TECHNICAL MANUAL
No. 9–1300–204

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *25 May 1959*

AMMUNITION
FOR
RECOILLESS RIFLES

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*This manual supersedes those portions of TM 9–1901, 11 September 1950, including 1, 12 March 1954, and 2, 22 August, 1955, that pertain to rifles of the recoilless type.

CHAPTER 1

GENERAL

Section I. INTRODUCTION

1. Purpose and Scope

a. This manual is intended for instruction and the dissemination of such general and technical information concerning recoilless rifle ammunition (fig. 1) and components thereof as may be necessary for their proper care, handling, and use. General information on all types of conventional ammunition is contained in TM 9–1900. General information on care, handling, preservation, and destruction of conventional ammunition is contained in TM 9–1903. Both manuals should be available for use as required in connection with this manual.

b. The appendix contains a list of current references, including supply and technical manuals, forms, and other available publications applicable to this material.

c. This manual covers the characteristics, specific data, means of identification, special precautions in handling and use, information on packing and shipping, and methods of destruction to prevent enemy use.

d. This manual differs from pertinent portions of TM 9–1901, 11 September 1950, which it partly supersedes as follows:

(1) Adds information on ammunition

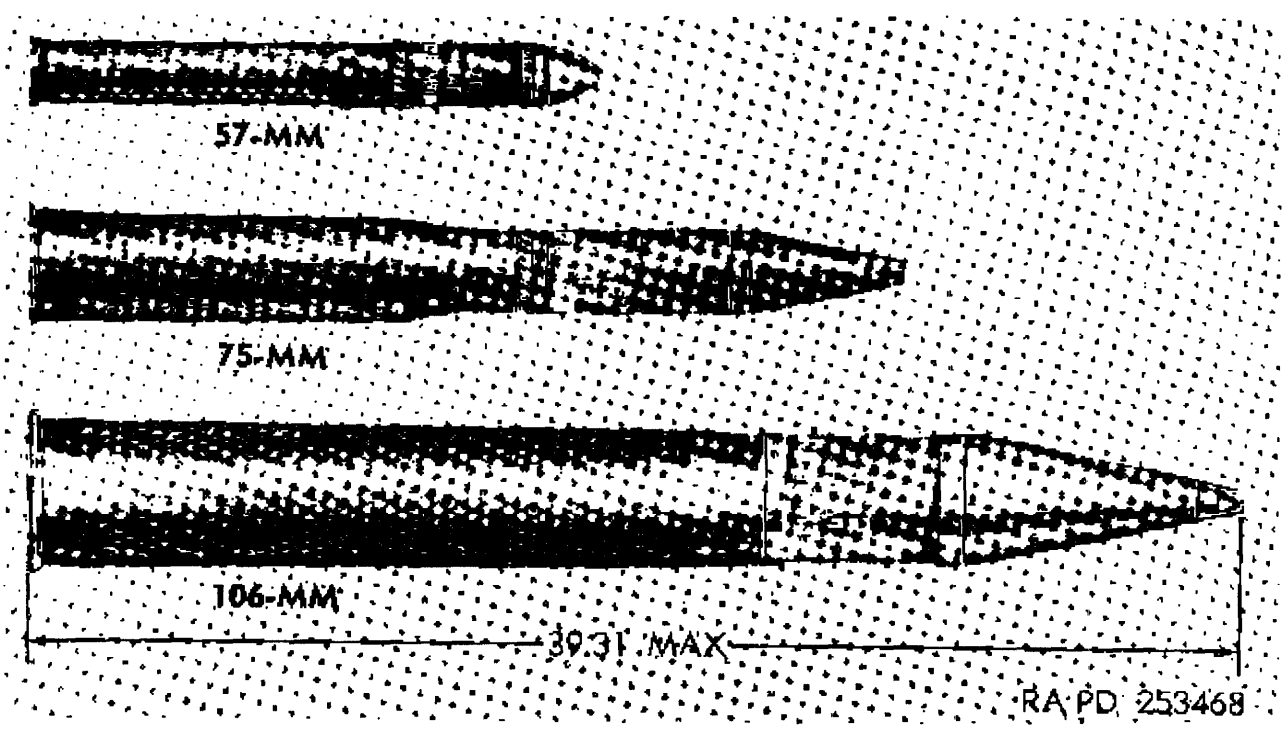

Figure 1. Recoilless rifle ammunition.

for 106-mm rifles and for caliber .50 spotting rifles.

(2) Adds information on:
  (*a*) Fuze PIBD M509.
  (*b*) New ammunition items and components.
  (*c*) Fuze wrench M27.

(3) Revises data, descriptions, and illustrations to bring the information up to date.

(4) Deletes obsolete ammunition items and components.

2. Arrangement of Text

a. Chapter 1 covers ammunition terms, classification of ammunition, means of identification, packing and marking for shipment, storage precautions, care in handling and use, and a discussion of recoilless rifle projectiles.

b. Chapter 2 presents specific data for and description of recoilless rifle cartridges and spotting rifle cartridges.

c. Chapter 3 describes subcaliber equipment and the ammunition therefor used with recoilless rifles.

d. Chapter 4 deals with the components, other than projectiles and cartridge cases, of complete rounds: fuzes, propelling charges, primers, boosters, and bursters.

e. Chapter 5 covers destruction of ammunition to prevent enemy use.

3. Forms and Reports

a. Authorized Forms. For a listing of all forms, refer to DA Pam 310–2. For instructions on use of these forms, refer to FM 9–10.

b. Field Reports of Accidents.

(1) *Injury to personnel or damage to materiel.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in AR 385–40. These reports are required whenever accidents involving injury to personnel or damage to materiel occur.

(2) *Ammunition.* Whenever an accident or malfunction involving the use of ammunition occurs, firing of the lot which produced malfunctions will be immediately discontinued. In addition to any applicable reports required in (1) above, details of the accident or malfunction should be immediately reported as prescribed in AR 700–1300–8 and AR 385–63.

c. Report of Errors or Omissions in Publications. Any errors or omissions will be forwarded to the Commanding Officer, Raritan Arsenal, Metuchen, N. J., ATTN: ORDJR-CPRA, using DA Form 2028.

Section II. GENERAL DISCUSSION

4. Definitions

a. Ammunition comprises that class of supplies usually containing explosives and chemicals and intended for use in combat, simulated combat, or training.

b. A cartridge, or a complete round of ammunition, comprises all the components necessary to fire the weapon once. For 75-mm rifle, the HE, AT cartridge includes the following: a base-fuzed high-explosive-loaded projectile and a cartridge case (with liner), which contains a propelling charge, primer, and an igniter charge. The primer initiates the igniter charge and propelling charge. The fuze detonates the explosive in the projectile at the most effective time and position. Recoilless rifle ammunition is termed *fixed,* because the propelling charge is not adjustable and the round is loaded into the weapon as a unit. The propelling charge develops a large volume of gas at an appropriate pressure to accomplish (1) and (2) below.

(1) Provide the gas to propel the projectile to its target.

(2) Provide the gas for rearward movement (momentum) through the rifle orifices to balance and counteract the forward movement (momentum) of the projectile (and gases) leaving the muzzle.

5. Classification

a. Recoilless Rifle Ammunition. Recoilless rifle ammunition is classified according to type of filler as explosives, chemical, or inert. It is classified according to use as service, practice, or dummy, which are employed as follows:

(1) *Service ammunition.* Service ammunition is fired for effect in combat. Dependent upon type of projectile, it may be high-explosive (HE or HEP); high-explosive with tracer (HEP-T); high-explosive, antitank (HE, AT); high-explosive, antitank with tracer (HE, AT-T); smoke (WP); or canister.

(2) *Practice ammunition.* Target practice (TP) ammunition is fired for training in marksmanship. The projectile has an inert filler and a small quantity of low explosive to serve as a spotting charge.

(3) *Dummy ammunition.* Dummy ammunition is used for training in handling and service of the rifle. It is completely inert.

b. Spotting Rifle Ammunition. Spotter-tracer cartridges are fired for spotting purposes from the caliber .50 spotting rifles used in conjunction with 106-mm rifles.

c. Subcaliber Equipment and Ammunition Therefor. A subcaliber device, called a subcaliber rifle, is equipment that is used for firing ammunition of a caliber smaller than standard for the recoilless rifle, to simulate firing conditions with the standard ammunition. The subcaliber rifles fire standard caliber .30 ball ammunition. Hence, no ammunition is specifically manufactured as subcaliber ammunition for recoilless rifles.

6. Standard Nomenclature (Description)

Standard nomenclature is established in order that each item supplied may be identified specifically by name. The standard nomenclature for recoilless rifle complete rounds normally consists of the following elements in the order given: The item name, a colon, the type of projectile, projectile model number, and fuze type, and model, if applicable, e.g., CARTRIDGE, 75 MILLIMETER: HE, AT-T, M310A1, w/fuze, BD, M91A1, for rifles M20, T21, and T21E4. The use of standard nomenclature for all purposes of record is mandatory. Recoilless rifle and spotting rifle ammunition authorized for issue is published in SM 9–5–1305, SM 9–5–1310, and SM 9–5–1315.

7. Identification

Ammunition for recoilless rifles is identified completely by the model, ammunition lot number, and the painting and marking on the cartridges and the packing containers. See TM 9–1900 for more detailed discussion.

8. Care, Handling, and Preservation

Recoilless rifle ammunition is packed to withstand conditions ordinarily encountered in the field, moisture-resistant containers and suitable packing boxes or crates being used to provide the desired protection for shipment and storage. For precautions and instructions for the care, handling, and preservation of ammunition, refer to TM 9–1903.

9. Storage Precautions

Recoilless rifle ammunition is composed of metals which are subject to corrosion and chemical agents and explosives which are subject to decomposition during storage. Hence, in order to preserve the ammunition during storage most effectively, the storage precautions given in TM 9–1903 should be observed.

10. Projectiles

a. General. Projectiles for recoilless rifle ammunition are hollow casings containing high-explosive, chemical, or inert fillers. Fuzes are required with projectiles containing high-explosive and chemical fillers and with projectiles containing inert fillers with black powder spotting charges. Completely inert projectiles use dummy or inert fuzes. Recoilless rifle projectiles are stabilized in flight by spin or by fins.

b. Components of Projectiles. The parts of typical recoilless rifle projectiles are described in (1) through (9) below. Complete general information is contained in TM 9–1900.

(1) *Fuze.* Point-detonating (PD), point-initiating (PI), and mechanical time superquick (MTSQ) fuzes are threaded to the noses of projectiles, continuing the contour of the projectile. Base-detonating and point-initiating base-detonating fuzes are threaded to the base. See section I, chapter 4, for fuze discussion.

(2) *Ogive.* The curved or conical portion of the projectile from the point to the bourrelet is called the ogive.

(3) *Bourrelet.* The bourrelet is an accurately machined cylindrical surface, of diameter slightly larger than the body, which bears on the lands of the bore of the rifle.

