insufficient to cause the delay plunger of the fuze to function reliably. However, when set superquick (SQ), normal functioning may be expected.

(2) The conditions in (1) above apply particularly to —

- 155-mm howitzer ........................................ Zones 1 and 2
- 8-inch howitzer .......................................... Zones 1 and 2

207. Fuze, Point Detonating: M56

Note. The key letters shown below in parentheses refer to figure 72.

a. General. The fuze M56 (fig. 72) is a supersensitive type used with 37-mm high-explosive projectile.

b. Data. Length, visible, 1.74 inches; overall, 2.21 inches; weight, 0.17 pound; thread size, 1.125-20NS-1.

c. Description. The fuze consists of two main parts: a head assembly and a body (L) containing a booster charge (M), and an interrupter (N) which holds a part of the explosive train connecting the booster with the detonator (H). The head assembly is made in three parts: the head (F), the detonator assembly (G), which screws into the base of the head proper, and a nose (B). The nose holds the firing pin (C) and screws into the upper end of the head in such a manner as to leave a recess below the firing pin. Half-blocks (E) and a coiled spring (D) are positioned in the recess to hold the firing pin in an unarmed position prior to firing. The front end of the nose is closed by a thin aluminum disk (A) for protection against foreign matter or air resistance. Safety in handling and boresafety are provided for by half-blocks and interrupter devices which hold the fuze in an unarmed condition until sufficient rotational force overcomes resistance of springs, setback, and friction.

d. Functioning. When sufficient rotational speed has been established to offset the resistances of springs, setback, and friction, the slider (J) of the interrupter moves outward, bringing the slider charge (K) into alignment with the detonator and booster. While in the bore, setback causes the firing pin to seat firmly in the half-blocks, preventing them from flying outward. Upon leaving the bore, the firing pin "creeps" forward and the half-blocks holding the firing pin in the unarmed position against the coiled flat steel spring then move outward under centrifugal force, leaving the firing pin in a "floating" position with an unobstructed passage to the detonator. In this position, the fuze is fully armed. Upon impact, the thin closing disk is perforated, or the head is crushed, depending on the force of impact. In either case, the firing pin is driven against the detonator. Action of the detonator is transmitted through the slider charge to the booster, which then causes the projectile to explode.

e. Preparation for Firing. There are no preparations.

Caution: Fuzes with perforated or imperfect closing disks will not be fired.

208. Fuze, Point Detonating: M57

a. General. The fuze M57 (fig. 73) is a single-action superquick type of the same size, shape, and weight as the fuze M48A3 or M51A5 without booster. It is essentially the same as the fuze M48A3 without a delay element. The fuze M57 is used primarily with 75-mm smoke cartridge, and in conjunction with the booster M22 in 105-mm smoke cartridge. As the booster M22 has no interrupter, the combination of fuze M57 and booster M22 is not considered as falling strictly within the definition of "boresafe." However, since the fuze itself contains an interrupter, the combination may be used under conditions requiring boresafety. The fuze M57 has been superseded for such use by the fuze M48A3 with 0.05-second delay in 75-mm smoke cartridge M64 and by the fuze M51A5 with 0.05-second delay in 105-mm howitzer smoke cartridge.
Figure 71. Fuze, PD, M51A5 0.05-sec delay.
j. Duds.

(1) An appreciable percentage of duds may be expected when firing ammunition fitted with FUZE, PD, M51A5, 0.05-second delay (w/booster M21A4), set delay (DEL), in low zones of fire in howitzers. This is due to the inherent insensitivity of the delay action of this fuze to conditions of low-striking velocity or impact on soft ground. Under these conditions, the set forward force, resulting from the low rate of retardation, is insufficient to cause the delay plunger of the fuze to function reliably. However, when set superquick (SQ), normal functioning may be expected.

(2) The conditions in (1) above apply particularly to —

<table>
<thead>
<tr>
<th>155-mm howitzer</th>
<th>Zones 1 and 2</th>
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<tbody>
<tr>
<td>8-inch howitzer</td>
<td>Zones 1 and 2</td>
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207. Fuze, Point Detonating: M56

a. General. The fuze M56 (fig. 72) is a supersensitive type used with 37-mm high-explosive projectile.

b. Data. Length, visible, 1.74 inches; overall, 2.21 inches; weight, 0.17 pound; thread size, 1.125-20NS-1.

c. Description. The fuze consists of two main parts: a head assembly and a body (L) containing a booster charge (M), and an interrupter (N) which holds a part of the explosive train connecting the booster with the detonator (H). The head assembly is made in three parts: the head (F), the detonator assembly (G), which screws into the base of the head proper, and a nose (B). The nose holds the firing pin (C) and screws into the upper end of the head in such a manner as to leave a recess below the firing pin. Half-blocks (E) and a coiled spring (D) are positioned in the recess to hold the firing pin in an unarmed position prior to firing. The front end of the nose is closed by a thin aluminum disk (A) for protection against foreign matter or air resistance. Safety in handling and boresafety are provided for by half-blocks and interrupter devices which hold the fuze in an unarmed condition until sufficient rotational force overcomes resistance of springs, setback, and friction.

d. Functioning. When sufficient rotational speed has been established to offset the resistances of springs, setback, and friction, the slider (J) of the interrupter moves outward, bringing the slider charge (K) into alignment with the detonator and booster. While in the bore, setback causes the firing pin to seat firmly in the half-blocks, preventing them from flying outward. Upon leaving the bore, the firing pin "creeps" forward and the half-blocks holding the firing pin in the unarmed position against the coiled flat steel spring then move outward under centrifugal force, leaving the firing pin in a "floating" position with an unobstructed passage to the detonator. In this position, the fuze is fully armed. Upon impact, the thin closing disk is perforated, or the head is crushed, depending on the force of impact. In either case, the firing pin is driven against the detonator. Action of the detonator is transmitted through the slider (J) to the booster which in turn causes the projectile to explode.

e. Preparation for Firing. There are no preparations.

Caution: Fuzes with perforated or imperfect closing disks will not be fired.

208. Fuze, Point Detonating: M57

a. General. The fuze M57 (fig. 73) is a single-action superquick type of the same size, shape, and weight as the fuze M48A3 or M51A5 without booster. It is essentially the same as the fuze M48A3 without a delay element. The fuze M57 is used primarily with 75-mm smoke cartridge, and in conjunction with the booster M22 in 105-mm smoke cartridge. As the booster M22 has no interrupter, the combination of fuze M57 and booster M22 is not considered as falling strictly within the definition of "boresafe." However, since the fuze itself contains an interrupter, the combination may be used under conditions requiring boresafety. The fuze M57 has been superseded for such use by the fuze M48A3 with 0.05-second delay in 75-mm smoke cartridge M61 and by the fuze M51A5 with 0.05-second delay in 105-mm howitzer smoke cartridge.
Figure 72. Fuze, point detonating: M56.
b. Data. Length, visible, 3.74 inches; overall 5.93 inches (including booster); weight 2.14 pounds; thread size of fuze, 1.7–14NS–1, of booster, 2–12NS–1.

c. Description. The superquick element is identical in construction and functioning to the fuze M48A3 or M51A5 without booster (pars. 205 and 206), except that there is no setting sleeve on the centrifugal interrupter and there is no delay assembly. All chemical (gas and smoke) cartridge M60 and all other ammunition for 105-mm howitzers M2A1, M4, and M49 (fitted with PD fuze M57 and booster M22) are, or will be prior to use, modified by having an aluminum safety disk inserted at the base of the flash hole between the fuze and the booster as shown on drawing 73–2–252, 20 May 1946. Following is an example of a changed marking: Cartridge, smoke, WP, w/fuze, PD, M57, Modified, for 105-mm Howitzers M2A1, M4, and M49.

Caution: Any ammunition encountered in the field fitted with PD fuze M57 but which does not include “MODIFIED” in the marking, as shown in the above example, will not be used.

d. Functioning. For details on functioning, see paragraph 206f.

e. Preparation for Firing. There are no preparations.

209. Fuze, Point Detonating: M74

a. General. The fuze M74 (fig. 74) is a point fuze containing a direct-action firing pin and a cylindrical rotor. The fuze is provided for use with the practice cartridge M92 in 37-mm subcaliber guns. It is used to ignite the black powder spotting charge of the cartridge and does not have or require a booster.

b. Data. Length, visible, 0.965 inch; overall, 1.43 inches; weight, 0.21 pound; thread size 1.125–20NS–1.

c. Description. The fuze consists of a zinc-alloy body recessed at the forward end to hold the firing pin and recessed again at about the middle of the fuze to hold a rotor housing and rotor assembly. The base is closed by a zinc-alloy plug which screws into the body, serving both to close the base of the fuze and to hold the rotor housing assembly firmly in position in its recess. The rotor housing is drilled through, at right angles to the vertical axis of the fuze, to provide a recess for the rotor. The rotor is a cylindrical steel assembly slotted and weighted with two lead plugs at one end and drilled in two places, one to hold the detonator, the only explosive assembly in the fuze, and the other to provide a recess for a U-shaped setback pin. In the unarmed or interrupted position, the rotor holds the detonator diagonally across the vertical fuze axis and away from the firing pin, providing for safety in handling and during firing. The rotor is locked in the unarmed position by the setback pin.

d. Functioning. Upon firing, setback causes the setback pin to move rearward into its recess. After the friction due to setback is overcome, the rotor is free to turn under the action of centrifugal force, thereby bringing the detonator in line with the firing pin. The firing pin remains in a “floating” position until impact, whereupon it is driven rearward into the detonator. The flash from the detonator ignites the black powder charge of the shell.

e. Preparation for Firing. There is no preparation for firing.

210. Fuze, Point Detonating: Concrete Piercing, M78 and M78A1 and Booster M25

a. General. The fuze M78 series (fig. 75) are constructed especially for use against concrete targets and are issued for use with high-explosive projectiles of 76-mm through 280-mm. The fuzes M78A1 are of two types: a nondelay type using delay plunger assembly M1 (nondelay), primarily for spotting purposes, and a delay type using delay plunger assembly M1 (0.025-second delay) for fire against concrete targets. The nondelay fuze has its nose painted white about 1 inch wide from the tip. Booster M25 is a separate assembly, but is packed and shipped with the fuze for assembly to the projectile at the time the projectile is to be fuzed. This booster is designed especially for use with the fuze M78 series and cannot be used with any other fuze.

b. Data. Length, visible, 2.68 inches; overall (fuze alone), 3.48 inches; weight (fuze alone), 2.09 pounds; thread size, 2–12NS–1.
Figure 72. Fuze, point detonating: M56.
b. Data. Length, visible, 3.74 inches; overall 5.93 inches (including booster); weight 2.14 pounds; thread size of fuze, 1.7–14NS–1, of booster, 2–12NS–1.

c. Description. The superquick element is identical in construction and functioning to the fuze M48A3 or M61A5 without booster (pars. 205 and 206), except that there is no setting sleeve on the centrifugal interrupter and there is no delay assembly. All chemical (gas and smoke) cartridge MD0 and all other ammunition for 105-mm howitzers M2A1, M4, and M49 (fitted with PD fuze M57 and booster M22) are, or will be prior to use, modified by having an aluminum safety disk inserted at the base of the flash hole between the fuze and the booster as shown on drawing 73–2–252, 20 May 1946. Following is an example of a changed marking: Cartridge, smoke, WP, w/fuze, PD, M57, Modified, for 105-mm Howitzers M2A1, M4, and M49.

c. Action: Any ammunition encountered in the field fitted with PD fuze M57 but which does not include “MODIFIED” in the marking, as shown in the above example, will not be used.

d. Functioning. For details on functioning, see paragraph 206f.

e. Preparation for Firing. There are no preparations.

209. Fuze, Point Detonating: M74

a. General. The fuze M74 (fig. 74) is a point fuze containing a direct-action firing pin and a cylindrical rotor. The fuze is provided for use with the practice cartridge M92 in 37-mm sub-caliber guns. It is used to ignite the black powder spotting charge of the cartridge and does not require or need a booster.

b. Data. Length, visible, 0.965 inch; overall, 1.43 inches; weight, 0.21 pound; thread size 1.125–20NS–1.

c. Description. The fuze consists of a zine-alloy body recessed at the forward end to hold the firing pin and recessed again at about the middle of the fuze to hold a rotor housing and rotor assembly. The base is closed by a zinc-alloy plug which screws into the body, serving both to close the base of the fuze and to hold the rotor housing assembly firmly in position in its recess. The rotor housing is drilled through, at right angles to the vertical axis of the fuze, to provide a recess for the rotor. The rotor is a cylindrical steel assembly slotted and weighted with two lead plugs at one end and drilled in two places, one to hold the detonator, the only explosive assembly in the fuze, and the other to provide a recess for a U-shaped setback pin. In the unarmed or interrupted position, the rotor holds the detonator diagonally across the vertical fuze axis and away from the firing pin, providing for safety in handling and during firing. The rotor is locked in the unarmed position by the setback pin.

d. Functioning. Upon firing, setback causes the setback pin to move rearward into its recess. After the friction due to setback is overcome, the rotor is free to turn under the action of centrifugal force, thereby bringing the detonator in line with the firing pin. The firing pin remains in a “floating” position until impact, whereupon it is driven rearward into the detonator. The flash from the detonator ignites the black powder charge of the shell.

e. Preparation for Firing. There is no preparation for firing.

210. Fuze, Point Detonating: Concrete Piercing, M78 and M78A1 and Booster M25

a. General. The fuze M78 series (fig. 75) are constructed especially for use against concrete targets and are issued for use with high-explosive projectiles of 76-mm through 280-mm. The fuzes M78A1 are of two types: a nondelay type using delay plunger assembly M1 (nondelay), primarily for spotting purposes, and a delay type using delay plunger assembly M1 (0.025-second delay) for fire against concrete targets. The nondelay fuze has its nose painted white about 1 inch wide from the tip. Booster M25 is a separate assembly, but is packed and shipped with the fuze for assembly to the projectile at the time the projectile is to be used. This booster is designed especially for use with the fuze M78 series and cannot be used with any other fuze.

b. Data. Length, visible, 2.68 inches; overall (fuze alone), 3.18 inches; weight (fuze alone), 2.09 pounds; thread size, 2–12NS–1.
Figure 73. Fuze, point detonating: M57.
c. Description. The fuze consists of a solid, hardened steel body with ogival nose, with a cylindrical well in the base end which holds an inertia firing mechanism. The firing mechanism used in the fuze M78 is similar to the delay plunger mechanism in the fuze M51A4 and the mechanism used in the fuze M78A1 is similar except in delay time to that of the fuze M51A5 (par. 206) (fig. 71). Safety devices consist of two plunger pins which hold the firing assembly in the unarmed position until acted upon by rotational forces, and arrangements within the booster M25 which prevent arming until setback and centrifugal forces operate. For a complete description of booster M25, see paragraph 274.

d. Preparation for Firing.

(1) When assembled to projectile, no further preparation or adjustment is necessary.

(2) The fuze and booster are assembled to the projectile as described below.

When a staked setscrew is used to retain the original fuze and booster in the projectile, the disassembly and assembly operations must be performed by or under supervision of Ordnance personnel; when no setscrew is present, defuzing and refuzing may be done by qualified artillery personnel.

(a) Examine fuze threads in the projectile and the threads on the booster M25 and fuze M78 to insure that they are in good condition. Do not use components with damaged threads.

(b) Remove the safety pin from the booster M25 and screw the booster into the booster cavity of the projectile. Tighten the booster firmly with booster end of fuze wrench M16. Boosters which are issued without safety pins should not be used.
Figure 74. Fuze, point detonating: M57.
c. Description. The fuze consists of a solid, hardened steel body with ogival nose, with a cylindrical well in the base end which holds an inertia firing mechanism. The firing mechanism used in the fuze M78 is similar to the delay plunger mechanism in the fuze M51A4 and the mechanism used in the fuze M78A1 is similar except in delay time to that of the fuze M51A5 (par. 206) (fig. 71). Safety devices consist of two plunger pins which hold the firing assembly in the unarmed position until acted upon by rotational forces, and arrangements within the booster M25 which prevent arming until setback and centrifugal forces operate. For a complete description of booster M25, see paragraph 274.

d. Preparation for Firing.

(1) When assembled to projectile, no further preparation or adjustment is necessary.

(2) The fuze and booster are assembled to the projectile as described below.

When a staked setscrew is used to retain the original fuze and booster in the projectile, the disassembly and assembly operations must be performed by or under supervision of Ordnance personnel; when no setscrew is present, defuzing and refuzing may be done by qualified artillery personnel.

(a) Examine fuze threads in the projectile and the threads on the booster M25 and fuze M78 to ensure that they are in good condition. Do not use components with damaged threads.

(b) Remove the safety pin from the booster M25 and screw the booster into the booster cavity of the projectile. Tighten the booster firmly with booster end of fuze wrench M16. Boosters which are issued without safety pins should not be used.
(c) Screw the fuze M78 into the fuze cavity and tighten it securely with the fuze end of fuze wrench M16. Make sure the fuze shoulder seats firmly against the nose of the projectile. There should be no space between the fuze shoulder and the projectile. Do not stake the fuze to the projectile.

(d) Some projectiles have a booster setscrew, but this plays no part in the use of fuze M78 and booster M25. If a setscrew is present in a projectile fused and boosted with fuze M78 and booster M25, the setscrew should be screwed tightly into the projectile so that no part of it protrudes outside of the ogival surface of the projectile.

211. Fuze, Point Detonating: M535 (T177E3)

The fuze M535 (T177E3), 0.05-second delay (fig. 76) is an impact-type fuze similar to the PD fuze M51A5 (par. 206). This fuze includes the booster M124 (T35E7) which incorporates a delayed arming feature. The fuze base (2-inch thread) is assembled directly into the projectile; the booster, which is a manufacturing component of the fuze, is screwed into the base of the fuze. Other data is classified.

212. Fuze, Point Detonating, Self-Destroying: T234E2

a. General. The fuze T234E2 (fig. 77) is a point detonating self-destroying fuze, developed for use in the 75-mm HE cartridge T50E2. After the cartridge travels 60 to 200 feet from the gun, the fuze will function if either nose or graze impact occurs within 30 seconds of flight time, decreasing of rate of projectile spin will cause the fuze to detonate the cartridge.

b. Data. Length 5.976 inches (max.), visible length 3.761 inches, weight 2.03 pounds, thread 2-12NS-1.

213. Fuze, Point Detonating: M507

a. Description. The fuze M507 is a dual purpose (superquick or delay) point detonating fuze for use on the HE projectile M73 fired from the 120-mm antiaircraft cannon. The fuze is boresafe delay arming. Boresafety is provided by the canted interrupting plunger in the fuze body, by the canted plunger pins in the delay plunger assembly, and by the displaced booster detonator. The fuze includes the booster T35E7. The fuze weighs approximately 2.85 pounds.
b. **Preparation for Use.** The fuze is assembled and shipped with one setting sleeve set on "SQ." If delay action is required, the setting sleeve slot must be set on "DELAY" prior to loading the projectile in the gun.

c. **Ballistic Data.** The fuze has a delayed arming distance of 75 to 100 feet from the gun muzzle.

214. **Fuze, Point Detonating: M508**

a. **Description and Use.** The fuze M508 (fig. 78) is a single-action point detonating (PD) type for use with 105-mm, 155-mm, and 8-inch chemical (gas or smoke) projectiles. The fuze is boresafe and detonator safe. Upon impact, the firing pin fires the detonator. The flash from the detonator passes through the flash tube and flash hole, ruptures the body closing disk, and ignites the detonator assembly in the booster. The detonator assembly initiates the closing cup charge which in turn functions the booster pellet. Delayed arming is provided by an interrupter and the booster M125. Centrifugal force causes the interrupter to move outwards clearing the flash path thereby arming the forward part of the fuze. The delayed arming mechanism in the booster consists essentially of a rotor which carries a detonator assembly, two rotor detents with their springs, and a gear train. Prior to firing, the detonator assembly is held "out-of-line" with respect to the fuze explosive train by means of the rotor. After firing, the rotor and rotor detents move out under centrifugal force, causing the rotor to turn; also, centrifugal force causes the gear train to turn. When the detonator assembly reaches the "in-line" position, the fuze is armed. The rotor is locked in the armed position by a pin and ball combination. To reach the armed position, the booster requires approximately 150 to 300 feet of projectile travel depending on the velocity and spin rate of the projectile.

b. **Setting.** This fuze requires no setting or other preparation for firing.

c. **Care, Handling, and Preservation.** General information concerning the care, handling, and preservation of ammunition that is set forth in TM 9–1903 is also applicable to this fuze.

d. **Precautions in Firing.** This fuze is not to be fired in rain or snow as premature functioning may occur.