(4) *Body.* The main portion of the projectile is called the body. The term "body diameter" is used to designate diameter of the cylindrical portion of the projectile between the front bourrelet and rotating band or rear bourrelet.

(5) *Bursting charge.*

(*a*) High explosives fill the entire cavity in high-explosive projectiles except the space for the booster and the fuze. In smoke projectiles, a burster (pars. 71 and 72) is located axially in the projectile. The burster ruptures the projectile sufficiently to permit dispersion of the smoke filler

(*b*) Bursting charges for HE, AT projectile (*c*(2) below) are conical or hemispherical at the front end for penetration effect against armored targets. These charges also are referred to as "shaped charges" or "hollow charges."

(6) *Rotating band.* The spin-stabilized recoilless rifle projectiles have preengraved rotating bands. The rotating band may be of steel, integral with the projectile, or it may be of gilding metal. As the projectile moves forward in the rifle, the rotating band engages the rifling (lands and grooves), which has a helical twist. This imparts spin to the projectile. The rotating band prevents the escape of a large percentage of the propellent gases forward of the projectile by filling the grooves of the rifling.

(7) *Fins.* Some recoilless rifle projectiles are stabilized in flight by fins. These projectiles do not have rotating bands but have rear bourrelets. The fins may be either fixed or capable of folding. The folding fins in the closed position can be housed with the cartridge case. At the time the projectile leaves the muzzle, gas pressure actuates a piston, causing the fins to extend outward at an angle from the fixed pivot points.

(8) *Base.* Recoilless rifle projectiles (except fin stabilized and canister) have boat-tailed bases, that is, the surface to the rear of the rotating band (rear bourrelet) is conical.

(9) *Tracer.* For observation of fire, some projectiles are fitted with a tracer in the base.

c. Types of Projectiles. Dependent upon the type of projectile, recoilless rifle ammunition may be classified as indicated in paragraph 5. More complete descriptions of other types of projectiles are given in (1) through (6) below and in TM 9–1900.

(1) *High-explosive (HE) projectiles.* High-explosive projectiles, which are made of forged steel, have comparatively thin walls and a large bursting charge of high explosive. They are used against personnel and materiel targets, producing blast effect and fragmentation at the target. They have normal fuze cavities and may be fitted with an appropriate time and impact or impact fuze according to the action desired.

(2) *High-explosive, antitank (HE, AT) projectile.* This is a shaped-charge type of high-explosive projectile fuzed with a base-detonating (BD) fuze or a point-initiating base-detonating fuze and is used against armored targets. Its effect is dependent upon many factors, including the type and shape of the high-explosive charge, the standoff distance, the rotation (if present), and the characteristics of the fuze employed. When the projectile is detonated, the cone collapses and a jet is formed, which perforates the target. The jet consists of particles of metal from the cone traveling at very high velocities.

(3) *Smoke projectile.* The smoke projectile is of the burster type. It is similar to high-explosive projectiles. The burster, which is a tube filled with high explosive, is used to rupture the

projectile body and aid in dispersion of the smoke filler (WP).

(4) *Canister projectile.* The canister projectile consists of a relatively thin-walled cylindrical body welded to a heavy steel base. The body is filled with stacked cylindrical steel slugs. The canister body is designed to withstand the radial forces acting upon it while the projectile is in the bore of the weapon. Immediately after the projectile leaves the muzzle of the weapon, air pressure on the closing disk and centrifugal force acting on the steel slugs and canister body cause the body to open at four longitudinal slits, with resultant dispersion of the contents. Canister ammunition is intended for short range antipersonnel use.

(5) *Dummy projectiles.* Dummy projectiles simulate service projectiles and have the same dimensions, weight, and center of gravity as service projectiles. The dummy projectiles are essentially service projectiles which are inert loaded to bring them up to weight.

(6) *Target practice projectile.* Target practice projectiles simulate service projectiles and have the same dimensions, weight, and center of gravity as the service projectiles. Target practice projectiles are essentially service projectiles in which the standard high-explosive filler has been replaced by an inert filler and a black powder spotting charge.

d. Refuzing of Projectiles.

(1) *General.* Recoilless rifle projectiles, except canister, are fuzed as shipped with time and impact or impact fuzes. Fuze interchangeability is provided for in 75-mm high-explosive projectiles.

(2) *Refuzing projectiles.*

(*a*) Using an appropriate fuze wrench, remove the fuze from the projectile. Strike the wrench handle sharply with the heel of the hand in a counterclockwise direction to loosen the fuze. Remove the fuze.

(*b*) Screw in the appropriate fuze by hand in a clockwise direction. Tighten the fuze to the projectile, using an appropriate fuze wrench. Use only such force as can be applied by hand.

11. Cartridge Cases

a. General. Cartridge cases for recoilless rifle ammunition are made of steel. They have perforations and are attached to projectiles, in most cases, by ball-point or stab crimps.

b. Perforations. The perforations are for the purpose of venting the propellent gases to the rear through nozzles in the breechblock of the rifle. To protect the propellant and prevent loss of grains through the perforations, the inner surface of the cartridge case is lined, usually with a paper or plastic liner. Upon firing, the liner burns, permitting the propellent gases to escape through the perforations in the cartridge case.

c. Crimping. Cartridge cases for recoilless rifle ammunition are rigidly attached to the projectile by means of equally spaced ball-point or stab crimps. Crimps serve not only to hold the cartridge assembly together but also to provide the necessary shot-start. This is accomplished by restraining the projectile until the ignition system has had time to effectively ignite the propellant, thus providing for more effective burning.

12. Packing and Marking

a. General. Moisture-resistant packing are used for recoilless rifle ammunition. These packings are marked to furnish all essential information. Specific packing data for recoilless rifle cartridges will be found in SM 9–5–1310 and SM–9 5–1315; for cartridge used with subcaliber rifles and spotter-tracer cartridges, in SM 9–5–1305; and for fuzes, in SM 9–5–1390.

b. Packing. Recoilless rifle cartridges are packed individually in fiber containers (fig. 2). The fiber containers are overpacked in wooden boxes (four to a box) (fig. 3). 75-mm HE cartridges packed in fiber containers have "U" shaped packing stops fitted into the fuze wrench slots.

Note. These stops must be removed before firing.

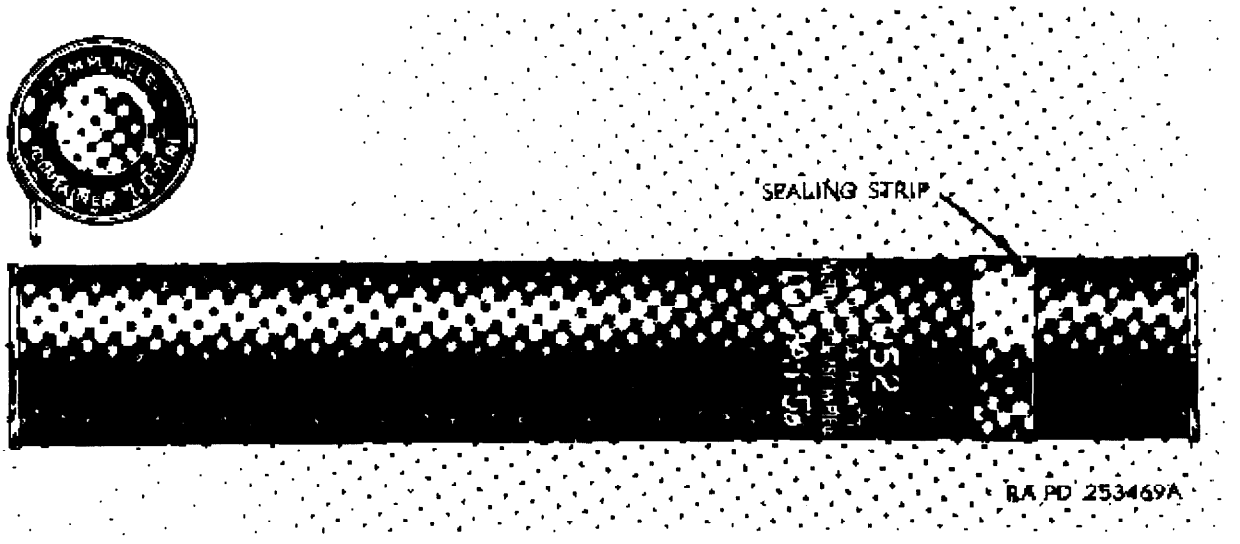

Figure 2. Fiber container M171A1.

c. Sealing.

(1) *Fiber containers.* Fiber containers are sealed by the application of colored sealing strips (adhesive tape) to the juncture between the cap and body. The strip seals the fiber container and provides, by its color, a means for identifying the type of cartridge as follows:

High explosive (HE) (HE, AT) (HEP)	yellow
Target practice (TP)	blue

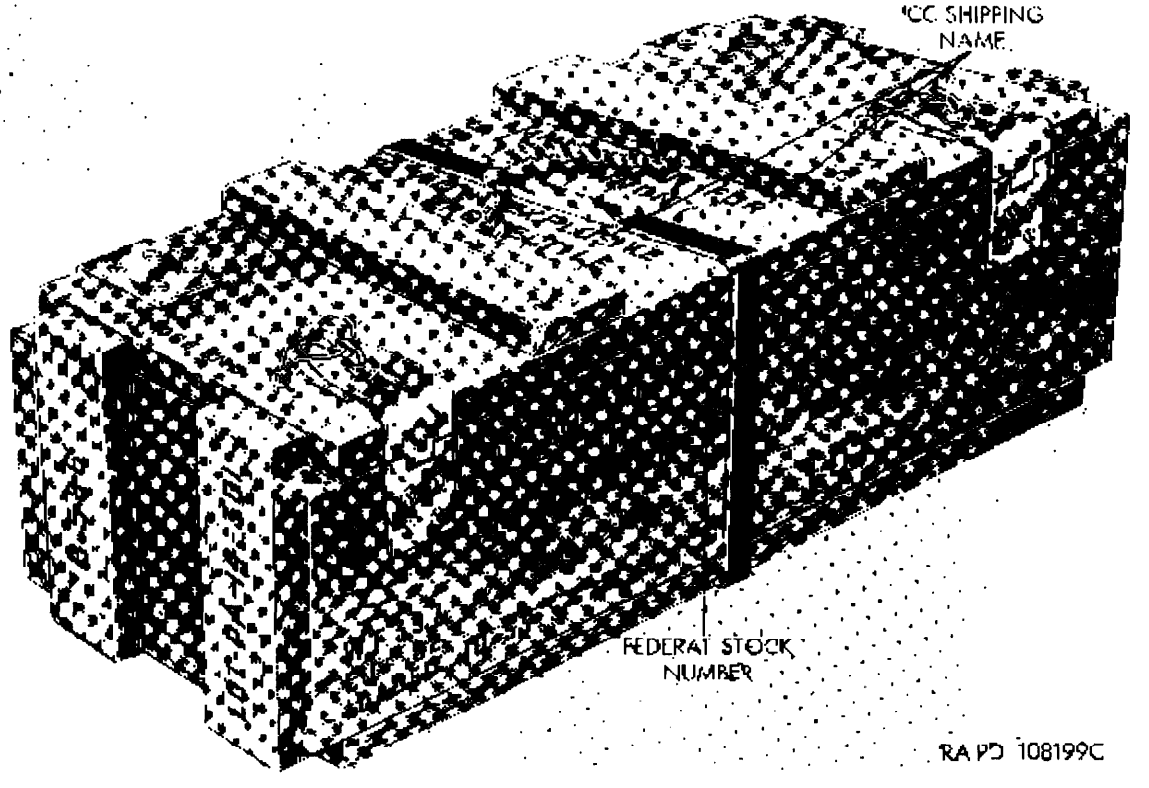

Figure 3. Wooden packing box.