![Figure 76. Fuze, point detonating: M508 (T177E3).](image-url)
Figure 77. Fuze, point detonating, self-destroying: T224E2.

Figure 78. Fuze, point detonating: M508 (T227E1).
215. Fuze, Point Detonating: Mk 27 (Navy)

Note. The key letters shown below in parentheses refer to figure 79.

a. General. The fuze Mk 27 is a point detonating fuze of Navy origin which has been standardized for Army procurement for use with 40-mm high-explosive ammunition. It is a single-action superquick type constructed to function on light impact.

b. Data. Length, visible, 1.9 inches; overall, 2.45 inches; weight, 0.22 pound; thread size, 1.18–14NS–2.

c. Description. The fuze mechanism consists of a firing pin (L), a striker (K), and a rotor assembly (F) holding a disk-shaped rotor (C). The explosive train consists of a detonator (D), a tetryl booster lead (B), and a tetryl booster charge (A). The fuze is made up of two major parts: a body (J) recessed to hold the firing pin with its striker and the rotor assembly, and a base plug which holds the booster lead and booster charge. The base plug also serves to seat the rotor assembly securely in its recess when the fuze is assembled. The rotor is seated in the rotor assembly so that it can revolve only on an axis perpendicular to the major axis of the fuze, and normally holds the detonator out of alignment with both the booster and the firing pin. Two centrifugally actuated plunger pins (E), under spring tension, lock the rotor in the unarmed position until a prescribed minimum centrifugal force has been established. A bushing (H), in the forward end of the rotor assembly recess, forms a guide for the firing pin. A peg-like striker (K) is secured to the forward end of the firing pin and occupies a narrow recess extending almost to the front end of the fuze, providing for increased sensitivity on impact. The firing pin is supported by two spring-held plunger pins (G) until sufficient centri-

fugal force has been established after firing to overcome the resistance of the plunger springs.

d. Functioning. No action takes place upon firing until a prescribed centrifugal force has been set up by rotation of the projectile in its travel, whereupon the plunger pins holding the rotor and those supporting the firing pin move outward. Upon release from its pins, the rotor revolves, bringing the detonator into alignment with the firing pin and the booster. Upon the outward movement of its plunger pins, the firing pin has an unobstructed passage to the detonator, but remains at the forward end of the fuze until impact, due to creep action. On impact, the striker rebounds from the impact, which is transmitted through the thin front section of the nose and forces the firing pin against the detonator. Action of the detonator is transmitted to the lead and booster charge, whereupon functioning of the booster charge causes the shell to explode.

e. Preparation for Firing. There is no preparation for firing.

216. Fuze, Time and Superquick: M54

Note. The key letters shown below in parentheses refer to figure 80.

a. General. The fuze M54 is a combination time and superquick fuze with settings for time action (to 25 seconds) and for superquick action. The fuze is used with fixed, semi-fixed, and separate-loading base-ejection smoke and illuminating projectiles. The fuze M54 is of the same size, shape, and weight as the fuze M48A2 (par. 205). It is identical with the fuze M55 series except that the fuze M55 models have a booster assembled to the fuze.

b. Data. Length, visible, 3.78 inches; overall, 4.59 inches; weight, 1.42 pounds; thread size, 1.7–14NS–1.
Figure 79. Fuze, point detonating: Mk 27 (Navy).
Figure 79. Fuze, point detonating: Mk 27 (Navy).
Figure 80. Fuze, time and superquick: M34.
c. Description. The fuze consists of three major parts: a closing cap or head (A) containing the superquick impact elements (B, C, and E) and the time-action plunger (F); two time-train rings, one fixed (K) and the other movable (graduated) (P); and a body (R) containing a time-action striker (H) and primer (V), a magazine charge (T), and an interrupter (S). The superquick action is identical in construction and functioning with that in fuze M48A3 except that the interrupter incorporated in the body of the fuze has no setting sleeve, being automatic and always operative regardless of fuze setting. Hence, the fuze will function on impact unless prior functioning has been caused by the time action. The time action is typical of powder-train types and is initiated upon firing by the time-action plunger under setback. The fixed upper and movable lower time rings have a tunnel-shaped slot or groove in their lower surfaces which is filled with compressed black powder (N). One end of the lower ring powder train is connected by a black powder pellet (U) with the upper ring train; one end of the upper train is connected by a pellet (L) with the primer. Movement of the lower ring in relation to the fixed upper ring and a pellet (Q) in the body determines the time of functioning. Counterclockwise turning of the lower ring (viewed from the point of the fuze) lengthens the time by increasing the amount of powder which must burn in the upper and lower rings before the flame reaches the pellet in the body and is transmitted thereby to the body and magazine charges. For setting purposes, the lower ring is graduated to 25 seconds, with 0.2-second graduations, and a register line is engraved on the body.

d. Safety Devices. When used with the booster M20 or M21 series, boresafety is provided by the arrangement of the booster mechanism. Provision is made also for boresafe superquick action by the interrupter, which shuts off the superquick flash hole (J) until sufficient rotational speed has been established. A metal cup-shaped support (C), which is sufficiently strong to withstand initial setback, holds the superquick element firing pin (B) away from the detonator (E) until impact at the target. When the fuze is set safe (“S”), the time-train rings are positioned so that either or both may burn without causing functioning of the succeeding elements in the time train. To prevent functioning within dangerously short time limits, a safety disk incorporated in the lower time ring covers the body pellet and prevents its ignition when the fuze is set at less than 0.4 second. A pull (safety) wire (D) and a shear pin (G) are fitted in the time-action plunger to prevent accidental functioning of the plunger prior to firing. The safety pull wire must be removed before firing.

e. Functioning. Upon firing, with the safety wire removed, setback causes the time-action plunger to shear the shear wire and force the striker against the primer. The primer flash ignites the black powder pellet and the train in the upper time ring, which then burns at a relatively uniform rate. The burning progresses until the flame contacts and ignites the pellet of the graduated (lower) time ring, unless the fuze is set at safe (“S”). In this event, flame of the upper train cannot contact the graduated time-ring pellet since the lower-ring pellet is covered by the solid part of the upper ring, and time action stops at this point. Upon ignition, the pellet in the lower ring transmits the flame to the graduated time-ring powder train, which burns in manner similar to that of the upper ring. After burning for a time determined by the fuze setting, the flame contacts and ignites the black powder pellet in the fuze body unless the setting is less than 0.4 second. In this event, the flame is interrupted before making contact with the body pellet, and time action is stopped at this point. When ignited, the body pellet transmits the flame to the body charge and, thereby, to the magazine charge. This charge initiates action of the booster unless prior functioning has been caused by the superquick action on impact. The superquick action becomes armed when sufficient rotational speed has been established to force the slider of the interrupter outward against the resistance of its spring and thereafter remains operative until impact unless the time action has completed its functioning during flight. Upon impact, the firing pin support collapses and the firing pin strikes the superquick detonator.
Action of the detonator is transmitted directly to the projectile through the uninterrupted flash hole. The fuze will function on impact, therefore, with superquick action, when the time setting is set for a time greater than the time of flight or otherwise fails to complete its functioning. The gases formed by the burning of the powder train escape through vents (M) in both time rings.

f. Preparation for Firing. Prior to firing, with either superquick or time setting, the safety pull wire must be removed from the fuze (pull free end of wire off and out of hole). If superquick action is required, the graduated time ring can be left as shipped at safe ("S") or be set for a time greater than the time of flight. If time action is required, the graduated time ring is set for the required time of burning by means of a fuze setter.

217. Fuze, Time and Superquick: M55 and Modifications

a. Description. The fuzes M55A3, M55A2, M55A1, and M55 (fig. 81), which are employed with HE projectile primarily for high burst ranging, are identical in every respect with fuze M54 (par. 216) except that booster M21A4, M21A2, M21A1, or M21, respectively, is a manufacturing component of the fuze. The only difference between the fuzes M55A3 and M55 is in the booster with which each is assembled. See paragraphs 269 through 276 for a description of the boosters.

b. Data. Length, visible, 3.78 inches; overall, 5.99 inches (including booster); weight 2.16 pounds (including booster); thread size of fuze, 1.7–14NS–1, of booster, 2–12NS–1.

c. Preparation for Firing. The fuzes are shipped separately from the projectile with which they are used, for assembling to the projectile in the field. This is done by:

1. Removing the shipping plug from the projectile.
2. Examining all threads to insure that no foreign matter is present which may interfere with proper assembly.
3. Screwing the fuze with booster into the fuze hole by hand, then tightening with fuze wrench M18.
4. When thus assembled to the projectile, the fuze is set for the required action as described in paragraph 216 for the fuze M54.

Figure 81. Fuze, time and superquick: M55A3.
218. Proximity Fuzes

a. General. The fuzes, designed as proximity, also have been termed "Posit," "VT," "Buck Rogers," "Special," "Influence," and "Bonzo." In effect, proximity fuzes are automatic time fuzes. Without "setting" or adjustment, they detonate the missiles that carry them on approach to the target at the most effective point on their trajectories. Artillery proximity fuzes are essentially combination self-powered radio transmitting and receiving units. In flight, the armed fuze broadcasts radio waves. Those radio wave fronts which are reflected back from airplane, ground, or water to the moving projectile, interact with the transmitted wave. When this interaction of transmitted and reflected waves, resulting in ripples or beats, reaches a predetermined intensity, it trips an electronic switch, which then permits an electric charge stored in the firing capacitor (condenser) to flow through an electric firing squib. The proximity fuzes can be used only in deep-cavity projectile (booster cavity is 2.75 inches deeper than for PD, MT, and TSQ fuze booster cavities) without the supplementary bursting charge.

b. Data. Length, visible, 3.74 inches; overall, 8.6 inches; weight, 2.7 pounds; thread size, 2–12NS–1.

c. Characteristics. Newer-type proximity VT fuzes, M515 and M514 are designed for "bracket-arming" for antiaircraft artillery use and "adjustable delay arming" for field artillery use. VT fuze, M515 (par. 229) is of the "bracket-arming" type. This fuze has a time ring that must be set to the predicted time-to-target. When fired, the VT element of the fuze becomes armed a short time pretarget and functions on proximity approach to the target. In the event the fuze does not come within the influence range of a suitable target, the fuze will cause self-destruction of the shell at a time slightly greater than the set time. The fuze also contains an impact element that will function the shell if impact with a resistant object occurs at any time after arming of the impact element but before arming and functioning of the fuze by the proximity element. VT fuze M514 is of the "adjustable delay-arming" type. This fuze has a graduated time scale that must be set to correspond with the predicted time-to-target. The fuze becomes armed a short time pretarget and functions the projectile on proximity approach to the target. This fuze also contains a superquick impact element that will detonate, on impact, any shell that fails to function normally on proximity approach to the target.

d. Care, Handling, and Preservation.

(1) Temperature. Refer to paragraph 11q for storage and handling conditions.

(2) Weather conditions. Darkness has no effect on the functioning of proximity fuzes. Heavy rain or clouds containing rain, ice, hail, or snow may materially increase the malfunction rate of antiaircraft, and early types of field artillery proximity fuzes by causing early bursts. Occurrence of malfunctioning due to clouds may be anticipated when clouds having sufficient reflectivity to be apparent on S-band type radar target indicators are encountered. In cases where malfunctioning due to clouds or rain is so frequent it is objectionable, temporary substitution of mechanical time fuzes for proximity fuzes may be necessary.

(3) Moisture. Although proximity fuzes are nearly waterproof, exposure to damp climates may increase the number of duds. In all but tropical climates, fuzes can be used safely after 2 months' storage outside their original packing containers. In tropical climates, the storage time of unpacked fuzes should be kept to a minimum. Contact with rain or immersion in water will hasten deterioration. The earlier types and models of fuzes will not be affected by dampness if stored in their original sealed metal containers, provided the container is not damaged in such a manner as to permit air to enter. Proximity fuze models M504A1, M504A2, T73E9, M513 (T226) series and M514 (T227) series are waterproofed at time of manufacture and can remain outside

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the hermetically sealed container for a minimum of 2 years under normal conditions without undergoing any deterioration. To insure the best performance from all proximity fuzes, they should not be removed from the hermetically sealed container any sooner than is necessary.

(4) Resistance to shock. Proximity fuzes will withstand normal handling without danger of detonation or damage when in their original packing containers or when assembled to projectiles. However, care should be taken not to strike or drop the fuzes or fuzed rounds and projectiles as these actions may increase the number of duds. Excessive rough handling may increase the number of duds, but will not decrease fuze safety. A drop of 4 feet in certain positions may cause the electrolyte vial in the reserve-type battery to break, resulting in a dud when the fuze is fired.

219. Description of Projectiles Used with Proximity Fuzes

Deep-fuze-cavity projectiles of recent manufacture (fig. 82) are issued with a removable TNT pellet (CHARGE, supplementary, TNT, for artillery projectile, Pc Mk 75–14–468A) (fig. 83) placed in the deep-fuze cavity. Use of the supplementary charge adapts deep-fuze-cavity projectiles for use with any authorized standard mechanical-type fuze (fig. 82). In some calibers of ammunition, deep-fuze-cavity projectile of older manufacture was issued without a supplementary charge but with a closing plug in lieu of a fuze. Table VII lists the models of deep-fuze-cavity projectile for the various calibers of weapons using these proximity fuzes. The projectiles are issued assembled with supplementary charge and fuze or closing plug or with supplementary charge and eyebolt lifting plug as indicated in table VII.

<table>
<thead>
<tr>
<th>Model of deep-fuze-cavity projectile</th>
<th>Caliber and type of weapon in which fired</th>
<th>Model of fuze or type of plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>M48</td>
<td>75-mm howitzer cannon</td>
<td>MTSQ M500 series; PD M51 series; TSQ M55 series; or w/closing plug.</td>
</tr>
<tr>
<td>M71</td>
<td>90-mm gun-cannon</td>
<td>MT M43 series; MTSQ M500 series; M502 series, M51 series; TSQ M55 series; or w/closing plug.</td>
</tr>
<tr>
<td>M1</td>
<td>105-mm howitzer cannon</td>
<td>MTSQ M500 series; PD M51 series; TSQ M55 series; or w/closing plug.</td>
</tr>
<tr>
<td>M73</td>
<td>120-mm gun cannon</td>
<td>MT M61 series; or w/closing plug.</td>
</tr>
<tr>
<td>M101</td>
<td>155-mm gun cannon</td>
<td>Eyebolt lifting plug.</td>
</tr>
<tr>
<td>M107</td>
<td>155-mm howitzer cannon</td>
<td>Eyebolt lifting plug.</td>
</tr>
<tr>
<td>M106</td>
<td>8-inch howitzer cannon</td>
<td>Eyebolt lifting plug.</td>
</tr>
<tr>
<td>M124A1</td>
<td>280-mm gun cannon</td>
<td>Eyebolt lifting plug.</td>
</tr>
</tbody>
</table>
Figure 82. Deep-fuze-cavity projectile — disassembled view.
Figure 83. Components used with deep-fuze-cavity projectile

- Cardboard Spacer
- Closing Plug
- Charge, Supplementary, for Artillery Shell
- Eyebolt Lifting Plug

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220. Preparation of Projectiles and Proximity Fuze for Use

a. General. After removal from packing materials, fuzes and projectiles are prepared for firing as indicated in b through e below. Rounds prepared for firing but not fired will be returned to their original condition and packings and will be appropriately marked as described in e below. Safe temperature range for storage and use are given in paragraph 11q. The "special instruction card" which is packed with each box of proximity fuzes should always be checked before proximity fuzes are used.

b. Authorized Usage of Fuze. These fuzes may be used as indicated in table VIII.

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Caliber and model of weapon</th>
<th>Cartridge or projectile used</th>
<th>Conditions of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>M515 series (T225 and mods).</td>
<td>90-mm gun cannons M1A2, M1A3, M2A1, and M2A2.</td>
<td>M71</td>
<td>For antiaircraft firer only. Minimum quadrant elevation 400 mils with fuze set to &quot;15&quot; seconds or above, minimum 200 mils with fuze set below &quot;15&quot; seconds.</td>
</tr>
<tr>
<td></td>
<td>75-mm howitzer cannon M1A1.</td>
<td>M48</td>
<td></td>
</tr>
<tr>
<td>M513 series (T226 and mods).</td>
<td>90-mm gun cannons M1A2, M1A3, M2A1, and M2A2.</td>
<td>M71</td>
<td>For terrestrial firer only.</td>
</tr>
<tr>
<td></td>
<td>105-mm howitzer cannons M2A1, M4, and M49.</td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120-mm gun cannons M1, M1A1, and M1A2.</td>
<td>M73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>155-mm gun cannons M2 and M46</td>
<td>M101</td>
<td></td>
</tr>
<tr>
<td></td>
<td>155-mm howitzer cannons M1 and M45</td>
<td>M107</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8-inch howitzer cannon M2.</td>
<td>M106</td>
<td></td>
</tr>
<tr>
<td></td>
<td>280-mm gun cannon M66 (T131.)</td>
<td>M124 and M124A1.</td>
<td>For terrestrial firer only.</td>
</tr>
</tbody>
</table>

1Proximity fuse T225 is for antiaircraft use and is not reliably effective against other types of targets. It can be employed against terrestrial targets in an emergency but is less satisfactory than proximity fuse T226 for this purpose.

2Proximity fuse T227E2 and subsequent modifications may be used in the 280-mm gun cannon. Proximity fuzes T227 and T227B1 are not suitable for use in this weapon.

c. To Prepare 90-mm HE Projectiles for Use with Proximity Fuze M515 or M513; and 75-mm, 105-mm, and 120-mm Projectiles with Proximity Fuze M513. These deep-cavity projectiles are issued assembled with either standard mechanical-type fuzes or closing plugs and are prepared for firing with proximity fuzes as indicated in (1) through (4) below.

(1) Place the complete round (or 120-mm projectile) to be refuzed (or fuzed) on its side.

Caution: Protect the primer in the base of the cartridge case from being struck or damaged and the cartridge case from being dented.
(2) Remove the assembled fuze by inserting fuze wrench M18 (fig. 84) in the fuze wrench slots and striking the wrench handle sharply in a counterclockwise direction (as viewed from the front) to loosen the fuze from the projectile. Care should be taken not to strike any part of the fuze. Remove the fuze. For the fuzed 120-mm projectile, use fuze wrench M19 to remove the fuze assembled thereto. Removal of the fuze from the projectile does not constitute disassembly (taking apart) of the fuze, which is prohibited.

(3) If the round (or projectile) is assembled with a closing plug instead of a fuze, remove the plug and gasket with an appropriate wrench.

(4) Remove the supplementary charge (and spacer if present) by means of its lifting loop. Proceed as indicated in d(3) through (6) below.

d. To Prepare 155-mm, 8-inch and 280-mm HE Projectile for Use with Proximity Fuze M514 (or Its Modification as Authorized in Table VIII). These deep-cavity projectiles are prepared for firing with proximity fuze as indicated in (1) through (5):

1) Remove the eyebolt lifting plug gasket and grommet from the projectile.

2) Remove the spacer and the supplementary charge, if present, from the projectile cavity.

3) Remove the fuze from its metal container. Handle the fuze carefully. The fuze requires no preparation prior to assembly to the projectile. Safety wires or cotter pins are not provided nor required. The boosters are screwed to the fuzes with a left-hand thread. Boosters which appear to be loose should be tightened firmly by hand. Do not stake the booster.

4) Screw the proximity fuze into the fuze cavity by hand. If binding occurs, inspect the fuze cavity and threads of both projectile and fuze. Reject the component at fault.

Figure 84. Fuze wrench M18 for artillery fuzes.
220. Preparation of Projectiles and Proximity Fuzes for Use

a. General. After removal from packing materials, fuzes and projectiles are prepared for firing as indicated in b through e below. Rounds prepared for firing but not fired will be returned to their original condition and packings and will be appropriately marked as described in e below. Safe temperature range for storage and use are given in paragraph 11q. The “special instruction card” which is packed with each box of proximity fuzes should always be checked before proximity fuzes are used.

b. Authorized Usage of Fuzes. These fuzes may be used as indicated in Table VIII.