Smoke (WP)	gray (one band marked in yellow)
Canister	black
Dummy	black

(2) *Wooden boxes.* When wooden packing boxes (fig. 3) containing ammunition are closed, the container is sealed in a manner which will indicate whether the container has been tampered with. In addition, wooden boxes are secured by metal strapping encircling the box.

d. Palletization. Boxes of ammunition are placed on pallets to reduce handling time and save man-hours in storing and shipping.

e. Marking for Shipment. Cartridges, fiber containers, and wooden packing boxes are marked as described in TM 9–1900.

CHAPTER 2

CARTRIDGES

Section I. AMMUNITION FOR 57-MM RIFLES M18, M18A1, AND T15E16

13. General

a. General Discussion. These rifles are portable recoilless weapons which can be fired from the shoulder, a bipod, or a caliber .30 machine gun tripod mount. Recoil is eliminated in these rifles by the controlled escape of propellent gases to the rear through openings in the breechblock. To assist in producing the required interior ballistics, ammunition for these rifles have a perforated cartridge case and an integral preengraved rotating band. The cartridges for these rifles are issued in the form of fixed complete rounds.

b. Identification. Ammunition for these rifles can be distinguished from the more conventional-type of fixed ammunition by the perforated cartridge case, a stop shoulder near the mouth of the cartridge case, and the preengraved integral rotating band on the projectile. 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 rifles is classified as canister; high-explosive (HE); high-explosive, antitank (HE, AT); smoke (WP); and target-practice (TP).

d. Fuze. Point-initiating (PI) fuze M90 or M90A1 is fitted to HE, AT cartridges. Point-detonating fuze M89 or M503 series is fitted to HE, smoke, and TP cartridges. See paragraphs 48 through 61 for more detailed information.

e. Cartridge Case. The cartridge case M30, M30A1, or M30A1B1 is used with 57-mm rifle ammunition. These cartridge cases, made of steel, have 400 circular perforations in the case side walls and have a stop shoulder near the forward end of the case. The perforations are for interior ballistic purposes and are arranged in a uniform pattern. The stop shoulder near the forward end of the cartridge case serves as a guide to facilitate engagement of the preengraved rotating band with the rifling of the weapon and as a stop to insure proper chambering of the round in the weapon. The cartridge cases M30, M30A1, and M30A1B1 are similar except for stop shoulders and cartridge case liners. The cartridge case M30 uses a gilding metal ring as a stop shoulder. The cartridge case M30A1 does not use a separate ring but has a raised integral circumferential stop shoulder. The cartridge case M30A1B1 is similar to the cartridge case M30A1 except that the stop shoulder consists of three (or more) equally spaced integral projections. These cartridge cases are coated with varnish to prevent rusting; the varnish imparts a brown color to the cases. Cartridge case M30 weighs 1.63 pounds and cartridge cases M30A1 and M30A1B1 weigh 1.33 pounds.

f. Propelling Charge. The cartridges contain 1.0 pound of propellant M10. See paragraphs 62 through 66 for more detailed information.

g. Liners. The interior of the cartridge case M30 is lined with a brown paper liner that is secured to the inner wall by means of lacquer. The paper liner is positioned to cover the perforations, thereby protecting the propellant and preventing its loss. Cartridge cases M30A1 and M30A1B1 are provided with a flexible plastic liner to protect and retain the propellant. The plastic liner has a formed ring in its bottom, which fits snugly over the primer and seals the bottom end. After filling with propellant, the liner is heat-sealed.

k. Primer. The percussion primer M60A1 (a 285-grain primer) is being used currently in 57-mm rifle ammunition. In cartridges of less recent manufacture, the primer M60 (285-grain) and the primer M46 (200-grain) were used. See paragraphs 71 and 72 for more detailed information.

l. Packing and Shipping Data. Cartridges for 57-mm rifles are packed one per fiber container, four fiber containers per wooden box. Packing and shipping data appear in SM 9–5-1310. Packing and marking for shipment are described in paragraphs 4 through 12.

14. Cartridge, 57 Millimeter: Canister, T25E5

a. General. This cartridge (fig. 4) is intended primarily for antipersonnel use at a close range. The plastic-lined cartridge case M30A1 or M30A1B1 is crimped to the canister projectile by means of four equally spaced ball-point crimps. The canister projectile consists of a relatively thin steel cylindrical body, which is soldered to a heavy steel base having an integral rotating band. The body has four equally spaced longitudinal body slits which extend rearward from the front end to within ¼ inch of the preengraved rotating band. The body, which contains 133 stacked cylindrical steel slugs, is closed at the forward end by means of a closing disk. Immediately after the projectile leaves the muzzle of the rifle, air pressure on the closing disk and centrifugal force acting on the body and the slugs cause the canister to break at the longitudinal slits in the body, with resultant dispersion of the slugs. The round has maximum lethal effect at ranges up to 175 feet. The approximate pattern density for this canister is one complete penetration per 4 square feet on a target of 1-inch thick pine board at a range of 175 feet.

b. Data.

Weight of complete round	5.48 lb
Weight of canister, as fired	2.75 lb
Length of complete round	15.48 in.
Length of canister	4.36 in.
Length of cartridge case	12.00 in.
Width of rotating band	0.87 in.
Type of base	Square

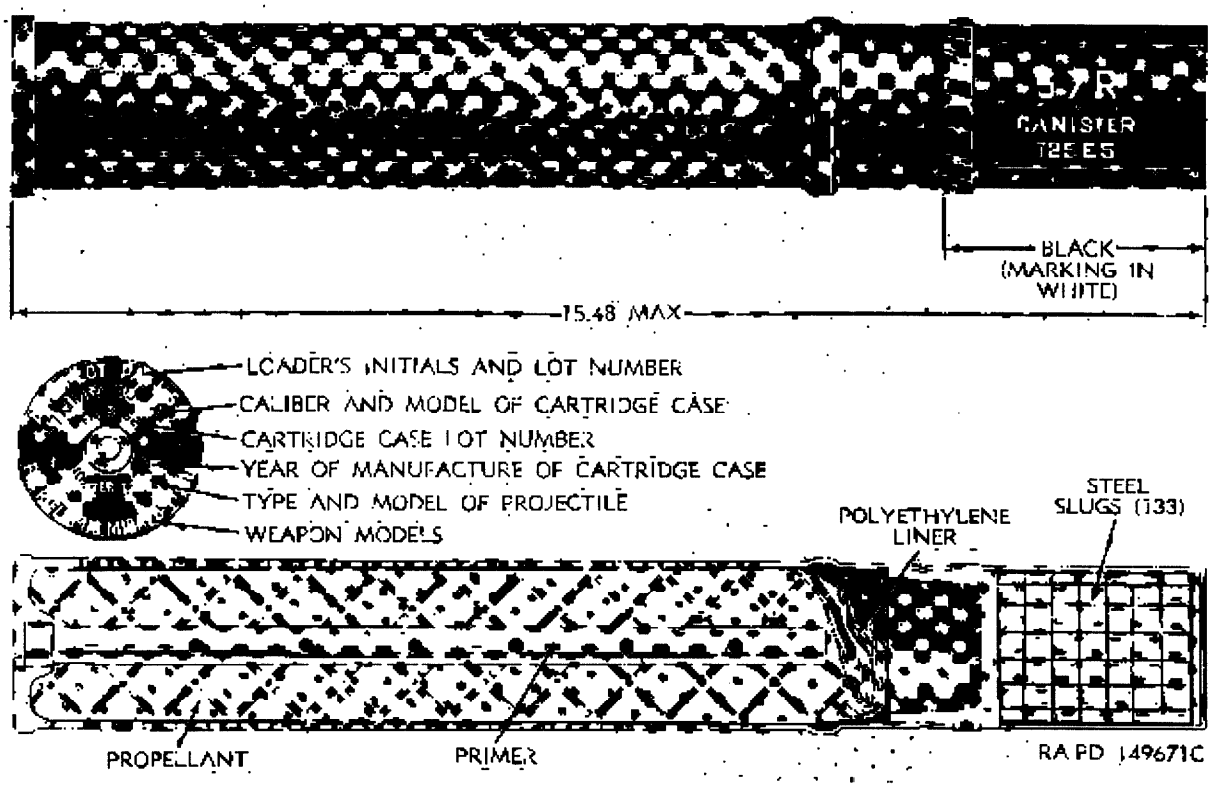

Figure 4. Cartridge, 57 millimeter: canister, T25E5.

15. Cartridge, 57 Millimeter: HE, M306, w/Fuze, PD, M89

This cartridge resembles the high-explosive cartridge M306A1 described in paragraph 16. The cartridge differs principally from the cartridge M306A1 in the design of the crimping groove. The projectile is crimped to paper-lined cartridge case M30 fitted with percussion primer M46. The high-explosive filler is 0.60 pound of cast TNT.

16. Cartridge, 57 Millimeter: HE, M306A1, w/Fuze, PD, M503 or M503A1

a. General. This cartridge (fig. 5) is intended for blast and fragmentation effect. The plastic-lined cartridge case M30A1 or M30A1B1 is crimped to the high-explosive projectile by means of four equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing an 0.55-pound explosive charge of Composition B. Cartridges of earlier manufacture contain an 0.52-pound TNT explosive charge. The projectile has a square base, a short internally threaded ogival nose, and an integral preengraved rotating band. A bourrelet to the rear of the ogive and another immediately in front of the rotating band provide bearing surfaces for the projectile during its travel through the rifle bore.

b. Data.

Weight of complete round	5.46 lb
Weight of projectile, as fired	2.78 lb
Length of complete round	17.54 in.
Length of fuzed projectile	6.47 in.
Length of cartridge case	12.0 in.
Width of rotating band	0.37 in.
Type of base	Square
Muzzle velocity	1,200 fps
Maximum range	4,030 yd

17. Cartridge, 57 Millimeter: HE, AT, M307, w/Fuze, PI, M90

This cartridge resembles the cartridge M307A1 described in paragraph 18. The cartridge M307 differs principally from the cartridge M307A1 in the design of the crimping groove. The projectile is crimped to paper-lined cartridge case M30 fitted with percussion primer M46. The projectile filler is 0.39 pound of 50-50 pentolite.