Table VIII. Authorized Use of Proximity Fuzes

<table>
<thead>
<tr>
<th>Fuzes</th>
<th>Caliber and model of weapon</th>
<th>Cartridge or projectile used</th>
<th>Conditions of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>M515 series (T225 and mods).</td>
<td>90-mm gun cannons M1A2, M1A3, M2A1, and M2A2.</td>
<td>M71</td>
<td>For antiaircraft fire only. Minimum quadrant elevation 400 mils with fuze set to “15” seconds or above, minimum 200 mils with fuze set below “15” seconds.</td>
</tr>
<tr>
<td></td>
<td>75-mm howitzer cannon M1A1.</td>
<td>M48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>105-mm howitzer cannons M2A1, M2A2, M2A3, M3A1, and M19.</td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120-mm gun cannons M1, M1A1, and M1A2.</td>
<td>M73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>155-mm gun cannons M2 and M46.</td>
<td>M101</td>
<td>For terrestrial fire only.</td>
</tr>
<tr>
<td></td>
<td>155-mm howitzer cannons M1 and M45.</td>
<td>M107</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8-inch howitzer cannon M2.</td>
<td>M106</td>
<td></td>
</tr>
<tr>
<td></td>
<td>280-mm gun cannon M66 (T131.)</td>
<td>M124 and M124A1.</td>
<td></td>
</tr>
<tr>
<td>M514 series (T227 and mods).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Place the complete round (or 120-mm projectile) to be refuzed (or fuzed) on its side.

Caution: Protect the primer in the base of the cartridge case from being struck or damaged and the cartridge case from being dented.

Footnotes:

3Proximity fuze T225 is for antiaircraft use and is not reliably effective against other types of targets. It can be employed against terrestrial targets in an emergency but is less satisfactory than proximity fuze T226 for this purpose.

3Proximity fuze T227E2 and subsequent modifications may be used in the 280-mm gun cannon. Proximity fuzes T227 and T227R1 are not suitable for use in this weapon.

c. To Prepare 90-mm HE Projectiles for Use with Proximity Fuze M515 or M513; and 75-mm, 105-mm, and 120-mm Projectiles with Proximity Fuze M514. M515: These deep-penetrating projectiles are assembled and assembled with either standard mechanical fuze of case fuze or are prepared for firing with proximity fuzes as indicated in (1) through (4) below.
(2) Remove the assembled fuze by inserting fuze wrench M18 (fig. 84) in the fuze wrench slots and striking the wrench handle sharply in a counterclockwise direction (as viewed from the front) to loosen the fuze from the projectile. Care should be taken not to strike any part of the fuze. Remove the fuze. For the fuzeed 120-mm projectile, use fuze wrench M19 to remove the fuze assembled thereto. Removal of the fuze from the projectile does not constitute disassembly (taking apart) of the fuze, which is prohibited.

(3) If the round (or projectile) is assembled with a closing plug instead of a fuze, remove the plug and gasket with an appropriate wrench.

(4) Remove the supplementary charge (and spacer if present) by means of its lifting loop. Proceed as indicated in (4)(3) through (6) below.

**END FOR SETTING M48 AND M51 TYPE FUZES**

**Figure 84. Fuze wrench M18 for artillery fuzes.**
(5) Tighten the fuze to the projectile, using fuze wrench M18. Use only such force as can be applied to the wrench handle. If the fuze cannot be tightened to form a good seat between the projectile and the fuze, reject the component at fault.

_Caution:_ Do not hammer on the fuze wrench. Do not use an extension handle on the fuze wrench. Do not stake the fuze to the projectile under any circumstances. Any large shocks transmitted to the proximity fuzes during assembly operations may increase the percentage of duds.

e. Projectiles Prepared for Firing but not Fired.

(1) Projectiles prepared for firing but not fired will either be returned to their original packing or will be defuzed and the components returned to their original condition and packings. If projectiles fuzed with proximity fuze M515 or M513 are to be transported in a fuzed condition, they should be handled as indicated in paragraph 218. It is not considered advisable to transport projectiles fuzed with proximity fuze M514.

(2) If the projectiles are to be defuzed and the components returned to their original condition and packings, proceed as indicated in (a) through (g) below.

(a) Place the round on its side.

_Caution:_ Protect the primer in the base of the cartridge case of fixed and semifixed rounds from being struck or damaged and the cartridge case from being dented.

(b) Remove the fuze from the projectile, using fuze wrench M18.

(c) Replace the supplementary charge and spacer, if originally present, into the projectile cavity.

(d) Assemble the original fuze, closing plug, or eyebolt lifting plug to the projectile by hand. Tighten the fuze securely with fuze wrench M18 (M19 for 120-mm projectile); use an appropriate wrench or tool for tightening closing plugs or eyebolt lifting plugs.

(e) Return the fuzed or plugged projectile to its original packings whenever possible. If this is not possible, correct the markings on the container to correctly identify the contents of the package. If necessary, completely deface the old marking before applying the new. Replace the proximity fuze into its original packings, on tear-type containers; seal the opening with adhesive tape or similar seals.

(f) Opened packings of rounds and components will be marked with the correct description and identification and any other pertinent information including date of opening.

(g) Rounds and fuze prepared for firing but not fired will be used first in subsequent firings in order that stocks of opened packings may be kept to a minimum.

221. Fuze, Proximity: M504A2, M504A1 (T75E7), and M504 (T75E6)

a. _Description._ The fuzes M504 series are long contour proximity fuzes provided for use with the 120-mm deep-cavity high-explosive projectile M73 in antiaircraft fire. Boresafety is provided by an arming switch which delays arming of the fuze. The fuzes M504A2, M504A1, and M504 have similar characteristics.

b. _Setting._ No setting is required. Any attempt to set these fuzes may result in malfunction. When the firing projectiles fitted with these fuzes, the automatic fuze setter for the weapon should be disconnected.
222. Fuze, Proximity: M513A1 (T226E2), M513A2 (T226E3), M513B1 (T226B1), and M513 (T226)

a. Description. These fuzes (fig. 85) are of the "adjustable delay arming" type provided for use in field artillery projectiles from 75-mm to 105-mm, inclusive, against terrestrial targets. The fuze, which is similar in external appearance to the proximity fuze M515 (T225), may be identified by the markings thereon. The metal base is provided with a graduated time scale with graduations from 5 to 100 seconds. A movable time ring, with register line, is used to set the fuze to the appropriate time. A superquick impact element is mounted internally in the nose of the fuze. No self-destruction element is provided. The set time should usually be the same as the "time-to-target" to insure maximum time of unarmed flight of the proximity element.

b. Setting. When set on 5 to 100 seconds, the proximity element becomes armed approximately 3 seconds prior to set time. The proximity element will function on proximity approach (at optimum distance) to any land or water mass. The impact and proximity circuits are armed independently. While proximity arming is a function of time setting, impact arming occurs independently at approximately 3 seconds after firing regardless of the fuze time setting. The fuze M513 (T226) differs from the fuze M513A1 (T226E2) in that, when the fuze is set on 5 to 100 seconds, the proximity element and the impact element become armed approximately 3 seconds prior to the set time. When fired set on the shipping line, proximity arming occurs at approximately 8 seconds; when set in the slot (notch) on "PD," the proximity portion is not activated and the fuze will function as a PD fuze. The fuze M513 (T226) is ½ pound heavier than the fuzes M513A1 (T226E2) and M513B1 (T226B1). The fuzes M513 (T226) and M513B1 (T226B1) have an "S" (shipping line) marking in the slot (notch) instead of "PD" as in the case of the fuze M513A1. There is little hazard in firing the fuzes M513 over friendly territory, except in the case of personnel or installations close to the target area. If personnel are in the target area, proper consideration should be given to the following:

1. Avoid firing 105-mm projectiles at targets that are closer than 350 yards to friendly positions.

2. If firing over crests or ridges, arming should be set to be delayed until the projectile has passed the irregularity, unless the irregularity should be cleared by 70 yards or more.

3. When projectiles are approaching the target area at small angles of approach, the area between the point of full arming of the proximity element and the target may be sprayed by fragments from occasional bursts. At larger angles of approach, any such projectile fragments decelerate and usually reach state of free fall and do not constitute a serious hazard.

4. When set for delay arming, air observation posts may safely be used to direct fire but they should avoid the region between the gun and target. The part that is close to the target should particularly be avoided. To avoid danger from normal or early bursts, aircraft should approach the trajectory or target area not closer than 350 yards for 105-mm projectiles.

5. Time settings are made in the same manner as for the corresponding mechanical time fuze: while looking down on the nose of the fuze, rotate the fuze setter M28 (T46) in a clockwise direction.

Note. Proximity fuze M513 series is for use against terrestrial targets only and is not reliable against airborne targets.
223. Fuze, Proximity: M514A1 (T227E2), M514B1 (T227B1), and M514 (T227)

These fuzes are of the "adjustable delay arming" type of fuze provided for use with 155-mm and larger projectiles against terrestrial targets. The fuzes are similar to the M513 series (par. 222) and identical in appearance. Data on the M513 series is applicable to the M514 series fuzes, except paragraph 222b (1) through (4). Several modifications exist, resulting in improved technical characteristics and design, but will not effect the operation of the fuzes. The impact elements of proximity fuzes M513, M513B1, M514, and M514B1 are not normally operable unless the fuze is armed for proximity action. Avoid firing 155-mm projectiles at targets that are closer than 800 yards to friendly positions. Friendly aircraft should not be closer than 800 yards from the target when firing 155-mm projectiles.

224. Fuze, Proximity: M515 (T225)

a. Description. This fuze (fig. 86) which is a "bracket arming" type, incorporates features that make it usable with 90-mm deep-cavity HE projectiles. The fuze has a plastic nose which is fitted to a movable time ring and a metal base. The metal base is provided with a graduated time scale; graduations are from 3 through 27 seconds. A movable time ring, with register line, is used to set the fuze to the appropriate time. A superquick element and a self-destruction element are contained in the fuze. The impact element is mounted internally and is hidden from view by the plastic nose. It is recommended that the time ring on the fuze be set to the predicted time-to-target. When fired, regardless of time setting, the impact element arms at approximately 500 feet from the muzzle of the gun. At (predicted time-to-target) settings of 3 seconds or greater than 3 seconds, the proximity element of the fuze becomes armed at approximately 2 seconds prior to the set time, and will then detonate the projectile upon proximity approach (within approximately 60 feet) of a suitable airborne target. If no suitable target is encountered, the self-destruction element will detonate the projectile at approximately 2 seconds after set time. The impact element will cause the fuze to function with superquick action, if impact with a resistant object occurs at any time after arming of the impact element but before arming of the proximity element. If the fuzed projectile does not come within the influence radius of a suitable aerial target and the proximity element and the self-destruction element fail, the impact element will cause the projectile to function upon impact with the ground.

b. Setting. There are three markings in addition to the time scale graduations on the metal base. The markings are "SD-14," "SD-17," and "MAX." When set on "SD-14" in the slot (notch), proximity arming occurs at 0.3 second and self-destruction occurs at 14 seconds. When set on the "SD-17" registration line, proximity arming occurs at 0.3 second and self-destruction occurs at 17 seconds. When set on "MAX,"
the fuze is activated at 26 seconds; proximity arming occurs at 27 seconds and self-destruction is performed by reed spin switch at approximately 45 seconds (depending on gun elevation and barrel wear). PD action can still occur from approximately 500 feet from the muzzle of the gun. At any setting from 3 to 27 seconds, the fuze will be activated at target time minus 3 seconds and fully armed at target minus 2 seconds. Self-destruction will occur at 18 seconds when set on 8 seconds, and at target time plus 2 seconds on any setting of 4 through 27 seconds. With any of the above settings, the impact circuit is armed at 0.2 second after firing. When firing at airborne targets over friendly territory, it is important that each projectile burst at a safe height above the ground. The height of burst must be great enough to permit projectile fragments to decelerate to the velocity of free fall. For normal antiaircraft use in the 90-mm weapon, the fuze is usually set by means of the manual fuze setter M13A1 or M13 or by means of an automatic fuze setter.

Note. Proximity fuze M515 is for antiaircraft use and is not reliably effective against other types of targets. It can be employed against terrestrial targets in an emergency but for this purpose it is less satisfactory than proximity fuze M516 series.

225. Fuze, Proximity: M516A1 (T73E10), M516B2 (T73E14), M516B1 (T73E13), and M516 (T73E12)

a. Description. These fuzes are provided for use with 75-mm HE cartridge against airborne targets. The fuze has a plastic nose fitted to a metal base. No time settings are provided for the fuze. Boresafety is provided by an arming switch which delays arming of the fuze for a preset time. A shell-destroying (SD) element is also incorporated. The shell-destroying switch causes the armed fuze to detonate when the spin of the projectile drops to a preset value. This feature of the fuze is intended to detonate the projectile sufficiently high on the descending branch of the trajectory to prevent injury to friendly troops and damage to friendly installations. The fuze M516A1 (T73E10) incorporates an impact element in the nose, which becomes armed within 400 to 750 feet from the muzzle of the weapon. The proximity element of the fuzes M516 series armed at approximately 0.8 second after leaving the muzzle of the weapon.

b. Setting. No setting is required. Any attempt to set this fuze may result in a malfunction.

Figure 86. Fuze, proximity: M515.
223. Fuze, Proximity: M514A1 (T227E2), M514B1 (T227E1), and M514 (T227)

These fuzes are of the “adjustable delay arming” type of fuze provided for use with 155-mm and larger projectiles against terrestrial targets. The fuzes are similar to the M513 series (par. 222) and identical in appearance. Data on the M513 series is applicable to the M514 series fuzes, except paragraph 222b (1) through (4). Several modifications exist, resulting in improved technical characteristics and design, but will not effect the operation of the fuzes. The impact elements of proximity fuzes M513, M513B1, M514, and M514B1 are not normally operable unless the fuze is armed for proximity action. Avoid firing 155-mm projectiles at targets that are closer than 800 yards to friendly positions. Friendly aircraft should not be closer than 800 yards from the target when firing 155-mm projectiles.

224. Fuze, Proximity: M515 (T225)

a. Description. This fuze (fig. 86) which is a “bracket arming” type, incorporates features that make it usable with 90-mm deep-cavity HE projectiles. The fuze has a plastic nose which is fitted to a movable time ring and a metal base. The metal base is provided with a graduated time scale; graduations are from 3 through 27 seconds. A movable time ring, with register line, is used to set the fuze to the appropriate time. A superquick element and a self-destruction element are contained in the fuze. The impact element is mounted internally and is hidden from view by the plastic nose. It is recommended that the time ring on the fuze be set to the predicted time-to-target. When fired, regardless of time setting, the impact element arms at approximately 500 feet from the muzzle of the gun. At (predicted time-to-target) settings of 3 seconds or greater than 3 seconds, the proximity element of the fuze becomes armed at approximately 2 seconds prior to the event and will then detonate the projectile upon proximity approach (within approximately 60 feet) of a suitable airborne target. If no suitable target is encountered, the self-destruction element will detonate the projectile at approximately 2 seconds after set time. The impact element will cause the fuze to function with superquick action, if impact with a resistant object occurs at any time after arming of the impact element but before arming of the proximity element. If the fuzed projectile does not come within the influence radius of a suitable aerial target and the proximity element and the self-destruction element fail, the impact element will cause the projectile to function upon impact with the ground.

b. Setting. There are three markings in addition to the time scale graduations on the metal base. The markings are “SD-14,” “SD-17,” and “MAX.” When set on “SD-14” in the slot (notch), proximity arming occurs at 0.3 second and self-destruction occurs at 14 seconds. When set on the “SD-17” registration line, proximity arming occurs at 0.3 second and self-destruction occurs at 17 seconds. When set on “MAX,”
the fuze is activated at 26 seconds; proximity arming occurs at 27 seconds and self-destruction is performed by reed spin switch at approximately 45 seconds (depending on gun elevation and barrel wear). PD action can still occur from approximately 500 feet from the muzzle of the gun. At any setting from 3 to 27 seconds, the fuze will be activated at target time minus 3 seconds and fully armed at target minus 2 seconds. Self-destruction will occur at 18 seconds when set on 3 seconds, and at target time plus 2 seconds on any setting of 4 through 27 seconds. With any of the above settings, the impact circuit is armed at 0.2 second after firing. When firing at airborne targets over friendly territory, it is important that each projectile burst at a safe height above the ground. The height of burst must be great enough to permit projectile fragments to decelerate to the velocity of free fall. For normal antiaircraft use in the 90-mm weapon, the fuze is usually set by means of the manual fuze setter M13A1 or M13 or by means of an automatic fuze setter.

Note. Proximity fuze M615 is for antiaircraft use and is not reliably effective against other types of targets. It can be employed against terrestrial targets in an emergency but for this purpose it is less satisfactory than proximity fuze M513 series.

225. Fuze, Proximity: M516A1 (T73E10), M516B2 (T73E14), M516BI (T73E13), and M516 (T73E12)

a. Description. These fuzes are provided for use with 75-mm HE cartridge against airborne targets. The fuze has a plastic nose fitted to a metal base. No time settings are provided for the fuze. Boresafety is provided by an arming switch which delays arming of the fuze for a preset time. A shell-destroying (SD) element is also incorporated. The shell-destroying switch causes the armed fuze to detonate when the spin of the projectile drops to a preset value. This feature of the fuze is intended to detonate the projectile sufficiently high on the descending branch of the trajectory to prevent injury to friendly troops and damage to friendly installations. The fuze M516A1 (T73E10) incorporates an impact element in the nose, which becomes armed within 400 to 750 feet from the muzzle of the weapon. The proximity element of the fuzes M516 series armed at approximately 0.8 second after leaving the muzzle of the weapon.

b. Setting. No setting is required. Any attempt to set this fuze may result in a malfunction.
226. General

a. General Discussion. A propelling charge is one of the principal parts of a complete round of artillery ammunition. It consists of a quantity of solid propellant (formerly known as smokeless powder) in the form of single or multiperforated grains (fig. 87). In “fixed” and “separated” ammunition, the grains are loose in metal cartridge cases. In “fixed” ammunition, the cartridge case is closed by being crimped to the projectile to form a complete cartridge. In “separated” ammunition, the cartridge case is closed with a plug or similar device. In “separated” ammunition, the grains are in cloth bags which are in a metal cartridge case which is telescoped to, and removable from, a projectile. In fixed, semifixed, and separated ammunition, complete rounds are loaded as a unit into a weapon. In “separate-loading” ammunition, the grains are in cloth bags which are loaded separately into the chamber of a weapon in which a projectile has previously been separately loaded. Depending upon the type of ammunition, a propelling charge may include an igniter charge, usually in the form of a relatively small quantity of black powder. Propelling charges for howitzers, whether “fixed” or “separate-loading,” are divided into increments to provide “zone” firing.

Note. For illustrations of propellants in fixed, semifixed, and separated ammunition, see the particular cartridge illustration.


c. Determination of Propellant Weight. The weight of propellant in a propelling charge varies slightly from one lot (par. 9c) to another. Ballistic tests are conducted on each lot of propellant manufactured to determine the weight of propellant needed to give the ballistic performance desired. Thus, variations in ballistic performance of ammunition due to variations in composition of propellant are minimized.

d. Identification.

(1) Propellant for fixed ammunition is contained loosely in the metal cartridge case of the round. Ammunition lot numbers are stamped on the base of the cartridge case (par. 9d).

(2) Propelling charges for semifixed ammunition are contained in bags in the metal cartridge case. They may be identified by the markings on the cloth bags of the increments which comprise the charge, on the round, or on the container of the round.

(3) Propelling charges for separate ammunition may be identified by the markings on the metal cartridge case, fiber container, or wooden box.

(4) Propelling charges for separate-loading ammunition may be identified by the markings on the cloth bags of the charge, by the color of the cloth containing the charge, by the markings on the packing container, or from the propelling charge data tag which usually is tied to one of the tying straps which holds the parts of the charges together.

Note. This tag must be removed before inserting the charge into a weapon.

e. Flashless and Smokeless Characteristics. The characteristics of flashlessness and smokelessness of propellants upon firing depend upon the chemical composition of the propellant, the design of the ignition system, and the characteristics of the weapon in which fired. Factors for which allowances must be made in the original design of flashless and smokeless ammunition are weapon and ammunition temperature, degree of wear of weapon, and weather conditions. The terms “FNH” and “NH” were used originally to differentiate between the later-developed less-hygrosopic compositions
Figure 87. Comparative sizes of propellant grains.
Section II. PROPELLING CHARGES, FLASH REDUCERS, AND PROPELLANT TEMPERATURE INDICATORS

226. General

a. General Discussion. A propelling charge is one of the principal parts of a complete round of artillery ammunition. It consists of a quantity of solid propellant (formerly known as smokeless powder) in the form of single or multiperforated grains (fig. 87). In “fixed” and “separately” ammunition, the grains are loose in metal cartridge cases. In “fixed” ammunition, the cartridge case is closed by being crimped to the projectile to form a complete cartridge. In “separately” ammunition, the cartridge case is closed with a plug or similar device. In “separately” ammunition, the grains are in cloth bags which are in a metal cartridge case which is telescoped to, and removable from, a projectile. In fixed, semifixed, and separately ammunition, complete rounds are loaded as a unit into a weapon. In “separately” ammunition, the grains are in cloth bags which are loaded separately into the chamber of a weapon in which a projectile has previously been separately loaded. Depending upon the type of ammunition, a propelling charge may include an igniter charge, usually in the form of a relatively small quantity of black powder. Propelling charges for howitzers, whether “fixed” or “separately-loading,” are divided into increments to provide “zone” firing.