18. Cartridge, 57 Millimeter: HE, AT, M307A1, w/Fuze, PI, M90 or M90A1

a. General. This cartridge (fig. 6) is used against armored targets. The plastic-lined cartridge case M30A1B1 is crimped to the high-explosive antitank projectile by means of four equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing a shaped charge of 0.40 pound of Composition B. Cartridges of earlier manufacture have the plastic-lined cartridge case

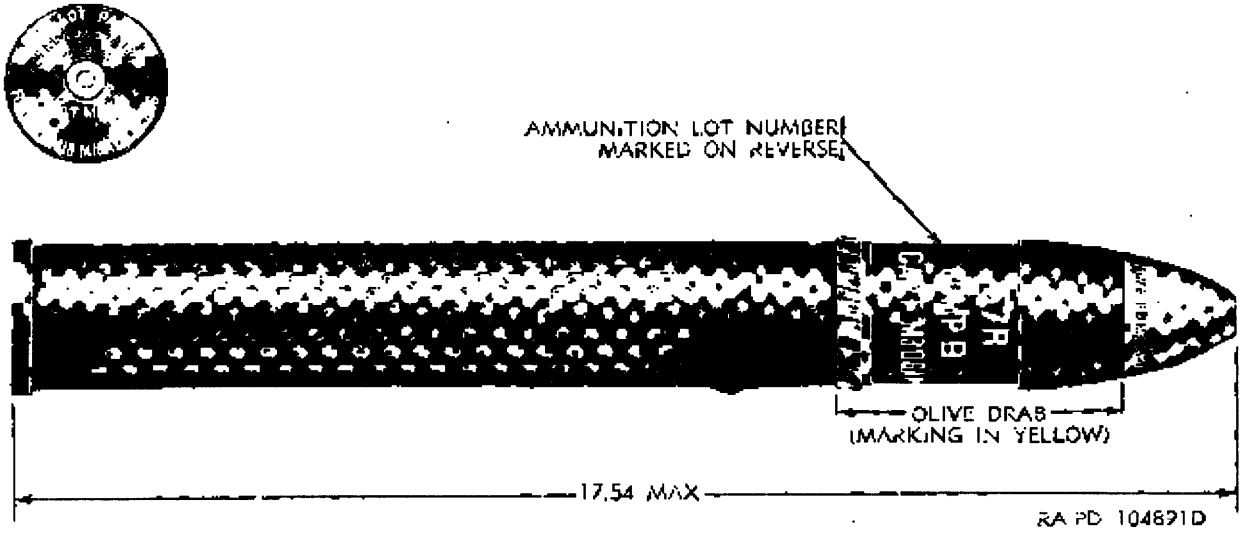

Figure 5. Cartridge, 57 millimeter: HE, M306A1, w/fuze, PD, M503A1.

M30A1 and are assembled with projectiles containing 0.39 pound of 50-50 pentolite. The projectile is threaded externally at the forward end to receive the PI fuze M90 or M90A1. The shaped charge is to the rear of a hemispherical copper liner, which is crimped to the interior of the projectile. A steel sleeve brazed to the neck of the copper liner extends axially through the shaped charge as a passage from the fuze to the booster pellet in the base of the explosive charge. Functioning is initiated by by impact; the flash from the fuze fires the booster pellet in the base of the explosive charge, which in turn, causes detonation of the charge. Concentration of blast is obtained as a result of the shape of the charge. The space forward of the copper liner provides the "stand off" necessary for the penetration of target.

b. Data.

Weight of complete round	5.43 lb
Weight of projectile, as fired	2.75 lb
Length of complete round	18.78 in.
Length of fuzed projectile	8.07 in.
Length of cartridge case	12.0 in.
Width of rotating band	0.37 in.
Type of base	Square
Muzzle velocity	1,200 fps
Maximum range	4,860 yd

19. Cartridge, 57 Millimeter: Smoke, WP, M308, w/Fuze, PD, M89

This cartridge is similar to the smoke cartridge described in paragraph 20. Cartridge M308 differs principally from the cartridge M308A1 in the design of the crimping groove. The projectile is crimped to a paper-lined cartridge case M30 fitted with percussion primer M46.

20. Cartridge, 57 Millimeter: Smoke, WP, M308A1, w/Fuze, PD, M503A1

a. General. This cartridge (fig. 7) is used to produce a screening smoke and for spotting purposes. The projectile is crimped to the plastic-lined cartridge case M30A1B1 by means of four equally spaced ball-point crimps. In external contour and ballistically, this projectile matches the high-explosive projectile (par. 16). The projectile consists of a relatively thin-walled body having front and rear bourrelets and containing 0.37 pound of white phosphorus (WP). The projectile body is fitted with a steel adapter at the nose end to accommodate the fuze and the burster assembly (pars. 71 and 72). Functioning of the fuze on impact causes detonation of the burster, rupturing the projectile body and dispersing the WP smoke charge. The smoke charge ignites on contact with the air, creating a dense, white smoke. Some cartridges are issued fitted with PD fuze M89 or M503.

b. Data.

Weight of complete round	5.43 lb
Weight of projectile, as fired	2.75 lb
Length of complete round	17.54 in.
Length of fuzed projectile	6.48 in.
Length of cartridge case	12.0 in.
Width of rotating band	0.37 in.
Type of base	Square
Muzzle velocity	1,200 fps
Maximum range	4,530 yd

21. Cartridge, 57 Millimeter: TP, M306 (inert projectile), w/Fuze, PD, M89, Inert, or Fuze, Dummy, T126

This cartridge is similar to that described in paragraph 22. It differs chiefly in having a completely inert projectile, loaded with 0.52-pound inert filler and an inert fuze. The projectile is crimped to the cartridge case M30 fitted with primer M46.

22. Cartridge, 57 Millimeter: TP, M306A1, w/Fuze, PD, M503 or M503A1

a. This cartridge (fig. 8) is intended for use in target practice. The components comprising this cartridge are the same as those used in the high-explosive cartridge described in paragraph 16, except for filler. The TP projectile M306A1 differs from the HE projectile M306A1 only in the filler, which is 0.448 pound of inert material and a 0.07-pound black powder pellet to serve as a spotting charge. Ballistically, the TP projectile matches the HE projectile.

b. Data. All data for the HE cartridge in paragraph 16*b* are applicable to the TP cartridge.

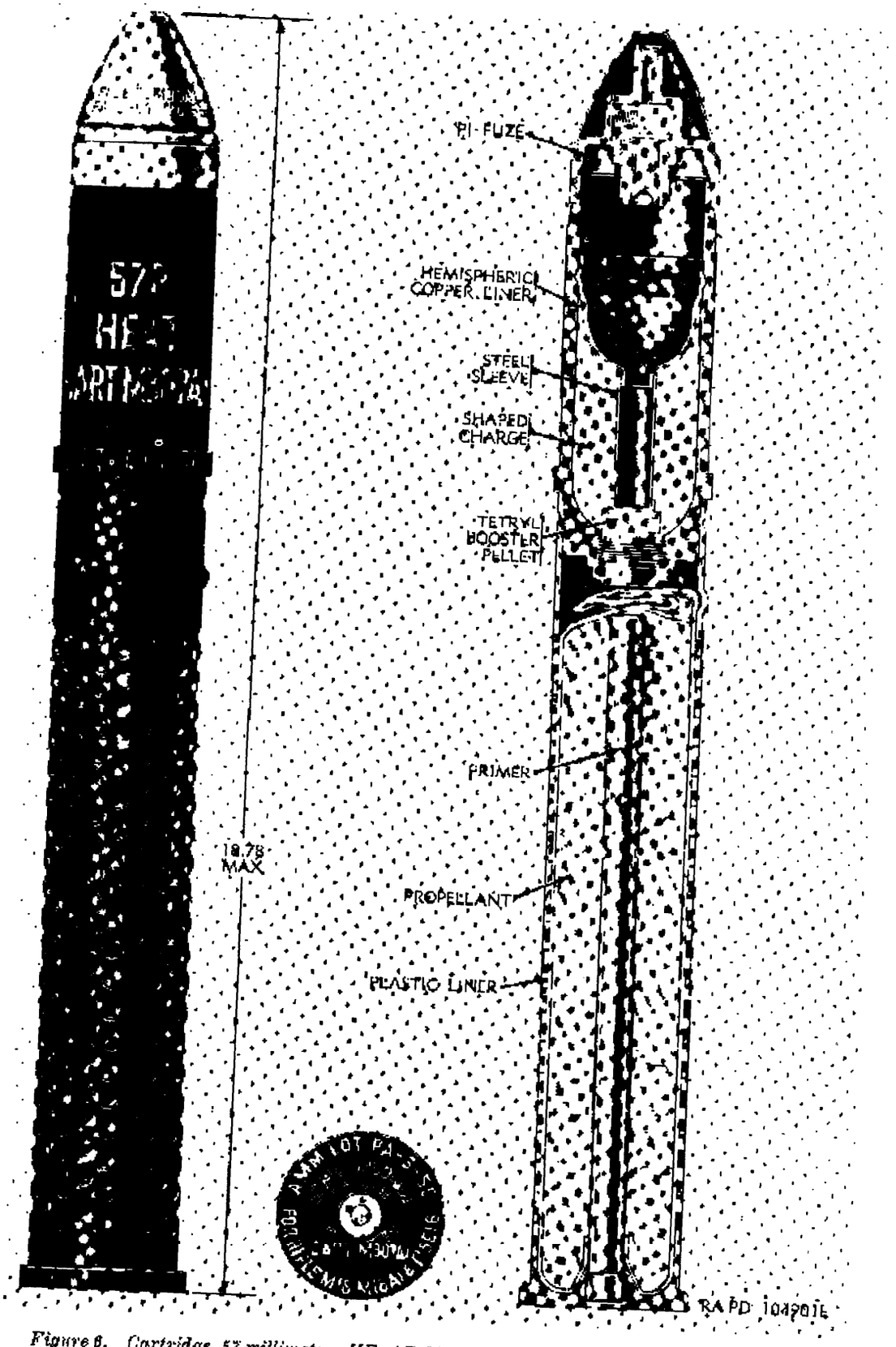

Figure 6. Cartridge, 57 millimeter: HE, AT, M307A1, w/fuze, PI, M80 or M80A1 (color).