Note. For illustrations of propellants in fixed, semifixed, and separated ammunition, see the particular cartridge illustration.


c. Determination of Propellant Weight. The weight of propellant in a propelling charge varies slightly from one lot (par. 9c) to another. Ballistic tests are conducted on each lot of propellant manufactured to determine the weight of propellant needed to give the ballistic performance desired. Thus, variations in ballistic performance of ammunition due to varia-

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Figure 87. Comparative size of propellant grains.
and the earlier pyro powder. The term "FNH" and "NH" were intended to indicate, respectively, that the propellant was flashless-nonhygroscopic or nonhygroscopic. This practice was discontinued and propellant compositions were given model designations. In order to indicate the performance of ammunition, the word "FLASHLESS," "SMOKELESS," or "FLASHLESS-SMOKELESS" is stenciled on cartridges for 76-mm gun and 90-mm gun ammunition and on their packing containers. Flashless ammunition does not flash more than 5 percent of the time under average conditions in weapons having average wear. "Smokeless" ammunition produces less than half the amount of smoke produced by ammunition not so designated. Cartridges having both flashlessness and smokelessness are designated "FLASHLESS-SMOKELESS."

f. Flash Reducers. For 155-mm gun cannons, 165-howitzer cannons, and 8-inch howitzer cannons, a flash reducer consisting of a charge of black powder and a cooling agent (inorganic salt such as potassium sulfate), in a cloth bag, may be added to a propelling charge to aid in reducing flash upon firing. These flash reducers are intended for use primarily for night firing.

g. Cartridge Case. A cartridge case, usually made of drawn brass, drawn steel, or wrapped steel, serves as a container for the propellant in fixed, semifixed, and separated artillery ammunition. The case has a profile and size to conform to the chamber of the weapon for which it is designed. The head of the case is relatively thick and has a flange or rim to aid in seating the round in the weapon and to permit mechanical extractions (the round used in the 37-mm automatic gun M1A2 has a cartridge case with extracting grooves instead of a flange or rim). The cartridge case holds the primer, propellant, and the projectile so that the assembly (complete round) can be inserted into the weapon in one operation. A secondary function of the cartridge case is to provide for obturation; the cartridge case (especially the mouth) is sufficiently thin to expand by the pressure of the burning gases against the side of the weapon chamber, thereby making a tight joint and preventing the escape of gas to the rear.

a. Propelling Charge in Fixed Ammunition. The propelling charge in a round of fixed ammunition consists of loose propellant in the cartridge case. In a reduced velocity round where the propellant charge is small compared to case capacity, distance wadding or a bagged charge is used to prevent shifting of the charge with relation to the primer. Where the primer charge is insufficient for satisfactory ignition of the propellant, a supplementary igniter charge is attached to the bottom of the distance wadding to supplement the primer charge.

i. Propelling Charge in Semifixed Ammunition. The propelling charge in a round of semifixed ammunition consists of propellant in cloth cartridge bags tied together with silk twine. These bags of propellant, known as base and increment charges, are contained in a metal cartridge case. Since the cartridge case is fitted loosely to a projectile, it can be removed so that any of the increment charges may be removed prior to firing to adjust for charge (zone) firing.

j. Propelling Charge in Separated Ammunition. This consists of a metal cartridge case and its contents, which are a primer, a quantity of propellant grains, and a plastic plug to close the cartridge case. This case may also contain a supplementary igniter and a distance wadding to position the propellant.

k. Propelling Charge in Separate-Loading Ammunition. (1) The propelling charge in separate-loading ammunition consists of propellant grains contained in cartridge bags and an igniter of black powder. The cartridge bag cloth was previously made of silk or cotton. Bags made of rayon sometimes are used to replace silk. Only certain ash-free grades of these fabrics are suitable, since the use of other grades might leave smoldering residue in the bore of the cannon after firing. Cartridge-igniter pads, which are circular disk-shaped bags, and core igniters, which are tubular bags, are made of silk or the newly developed rayon or synthetic fibers, similar to that of the cartridge bag cloth except that it is
more closely woven to prevent the black ignition powder from sifting through. In order to indicate clearly that they contain black powder, all igniter cloths are dyed bright red.

(2) Separate-loading propelling charges, in general, are of the multi-section type known as “base and increment” and “unequal section” type. The base and increment type of propelling charge consists of a base section and one or more increments. The increments may be of equal or unequal size but are generally smaller than the base section. With some types, one cartridge-igniter pad is attached to the breech end of the base section only, while other types have a core-type igniter extending through the axis of the base section and sometimes through one or more increments.

(3) In certain cases, two types of propelling charges may be provided for a given howitzer, one for inner and the other for outer charges of fire. The cloth of the bags for the inner charges is green to distinguish that charge from the other type which is assembled in white bags. Accordingly, these two types are called “green bag” and “white bag” charges.

(4) Certain earlier charges may be issued with ordinary safety pins holding igniter pads in place during shipment; if so, the safety pins should be removed and the igniter pad attached to the charge by stitching it in at least three places 120 degrees apart. The stitching should be through the outside edge of the igniter pad in order not to puncture the cloth holding the black powder. Care must be taken when loading the charge to have the red igniter pad at the rear, that is, toward the breech of the weapon.

(5) Separate-loading propelling charge data are given in table IX.

### Table IX. Separate-Loading Propelling Charge Data

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Length (in.)</th>
<th>Diameter (in.)</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 155-mm Gun Cannons M2 and M49 (T30)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER: M19</td>
<td>37.4</td>
<td>6.5</td>
<td>31.6</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER, DUMMY: M100</td>
<td>35-37.4</td>
<td>5.00</td>
<td>32.2</td>
</tr>
<tr>
<td>REDUCER, FLASH: M1</td>
<td>35-37.4</td>
<td>5 (width of end see)</td>
<td></td>
</tr>
<tr>
<td>For 155-mm Howitzer Cannons M1, M1A1, and M45 (T97E2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER: M3 (green bag)</td>
<td>16</td>
<td>5</td>
<td>5.75</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER: M4 (white bag)</td>
<td>21</td>
<td>5.8</td>
<td>13.65</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER: M4A1 (white bag)</td>
<td>21</td>
<td>5.8</td>
<td>13.65</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 155-MILLIMETER, DUMMY, M2</td>
<td>11</td>
<td>6</td>
<td>7.37</td>
</tr>
<tr>
<td>REDUCER, FLASH: M2</td>
<td>4</td>
<td>4 (width)</td>
<td>1.5 (oz)</td>
</tr>
<tr>
<td>For 8-Inch Howitzer Cannons M2 and M47 (T89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 8-INCH: M1</td>
<td>21</td>
<td>6.5</td>
<td>13.3</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 8-INCH: M2</td>
<td>24</td>
<td>7.75</td>
<td>28.3</td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 8-INCH, DUMMY: M4, 29-lb</td>
<td>22.5-24</td>
<td>7.75</td>
<td>28.75</td>
</tr>
<tr>
<td>REDUCER, FLASH: M3</td>
<td>7</td>
<td>7 (width)</td>
<td>16 (oz)</td>
</tr>
<tr>
<td>For 280-mm Gun Cannon M66 (T131)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGE, PROPELLING, 280-MILLIMETER: M43 (T44)</td>
<td>75</td>
<td>10.25</td>
<td>128</td>
</tr>
</tbody>
</table>
I. Igniter-Protector Caps.

(1) Igniter-Protector caps are made of cloth or paper. The cloth cap is cup-shaped about 5 inches deep to fit over the end of a propelling charge. It is fastened to the charge by means of a drawstring at the open end and a cloth trace (strap) (with 8 inch and larger charges) longitudinally around the charge and cap. A cloth handle is sewed to the cap to facilitate its removal. The paper igniter-protector cap, which is made of waterproof paper, is fastened to the propelling charge by means of a drawstring. With the paper igniter-protector cap, only the drawstring is used for attaching it to the propelling charge.

(2) Igniter-protector caps must be removed before loading the charge into a weapon.

(3) The side of the igniter-protector cap is stenciled with the words, "Igniter-Protector Cap" followed by size and model of the weapon. For example, in the case of gun charges, the words "REMOVE CAP BEFORE INSERTING IN GUN" are stenciled on the bottom and on the side of the cap.

227. Propellant for 37-mm Gun M1A2

Ammunition for the 37-mm gun M1A2 is of the fixed type. The HE-T and TP-T rounds contain 0.4 pound of single-base propellant M1, or 0.275 pound of double-base propellant M2 or M5 in cartridge case M17. The APC-T round contains 0.338 pound of single-base propellant M1.

228. Propellant for 40-mm Gun Cannons M1, M2, and Mk I (Navy)

Ammunition for these cannons is of the fixed type. The HE-T and TP-T rounds contain 0.72 pound of single-base multiperforated cylindrical grain propellant M1 in cartridge case M25. The AP-T round contains 0.65 pound of propellant M1 in cartridge case M25.

229. Propellant for 75-mm Gun Cannon M3

Ammunition for this cannon is of the fixed type. The propelling charge consists of propellant in the form of multiperforated cylindrical grains in cartridge case M18. Four weights of charge are used. The "reduced" charge used with the HE rounds consists of 0.59 pound of double-base propellant M2 which produces a muzzle velocity of 950 feet per second. The "normal" charge used with HE rounds consists of 1.15 pounds of single-base propellant M1 which produces a muzzle velocity of 1,500 feet per second. The "super" charge used with HE and smoke rounds consists of 2.0 pounds of single-base propellant M1 which produces a muzzle velocity of 2,080 feet per second. The propelling charge used with AP-T rounds consists of 2.1 pounds of triple-base propellant M17 which produces a muzzle velocity of 2,340 feet per second.

230. Propellant for 75-mm Gun Cannon M35

Ammunition for this cannon is of the fixed type. The propelling charge consists of 3.2 pounds of single-base propellant M6 in cartridge case T6E3.

231. Propellant for 75-mm Pack Howitzer Cannon M1A1

Ammunition for this howitzer is of the fixed and semifixed type. The HEAT-T round uses a fixed charge which consists of 0.41 pound of double-base propellant M2 in cartridge case M5A1. The HE and smoke rounds are of the semifixed type. The propelling charge consists of 1.06 pounds of single-base propellant (single perforated) M1 in four cartridge cloth bags which comprise a base charge and three unequal increments. The charge is in cartridge case M5A1. The projectile fits freely into the mouth of the cartridge case thus permitting removal of the desired number of increments to provide for adjusting the charge for charge (zone) firing. Increments of the charge are tied together with twine to facilitate removal from the cartridge case. In rounds of earlier manufacture, the base charge is attached to the primer in the base of the cartridge by means of a retainer clip.
232. Propellant for 76-mm Gun Cannons M32 and M48 (T124)

Ammunition for these cannons is of the fixed type. The propelling charge consists of a quantity of propellant in the cartridge case. The charge in the HE, TP, and WP smoke cartridges is 3.64 pounds of single-base propellant M6 in cartridge case T19E1. The HVAP-T cartridge uses 5.03 pounds of propellant M6 in cartridge case T19E1B1. The HVAP-DS-T, AP-T, and TP-T cartridges use 5.60-5.83 pounds of triple-base propellant M17 in cartridge case T19E1B1.

233. Propellant for 90-mm Gun Cannons M1A2, M1A3, M2A1, M2A2, and M2A3

Ammunition for these cannons is of the fixed type. The propelling charge consists of propellant in the form of multiperforated cylindrical grains in the cartridge case M19 with or without a distance wad. Single-base propellant M6, double-base M2, and triple-base M15 and M17 (T12) are used. The HE, TP, and smoke rounds contain 7.31 pounds of propellant M6 or M15. The APC-T round contains 8.06 pounds of propellant M6 and a supplementary igniter charge of black powder assembled to a cardboard on top of the propellant and held in place by a distance wadding. APC-T rounds of earlier manufacture contain 7.31 pounds of propellant M6 with a supplementary igniter and distance wadding. The HVAP-T and HVTP-T rounds contain 8.40 pounds of propellant M6 or 8.50 pounds of propellant M17. The HVAP-T and HVTP-T rounds contain a supplementary igniter charge of black powder assembled to a cardboard on top of the propellant and held in place by distance wadding. Dependent upon performance in the weapon, 90-mm rounds are designated as flashless, smokeless, or flashless-smokeless.

234. Propellant for 90-mm Gun Cannons M36, M41, and M54

Ammunition for these cannons is of the fixed type. Two types of propelling charges are used. The propelling charge for AP-T cartridge M318 consists of 8.6 pounds of triple-base propellant M17 in cartridge case M108 (T24) and a supplementary igniter charge of black powder with a distance wadding. The propelling charge for target practice cartridge TP-T M353A1, which simulates the armor-piercing cartridge AP-T M318, consists of 8.6 pounds of triple-base propellant M17 in cartridge case M108 (T24) with a supplementary igniter charge of black powder and distance wadding. The propelling charge for cartridge HE-T COMP B T91 consists of 4.44 pounds of single-base propellant M1 in a silk cartridge bag with a recess through its axis to permit entry of the primer; the silk cartridge bag fits into the cartridge case M108 (T24) over the primer.

235. Propelling Charges for 105-mm Howitzer Cannons M2A1, M2A2, M4, M4A1, and M49 (T96)

Ammunition for these howitzer cannons is of the semifixed or fixed type.

a. The semifixed ammunition includes the high-explosive cartridge M1, the BE smoke cartridge M84 or M84B1, the gas or smoke cartridge M60, and the illuminating cartridge M314A1. Two types of propelling charges are used with the semifixed rounds.

(1) The dualgran propelling charge, which consists of seven bag charges of unequal size, has a base charge (numbered 1) and six increment charges (numbered 2—7) to provide for seven charges (zones) of fire. The propelling charge is designated “dualgran” because two different types of propellant grains are used in the overall charge. The base charge and number 2 increment are filled with relatively small single-base single-perforated grains (fast-burning) of propellant M1. Increments numbered 3—7 are loaded with larger size single-base multiperforated grains (slow-burning) of propellant M1. The total weight of a full charge is 2.75 pounds. The seven bag charges are tied to each other by twine in order to facilitate removal from the cartridge case. They are in the cartridge case M14, arranged around the long primer in such a manner that the open ends are staggered. Charge 5 incorporates lead foil to act as a decoppering agent to protect the bore of the howitzer. Dual-
gran charges produce less flash than older types of propelling charges, improve uniformity of performance, and increase accuracy.

(2) A propelling charge of earlier manufacture, composed of a base charge (numbered 1) and six increment charges (numbered 2—7) is also used in cartridges for 105-mm weapons. This propelling charge is similar to the charge described in (1) above, except that the base charge and increments are doughnut shaped and filled with the single-base "smokeless" composition M1 propellant of uniform granulation.

b. The fixed ammunition includes HEP-T, M327, HEAT-T M67, and TP-T M67 projectiles. Although assembled with removable (from cartridge case) projectile, these rounds have a fixed (nonadjustable) propelling charge. The propelling charge consists of 1.54 pounds of single-base propellant M1 in a single, doughnut-shaped cartridge bag which is wrapped around the primer in cartridge case M14.

c. The dummy propelling charge M3 is used in the dummy cartridge M14 (par. 131). It simulates the dualgran charges of early manufacture comprising a doughnut-shaped base charge and six increments. The individual charges are of cotton cartridge cloth and are filled with an inert filler (asbestos fiber).

d. Flash reducer M4 (T4) is provided for reduction of flash in night firing with the howitzers M2A1, M2A2, M4, M4A1, and M49 (T96). It consists of 438 grains of black powder in a square cotton cloth bag. It should be noted that no flash reducer is needed when firing dualgran propelling charges.

236. Propelling Charges for 120-mm Gun Cannons M1, M1A1, M1A2, and M1A3

a. Charge, Propelling, 120 Millimeter: M15, for Guns M1, M1A1, M1A2, and M1A3. This charge (fig. 49) is of the "separated" ammunition type. It is used with 120-mm HE projectiles M73 to make up a complete round for these guns. It consists of a metal cartridge case M24 fitted with primer M1B1A2 (short type) and contains 24 pounds of single-base propellant M6 in the form of multiperforated cylindrical grains. A doughnut-shaped igniter containing 8 ounces of black powder is fitted around the base of the primer to insure complete ignition of the propellant. The cartridge case is closed with closing plug M2 of palmetto pulp cemented in place.

b. Charge, Propelling, 120 Millimeter: M15A1, for Guns M1, M1A1, M1A2, and M1A3. This charge is similar to the charge described in a above, except that it utilizes primer M2BB2, which requires no igniter, and that it is closed with plastic closing plug M2E1, M5 (M2E2), or M2E3 cemented in place.

c. Charge, Propelling, 120 Millimeter, Dummy: M13, for Guns M1, M1A1, M1A2, and M1A3. This charge simulates the service charges M15, M15A1, and M15A2 described in a, b, and c above. It consists of a service cartridge case filled with an inert filler and closed with a wooden plug. It is used in conjunction with dummy projectile M15 (par. 146) for drill purposes in handling a complete round for these weapons.

237. Propelling Charges for 120-mm Gun Cannon M58 (T123E1)

a. Charge, Propelling, 120 Millimeter: M45, for Gun M58. This charge is of the "separated" ammunition type. It is used with high-explosive and smoke projectiles (sec XIII, ch 2) to make up complete rounds for these guns. The charge consists of 12.4 pounds of triple-base propellant M15 in a silk bag which has an axial opening to accommodate primer M67 (T85E3). The charge fits into the brass cartridge case M109 (T25) over the primer and is held in place by distance wadding. The cartridge case is closed by plastic plug M6 (T23E1). Some rounds of earlier manufacture may be encountered in which loose propellant is held in the cartridge case by distance wadding to which a supplementary igniter is attached.
b. Charge, Propelling, 120 Millimeter: T21, for Gun M58. This charge is similar to the charge described in a above, except that it utilizes brass cartridge case M34, primer M57, and plastic closing plug T18.

c. Charge, Propelling, 120 Millimeter: M46 (T38E1), for Gun M58. This charge, which is used in conjunction with AP-T and TP-T projectiles, is similar to the charge described in a above, except that the cartridge case M109 (T25) (brass) contains 29 pounds of propellant M17 and is closed by plastic plug M7. This charge is also issued in a spiral-wrapped cartridge case.

238. Propelling Charges (Separate-Loading) for 155-mm Gun Cannons M2 and M46 (T80)

a. Charge, Propelling, 155 Millimeter: M19. This charge (fig. 88) is of the separate-loading type. It consists of a base section containing 20.35 pounds of single-base propellant M6 and an increment section containing 10.65 pounds of propellant M6. The propellant is in the form of multiperforated grains (fig. 87). An igniter containing 10 ounces of black powder is sewed to the rear end of the base section. The increment is attached to the forward end of the base section by four tying straps. The full charge (base and increment) is known as the “supercharge,” which is used for extreme ranges only. The base section alone (increment removed) is known as the “normal charge,” which is used for all ranges up to the maximum obtainable with it. The following 155-mm projectiles are authorized for use in these cannons with the normal charge (base section) only: HE projectiles M107, smoke WP projectile M110, smoke projectile BE M116, and illuminating projectiles M118 series.

Note: Illuminating projectiles of the M118 series are authorized also for use in 155-mm howitzer cannons M1, M1A1, and M45 with normal charge (base section only) M19.

The full charge M19 is packed in metal container M16A2. An “ammunition container” containing one percussion primer Mk 2A4 is packed with the charge in the metal container.

Caution: Propelling charge M19 when used with primer Mk 2A4 is authorized for use only in 155-mm gun cannon M2.

In gun M46 (T80), electric and percussion primer Mk 15 Mod 1 or electric primer Mk 34 Mod 0 is authorized for use.

b. Charge, Propelling, 155 Millimeter, Dummy: M100. This charge (fig. 88), weighing 32.2 pounds, simulates the service charge M19. It is used in conjunction with dummy projectile M7 in these cannons to make up a complete drill round for training in handling the ammunition.

c. Reducer, Flash: M1. This flash reducer (fig. 89) is used tied around service charges M19 (supercharge) and M19 (base section only) with silk tie strings. It consists of two strips of red cotton cloth, linked with silk strings. Each strip has three channels. The two outside channels of each strip contain a mixture of 40 percent black powder and 60 percent potassium sulfate. The center channel contains black powder only. The flash reducer is divided into two sections, base section and increment section. When using a normal propelling charge (base section only) the increment section of the flash reducer is removed and discarded. The flash reducer is not authorized for use with the supercharge (base section and increment section).

Caution: Flash reducers containing black powder should be handled with the same precautions as any other item containing black powder (par. 11).

239. Propelling Charges (Separate-Loading) for 155-mm Howitzer Cannons M1, M1A1, and M45 (T97E2)

a. Charge, Propelling, 155 Millimeter: M3. This charge (fig. 90) is of the separate-loading type. It is known as “green bag” charge and consists of propellant M1 in cloth bags to which is attached an igniter charge of black powder in a red cloth igniter pad. This pad is sewed to the rear (breech end) of the base section of the charge. The charge is divided into increments of unequal size to provide for coverage for charge (zone) firing. Charge M3 is used for firing in zones 1 through 5 exclusively hence is composed of charge 1 (base charge) and increments 2, 3, 4, and 5. Thus, charge 1 is composed of the base charge (numbered 1) only; charge 2 is composed of charge 1 and increment 2; charge 3 is composed of
Figure 88. Separate-loading propelling charges for 155-mm guns.
charge 1 and increments 2 and 3; charge 4 is composed of charge 1 and increments 2, 3, and 4; and charge 5 is composed of charge 1 and increments 2, 3, 4, and 5. Charge M3 is packed two per metal container M14A1. Also packed in the metal container is one ammunition retainer containing two percussion primers Mk 2A4.

b. Charge, Propelling, 155 Millimeter: M4. This charge, which is known as "white bag" charge, is of similar composition and makeup as charge M3 described in a above, except that the bag cloth is "white" and that the charge is for charge (zone) firing with charges 5, 6, and 7. It consists of base charge (charge 5) and increments 6 and 7. This charge is packed one per metal container M13A1 with an ammunition retainer containing one primer Mk 2A4.

c. Charge, Propelling, 155 Millimeter: M4A1. This white bag charge (fig. 91) is similar to the charge described in b above, except that it is for firing charges 3, 4, 5, 6, and 7, hence is composed of base charge (charge 3) and increments 4, 5, 6, and 7. It is packed one per metal container with an ammunition retainer containing one percussion primer Mk 2A4.

Note. Percussion primer Mk 2A4 is authorized for use with howitzers M1 and M1A1, not with howitzer M45. When using howitzer M45, electric and percussion primer Mk 15 Mod 1 or electric primer Mk 34 Mod 0 is to be used.

Caution: Green bag and white bag charges are different in design and in the amount and type of propellant, hence green bag sections or increments must not be mixed with white bag sections or increments in making up a propelling charge. The use of propelling charges having increments of more than one color is prohibited.

d. Charge, Propelling, 155 Millimeter, Dummy: M2. This charge simulates a service propelling charge. It is used in conjunction with either dummy projectile M7 or dummy projectile Mk 1 in these howitzers to make up a complete drill round for training in handling the ammunition. It is packed as required.

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Figure 89. Reducer, flash: M1.
Figure 90. Separate-loading green bag propelling charges for howitzers.

Figure 91. Separate-loading white bag propelling charge for howitzers.
Figure 90. Separate-loading green long propelling charges for howitzers.

Figure 91. Separate-loading white long propelling charge for howitzers.
e. Reducer, Flash: M2 (T9). This flash reducer (fig. 92) consists of a red cotton cloth flat bag 4 inches square containing 1-1/2 ounces of black powder and potassium sulfate. In preparing a white bag propelling charge M4 or M4A1 for firing, one flash reducer is added at the forward end of the base charge and one at the forward end of each increment used. No flash reducers are required for flashlessness when using charge M3 (green bag). This flash reducer is packed 40 per bag, 10 bags (400 reducers) per metal lined wooden box M18.

240. Propelling Charges (Separate-Loading) for 8-Inch Howitzer Cannons M2 and M47 (T89)

a. Charge, Propelling, 8-Inch: M1. This charge (fig. 90) consists of base section (charge 1) and four unequal increments used for charge (zone) firing with charges 1 to 5. The charge, which consists of propellant M1, in cartridge is in a green cloth bag and is referred to commonly as the “green bag” charge to distinguish it from charge M2 (white bag) (fig. 91). Charge M1 contains 13.3 pounds of multiperforated cylindrical grains of propellant. An igniter pad containing 5 ounces of black powder is sewed to the breech end of the base section. The charge is packed in metal container M1A1. Also packed with the charge in the metal container is one ammunition retainer containing one percussion primer Mk 2A4.

Caution: The only primer authorized for use in howitzer cannon M2 is percussion primer Mk 2A4. In 8-inch howitzer cannon M47 (T89), electric and percussion primer Mk 15 Mod 1 or electric primer M34 Mod 0 is authorized.

b. Charge, Propelling, 8-Inch: M2. This charge (fig. 91) consists of a base section (charge 5) and two unequal increments (charges 6 and 7) in white cloth bags for charge (zone) firing, with charges 5, 6, and 7. The charge contains 28.3 pounds of multiperforated cylindrical grains of propellant. Propelling charge M2 for 8-inch howitzers M2 and M47 (T89) is packed in metal container M19A1. Also packed with the charge in the metal container is one ammunition retainer containing one percussion primer Mk 2A4.

Caution: The only primer authorized for use in howitzer cannon M2 is percussion primer Mk 2A4. In 8-inch howitzer cannons M47 (T89), electric and percussion primer Mk 15 Mod 1 or electric primer M34 Mod 0 is authorized.

c. Charge, Propelling, Dummy: M4, for 8-Inch Howitzer Cannon. This charge simulates the white bag service charge M2 (b above). It consists of a base charge and two increment sections. The fillers for the sections consist of blocks of wood, each of which is weighted with lead to produce the desired weight.

d. Reducer, Flash: M3 (T9). The flash reducer M3 is for use with 8-inch howitzer cannons M2 and M47 (T89). It consists of a red cotton cloth bag, 7 inches square. Each bag contains 16 ounces of flash reducing mixture consisting of black powder and potassium sulfate. No flash reducer is necessary for flashlessness with the M1 (green bag) type of charge (a above).

241. Propelling Charges (Separate-Loading) for 280-mm Gun Cannon M66 (T131) (Charge, Propelling, Dualgran, 280-Millimeter: M43 (T44) for 600-Pound Projectile)

This charge (fig. 93) consists of a base section (charge 1), two equal increment charges (charges 2 and 4), and one different sized increment charge (charge 3) for charge (zone) firing. The propelling charge consists of single-base propellant M6 in the form of multiperforated cylindrical grains of two different sized granulations (dualgran) and weighs 158 pounds. The charge is authorized for use with high-explosive projectile M124 series. It is packed in metal container M349. Also packed with the charge in the metal container is one ammunition retainer containing one electric and percussion primer Mk 15 Mod 1.

Caution: Increment charge 4 is not to be used with 280-mm guns equipped with recoil mechanisms T80E1.
242. Propelling Charges for Subcaliber Ammunition

a. Propellant for Fixed-Type Cartridges Used in 37-mm Subcaliber Guns M12, M13, M14, M15, and M1916. This consists of 0.07 pound of single-base propellant for TP cartridge M92 and 0.06 pound of single-base propellant for TP cartridge M63 Mod 1. The propellant, which is in the form of perforated cylindrical grains (fig. 87), is in cartridge case Mk 1A2.

b. Propellant for Semifixed Cartridges Used in 75-mm Subcaliber Howitzer M1A1. The propelling charge for the 75-mm subcaliber howitzer is of the semifixed type and is identical with the propelling charge used as a service charge in the 75-mm howitzers M1A1 and M3 (sec VI, ch 2).

243. Propellant Temperature Indicators

a. Propellant temperature indicators (fig. 94) are used to indicate propellant temperatures at the firing location in order that corrections to firing tables may be made. The indicator consists of the propellant temperature thermometer M1A1 (or M1 which has a more limited temperature scale) and a cast-iron plug crimped into the mouth of a service cartridge case containing propellant. Although the cartridge case contains a propelling charge, it has no primer, the primer hole being sealed. A plug seals the propellant in the mouth of the case and provides a seat for the thermometer. The thermometer is a dial type with a 6-inch stem which extends through a hole in the plug into the propellant. The complete indicator is sealed in a fiber container, one end of which has a transparent plastic window through which temperature readings may be taken. The indicator is issued on the basis of two per firing battery. One is retained with ammunition at the gun position, the other at the central battery ammunition dump. Temperature range for the thermometer M1A1 is −80° to +160° F, while the temperature range for the thermometer M1 is −40° to +160° F.
c. Reducer, Flash: M2 (T2). This flash reducer (fig. 92) consists of a red cotton cloth flat bag 4 inches square containing 1-1/2 ounces of black powder and potassium sulfate. In preparing a white bag propelling charge M4 or M4A1 for firing, one flash reducer is added at the forward end of the base charge and one at the forward end of each increment used. No flash reducers are required for flashlessness when using charge M3 (green bag). This flash reducer is packed 40 per bag, 10 bags (400 reducers) per metal lined wooden box M18.

240. Propelling Charges (Separate-Loading) for 8-Inch Howitzer Cannons M2 and M47 (T89)

a. Charge, Propelling, 8-Inch: M1. This charge (fig. 90) consists of base section (charge 1) and four unequal increments used for charge (zone) firing with charges 1 to 5. The charge, which consists of propellant M1, is known as a "green bag" charge to distinguish it from charge M2 (white bag) (fig. 91). Charge M1 contains 13.3 pounds of multiperforated cylindrical grains of propellant. An igniter pad containing 5 ounces of black powder is sewed to the breech end of the base section. The charge is packed in metal container M18A1. Also packed with the charge in the metal container is one ammunition retainer containing one percussion primer Mk 2A4.

Caution: The only primer authorized for use in howitzer cannon M2 is percussion primer Mk 2A4. In 8-inch howitzer cannon M47 (T89), electric and percussion primer Mk 15 Mod 1 or electric primer M34 Mod 0 is authorized.

b. Charge, Propelling, 8-Inch: M2. This charge (fig. 91) consists of a base section (charge 5) and two unequal increments (charges 6 and 7) in white cloth bags for charge (zone) firing, with charges 5, 6, and 7. The charge contains 28.3 pounds of multiperforated cylindrical grains of propellant. Propelling charge M2 for 8-inch howitzers M2 and M47 (T89) is packed in metal container M19A1. Also packed with the charge in the metal container is one ammunition retainer containing one percussion primer Mk 2A4.

Caution: The only primer authorized for use in howitzer cannon M2 is percussion primer Mk 2A4. In 8-inch howitzer cannons M47 (T89), electric and percussion primer Mk 15 Mod 1 or electric primer M34 Mod 0 is authorized.

c. Charge, Propelling, Dummy: M4, for 8-Inch Howitzer Cannon. This charge simulates the white bag service charge M2 (b above). It consists of a base charge and two increment sections. The fillers for the sections consist of blocks of wood, each of which is weighted with lead to produce the desired weight.

d. Reducer, Flash: M3 (T3). The flash reducer M3 is for use with 8-inch howitzer cannons M2 and M47 (T89). It consists of a red cotton cloth bag, 7 inches square. Each bag contains 16 ounces of flash reducing mixture consisting of black powder and potassium sulfate. No flash reducer is necessary for flashlessness with the M1 (green bag) type charge (a above).

241. Propelling Charges (Separate-Loading) for 280-mm Gun Cannon M66 (T131) (Charge, Propelling, Dualgran, 280-Millimeter: M43 (T44) for 600-Pound Projectile)

This charge (fig. 93) consists of a base section (charge 1), two equal increment charges (charges 2 and 4), and one different sized increment charge (charge 3) for charge (zone) firing. The propelling charge consists of single-base propellant M6 in the form of multiperforated cylindrical grains of two different sized granulations (dualgran) and weighs 158 pounds. The charge is authorized for use with high-explosive projectile M124 series. It is packed in metal container M349. Also packed with the charge in the metal container is one ammunition retainer containing one electric and percussion primer Mk 15 Mod 1.

Caution: Increment charge 4 is not to be used with 280-mm guns equipped with recoil mechanisms T30E1.
242. Propelling Charges for Subcaliber Ammunition

a. Propellant for Fixed-Type Cartridges Used in 37-mm Subcaliber Guns M12, M13, M14, M15, and M1916. This consists of 0.07 pound of single-base propellant for TP cartridge M92 and 0.06 pound of single-base propellant for TP cartridge M63 Mod 1. The propellant, which is in the form of perforated cylindrical grains (fig. 87), is in cartridge case Mk 1A2.

b. Propellant for Semifixed Cartridges Used in 75-mm Subcaliber Howitzer M1A1. The propelling charge for the 75-mm subcaliber howitzer is of the semifixed type and is identical with the propelling charge used as a service charge in the 75-mm howitzers M1A1 and M3 (sec VI, ch 2).

243. Propellant Temperature Indicators

a. Propellant temperature indicators (fig. 91) are used to indicate propellant temperatures at the firing location in order that corrections to firing tables may be made. The indicator consists of the propellant temperature thermometer M1A1 (or M1 which has a more limited temperature scale) and a cast-iron plug crimped into the mouth of a service cartridge case containing propellant. Although the cartridge case contains a propelling charge, it has no primer, the primer hole being sealed. A plug seals the propellant in the mouth of the case and provides a seat for the thermometer. The thermometer is a dial type with a 6-inch stem which extends through a hole in the plug into the propellant. The complete indicator is sealed in a fiber container, one end of which has a transparent plastic window through which temperature readings may be taken. The indicator is issued on the basis of two per firing battery. One is retained with ammunition at the gun position, the other at the central battery ammunition dump. Temperature range for the thermometer M1A1 is -80 to -160 °F, while the temperature range for the thermometer M1 is -40 to +160 °F.
b. The propellant temperature indicator M13 is used with 90-mm gun batteries and the propellant temperature indicator M15 is used with 120-mm gun batteries.

c. The propellant temperature thermometer M1 or M1A1 has a sharp point so that it can be pushed directly into the cloth bags of semifixed and separate-loading propelling charges to take the temperature of those types of charges.

Section III. PRIMERS

244. General

a. General Discussion. A primer (figs. 98, 99, and 100) is used in a propelling charge explosive train as the component which produces a flame to initiate burning of the propelling charge. Such primers vary in size and complexity, depending upon their type and the quantity of propellant in the propelling charge to be ignited. A primer of the artillery type used in fixed, semifixed, or separated ammunition contains a sensitive percussion element of primer mixture plus a primer charge of black powder to insure ignition of the propelling charge. This type of primer is in a hole in the head of the cartridge case and extends into the propelling charge contained in the cartridge case. In some types, in addition to the primer charge in the artillery-type primer, there is a charge of black powder, called an igniter charge, inside the cartridge case. The type of primer used in weapons firing separate-loading ammunition contains a sensitive element of primer mixture and a relatively small black powder charge to ignite a larger black powder igniter charge which is attached to the propelling charge. The separate-loading type of primer is for insertion into the breechblock of a weapon.

b. Classification.

(1) By method of initiation.

(a) Blow of firing pin — percussion primer; electric and percussion primer; or percussion-electric primer. A mechanical firing device causes the firing pin in the breechblock of the weapon to strike the percussion element of the primer and initiate it.

(b) Electric current — electric primer; electric and percussion primer; or percussion-electric primer. The electric current from an electric firing mechanism in the weapon passes through a resistance wire imbedded in an ignition mixture or through a conductive primer mixture in the primer and produces heat which ignites the mixture.

(c) Flame — igniting primer. Flame is produced by a percussion primer in the breechblock of the weapon subcalibered. The flame passes through the vent in the obturator spindle of the breechblock to the igniting primer of the subcaliber ammunition in the interior-type subcaliber weapon. The flame passes through a hole in the inert cap of the primer and ignites the black powder charge of the igniting primer.

(2) By type of ammunition with which used.

(a) Primers for use in cartridges and "separated" propelling charges (37-mm through 120-mm).

(b) Primers for use in breechblock of weapons using a separate-loading ammunition (155-mm and over).

c. Models. Data for primer models are listed in table X.

d. Packing and Shipping Data. Packing and shipping data appear in SM 9-5-1890. Primers for cartridges are shipped assembled in the cartridge case of the round. Primers for "separated" propelling charges (120-mm) are shipped assembled in the cartridge case. Primers for separate-loading ammunition are shipped separately or, as in the case of the Mk 2A4, are packed in the propelling charge metal container with the propelling charge. When shipped separately, the primers are packed in metal containers holding 16, 24, 38, 41, 48, or 50 primers. The metal containers are packed in wooden boxes containing from 576 to 2,400 primers.
Figure 94. Propellant temperature indicator with thermometer.

A—PROPELLANT
B—CARTRIDGE CASE
C—FIBER CONTAINER
D—THERMOMETER, M1A1
E—IRON PLUG
F—RUBBER GASKET
G—STEEL WASHER
H—PLASTIC WINDOWS
e. General Design and Method of Functioning.

(1) Percussion primer used in cartridges and "separated" propelling charges (37-mm through 120-mm). Several models of artillery-type percussion primers are of the same general construction, being made up of a head assembly with a body assembly screwed and crimped to it. The head assembly consists of a brass head containing a percussion element assembly (primer cup, primer charge, foiling paper, and anvil) and a brass firing plug which is held and guided by a battery cup. The purpose of the firing plug is to transmit a force (blow) from the firing pin of the breechblock firing mechanism of a weapon to the explosive initiating element of the primer and to prevent "blowback" (escape of gas) in firing. Being made of brass, the firing point of the firing plug is less liable to perforate the primer cup than is the point of the firing pin (steel) of the weapon. If perforation should occur on firing, the plug would move back and seal against the battery cup to prevent the escape of gas. Also, being for one-time use, its finish and length is not subject to deformation due to continual wear. The primer head has a center flash hole leading from the percussion element assembly to a primer charge in the body. Heads vary in size and configuration of the portion which extends into the body. The body assembly consists of a tube radially perforated to form flash holes, lined with a paper liner, and containing a loose black powder primer charge. Bodies vary in material (brass or steel), in length, in number and size of radial flash holes, and in type of end. There are three types of closed ends, depending on method of manufacture, and one type of open end. If the volume of the primer charge is less than that of the body of the primer, a cardboard diaphragm is cemented to the liner to retain the charge at the head end of the primer. Bodies with open forward ends have the end closed by a cardboard diaphragm. This type of primer functions as follows: A sharp blow from the firing pin of the weapon is transmitted through the firing plug to the primer cup; the cup bends inward under the force, squeezing the primer mixture between itself and the anvil, causing the sensitive primer mixture to explode. The blast from the mixture travels around the anvil, through the flash hole in the head into the primer charge in the body, igniting it. The paper liner burns, and flames from the burning primer charge extend through the radial flash holes, igniting the propelling charge in the cartridge case. In a primer having a body with open end, the cardboard diaphragm burns, and flames extend through the forward end of the body as well as through the radial flash holes.

(2) Percussion-electric primer used in cartridge case ammunition.

(a) This type primer, which can be initiated by either percussion or by an electric current, is made of a steel head and a steel body. The end of the body fits into a cavity in the head and is secured by brazing. The head assembly consists of a steel head containing a percussion-electric igniter. The head is threaded externally to screw into the head of the cartridge case. The igniter consists of a percussion electric ignition element, a gilding metal closing disk, and a brass closing plug with a central flash hole, all contained in cylindrical brass igniter body which screws into the head of the primer. The ignition element contains a brass plunger (with a firing point) restrained from forward movement by a copper plunger pin, a small-arms type primer, a bridge wire, and an igni-
Figure 94. Propellant temperature indicator with thermometer.

A—PROPELLANT
B—CARTRIDGE CASE
C—FIBER CONTAINER
D—THERMOMETER, MIAI
E—IRON PLUG
F—RUBBER GASKET
G—STEEL WASHER
H—PLASTIC WINDOWS
v. General Design and Method of Functioning.