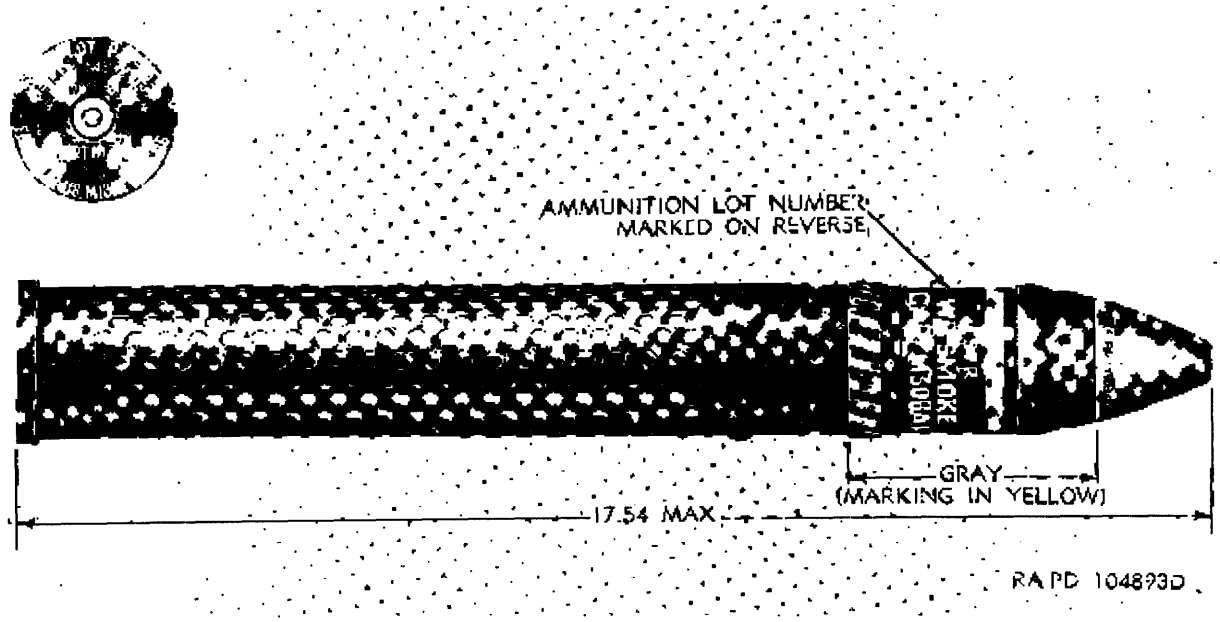

Figure 7. Cartridge, 57 millimeter: smoke, WP, M508A1, w/fuze, PD, M508A1.

Section II. AMMUNITION FOR 75-MM RIFLES M20 AND T21E12

23. General

a. General Discussion. These rifles are portable recoilless weapons which are fired from the caliber .30 machinegun tripod mount M1917A1. Recoil is eliminated in these rifles by the controlled escape of propellent gases to the rear through openings in the breechblock. To assist in producing the required interior ballistics, cartridges for these rifles have perforated cartridge cases and integral preengraved rotating bands. The cartridges for these rifles are issued in the form of fixed complete rounds.

b. Identification. Ammunition for these rifles can be distinguished from older types of fixed ammunition by the perforated cart-

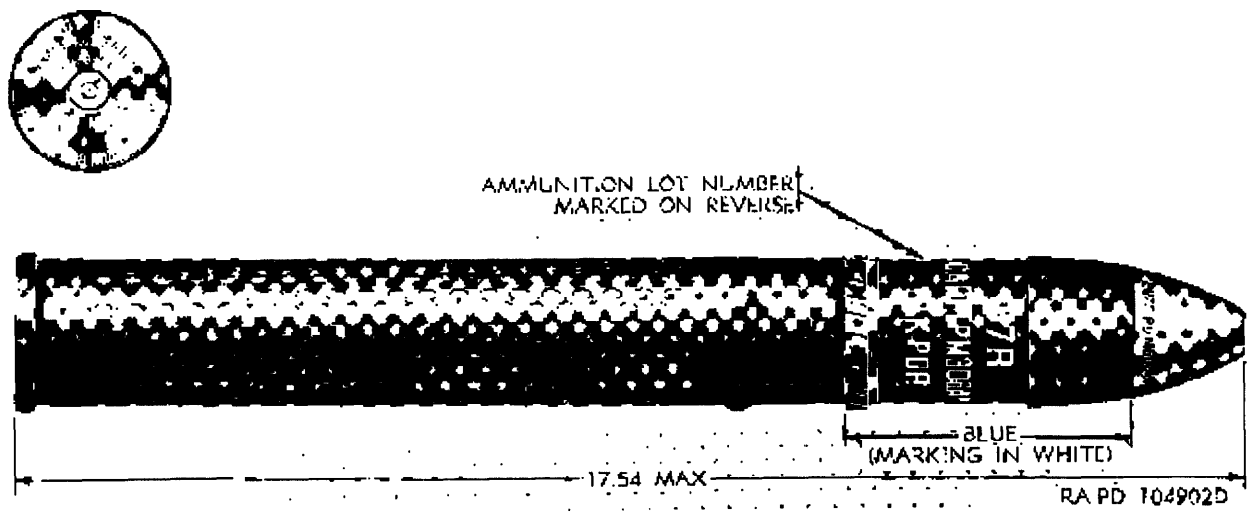

Figure 8. Cartridge, 57 millimeter: TP, M306A1, w/fuze, PD, M503 or M503A1.

ridge case and the preengraved rotating band on the projectile. Painting and marking for identification are in accordance with the basic color scheme prescribed in TM 9–1900. See also figures 9 through 12.

c. Projectile. Dependent upon type of projectile, ammunition for these rifles is classified as high-explosive (HE or HEP–T), high-explosive antitank (HE, AT or HE, AT–T), smoke (WP), and target practice (TP).

d. Fuze. The PD fuzes M48A3 and M57 are impact-type fuzes and are used in conjunction with burster initiator M1 with smoke (WP) rounds. The PD fuze M51A5 (or M51A4) is an impact-type fuze and is used with HE and TP rounds. The MTSQ fuzes M500 series are mechanical time and impact fuzes that permit adjustment of time setting to 75 seconds and are used with HE rounds. The MTSQ fuzes M500 series also incorporate an impact element. The BD fuze M62A1 and the BD fuze M91 series are of the inertia-type and are used with HE, AT or HE, AT–T, and HEP–T rounds. The dummy fuze M73 has approximately the same contour and weight as the PD fuzes but is not designed to function. The dummy fuze is used with TP rounds that have inert projectiles.

e. Cartridge Case. The cartridge case M31 or M31A1 is used with 75-mm rifle ammunition. These cartridge cases are made of steel and differ from the more conventional type of cartridge cases by having 992 circular perforations in the side walls. The perforations are for interior ballistic purposes and are arranged in a uniform pattern. The cartridge cases are coated with varnish to prevent rusting; the varnish imparts a brown color to the cases. The weight of the cases is approximately 4.25 pounds.

f. Liner. The interior of the cartridge case M31 is lined with a brown paper liner that is secured to the inner wall by means of lacquer. The paper liner is positioned to cover the perforations, thereby protecting the propellant and preventing its loss. The cartridge case M31A1 employs a separate rayon liner within a plastic liner to protect and retain the propellant. The plastic liner has a tight-fitting ring in its formed bottom which fits snugly over the primer and seals the bottom end. After the propellant and the igniter charge are loaded into the liners, the top of the plastic liner is tied or heat-sealed.

g. Propelling Charge. The propelling charge for 75-mm rifle ammunition consists of varying quantities of propellant M10 as follows: for HE, AT rounds, 3.19 pounds; for HE and TP rounds, 3.30 pounds; and for WP rounds, 3.42 pounds. See paragraphs 62 through 66 for more detailed information.

h. Primer. The percussion primer M47 or M47B2, a 300-grain primer, is used with 75-mm rifle ammunition. See paragraphs 67 through 70 for more detailed information.

i. Igniter Charge. The igniter charge consists of 305 grains 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.

j. Packing and Shipping Data. Cartridges for 75-mm rifles are packed one per fiber container, two fiber containers per wooden box. Packing and shipping data appear in SM 9–5–1310. Packing and marking for shipment are described in paragraph 12.

24. Cartridge, 75 Millimeter: HE, M309, w/Fuze, PD, M51A4, 0.05-Sec Delay

This cartridge resembles the cartridge M309A1 described in paragraph 26. The cartridge M309 differs principally from the cartridge M309A1 in the crimping groove. The projectile is crimped to paper-lined cartridge case M31.

25. Cartridge, 75 Millimeter: HE, M309A1, w/Fuze, MTSQ, M500A1 (or M500)

This cartridge is similar to the cartridge described in paragraph 26 except that it is assembled with the mechanical time and superquick fuze M500A1 (or M500). The data listed in paragraph 26*b* are applicable to this cartridge.

26. Cartridge, 75 Millimeter: HE, M309A1, w/Fuze, PD, M51A5, 0.05-Sec Delay

a. General. This cartridge (fig. 9) is intended for blast and fragmentation effect. The plastic-lined cartridge case M31A1 is crimped to the high-explosive projectile by means of four equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing a 1.49-pound bursting charge

of TNT. The projectile has a boat-tailed base, a long, internally threaded ogival nose, and an integral preengraved rotating band. A bourrelet to the rear of the ogive and another immediately in front of the rotating band provide bearing surfaces for the projectile during its travel through the rifle bore.

b. Data.

Weight of complete round	22.37 lb
Weight of projectile, as fired	14.40 lb
Length of complete round	28.92 in.
Length of fuzed projectile	15.1 in.
Length of cartridge case	10.0 in.
Width of rotating band	0.35 in.
Type of base	Boat-tailed
Degree of taper of base	8° 45′
Radius of ogive	7.47 cal.
Muzzle velocity	900 fps
Maximum range	6,960 yd

27. Cartridge, 75 Millimeter: HE, AT, M310, w/Fuze, BD, M62A1

This cartridge resembles the cartridge M310A1 described in paragraph 28. The cartridge M310 differs principally from the cartridge M310A1 in the crimping groove. The projectile is crimped to paper-lined cartridge case M31. The projectile filler is 0.81 pound of 50-50 pentolite; and 0.19 pound of 10-90 pentolite surrounds the fuze well.

28. Cartridge, 75 Millimeter: HE, AT-T, M310A1, w/Fuze, BD, M91A1

a. General. This cartridge (fig. 10) is used against armored targets. The plastic-lined cartridge case M31A1 is crimped to the high-explosive antitank projectile by means of four equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing a shaped charge of 1.00 pound of Composition B. Projectiles of earlier manufacture contain 0.81 pound of 50-50 pentolite; and 0.19 pound of 10-90 pentolite surrounds the fuze well. The projectile body is internally threaded at the base to receive the BD fuze M91A1 (or M91) with integral tracer and at the nose to receive the ogive assembly, which acts as a ballistic cap. The shaped charge is to the rear of a thin copper cone which is cemented to the interior of the projectile. Concentration of blast is obtained by the shape of the charge. The space forward of the copper cone provides the "stand off" necessary for the penetration of target.

b. Data.