(1) Percussion primer used in cartridges and “separated” propelling charges (37-mm through 120-mm). Several models of artillery-type percussion primers are of the same general construction, being made up of a head assembly with a body assembly screwed and crimped to it. The head assembly consists of a brass head containing a percussion element assembly (primer cup, primer charge, foiling paper, and anvil) and a brass firing plug which is held and guided by a battery cup. The purpose of the firing plug is to transmit a force (blow) from the firing pin of the breech-block firing mechanism of a weapon to the explosive initiating element of the primer and to prevent “blowback” (escape of gas) in firing. Being made of brass, the firing plug is less liable to perforate the primer cup than is the point of the firing pin (steel) of the weapon. If perforation should occur on firing, the plug would move back and seal against the battery cup to prevent the escape of gas. Also, being for one-time use, its finish and length is not subject to deformation due to continual wear. The primer head has a center flash hole leading from the percussion element assembly to a primer charge in the body. Heads vary in size and configuration of the portion which extends into the body. The body assembly consists of a tube radially perforated to form flash holes, lined with a paper liner, and containing a loose black powder primer charge. Bodies vary in material (brass or steel), in length, in number and size of radial flash holes, and in type of end. There are three types of closed ends, depending on method of manufacture, and one type of open end. If the volume of the primer charge is less than that of the body of the primer, a cardboard diaphragm is cemented to the liner to retain the charge at the head end of the primer. Bodies with open forward ends have the end closed by a cardboard diaphragm. This type of primer functions as follows: A sharp blow from the firing pin of the weapon is transmitted through the firing plug to the primer cup; the cup bends inward under the force, squeezing the primer mixture between itself and the anvil causing the sensitive primer mixture to explode. The blast from the mixture travels around the anvil, through the flash hole in the head into the primer charge in the body, igniting it. The paper liner burns, and flame from the burning primer charge extends through the radial flash holes igniting the propelling charge in the cartridge case. In a primer having a body with open end, the cardboard diaphragm burns and flames extend through the forward end of the cup as well as through the radial flash holes.

(2) Percussion-electric primer used in cartridge case ammunition. 
(a) This type primer, which can be initiated by either percussion or by an electric current, is made of a steel head and a steel body. The end of the body fits into a cavity in the head and is secured by brazing. The head assembly consists of a steel head containing a percussion-electric igniter. The head is threaded externally to screw into the head of the cartridge case. The igniter consists of a percussion electric ignition element, a gilding metal closing disk, and a brass closing plug with a central flash hole all contained in cylindrical brass igniter body which screws into the head of the primer. The ignition element contains a brass plunger (with a firing point) restrained from forward movement by a copper plunger pin, a small-arms type primer, a bridge wire, and an igni
tion charge which surrounds the wire. A flash hole leads from the primer to the ignition charge. The plunger and a brass ignition cup, which makes electrical contact with the plunger and contains the primer mixture, are insulated from the igniter body. The body is a steel tube radially perforated to form flash holes and open at the end opposite the head. The body is lined with a paper liner and contains a loose black powder charge retained in place by a cardboard diaphragm cemented to the liner. The flash hole in the closing plug in the head leads from the ignition charge to the primer charge in the body.

(b) In percussion functioning, a sharp flow from the firing pin of the weapon is transmitted through the plunger (plug) to the primer cap; the cup bends inward under the force, squeezing the primer mixture between itself and the anvil, causing the sensitive primer mixture to explode. The blast from the mixture travels around the anvil, through the flash hole in the ignition cup (component of ignition element), to the ignition mixture and ignites the mixture. Flame from the ignition mixture travels through the flash hole in the closing plug of the percussion-electric igniter to the primer charge in the body, igniting it. The paper liner and the cardboard diaphragm burn, and flames from the burning primer charge extend through the radial flash holes and through the open forward end of the body, igniting the propelling charge in the cartridge case.

(c) In electric functioning, electric current from the electric firing mechanism of the weapon flows through the plunger, through the ignition cup, and through the bridge wire to the head of the primer. When the electric current passes through the wire, heat is produced which ignites the ignition mixture.

(3) Electric primer for use in breech-block of weapons using separate-loading ammunition (155-mm and over). This type of primer is designed to be fired electrically only. The primer includes a plug, an ignition cup loaded with an ignition charge and containing a resistance wire surrounded by guncotton, and a cup containing a primer charge of black powder. These components are assembled in a cylindrical housing (primer stock). An electric current transmitted by the electric firing mechanism of the weapon flows through the plug and through the resistance wire to the housing. The current in the wire produces heat, igniting the guncotton and the ignition charge. The burning ignition charge ignites the primer charge. Flame from the burning primer charge escapes through slits in the bottom of the cup and ignites the propelling charge.
Figure 95. Artillery-type primers for fixed and semifixed ammunition.
tion charge which surrounds the wire. A flash hole leads from the primer to the ignition charge. The plunger and a brass ignition cup, which makes electrical contact with the plunger and contains the primer mixture, are insulated from the igniter body. The body is a steel tube radially perforated to form flash holes and open at the end opposite the head. The body is lined with a paper liner and contains a loose black powder charge retained in place by a cardboard diaphragm cemented to the liner. The flash hole in the closing plug in the head leads from the ignition charge to the primer charge in the body.

(b) In percussion functioning, a sharp flow from the firing pin of the weapon is transmitted through the plunger (plug) to the primer cup; the cup bends inward under the force, squeezing the primer mixture between itself and the anvil, causing the sensitive primer mixture to explode. The blast from the mixture travels around the anvil, through the flash hole in the ignition cup (component of ignition element), to the ignition mixture and ignites the mixture. Flame from the ignition mixture travels through the flash hole in the closing plug of the percussion-electric igniter to the primer charge in the body, igniting it. The paper liner and the cardboard diaphragm burn, and flames from the burning primer charge extend through the radial flash holes and through the open forward end of the body, igniting the propelling charge in the cartridge case.

(c) In electric functioning, electric current from the electric firing mechanism of the weapon flows through the plunger, through the ignition cup, and through the bridge wire to the head of the primer. When the electric current passes through the wire, heat is produced which ignites the ignition mixture.

(3) Electric primer for use in breech-block of weapons using separate-loading ammunition (155-mm and over). This type of primer is designed to be fired electrically only. The primer includes a plug, an ignition cup loaded with an ignition charge and containing a resistance wire immersed in gunpowder, and a cup containing a primer charge of black powder. These components are assembled in a cylindrical housing (primer stock). An electric current transmitted by the electric firing mechanism of the weapon flows through the plug and through the resistance wire to the housing. The current in the wire produces heat, igniting the guncotton and the ignition charge. The burning ignition charge ignites the primer charge. Flame from the burning primer charge escapes through slits in the bottom of the cup and ignites the propelling charge.
Figure 95. Artillery-type primers for smooth and semi-smooth ammunition.
Figure 9G. Artillery-type primers for fixed or semi-fixed ammunition.

Table X. Primer Data

<table>
<thead>
<tr>
<th>Description (nomenclature)</th>
<th>Diameter (in.)</th>
<th>Weight (grains)</th>
<th>Weapon for firing ammunition with which used</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMER, ELECTRIC AND PERCUSSION: Mk 15 Mod 1 and 2.</td>
<td></td>
<td></td>
<td>155-mm howitzer cannon M46 (T186E1)</td>
</tr>
<tr>
<td>PRIMER, ELECTRIC: Mk 34 Mod O.</td>
<td></td>
<td></td>
<td>105-mm gun cannon M46 (T90)</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M1A2.</td>
<td></td>
<td></td>
<td>155-mm howitzer cannon M45 (TSO)</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M1B1A2.</td>
<td></td>
<td></td>
<td>8-inch howitzer cannon M47 (T90)</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: Mk 2A4.</td>
<td>1.00</td>
<td>0.52</td>
<td>0.36</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: Mk 22 or Mk 22 Mod 1 and 2 (Navy).</td>
<td>2.00</td>
<td>0.52</td>
<td>0.54</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M22A2.</td>
<td>7.88</td>
<td>0.82</td>
<td>0.54</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M23A2.</td>
<td>1.16</td>
<td>0.52</td>
<td>0.56</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M24A2.</td>
<td>10.26</td>
<td>0.52</td>
<td>0.35</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M28A2.</td>
<td>10.51</td>
<td>0.52</td>
<td>0.54</td>
</tr>
<tr>
<td>Description (nomenclature)</td>
<td>Length (in.)</td>
<td>Diameter (in.)</td>
<td>Weight (grains)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M31A2 and M31B2</td>
<td>7.68/7.93</td>
<td>0.62 0.54</td>
<td>150.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M38A1</td>
<td>2.84</td>
<td>0.62 0.54</td>
<td>55.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M38B2</td>
<td>2.84</td>
<td>0.62 0.54</td>
<td>55.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M40A1</td>
<td>19.01</td>
<td>0.62 0.54</td>
<td>270.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M49 (T33)</td>
<td>19.01</td>
<td>0.62 0.54</td>
<td>400.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M57 (T36E6)</td>
<td>19.00</td>
<td>0.88 0.70</td>
<td>1,000.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M58 (T66)</td>
<td>16.16</td>
<td>0.80 0.54</td>
<td>400.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M62</td>
<td>16.16</td>
<td>0.80 0.54</td>
<td>300.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M64 and M64B1</td>
<td>7.68/7.93</td>
<td>0.62 0.54</td>
<td>100.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: T65E1</td>
<td>16.01</td>
<td>0.62 0.54</td>
<td>400.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M68 (T70)</td>
<td>10.66</td>
<td>0.80 0.54</td>
<td>300.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: M70 (T94)</td>
<td>2.90</td>
<td>0.80 0.54</td>
<td>55.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION: T88E1</td>
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<td>0.80 0.54</td>
<td>300.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION-ELECTRIC: M67 (T85E3)</td>
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<td>1.00 0.70</td>
<td>1,000.00</td>
</tr>
<tr>
<td>PRIMER, PERCUSSION-ELECTRIC: T85E2 (Superseded by M67 (T85E3))</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(4) Electric and percussion primer for use in breechblock of separate-loading weapons (155-mm and above).

(a) This type of primer (fig. 97) is so designed that it can be initiated either by percussion or electrically. The primer includes a plunger, a primer cap containing sensitive primer composition, an ignition cup loaded with an ignition charge and containing a resistance wire surrounded by guncotton, and a cup containing a primer charge of black powder. These components are assembled in a cylindrical housing (primer stock).

(b) In percussion functioning, the firing pin of the weapon strikes the face of the plunger. The firing point of the plunger, in turn, strikes the primer cap, compressing the primer composition in the cap and causing the sensitive composition to explode. The blast from the composition ignites the ignition charge which ignites the primer charge. Flame from the burning primer charge escapes through slits in the bottom of the cup and ignites the propelling charge.

(c) In electrical functioning, an electric current produced by the electric firing mechanism of the weapon flows through the plunger and metal parts of the primer cap, which are insulated from the housing, and through the resistance wire to the housing. The current in the wire produces heat, igniting the guncotton and the ignition charge. The flame from the ignition charge ignites the primer charge. Flame from the burning primer charge escapes through slits in the bottom of the cup and ignites the propelling charge.

(5) Percussion primers for use in breechblock of weapons (155-mm and over). This type of primer (fig. 98) is for insertion into the breechblock of the weapon at the time the projectile and propelling charge are loaded into the weapon. This type of primer differs from most artillery-type primers in that it contains a small amount of black powder to ignite the base igniter pad. The primer consists essentially of a relatively small one-piece body, with a percussion element assembly pressed into the head end of the body, a valve arrangement (gas check cone) to shut off back pressure, and a small charge of black powder. The primer functions as follows: The firing pin of the weapon imparts a sharp blow to the primer cup of the percussion element assembly, which bends inward under the force, squeezing the primer mixture between the primer cup and the anvil, causing the sensitive mixture to explode. The blast from the primer mixture travels past the valve to ignite the black powder primer charge. The burning primer charge forces flames through a flash hole in the breechblock into the gun chamber, where the flames ignite the black powder igniter bag sewn to the end of the base propelling charge bag. Flame from the burning igniter ignites the propelling charge. Pressure produced by gases from the burning propellant seats the gas check cone (valve) to prevent a blowback.

245. Primer, Electric and Percussion: Mk 15 Mods 1 and 2

This primer is of the breechblock type (par. 244e(4) ). For data and use, see table X. It can be fired by percussion action or electrically.

246. Primer, Electric: Mk 34 Mod 0

This primer is of the breechblock type for weapons using separate-loading ammunition (155-mm and above) (par. 244e(3) ). It is designed to be fired electrically only; it is somewhat similar to the primers Mk 15 Mods 1 and 2 but there is no provision for percussion firing. For data and use, see table X.
247. Primer, Percussion: M1A2

This primer is an alternate for primer M1B1A2 (par. 248), with which it differs in the design of the brass tube.

248. Primer, Percussion: M1B1A2 (fig. 95)

This primer is used with ammunition for 75- and 120-mm guns and 105-mm howitzers and blank cartridges for 75- and 90-mm weapons. It is of the standard cartridge case type (par. 244e(1)) and is held in the cartridge case by means of a force fit between the primer head and the primer pocket. An alternate is primer M1A2, which differs from it in the design of the brass tube. For data and use, see table X.

249. Primer, Percussion: Mk 2A4 (fig. 98)

This primer is of the breechblock type (par. 244e(5)). A 1/16-inch thick cork disk and a shellac seal are used to hold the primer charge in place in primers of present manufacture. For data and use, see table X. This primer is packed in a special packing in the metal container of the propelling charge.

250. Primer, Percussion: M22A3 (fig. 96)

This primer is used in fixed 75-mm HE cartridge using reduced and normal propelling charges for 75-mm gun M3. The design is of the standard cartridge case type (par. 244e(1)).
251. Primer, Percussion, Mk 22 or Mk 22 Mod 1 and Mod 2 (Navy)

This primer is of the cartridge-case type (par. 244e(1)). It is an alternate for use in 40-mm cartridge in place of the primer M38A1 described in paragraph 255. The firing plug is retained in position by a Belleville spring.

252. Primer, Percussion: M23A2 (fig. 95)

This 20-grain primer was used with blank cartridge for the 37-mm gun M6. It is used with the target practice cartridge M63 Mod 1 for 37-mm gun M1916 and HEAT cartridge M66 for 75-mm howitzer and cartridge of earlier manufacture for 40-mm guns. This primer is so short that the body is extruded from the head with the forward end left open. The percussion element, firing plug, and battery cup are the same as that in the standard design of head assembly. There are no vents in the body. A closing disk, of onionskin paper, is placed over the primer charge and the remainder is filled with molten beeswax.

253. Primer, Percussion: M28A2 (fig. 96)

This primer is used in older 76- and 90-mm ammunition and new dualgran 105-mm HE cartridge M1. The design is of the cartridge case type (par. 244e(1)). Alternate primer is M28B2 (steel). Earlier cartridge may have the primer M28A1 or the M28A1B1.

254. Primer, Percussion: M31A2 or M31B2 (fig. 96)

These primers are of the cartridge case type and are used with 75-mm cartridge, HE supercharge M48; AP-T M38A1; APC-T M61A1; and smoke M64 where a primer of higher black powder capacity than primer M22A3 is required.

255. Primer, Percussion: M38A1 (fig. 95)

The primer is of the cartridge case type. It is used with 37-mm cartridge and 40-mm Army procurement cartridge. Percussion primer M38B1 or M38B2 is an alternative. Some cartridges on hand have percussion primer M23A1 or M23A2.

256. Primer, Percussion: M38B2

This primer is an alternate for percussion primer M38A1 above.

257. Primer, Percussion: M40A1

This primer is of the cartridge case type. It is used on some 76-mm HE HVAP and smoke cartridge and 90-mm HVAP-T cartridge. It is 19 inches long. It consists of a brass head with increased thread area in combination with a steel body with an open forward end. Some 76-mm cartridges on hand have the primers M28A2 and M28B2.

258. Primer, Percussion: M49 (T33)

This primer is of the cartridge case type and is used with the HVAP-T cartridge and some HE cartridges M71 in the 90-mm weapons. The body has an open end.

259. Primer, Percussion: M57 (T36E6)

This primer consists of a perforated steel tube and a brass head, 19 inches overall length. The tube, which is open at one end, is brazed to the head at the other end. The head, which contains a striker and percussion element, is force-fitted to the head of the cartridge case M34 for the 120-mm propelling charge M15A2. The primer has a charge of 1,000 grains of black powder and provides more powerful ignition than earlier-type cartridge case primers. It is therefore suitable for priming propelling charges that require positive ignition throughout practically the length of the charge contained in the cartridge case.

260. Primer, Percussion: M58 (T66)

This primer is of the cartridge case type and consists of a perforated steel tube containing 400 grains of black powder, closed at one end and the other end is screwed to a brass head that contains a striker and percussion element. The brass head is screwed into the head of the cartridge case. For data and use, see table X.

261. Primer, Percussion: M62

This primer is of the cartridge case type. For data and use, see table X.
262. Primer, Percussion: M64 and M64B1

This primer is of the cartridge case type. For data and use, see table X. The primer M64B1 (steel) is alternate for the primer M64.

263. Primer, Percussion: M68 (T70)

This primer is of the cartridge case type. This primer will supersede the primer M58 when that stock is exhausted. For data and use, see table X.

264. Primer, Percussion: M70 (T94)

This primer is of the cartridge case type. For data and use, see table X.

265. Primer, Percussion: T65E1

This primer is of the cartridge case type. For data and use, see table X.

266. Primer, Percussion: T88E1

This primer is of the cartridge case type.

It can be used instead of the primer M62 (par. 261). Because of its graduated flash hole configuration, it produces a uniform ignition of the propellant. For data and use, see table X.

267. Primer, Percussion-Electric: M67 (T85E3)

This primer is of the cartridge case type (par. 244e(2)) with percussion-electric igniter for use in 120-mm tank gun with propelling charge M45 (T21E1) or M46 (T38E1) or T38E2. This primer requires only 0.01 joule of electrical energy instead of 0.10 required by primer T85E2 which it superseded. For data and use, see table X.

268. Primer, Percussion-Electric, T85E2

This primer is superseded by percussion-electric primer M67 (T85E3) (par. 267). It was furnished with propelling charge T21E1 of earlier manufacture.

Section IV. ADAPTERS AND BOOSTERS

269. General

a. Adapter. The openings in the nose of some projectiles (those requiring point fuzes) are threaded to conform to the requirements of the fuze or fuze with booster combinations. With the standardization of fuze threading, several types of fuzes are interchangeable. In order to facilitate manufacture, some projectiles of earlier design are made with large nose openings; for such projectiles, a suitable threaded metal bushing, called an adapter, is utilized to reduce the size of the opening to conform to the threaded portion of the fuze. Some chemical projectiles have nose adapters in order to provide a means of seating the burster casing (par. 277).

b. Booster. A booster charge in an element of the high-explosive train intermediate between the fuze and main high-explosive charge (sec I, ch 1). It may be incorporated within the fuze itself or may be contained in a separate thin casing of metal or plastic attached to a threaded metal body. The assembly consisting of the casing (cup), booster charge, and metal body is known as a booster and is given a model designation. Boosters are generally provided with a boresafety mechanism (arming delay) and incorporate, in addition to the main charge, one or more other charges such as a detonator and a booster lead charge. Some of the latest boosters have a delay arming mechanism which prevents the booster from arming until the projectile is a desired distance from the gun. Generally, boosters are assembled to the fuze during manufacture, the fuze and booster being handled thereafter as a unit. Boosters provide a means of safety in addition to that provided in the associated fuze.

270. Booster M20 or M20A1

The boosters M20 and M20A1 are similar to the boosters described in paragraph 271. Boosters M20 series differ chiefly from the boosters M21 series in that the M20 series do not have centrifugal pin lock pins. The booster M20A1 differs from the booster M20 only in that it has a larger flash hole in the rotor cover. Boosters M20 series are in stock in small quantities assembled to fuzes of early manufacture.
271. Booster M21A4 and M21A2

Note. The key letters shown below in parentheses refer to figure 100.

a. General. The booster M21A4 is used in conjunction with point fuzes to effect the functioning of high-explosive projectiles. The booster consists of a brass body containing the booster mechanism, booster lead charge, and detonator and an aluminum booster cup threaded over the body containing a 340-grain tetryl booster pellet. The external threads of the booster fit projectiles (75-mm and larger) having 2-inch diameter 12 TPI threads and the internal threads will receive all fuzes having 1.7-inch diameter 14 TPI threads. Boosters M21A4 (of early manufacture) and M21A2 differ from currently manufactured boosters M21A4 in being fitted with safety (cotter) pins as an added safety measure, to prevent the rotor from moving out of its unarmed position prior to assembling the fuze with booster to the projectile. Experience has since shown that this safety (cotter) pin is unnecessary, as the centrifugally actuated pin (J) provides safety. In normal use, the booster M21A4 is assembled to the fuze during manufacture, the fuze and booster being handled thereafter as a unit. The booster M21A4 is staked to the fuze through a blind hole in the threaded portion of the booster. A setscrew, which is staked in position, secures booster M21A2 to the fuze. The booster M21A2 also differs from booster M21A4 in having a two-piece centrifugal pin lock pin making use of a ball and socket joint to permit some "play." The booster M21A4 has a one-piece centrifugal pin lock pin.

b. Description. The booster M21A4 is made up of two major parts: a cup and rotor. The Booster cup (M) contains a tetryl booster charge (N) and screws onto a threaded brass body (A) containing tetryl booster lead (L) and a rotor (F). The rotor assembly is made up of a rotor (F) containing a lead azide-tetryl flash-initiated detonator (E), a centrifugally actuated pin (J), a centrifugal pin lock pin (P), a rotor stop pin (D), a rotor lock pin (G), and a rotor lock pin lock (H). The rotor is seated on its pivot pin (K) so that the detonator normally is out of alignment with other explosive elements in the booster and the fuze. The

Figure 99. Booster M21A4.
262. Primer, Percussion: M64 and M64B1

This primer is of the cartridge case type. For data and use, see table X. The primer M64B1 (steel) is alternate for the primer M64.