Weight of complete round	21.08 lb
Weight of projectile, as fired	13.10 lb
Length of complete round	28.92 in.
Length of fuzed projectile	15.95 in.
Length of cartridge case	10.0 in.
Width of rotating band	0.35 in.
Type of base	Boat-tailed

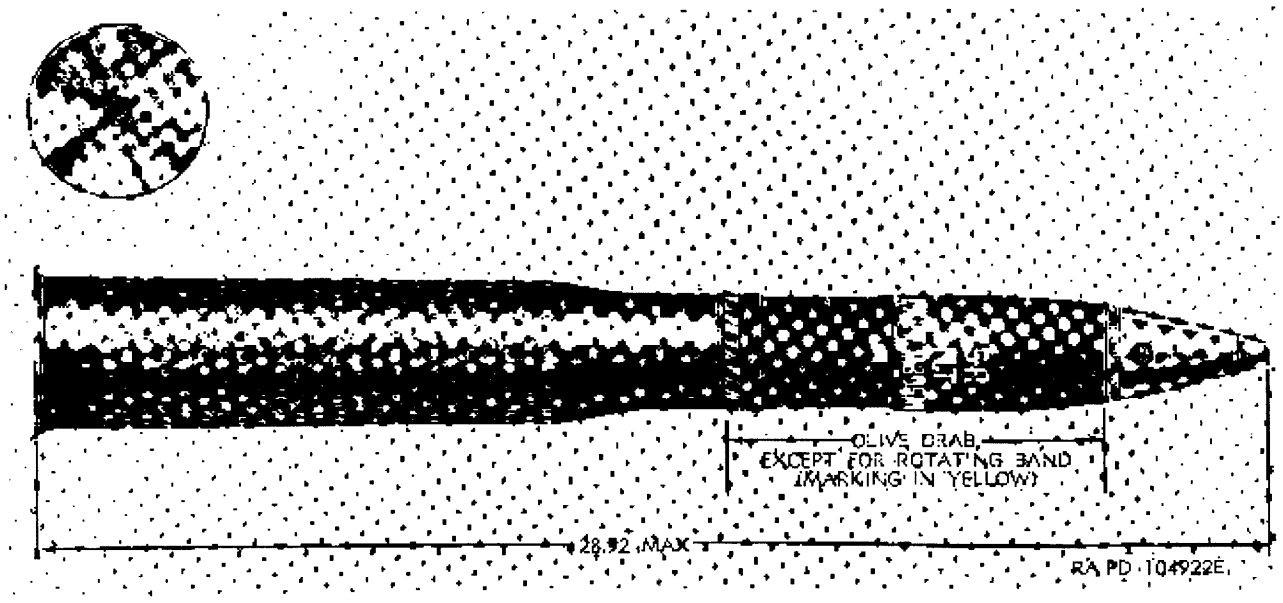

Figure 9. Cartridge, 75 millimeter: HE, M309A1, w/fuze, PD, M51A5, 0.05-sec delay.

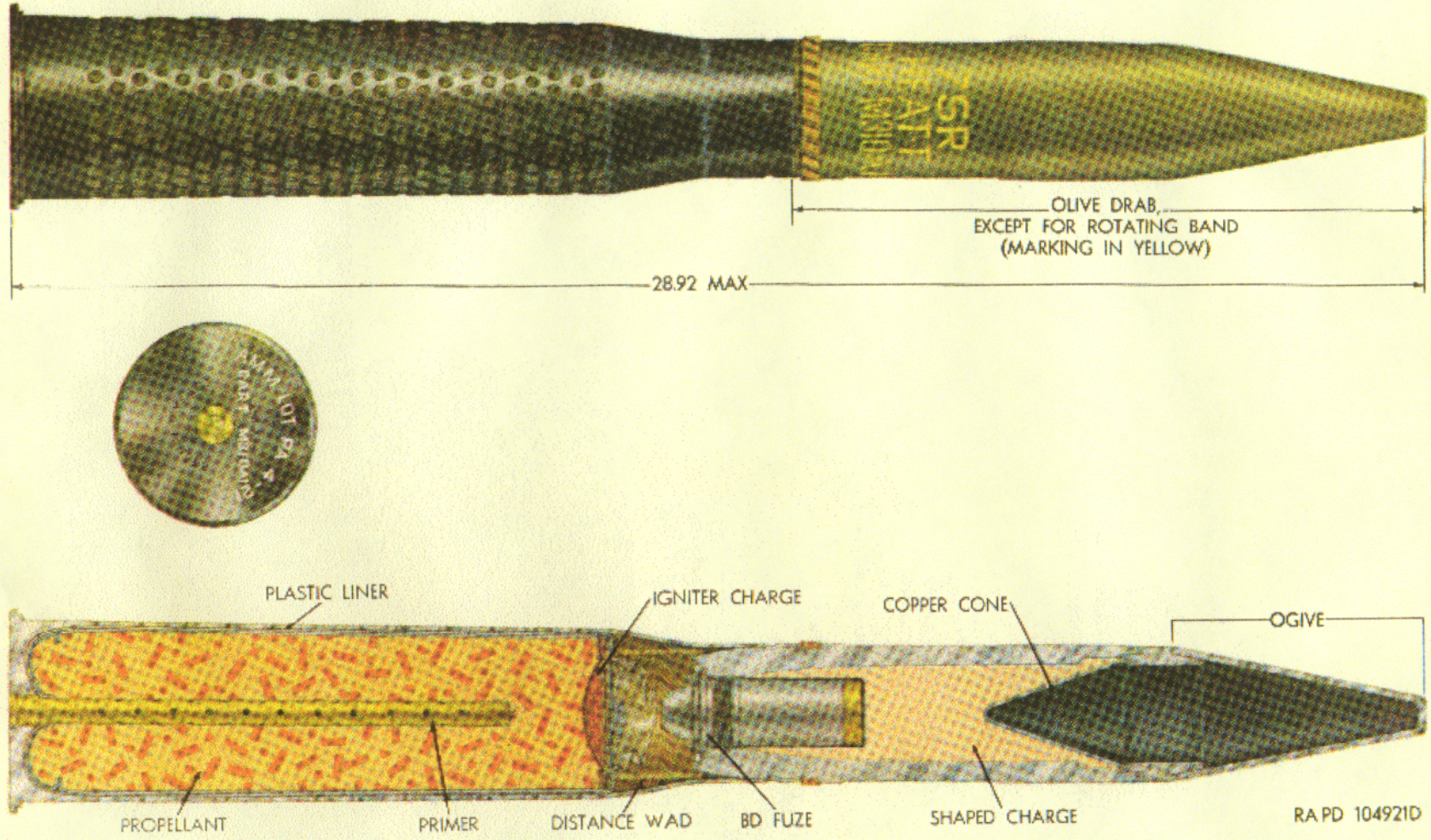

Figure 10. Cartridge, 75 millimeter: HE, AT–T, M310A1, w/fuze, BD, M91A1.

Degree of taper of base	8° 45′
Type of ogive	conical
Muzzle velocity	1,000 fps
Maximum range	7,300 yd

29. Cartridge, 75 Millimeter: HEP-T, M349, w/Fuze, BD, M91A1

a. General. This cartridge (fig. 11) is used against armored targets. The plastic-lined cartridge case M31A1 is crimped to the HEP–T projectile by means of four equally spaced ball-point crimps. The projectile has a blunt nose and is internally threaded in the base to receive the BD fuze M91A1 with integral tracer.

b. Data.

Weight of cartridge	16.52 lb
Weight of projectile, as fired	8.45 lb
Length of cartridge	26.36 in.
Length of cartridge case	16.0 in.
Width of rotating band	0.35 in.
Type of base	Boat-tailed
Muzzle velocity	1,400 fps
Maximum range	7,180 yd

30. Cartridge, 75 Millimeter: Smoke, WP, M311, w/Fuze, PD, M48A3, 0.05-Sec Delay, or M57

This cartridge is similar to the smoke cartridge described in paragraph 31. Cartridge M311 differs principally from the cartridge M311A1 in the crimping groove. The projectile is crimped to paper-lined cartridge case M31.

31. Cartridge, 75 Millimeter: Smoke, WP, M311A1, w/Fuze, PD, M48A3, 0.05-Sec Delay

a. General. This cartridge (fig. 12) is used to produce screening smoke and for spotting purposes. The projectile M311A1 is crimped to the plastic-lined cartridge case M31A1 by means of four equally spaced ball-point crimps. In external contour and ballistically, this projectile matches the high-explosive projectile (par. 26). The projectile body is a steel casing having a boat-tailed base and front and rear bourrelets and contains 1.35 pounds of white phosphorus (WP). The projectile body is fitted with a steel adapter at the nose end to accommodate the fuze and burster casing M6, containing burster initiator M1 and burster M8 (pars. 71 and 72). Functioning of the fuze on impact causes detonation of the burster, rupturing the body of the projectile and dispersing the WP smoke charge, which ignites on contact with the air, creating a dense white smoke. The fuze can also be set delay, for burst after ricochet or penetration.

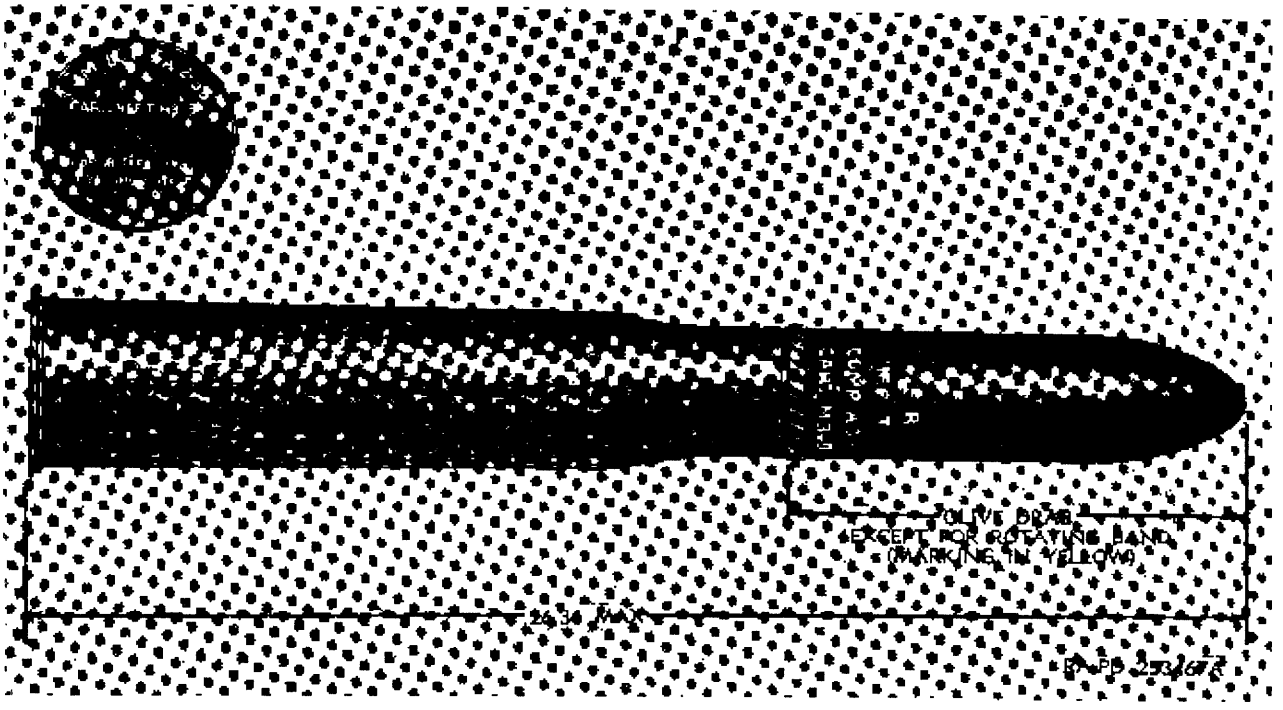

Figure 11. Cartridge, 75 millimeter: HEP–T, M349, w/fuze, BD, M91A1.