263. Primer, Percussion: M68 (T70)

This primer is of the cartridge case type. For data and use, see table X.

264. Primer, Percussion: M70 (T94)

This primer is of the cartridge case type. For data and use, see table X.

265. Primer, Percussion: T65E1

This primer is of the cartridge case type. For data and use, see table X.

266. Primer, Percussion: T88E1

This primer is of the cartridge case type. It can be used instead of the primer M62 (par. 261). Because of its graduated flash hole configuration, it produces a uniform ignition of the propellant. For data and use, see table X.

267. Primer, Percussion-Electric: M67 (T85E3)

This primer is of the cartridge case type (par. 244ε(2)) with percussion-electric igniter for use in 120-mm tank gun with propelling charge M45 (T21E1) or M46 (T85E1) or T38E2. This primer requires only 0.01 joule of electrical energy instead of 0.10 required by primer T85E2 which it supersedes. For data and use, see table X.

268. Primer, Percussion-Electric, T85E2

This primer is superseded by percussion-electric primer M67 (T85E3) (par. 267). It was furnished with propelling charge T21E1 of earlier manufacture.

Section IV ADAPTERS AND BOOSTERS

269. General

a. Adapter. The openings in the nose of some projectiles (those requiring point fuzes) are threaded to conform to the requirements of the fuze or fuze with booster combinations. With the standardization of fuze threading, several types of fuzes are interchangeable. In order to facilitate manufacture, some projectiles of earlier design are made with large nose openings; for such projectiles, a suitable threaded metal bushing, called an adapter, is utilized to reduce the size of the opening to conform to the threaded portion of the fuze. Some chemical projectiles have nose adapters in order to provide a means of seating the burster casing (par. 277).

b. Booster. A booster charge in an element of the high-explosive train intermediate between the fuze and main high-explosive charge (sec I, ch 1). It may be incorporated within the fuze itself or may be contained in a separate thin casing of metal or plastic attached to a threaded metal body. The assembly consisting of the casing (cup), booster charge, and metal body is known as a booster and is given a model designation. Boosters are generally provided with a boresafety mechanism (arming delay) and incorporate, in addition to the main charge, one or more other charges such as a detonator and a booster lead charge. Some of the latest boosters have a delay arming mechanism which prevents the booster from arming until the projectile is a desired distance from the gun. Generally, boosters are assembled to the fuze during manufacture, the fuze and booster being handled thereafter as a unit. Boosters provide a means of safety in addition to that provided in the associated fuze.

270. Booster M20 or M20A1

The boosters M20 and M20A1 are similar to the boosters described in paragraph 271. Boosters M20 series differ chiefly from the boosters M21 series in that the M20 series do not have centrifugal pin lock pins. The booster M20A1 differs from the booster M20 only in that it has a larger flash hole in the rotor cover. Boosters M20 series are in stock in small quantities assembled to fuzes of early manufacture.
271. Booster M21A4 and M21A2

Note. The key letters shown below in parentheses refer to figure 100.

a. General. The booster M21A4 is used in conjunction with point fuzes to effect the functioning of high-explosive projectiles. The booster consists of a brass body containing the booster mechanism, booster lead charge, and detonator and an aluminum booster cup threaded over the body containing a 340-grain tetryl booster pellet. The external threads of the booster fit projectiles (75-mm and larger) having 2-inch diameter 12 TPI threads and the internal threads will receive all fuzes having 1.7-inch diameter 14 TPI threads. Boosters M21A4 (of early manufacture) and M21A2 differ from currently manufactured boosters M21A4 in being fitted with safety (cotter) pins as an added safety measure, to prevent the rotor from moving out of its unarmed position prior to assembling the fuze with booster to the projectile. Experience has since shown that this safety cotter pin is unnecessary as the centrifugally actuated pin (J) provides safety. In normal use, the booster M21A4 is assembled to the fuze during manufacture, the fuze and booster being handled thereafter as a unit. The booster M21A4 is staked to the fuze through a blind hole in the threaded portion of the booster. A setscrew, which is staked in position, secures booster M21A2 to the fuze. The booster M21A2 also differs from booster M21A4 in having a two-piece centrifugal pin lock pin making use of a ball and socket joint to permit some "play." The booster M21A4 has a one-piece centrifugal pin lock pin.

b. Description. The booster M21A4 is made up of two major parts: a cup and rotor. The Booster cup (M) contains a tetryl booster charge (N) and screws onto a threaded brass body (A) containing tetryl booster lead (L) and a rotor (F). The rotor assembly is made up of a rotor (F) containing a lead azide-tetryl flash-initiated detonator (E), a centrifugally actuated pin (J), a centrifugal pin lock pin (P), a rotor stop pin (D), a rotor lock pin (G), and a rotor lock pin lock (H). The rotor is sealed with a polyethylene (P) which prevents the detonator normally is out of alignment with other explosive elements in the booster and the fuze. The
center of gravity of the rotor assembly is off the centerline of the pivot center so that the assembly can rotate. The rotor is locked in the unarmed position prior to firing by the spring-held centrifugal pin which, in turn, is held in the locking position by the centrifugal pin lock pin. The function of the rotor stop pin is to stop the rotor assembly when it has rotated to the alined (armed) position. The boresafety mechanism is covered at the forward end by a thin brass cover (B) which has a flash hole to permit the transmission of the fuze action to the detonator in the rotor. The flash hole is covered by a thin disk of onionskin parer (C) to prevent foreign matter from entering the booster.

c. Functioning. Upon firing, setback forces the centrifugal pin lock pin rearward against its spring, freeing the centrifugal pin. Centrifugal force moves the forward end of the lock pin under the shoulder in the lock pin cavity. This prevents the lock pin from returning to its original position. When the projectile reaches the required rotational velocity, the centrifugal pin is moved outward against its spring by centrifugal force. This releases the rotor, which then rotates to the alined or armed position against the stop pin, whereupon the rotor lock pin under centrifugal force moves radially outward from its cavity in the rotor and protrudes into a hole in the booster body. Creep force, as the projectile decelerates, causes the rotor lock pin lock to move forward into the space behind the rotor lock pin, preventing the rotor lock pin from returning to its original position. Thus, the booster is locked in the armed position throughout the flight of the projectile ready for detonation by the fuze action.

d. Preparation for Firing. No preparation for firing is necessary for booster M21A4. Boosters M21A4 of early manufacture and M21A2 may have safety (cotter) pins if they have not been renovated. In order to prepare these boosters for firing, remove the safety pin before inserting the fuze and booster into the projectile.

272. Booster M22

The booster M22 is used in conjunction with the superquick fuze M57, some of which are in stock assembled to 106-mm howitzer chemical projectiles. In external contour, this booster is similar to booster M21A4 described in paragraph 271. Booster M22 differs chiefly from booster M21A4 in that it is not boresafe, due to the omission of the rotor. The booster M22 body is solid except for a drill hole through the center. A detonator assembly, containing two pellets, one lead azide and the other tetryl, seats in the hole in the booster body. The booster charge is contained in a booster cup screwed on the base end of the booster.

273. Booster M24 or M24B1

Note. The key letters shown below in parentheses refer to figure 106.

The booster M24 (fig. 100) is an alternative for all modifications of the boosters M20 and M21 and for all purposes for which these are authorized. The booster M24 consists of a brass body (A) which is threaded internally to receive fuses having 1.7-inch diameter 14 TPI external threads and externally to fit in projectiles having 2-inch diameter 12 TPI nose threads. The flash hole (B) opens into the rotor chamber. The rotor (C) contains the detonator M30 (D) and holds it out of line until the fuze is armed. The rotor is held in the unarmed position by the lock (H) which has two protrusions on the end facing the rotor fitting into two corresponding holes in the rotor. The other end of the lock (H) contains a slot, engaging the fixed body which permits the lock to move in a radial direction but prevents it from rotating. The lock is held against the rotor by the helical centrifugal spring (G), one end of which is held stationary through the lock cup (M) against the fixed body pin (N). The rotor chamber is closed by a plate (J). On firing the projectile, centrifugal force causes the lock to move outward against the spring and release the rotor which turns until the detonator is alined with the flash hole and the booster lead (K). On reaching this position, the rotor is locked by the lock pin (E) which partially enters the lock pin cavity as far as the closing plug (F). The booster charge (L) is a 340-grain tetryl pellet. The booster M24B1 is similar to the booster M24, except for its body which is of drawn brass.
center of gravity of the rotor assembly is off the centerline of the pivot center so that the assembly can rotate. The rotor is locked in the unarmed position prior to firing by the spring-held centrifugal pin which, in turn, is held in the locking position by the centrifugal pin lock pin. The function of the rotor stop pin is to stop the rotor assembly when it has rotated to the aligned (armed) position. The boresafety mechanism is covered at the forward end by a thin brass cover (B) which has a flash hole to permit the transmission of the fuze action to the detonator in the rotor. The flash hole is covered by a thin disk of onionskin parer (C) to prevent foreign matter from entering the booster.

C. Functioning. Upon firing, setback forces the centrifugal pin lock pin rearward against its spring, freeing the centrifugal pin. Centrifugal force moves the forward end of the lock pin under the shoulder in the lock pin cavity. This prevents the lock pin from re-entering the original position. When the projectile reaches the required rotational velocity, the centrifugal pin is moved outward against its spring by centrifugal force. This releases the rotor, which then rotates to the aligned or armed position against the stop pin, whereupon the rotor lock pin under centrifugal force moves radially outward from its cavity in the rotor and protrudes into a hole in the booster body. Creep force, as the projectile decelerates, causes the rotor lock pin lock to move forward into the space behind the rotor lock pin, preventing the rotor lock pin from returning to its original position. Thus, the booster is locked in the armed position throughout the flight of the projectile ready for detonation by the fuze action.

d. Preparation for Firing. No preparation for firing is necessary for booster M21A4. Boosters M21A4 of early manufacture and M21A2 may have safety (cotter) pins if they have not been renovated. In order to prepare these boosters for firing, remove the safety pin before inserting the fuze and booster into the projectile.

272. Booster M22

The booster M22 is used in conjunction with the superquick fuze M57, some of which are in stock assembled to 105-mm howitzer chemical projectiles. In external contour, this booster is similar to booster M21A4 described in paragraph 271. Booster M22 differs chiefly from booster M21A4 in that it is not boresafe, due to the omission of the rotor. The booster M22 body is solid except for a drill hole through the center. A detonator assembly, containing two pellets, one lead azide and the other tetryl, seats in the hole in the booster body. The booster charge is contained in a booster cup screwed on the base end of the booster.

273. Booster M24 or M24B1

Note. The key letters shown below in parentheses refer to figure 100.

The booster M24 (fig. 100) is an alternative for all modifications of the boosters M20 and M21 and for all purposes for which these are authorized. The booster M24 consists of a brass body (A) which is threaded internally to receive fuze bushing 17 and diameter 11 TPI external threads and externally to fit in projectiles having 2-inch diameter 12 TPI nose threads. The flash hole (B) opens into the rotor chamber. The rotor (C) contains the detonator M30 (D) and holds it out of line until the fuze is armed. The rotor is held in the unarmed position by the lock (H) which has two protrusions on the end facing the rotor fitting into two corresponding holes in the rotor. The other end of the lock (H) contains a slot, engaging the fixed body which permits the lock to move in a radial direction but prevents it from rotating. The lock is held against the rotor by the helical centrifugal spring (G), one end of which is held stationary through the lock cup (M) against the fixed body pin (N). The rotor chamber is closed by a plate (J). On firing the projectile, centrifugal force causes the lock to move outward against the spring and release the rotor which turns until the detonator is aligned with the flash hole and the booster lead (K). On reaching this position, the rotor is locked by the lock pin (E) which partially enters the lock pin cavity as far as the closing plug (F). The booster charge (L) is a 540-grain tetryl pellet. The booster M24B1 is similar to the booster M24, except for its body which is of drawn brass.
Figure 100. Booster M24.
274. Booster M25

The booster M25 is similar to the booster M21A4 described in paragraph 271. It differs only in having three external threads instead of six and in having no external threads to receive the fuze. Boosters M25 of old manufacture have a safety (cotter) pin with pull ring which must be removed when preparing for firing. This booster is used only with concrete piercing fuze M78A1 or M78. The booster is shipped and packed in the same container as the fuze but not assembled to the fuze. The booster M25 with the fuze M78A1 or M78 is used to convert a standard high-explosive artillery projectile into a concrete-piercing projectile.

275. Booster M124 (T35E3)

a. General. The booster M124 (fig. 101) is used in conjunction with fuze M506. The booster consists of an externally threaded steel body housing the delay arming mechanism, the lead charge, and an aluminum alloy cup containing the booster charge. The aluminum alloy cup with the 330-grain tetryl booster charge is screwed over one end of the booster body. Unlike other boosters, the booster has 1.7-inch diameter 14 TPI external threads and threads into the base of the fuze M507 (which has 2-inch diameter 12 TPI external threads). The delay arming mechanism of the booster differs from that of the booster M21A4 in using a ball rotor to hold the detonator in an out-of-line position. The booster arms at between 1,500 and 4,000 revolutions per minute.

b. Functioning. The four detents, which lock the ball rotor, move outward under centrifugal force as soon as the projectile begins to rotate, thereby forcing the rotor. The rotor does not move immediately, since it is held against the spherical seat in the booster body by its own inertial resistance to the acceleration of the projectile. When the projectile begins to decelerate, the ball rotor begins to turn toward the "in-line" or "armed" position. As the ball rotor arms, the counterbore forward of the detonator cavity drops over the annular projection of the flash hole entrance of the rotor retainer. The inertial weight of the ball rotor brought to bear by this deceleration of the projectile serves to lock the rotor in this position. The booster is then armed and will be caused to function by a flash from either the superquick detonator or the delay element of the fuze.

c. Preparation for Firing. Remove plastic cap and screw into the base of the fuze (a above).

![Diagram of Booster M124](image-url)
276. Booster M125 (T23)

a. General. The booster is used in conjunction with point-detonating fuze M508 and MT SQ fuze M518 and M520. The booster consists of a brass body containing the spin activated arming delay mechanism, the detonator M17, a booster lead charge, and an aluminum alloy cup threaded over the body containing a 340-grain tetrytol charge. The booster M125 (T23) is externally threaded to fit projectiles 75-mm and larger having 2-inch diameter 12 TPI nose threads and internally threaded to receive fuzes having 1.7-inch diameter 14 TPI external threads.

b. Functioning. To reach the armed position, the booster requires from 550 to 1,200 feet of projectile travel, depending on the velocity and spin rate of the projectile. The arming delay mechanism consists essentially of a rotor which holds the detonator M17 out of line and a gear train. Centrifugal force acting on the rotor (due to the spin of the projectile) alines the detonator and arms the fuze. The rotor is locked in position by the rotor detents. Centrifugal force due to the projectile’s spin causes the detents to move out releasing the rotor and causes the rotor to turn against the gear train. The turning speed of the rotor is controlled by the gear train and balance wheel assembly and the torque on the rotor is transferred through the gear train to the escape wheel. The escape wheel turns in individually distinct steps, due to the stopping action of the balance wheel and its pallet, that is, the teeth of the pallet are alternately engaged and cammed out of engagement with the escape wheel. When the detonator M17 reaches the aligned position, the fuze is armed. The rotor is locked in the armed position by a pin and ball combination. A portion of the pin acting under centrifugal force enters the cavity in the booster body. The steel ball then moves forward due to “creep” and seats in the space left by the pin, locking the pin and the rotor.

Section V. BURSTERS

277. General

In chemical projectiles or cartridges, the function of the explosive charge in a burster is to burst the projectile casing and disperse the chemical contents. Hence, the charges generally are known as burster charges and the assembly as a burster. The burster consists essentially of a high-explosive charge in a suitable thin-walled container. The burster is contained in a long tube assembly extending into the interior of projectile. This long tube assembly is called a burster casing. The burster casing hermetically seals the chemical agent within the shell body and prevents the burster from coming into direct contact with the chemical filler. The burster casing is press-fitted to the projectile.

278. Burster M5

This burster is used in the burster casing M5 in the smoke cartridge M60 for the 105-mm howitzers. The burster M5 consists of 1,800 grains of tetrytol (70-percent tetryl and 30-percent trinitrotoluene) in a steel tube, 0.755 inches in diameter and 12.41 inches long. The burster casing M5 is made of seamless steel tubing, 1.005 inches in diameter and 12.62 inches long and extends the full length of the projectile cavity. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with these chemical projectiles are the PD M57 and M51A5.

279. Burster M6

This burster is used in the burster casing M1 in the smoke projectile M104 for the 155-mm guns and with the smoke or gas projectiles M105 and M110 for the 155-mm howitzers. The burster M6 consists of 2,900 grains of tetrytol (70-percent tetryl and 30-percent trinitrotoluene) in a steel tube, 0.755 inches in diameter and 20.45 inches long. The burster casing M1 is made of steel tubing, 1.005 inches in diameter and 20.633 inches long and extends the full length of the projectile casing. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with 155-mm guns are the PD M51A5 (or M51A4) and the TSQ M55 and MT M67.
280. Burster M8

This burster, in conjunction with burster initiator M1, is used in the burster casing M6 in smoke cartridge M64 for 75-mm howitzer M1A1. The burster M8 consists of 446.2 grains of tetryl pellets loaded under pressure in an aluminum-alloy tube, 0.503 inches in diameter and 7.90 inches long. The burster casing M6 is made of steel tubing, 0.693 inches in diameter and 9.30 inches long; however, the overall length of the burster casing assembly, including the sleeve, is 9.43 inches and extends the full length of the projectile cavity. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with these projectiles are the PD M48A3 and M57.

281. Burster M23

This burster, in conjunction with burster initiator M2, is used in the burster casing M12 in smoke cartridges M361 for 76-mm guns M32 and M48. The burster M23 consists of 524 grains of tetryl (70-percent tetryl and 30-percent trinitrotoluene) in an aluminum-alloy tube, 0.765 inches in diameter and 5.12 inches long. Steel tubing may be used as an alternative for the aluminum-alloy tubing. The burster casing M12 is made of steel tubing, 0.105 inches in diameter and the overall length of the burster casing M12 (including the sleeve) is 6.65 inches and extends approximately seven-eighths of the length of the projectile cavity. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with these projectiles are the PD M48A3 and M57.

282. Burster M24

This burster, in conjunction with burster initiator M2, is used in the burster casing M13 in smoke cartridge M313 for the 90-mm gun cannons M1 and M2 series and M36, M41, and M54. The burster M24 consists of 1,019 grains of tetryl (70-percent tetryl and 30-percent trinitrotoluene) in an aluminum-alloy tube, 0.754 inches in diameter and 9.12 inches long. Steel tubing may be used as an alternative for the aluminum-alloy tubing. One type of burster casing M13 is made of steel tubing, using a steel closing cup on one end and a steel sleeve on the other. The overall length is approximately 10.72 inches. Another type of burster casing M13 is made in one-piece from bar steel. The overall length is 10.667 inches. The burster casing is press-fitted in the adapter of the projectile and extends the full length of the projectile cavity. The fuzes used with these projectiles are the PD M48A2 and M48A3.

283. Burster M37

The burster is used in the burster casing M17 for M121 and M122 GB gas projectiles, for 155-mm cannon. The burster M37 consists of 2.72 pounds of tetryl in a steel tube. The burster casing M17 is made of steel tubing 20.10 inches long and 2.30 inches in diameter. The casing is press-fitted in the projectile and extends the full length of the cavity.

284. Burster M40

This burster is used in the 105-mm howitzer GB gas cartridge M360. The burster assembly has a unit weight of 1.90 pounds and is made of a forged steel casing. The casing is press-fitted in the projectile and extends the full length of the cavity.

Section VI. EYEBOLT LIFTING PLUGS, CLOSING PLUGS, AND GROMMETS

285. Eyebolt Lifting Plugs

Separate-loading projectiles which are issued and shipped unfuzed are fitted with a suitable plug, called eyebolt lifting plug, to protect against the entrance of foreign matter into the fuze hole during shipment, storage, and handling and to provide a means of lifting these heavy projectiles. The plug is a screw-in type made of steel or malleable iron, with an eye on the outer surface to facilitate handling. In deep-cavity projectiles, a short piece of cardboard tubing called a “spacer” is provided and is placed between the supplementary charge and lifting plug to keep the supplementary charge free from movement. Several types of eyebolt lifting plugs are provided, the essential difference between the plugs is the size and type of threads. Types of plugs generally found in the field and characteristics thereof are given in table XI. See also figure 102.
280. Burster M8

This burster, in conjunction with burster initiator M1, is used in the burster casing M6 in smoke cartridge M64 for 75-mm howitzer M1A1. The burster M8 consists of 446.2 grams of tetryl pellets loaded under pressure in an aluminum-alloy tube, 0.503 inches in diameter and 7.90 inches long. The burster casing M6 is made of steel tubing, 0.693 inches in diameter and 9.30 inches long; however, the overall length of the burster casing assembly, including the sleeve, is 9.13 inches and extends the full length of the projectile cavity. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with these projectiles are the PD M48A3 and M57.

281. Burster M23

This burster, in conjunction with burster initiator M2, is used in the burster casing M12 in smoke cartridges M361 for 76-mm guns M32 and M48. The burster M23 consists of 521 grams of tetryl (70 percent tetryl and 30 percent trinitrotoluene) in an aluminum-alloy tube, 0.765 inches in diameter and 5.12 inches long. Steel tubing may be used as an alternative for the aluminum-alloy tubing. The burster casing M12 is made of steel tubing, 0.105 inches in diameter and the overall length of the burster casing M12 (including the sleeve) is 6.65 inches and extends approximately seven-eighths of the length of the projectile cavity. The burster casing is press-fitted in the adapter of the projectile. The fuzes used with these projectiles are the PD M48A3 and M57.

282. Burster M24

This burster, in conjunction with burster initiator M2, is used in the burster casing M13 in smoke cartridge M313 for the 90-mm gun cannons M1 and M2 series and M36, M41, and M54. The burster M24 consists of 1,019 grams of tetryl (70 percent tetryl and 30 percent trinitrotoluene) in an aluminum-alloy tube, 0.754 inches in diameter and 9.12 inches long. Steel tubing may be used as an alternative for the aluminum-alloy tubing. One type of burster casing M13 is made of steel tubing, using a steel closing cup on one end and a steel sleeve on the other. The overall length is approximately 10.72 inches. Another type of burster casing M13 is made in one-piece from bar steel. The overall length is 10.667 inches. The burster casing is press-fitted in the adapter of the projectile and extends the full length of the projectile cavity. The fuzes used with these projectiles are the PD M48A2 and M48A3.

283. Burster M37

The burster is used in the burster casing M17 for M29 and M332 GB gas projectiles for 105-mm cannon. The burster M37 consists of 2.72 pounds of tetryl in a steel tube. The burster casing M17 is made of steel tubing 20.10 inches long and 2.30 inches in diameter. The casing is press-fitted in the projectile and extends the full length of the cavity.

284. Burster M40

This burster is used in the 105-mm howitzer GB gas cartridge M360. The burster assembly has a unit weight of 1.90 pounds and is made of a forged steel casing. The casing is press-fitted in the projectile and extends the full length of the cavity.

Section VI. EYEBOLT LIFTING PLUGS, CLOSING PLUGS, AND GROMMETS

285. Eyebolt Lifting Plugs

Separate-loading projectiles which are issued and shipped unfuzed are fitted with a suitable plug, called eyebolt lifting plug, to protect against the entrance of foreign matter into the fuze hole during shipment, storage, and handling and to provide a means of lifting these heavy projectiles. The plug is a screw-in type made of steel or malleable iron, with an eye on the outer surface to facilitate handling. In deep-cavity projectiles, a short piece of cardboard tubing called a “spacer” is provided and is placed between the supplementary charge and lifting plug to keep the supplementary charge free from movement. Several types of eyebolt lifting plugs are provided, the essential difference between the plugs is the size and type of threads. Types of plugs generally found in the field and characteristics thereof are given in table X1. See also figure 102.
Figure 102. Eyeholt lifters, plugs.

THREADS:

"C"—1.7-14NS-1
"G"—2-12NS-1
"G" (ALT.)—2-12NS-1
Table XII. Types of Closing Plugs

<table>
<thead>
<tr>
<th>Piece mark No.</th>
<th>Type of plug and ammunition with which used</th>
<th>Thread size</th>
<th>Overall length (in.)</th>
<th>Diameter of plug (in.)</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-14-6575A</td>
<td>Unfused deep-cavity HE projectiles for 75-mm, 90-mm, 105-mm, and 120-mm weapons.</td>
<td>2-12NS-1</td>
<td>2.12</td>
<td>2.412</td>
<td>0.39</td>
</tr>
<tr>
<td>GA2728</td>
<td>CARTRIDGE, 90 MILLIMETER: HE, M71, w/o fuze for cannons M1, M2, M3, and M26, when packed in metal container M159A2 only.</td>
<td>2-12NS-1</td>
<td>3.74</td>
<td>2.412</td>
<td>0.93</td>
</tr>
</tbody>
</table>

286. Closing Plugs

In unfused deep-cavity fixed and semifixed ammunition, normally packed in individual containers, a closing plug protects against entrance of foreign matter into the fuze hole during shipment, storage, and handling. Closing plugs are threaded and have heads suitable for prescribed packing containers and wrenches. Closing plugs of older manufacture are made of steel; those of present manufacture are made of aluminum. A short piece of cardboard tubing called a "spacer" is provided between the closing plug and the supplementary charge to keep the charge moving. Types of closing plugs and their characteristics are given in table XII. See also figure 103.
287. Grommets

a. Types. To provide protection for their relatively soft rotating bands, projectiles shipped without packing are fitted with a grommet or ring of suitable material. Several types have been manufactured, the earliest of which is a rope grommet cut to required length and looped at both ends. When one grommet is required, it is placed directly over or in front of the rotating band, or in the case of double banded projectiles, between the bands. Two grommets are required for oversea shipments, one placed behind and one in front of the band. Rope grommets are secured by hemp twine drawn tightly through the two end loops and secured by a slipknot. The current approved grommet for 155-mm, 8-inch, and 280-mm projectiles is the metal and fiber type (fig. 104), which consists of a split ring of thin steel faced on the inner surface with a fiber liner of approximately 1/4 inch thickness. This grommet covers the entire rotating band and seats on the projectile without pressure on the band. It is secured by soft wire drawn tightly through the notches provided in the rim as described in b below. A third type, the rubber and metal grommet (fig. 104), designed for use with 155-mm projectiles, is similar to the metal and fiber grommet in that it covers the entire rotating band. However, it is made of a steel core, with a rubber cushioning, faced on the end and lower surfaces with cotton sheeting. This type, as well as the rope grommet, are no longer placed on newly issued projectiles.

b. Method of Securing Metal and Fiber Grommets. Metal and fiber grommets may be assembled to the projectile by the following methods:

1. Using 17-page upset-end wire tie or equivalent, insert the wire in tying slots C and D as shown in figure 105. Length of wire used should be 6 inches for 155-mm projectiles and 8 inches for larger projectiles.

2. Grasp the ends of the wire with a tying tool and twist not less than three full turns. If pliers are used, the wires should be pulled taut and the twist made as close as possible to the grommet.
286. Closing Plugs

In unfuzed deep-cavity fixed and semifixed ammunition, normally packed in individual containers, a closing plug protects against entrance of foreign matter into the fuze hole during shipment, storage, and handling. Closing plugs are threaded and have heads suitable for prescribed packing containers and wrenches. Closing plugs of older manufacture are made of steel; those of present manufacture are made of aluminum. A short piece of cardboard tubing called a "spacer" is provided between the closing plug and the supplementary charge to keep the charge moving. Types of closing plugs and their characteristics are given in Table XII. See also figure 103.

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<th>Piece mark No.</th>
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<th>Diameter of plug (in.)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td></td>
<td>2-12NS-1</td>
<td>2.12</td>
<td>2.412</td>
<td>0.39</td>
</tr>
<tr>
<td>75-14-6575A</td>
<td>Unfuzed deep-cavity HE projectiles for 75-mm, 90-mm, 105-mm, and 120-mm weapons.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td></td>
<td>2-12NS-1</td>
<td>3.74</td>
<td>2.412</td>
<td>0.93</td>
</tr>
<tr>
<td>GA2728</td>
<td>CARTRIDGE, 90 MILLIMETER: HE, M71, w/o fuze for cannons M1, M2, M3, and M28, when packed in metal container M159A2 only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
287. Grommets

a. Types. To provide protection for their relatively soft rotating bands, projectiles shipped without packing are fitted with a grommet or ring of suitable material. Several types have been manufactured, the earliest of which is a rope grommet cut to required length and looped at both ends. When one grommet is required, it is placed directly over or in front of the rotating band, or in the case of double banded projectiles, between the bands. Two grommets are required for overseas shipments, one placed behind and one in front of the band. Rope grommets are secured by hemp twine drawn tightly through the two end loops and secured by a slipknot. The current approved grommet for 155-mm, 8-inch, and 280-mm projectiles is the metal and fiber type (fig. 104), which consists of a split ring of thin steel faced on the inner surface with a fiber liner of approximately 1/8 inch thickness. This grommet covers the entire rotating band and seats on the projectile without pressure on the band. It is secured by soft wire drawn tightly through the notches provided in the rim as described in b below. A third type, the rubber and metal grommet (fig. 104), designed for use with 155-mm projectiles, is similar to the metal and fiber grommet in that it covers the entire rotating band. However, it is made of a steel core, with a rubber cushioning, faced on the end and lower surfaces with cotton sheeting. This type, as well as the rope grommet, are no longer placed on newly issued projectiles.

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1. Using 17-page upset-end wire tie or equivalent, insert the wire in tying slots C and D as shown in figure 105. Length of wire used should be 6 inches for 155-mm projectiles and 8 inches for larger projectiles.

2. Grasp the ends of the wire with a tying tool and twist not less than three full turns. If pliers are used, the wires should be pulled taut and the twist made as close as possible to the grommet.
(3) After the twist has been made, the ends of the wire should be tucked under the edges of slots as shown and bent flat against the grommet.

Figure 104. Grommets for separate-loading projectiles.

Figure 105. Assembly of metal and fiber grommet.
CHAPTER 4
DESTRUCTION OF AMMUNITION TO PREVENT ENEMY USE

288. General
a. Destruction of ammunition described herein, when subject to capture or abandon-
ment, will be undertaken by the using arm only when, in the judgment of the unit com-
mander concerned, such action is necessary in accordance with orders of or policy established
by the Army commander.

b. The information which follows is for guid-
anance only. The conditions under which destruct-
tion will be effected are command decisions and may vary in each case, dependent upon a
number of factors, such as the tactical situa-
tion, security classification of the ammunition
(AR 380–5), quantity and location of ammu-
nition, facilities for accomplishing destruction,
and time. In general, destruction of ammu-
nition can be accomplished most effectively by
burning or detonation or a combination of
these. Selection of the particular method of de-
struction requires imagination and resource-
fulness in the utilization of the facilities at
hand under the existing circumstances. Time
is usually critical.

c. If destruction to prevent enemy use is re-
sorted to, ammunition and its components must
be damaged so badly that they cannot be re-
stored to a usable condition in the combat zone.
d. If destruction of ammunition is directed,
due consideration should be given to:

(1) Accomplishment of the destruction in
such a manner as to cause the great-
est obstruction to enemy movement
and also prevent hazard to friendly
troops from fragments.

(2) Observance of appropriate safety precautions.

289. Methods
Ammunition can be destroyed most quickly
by burning or demolition. The following meth-
ods, in order of preference, are considered the
most satisfactory for destruction to prevent
enemy use.
a. Method No. 1—By Demolition.

(1) General. Packed and unpacked high-
explosive ammunition may be de-
stroyed by placing them in piles and
detonating with TNT, component C,
or other explosives of equivalent poten-
tial.

(2) Method of destruction.
(a) One hundred pounds of packed high-
explosive ammunition requires a 2-
pound demolition charge to insure
complete demolition. For unpacked
ammunition, a 1-pound demolition
charge per pile is sufficient.

(b) Prepare the demolition charge (us-
ing the required demolition blocks
together with the necessary de-
tonating cord per charge) and place
the charge on the ammunition pile
to be destroyed.

(c) Connect the charges with detonating
cord for simultaneous detonation.

(d) Provide for dual priming to mini-
imize the possibility of a misfire.

(e) Detonate the charges. For complete
details on the use of demolition ma-
terials and methods of priming and
detonating demolition charges, re-
fer to FM 5–25. Training and care-
ful planning are essential. The dan-
ger area for piles of ammunition
demolished is a circular area of a
radius which varies according to
the quantity of explosive ammu-
nition to be destroyed. Quantity-dis-
tance data is given in TM 9-1903.

b. Method No. 2—By Burning.

(1) General. Packed and unpacked high-
explosive ammunition, fuzes, primers,
and separate-loading propelling
charges may be destroyed quickly and
effectively by burning.
(2) Method of destruction.

(a) Place sufficient quantities of unpacked propelling charges around the base and on top of piles of HE complete rounds, projectiles, fuzes, primers, and propelling charges to provide a hot fire.

(b) Ignite the propellant, using a train of flammable material, such as excelsior, about 25 feet long and so place it that it will burn into the direction from which the wind is blowing. Protection must be provided against possible early explosion and projection of fragments and burning particles.
APPENDIX

REFERENCES

1. Publication Indexes

The following indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this technical manual.

Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings ............... DA Pam 108-1

Military Publications:
 Index of Administrative Publications .............................................................. DA Pam 310-1
 Index of Blank Forms .......................................................................................... DA Pam 310-2
 Index of Graphic Training Aids and Devices ....................................................... DA Pam 310-6
 Index of Supply Manuals; Ordnance Corps ....................................................... DA Pam 310-29

Index of Training Publications .............................................................................. DA Pam 310-3

2. Supply Manuals

The following supply manuals of the Depart- ment of the Army supply manual pertain to this materiel:

a. Ammunition.
 Ammunition (Class 1320 Ammunition, over 125-Millimeter) .................................. SM 9-5-1320
 Ammunition, 75-Millimeter Through 125-Millimeter .......................................... SM 9-5-1315
 Ammunition and Explosives (Class 1390 Fuzes and Primers) .............................. SM 9-5-1390
 Ammunition, over 30-Millimeter up to 75-Millimeter ........................................ SM 9-5-1310
 Stock List of All Items, Price List (Type 2): Ammunition and Explosives .............. SM 9-2-1300 series

b. Destruction to Prevent Enemy Use.
 Ammunition, Explosives, Bulk Propellants, and Explosive Devices ...................... SM 9-5-1375

c. General.

Introduction ................................................................................................. ORD 1
d. Maintenance and Repair.
 Tool Kit: Field Maintenance, Explosive Ordnance Disposal Squad (FSN 5180-754-0644). SM 9-4-5180-J8-1
 Tool Set, Maintenance (Field), Ammunition Renovation Platoon (41-T-3499-85) ....... ORD 6 SNL J-8, Sec. 4

3. Forms

The following forms pertain to this materiel:

DA Form 2028, Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9 (cut sheet)
DA Form 468, Unsatisfactory Equipment Report
DD Form 6, Report of Damaged or Improper Shipment
OO Form 517, Ammunition Condition Report

4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment:
a. Ammunition.
 Ammunition for Recoilless Rifles .......................................................................... TM 9-1300-204
 Ammunition for Training .................................................................................... T/A 23-100
 Ammunition, General .......................................................................................... TM 9-1900 TO 11A-1-20
 Ammunition Renovation ...................................................................................... TM 9-1905
 Ammunition: Restricted or Suspended .................................................................. TB 9-AMM-2
 Artillery Ammunition ............................................................................................ TM 9-1901/TO 11A-1-22
Ballistic Data, Performance of Ammunition .................................................. TM 9-1907
Care, Handling, Preservation, and Destruction of Ammunition .................. TM 9-1903

Demolition Materials .................................................................................. TM 9-1946
Disposal of Supplies and Equipment: Ammunition .................................... SR 755-140-1
Explosives: Disposal by Dumping at Sea .................................................... SR 75-70-10
Field Behavior of Chemical Agents .............................................................. AFR 68-3

Issue of Supplies and Equipment: Preparation, Processing, and Documentation for Requisitioning, Shipping, and Receiving ...................................................... AR 722-5
Military Chemistry and Chemical Agents .................................................... TM 3-215
Military Explosives ..................................................................................... TM 9-1910

Safety:
Accident Reporting and Records ................................................................. AR 385-40
Coordination with Armed Services Explosive Safety Board ...................... SR 385-15-1
Identification of Inert Ammunition and Ammunition Components .......... AR 385-65
Regulations for Firing Ammunition for Training, Target Practice, and Combat AR 385-63
Storage, Shipment, and Handling of Chemical Agents and Hazardous Chemicals ... TM 3-250
Supply Control: Distribution of Ammunition for Training .......................... AR 710-1300-1

b. Camouflage.
Camouflage, Basic Principles and Field Camouflage .................................. FM 5-20
c. Decontamination.
Decontamination ......................................................................................... TM 3-220
Small Unit Procedures in Atomic, Biological, and Chemical Warfare ........ FM 21-40
d. Destruction to Prevent Enemy Use.
Explosives and Demolitions ....................................................................... FM 5-25
e. Firing Tables. (See DA Pam 310-3.)
12-inch Graphical Firing Tables .................................................................. TM 9-524
Graphical Firing Tables: M39, M40, M41, M42, M43, M44, M45, M46, M47, M48, TM 9-525
M49, M50, and M51.
f. General.
Ammunition: Federal Stock Number and Department of Defense Codes ...... TB 9-AMM-5
Ammunition: Supply Within the Continental United States ....................... SB 9-AMM-6
Artillery Materiel and Associated Equipment .......................................... TM 9-2300
Inspection of Ordnance Materiel in Hands of Troops ................................ TM 9-1100
Installations:
Administration ......................................................................................... AR 210-10
Report of Loss, Theft, and Recovery of Government Property in the Continental AR 210-84
United States.

Logistics (General):
Malfunctions Involving Ammunition and Explosives (Reports Control Symbol AR 700-1300-8
ORD-43).
Unsatisfactory Equipment Report ............................................................... AR 700-38
Military Pyrotechnics .................................................................................. TM 9-1370-200
Military Symbols ......................................................................................... FM 21-30

AFM 55-3

Military Terms, Abbreviations, and Symbols:
Authorized Abbreviations and Brevity Codes .......................................... AR 320-60
Dictionary of United States Army Terms .................................................. AR 320-6
Military Training ......................................................................................... FM 21-5
Ordnance Ammunition Service .................................................................. FM 9-5
Ordnance Direct Support Service .............................................................. FM 9-3
Ordnance General and Depot Support Service .......................................... FM 9-4
Research and Development of Materiel: Operation of Materiel Under Extreme AR 706-15
Conditions of Environment.
Supply and Service Installations and Activities Depots—Organization and Command AR 780–10
Relationship.
Tactics and Techniques of Chemical, Biological, and Radiological (CBR) Warfare FM 3–5
Targets, Target Material, and Training Course Lay-Outs TM 9–855
Techniques of Military Instruction FM 21–6
Transportation and Travel:
Military Traffic Management Regulation AR 55–355
Transportation by Water of Explosives and Hazardous Cargo AR 55–228


g. Maintenance and Repair.
Maintenance of Supplies and Equipment: Spot Check Inspection and Reports, AR 750–925
Ordnance Corps Materiel.


h. Shipment and Limited Storage.
Instrument Guide: Ordnance Preservation, Packaging, Packing, Storage and Shipping TM 9–1005
Logistics (General): Report of Damaged or Improper Shipment AR 700–68
Marking and Packing of Supplies and Equipment: Marking of Oversea Supply AR 746–80
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Text, arrangement of 2 2
By Order of Wilber M. Brucker, Secretary of the Army:

L. L. LEMNITZER,
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Chief of Staff.

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For explanation of abbreviations used, see AR 320-50.