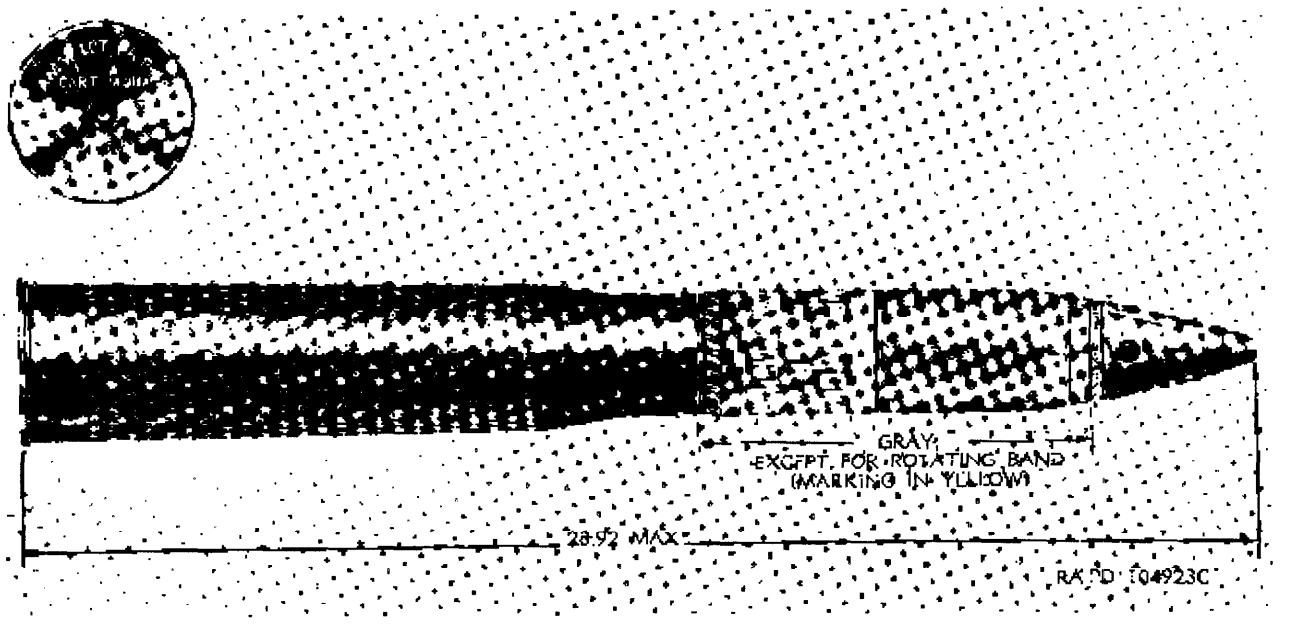

Figure 12. Cartridge, 75 millimeter: smoke, WP, M311A1, w/fuze, PD, M48A3, 0.05-sec delay.

b. Data.

Weight of complete round	23.20 lb
Weight of projectile, as fired	15.10 lb
Length of complete round	28.92 in.
Length of fuzed projectile	14.54 in.
Length of cartridge case	16.0 in.
Width of rotating band	0.35 in.
Type of base	Boat-tailed
Degree of taper of base	8° 45′
Radius of ogive	7.47 cal.
Maximum velocity	990 fps
Maximum range	7,020 yd

32. Cartridge, 75 Millimeter: TP, M309, w/Fuze, PD, M51A4, 0.05-Sec Delay, for 75-MM Rifles M20 and T21E12

This cartridge is similar to that described in paragraph 34. The TP cartridge M309 differs principally from the TP cartridge M309A1 in the crimping groove. The projectile is crimped to paper-lined cartridge case M31.

33. Cartridge, 75 Millimeter: TP, M309 or M309A1 (inert projectile), w/Fuze, Dummy, M73

These cartridges are similar to that described in paragraph 34. The TP cartridge M309 differs principally from the TP cartridge M309A1 in the crimping groove. These cartridges are assembled with completely inert projectiles and inert fuzes. The TP cartridge M309 is crimped to paper-lined cartridge case M31. The TP cartridge M309A1 is crimped to plastic-lined cartridge case M31A1.

34. Cartridge, 75 Millimeter: TP, M309A1, w/Fuze, PD, M51A5, 0.05-Sec Delay, for 75-MM Rifles M20 and T21E12

a. General. This cartridge is intended for use in target practice. The components comprising this cartridge are the same as those used in the high-explosive cartridge described in paragraph 26, except for the filler. The TP projectile M309A1 differs from the HE projectile M309A1 only in the filler, which is 1.27 pounds of inert material and two black powder pellets weighing 0.22 pound, which serve as the spotting charge.

b. Data. All data for the HE cartridge in paragraph 26*b* are applicable to the TP cartridge.

Section III. AMMUNITION FOR 106-MM RIFLES M40A1 AND M40A1C

35. General

a. General Discussion. The 106-mm rifles M40A1 and M40A1C are lightweight, portable, recoilless weapons. Recoil is eliminated by the controlled escape of propellent gases to the rear through openings in the breechblock. To assist in producing the required interior ballistics, ammunition for these rifles have a perforated cartridge case. Projectiles have preengraved rotating bands or fins to provide stabilization in flight. It is used as an antitank and as an antipersonnel weapon. Due to its specially designed tripod-type mount (M79), the 106-mm rifle M40A1 or M40A1C can be fired from the ground or while mounted on the ¼-ton truck or "mule." The cartridges for the 106-mm rifles M40A1 and M40A1C are issued in the form of fixed complete rounds.

***Warning:* Care should be exercised to insure that no attempt is made to fire rounds in 106-mm rifles of the M40 series other than those specifically authorized for use in these weapons.**

b. Identification. Ammunition for 106-mm rifles M40A1 and M40A1C can be distinguished from other types of ammunition by the perforated cartridge case. High-explosive cartridges have preengraved rotating bands; high-explosive antitank projectiles are fin-stabilized and, therefore, have no rotating bands. Painting and marking for identification are in accordance with the basic scheme prescribed in TM 9–1900. The designation of the weapon is marked on the containers and on the base of the cartridge case of each round.

c. Projectile. Dependent upon type of projectile, ammunition for 106-mm rifles M40A1 and M40A1C is classified as high-explosive antitank (HE, AT), high-explosive (HEP–T), and dummy. The HE, AT projectile has a shaped charge filler and a point-initiating base detonating (PIBD) fuze. The HEP–T is a high-explosive projectile which employs a base-detonating fuze. The dummy projectile is an inert-loaded HEP–T projectile.

d. Fuze. BD fuze M91A1 (which has a tracer in its base) is fitted to the HEP–T cartridge; and PIBD fuze M509 (T208E7) is fitted to the HE, AT cartridge. See paragraphs 50 and 56, for a description of these fuzes.

e. Cartridge Case. The cartridge cases M94B1 (T75) or M94 (alternative) and M93B1 (T76) or M93 (alternative) are used with 106-mm rifle ammunition. These cartridge cases are made of steel and differ from the more conventional-types of cartridge cases by having a series of staggered circular perforations in the side wall. The cartridge cases M94B1 (T75) and M93B1 (T76) are made of two pieces (head and tube). The weight of each cartridge case is 10.5 pounds and each has 1,160 perforations (5/16-in. dia.) in the side wall. The head of the cartridge case M93B1 (T76) has a 1¼-inch diameter loading hole, threaded to receive a steel plug. The alternative cartridge cases M93 and M94 each weigh 7.06 pounds and each has 1,488 perforations in the side wall. These alternative cartridge cases are one piece.

f. Liners. The interior of the cartridge case M94B1 (T75) or M94 contains a separate rayon liner within a plastic (polyethylene) liner to protect and retain the propellant. The plastic liner has a tight-fitting ring in its formed bottom, which fits snugly over the primer and seals the bottom end. After the propellant is loaded into the liners, the top of the rayon liner is folded shut and the plastic liner is tied or heat-sealed. The cartridge case M93A1 (T76) contains the plastic (polyethylene) liner M6 (T1E2), while the cartridge case M93 utilizes the plastic (polyethylene) liner M5. The liners M5 and M6 consist of a molded plastic (polyethylene) base and ring (top), which are heat-sealed to a plastic (polyethylene) coated rayon body to form a one-piece liner. The plastic base of each liner is formed with a tight-fitting ring, which fits snugly over the primer, having a 1¼-inch diameter opening that matches the loading hole in the head (base) of the cartridge case.

g. Propelling Charge. The propelling charge for 106-mm rifle ammunition consists of varying quantities of propellant M10 or M26 (T28) as follows: for HE, AT round, 8.10 pounds M10 propellant and 8.06 pounds M26 propellant; and for HEP–T round, 8.25 pounds M10 propellant and 8 pounds M26 propellant. See paragraphs 62 through 66 for more detailed information.

k. Primer. The percussion primer M57, a 1,000 grain primer, is used with 106-mm rifle ammunition. See paragraphs 67 through 70 for more detailed information.

l. Packing and Shipping Data. Cartridges for 106-mm rifles M40A1 and M40A1C are packed one per fiber container, two fiber containers (2 rd) per wooden box. Packing and shipping data appear in SM 9–5–1315. Packing and marking for shipment are described in TM 9–1903.

36. Cartridge, 106 Millimeter Dummy: M368

This dummy cartridge, which simulates the HEP–T M346A1 cartridge (par. 40), is intended for drill purposes. The cartridge is an inert HEP M346A1 cartridge with the cartridge case and inert-loaded projectile (with dummy fuze) welded at the joint. The inert propellant loading is omitted and the flash tube is replaced by a built-up metal bar, which provides the same weight and center of gravity as the service cartridge. A plastic liner is cemented to the inside of the cartridge case to exclude dust and moisture. The cartridge is chrome plated at the points subjected to hard-wear conditions.

37. Cartridge, 106 Millimeter: HE, AT, M344, w/Fuze, PIBD, M509

This cartridge is similar to that described in paragraph 38, except for differences in the design of the copper cone in the projectile and in the composition of propellant used.

38. Cartridge, 106 Millimeter: HE, AT, M344A1, w/Fuze, PIBD, M509

a. General. This cartridge (fig. 13) is used against armored targets. The plastic-lined cartridge case M93B1 or M93 is crimped to the high-explosive antitank projectile by means of eight equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing a shaped charge of 2.79 pounds of Composition B. The projectile body is internally threaded at the nose to receive the ogive assembly, which acts as a ballistic cap. The shaped charge is to the rear of a thin copper cone. Concentration of blast is obtained by the shape of the charge. The space forward of the copper cone provides the "stand off" necessary for the penetration of the target.

b. Data.

Weight of cartridge	36.19 lb
Length of cartridge	39.31 in.
Weight of projectile, as fired	17.55 lb
Weight of propelling charge	8.06 lb M20 (T28) propellant

39. Cartridge, 106 Millimeter: HEP-T, M346 or M346B1, w/Fuze, BD, M91A1

This cartridge is similar to that described in paragraph 40. It differs in the projectile and in the composition of the propellant used.

40. Cartridge, 106 Millimeter: HEP-T, M346A1, w/Fuze, BD, M91A1

a. General. This is a special high-explosive cartridge (fig. 14) intended primarily for defeat of armor. The plastic-lined cartridge case M94B1 (T75) (or alternative M94) is crimped to the high-explosive projectile by means of four equally spaced ball-point crimps. The projectile consists of a relatively thin-walled steel body containing a bursting charge of 7.72 pounds of Composition A–3. The projectile has a preengraved rotating band and two manganese bronze indexing buttons at the bourrelet to facilitate insertion of the cartridge into the tube.

b. Data.

Weight of cartridge	37.93 lb
Length of cartridge	38.1 in.
Weight of projectile, as fired	17.54 lb
Weight of propelling charge	8.00 lb M26 (T28) propellant

Section IV. AMMUNITION FOR CAL. .50 SPOTTING RIFLE M8C

41. General

a. General Discussion. The cal. .50 spotting rifle M8C is a gas-operated magazine-fed semiautomatic rifle designed to assist the gunner in determining range of the target; it is mounted on top of the 106-mm rifle tube and fires *special* caliber .50 ammunition (pars. 12–44). Cartridges for the cal. .50 spotting rifle M8C are classified as small-arms ammunition.

***Warning:* Caliber .50 cartridges for machine guns will not chamber properly in the spotting rifle M8C; hence, no attempt will be made to fire other than the special caliber .50 cartridges authorized for this rifle.**

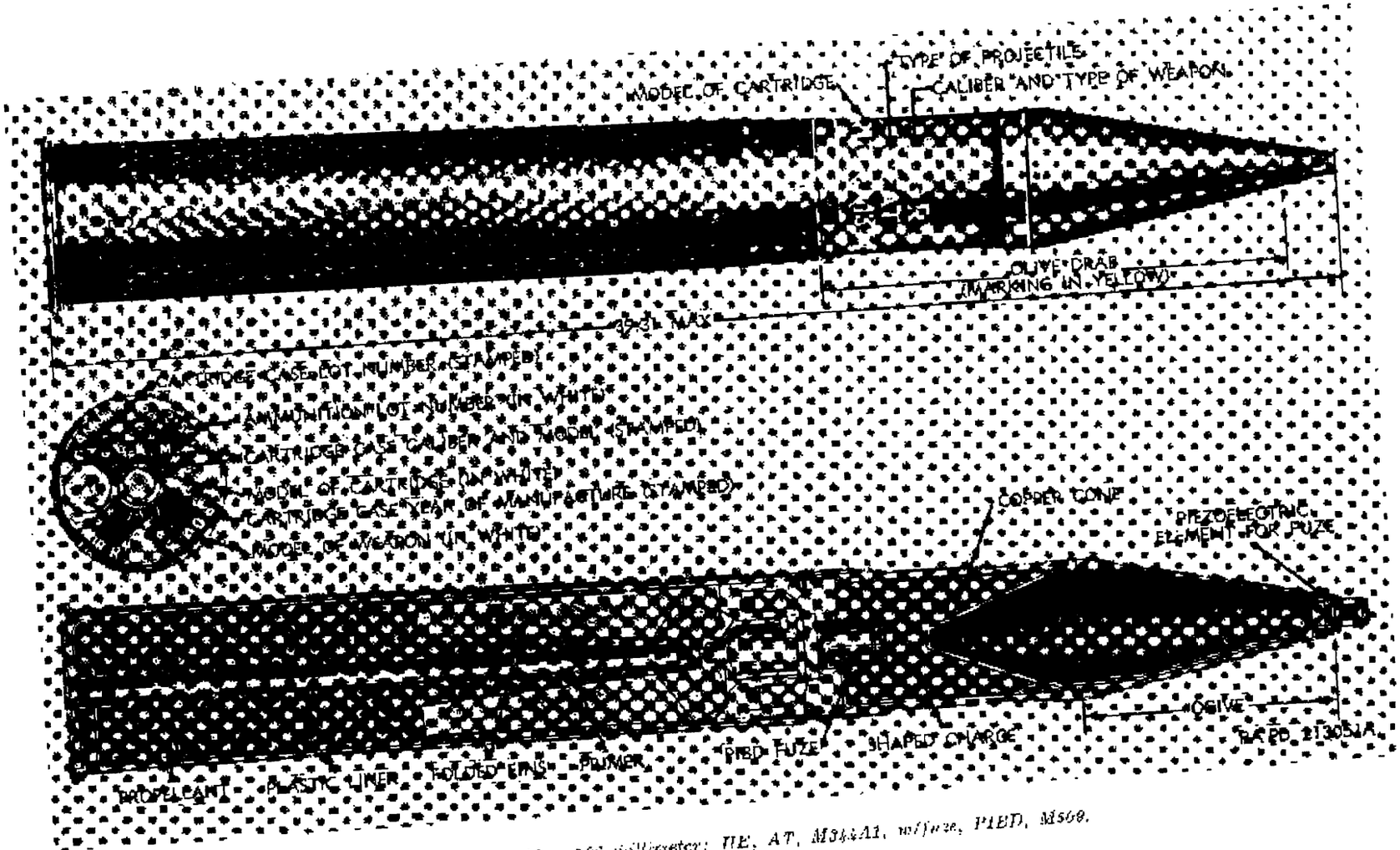

Figure 18. Cartridge, 106 millimeter: HE, AT, M344A1, w/fuze, PIBD, M500.

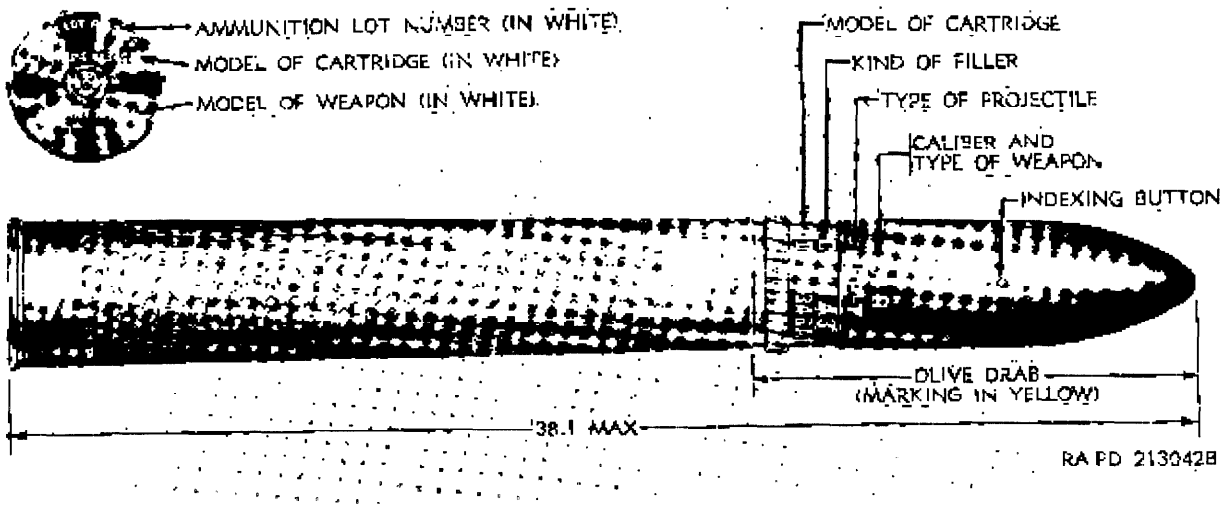

Figure 14. Cartridge, 106 millimeter: HEP T, M346A1, w/fuze, BD, M91A1.

b. Identification. Ammunition for the caliber .50 spotting rifle is completely identified by the marking on all packing containers. The base of the case is marked with the manufacturer's initials and the year of manufacture.

c. Projectile. Ammunition for the cal. .50 spotting rifle M8C is classified as spotter-tracer and practice.

d. Fuze. The caliber .50 spotter-tracer and practice cartridges do not utilize fuzes.

e. Cartridge Case. The cartridge case used with the caliber .50 spotter-tracer and practice cartridges is made of brass. It is similar in appearance to conventional caliber .50 cartridge cases but has different dimensions.

f. Propelling Charge. The propelling charge used in the caliber .50 spotter-tracer cartridge is double-base small-arms propellant or single-base tubular propellant, depending on the model. In the caliber .50 practice cartridge, single-base tubular propellant is used.

g. Primer. A caliber .50 small-arms percussion primer is used in the caliber .50 spotting rifle ammunition.

h. Packing and Shipping Data. Cartridges for cal. .50 spotting rifle M8C are packed 1 per individual tube, 104 tubes in metal box M2A1, 2 boxes (208 rd) per wirebound wooden box. Packing and shipping data appear in SM 9–5–1305. Packing and marking for shipment are described in TM 9–1903.

42. Cartridge, Caliber .50: Spotter-Tracer, M48 (T189E1)

This cartridge differs from the spotter-tracer cartridge described in paragraph 43, in that the cartridge case does not utilize a flash tube and the propelling charge is composed of double-base small-arms propellant.

43. Cartridge, Caliber .50: Spotter-Tracer, M48A1 (T189E3)

a. General. This cartridge (fig. 15) is used for "spotting" the target for the gunner before firing the 106-mm rifle M40A1 or M40A1C. The brass cartridge case, which contains the propelling charge of approximately 117.5 grains extruded single-base tubular propellant and percussion primer, is crimped to the spotter-tracer bullet by means of a 360° roll crimp. The cartridge case is fitted with a flash tube 0.970 inch long (orifice dia. 0.937 in.). The bullet contains a tracer element and an incendiary charge, which give off a puff of smoke and a flash on impact with the target. The tip of the spotter-tracer bullet is painted yellow with red rear annulus for purposes of identification.

b. Data.

Weight of cartridge	0.24 lb
Length of cartridge	4.53 in.
Weight of bullet, as fired	0.12 lb
Velocity of bullet at 78 feet from the muzzle	1,745 fps

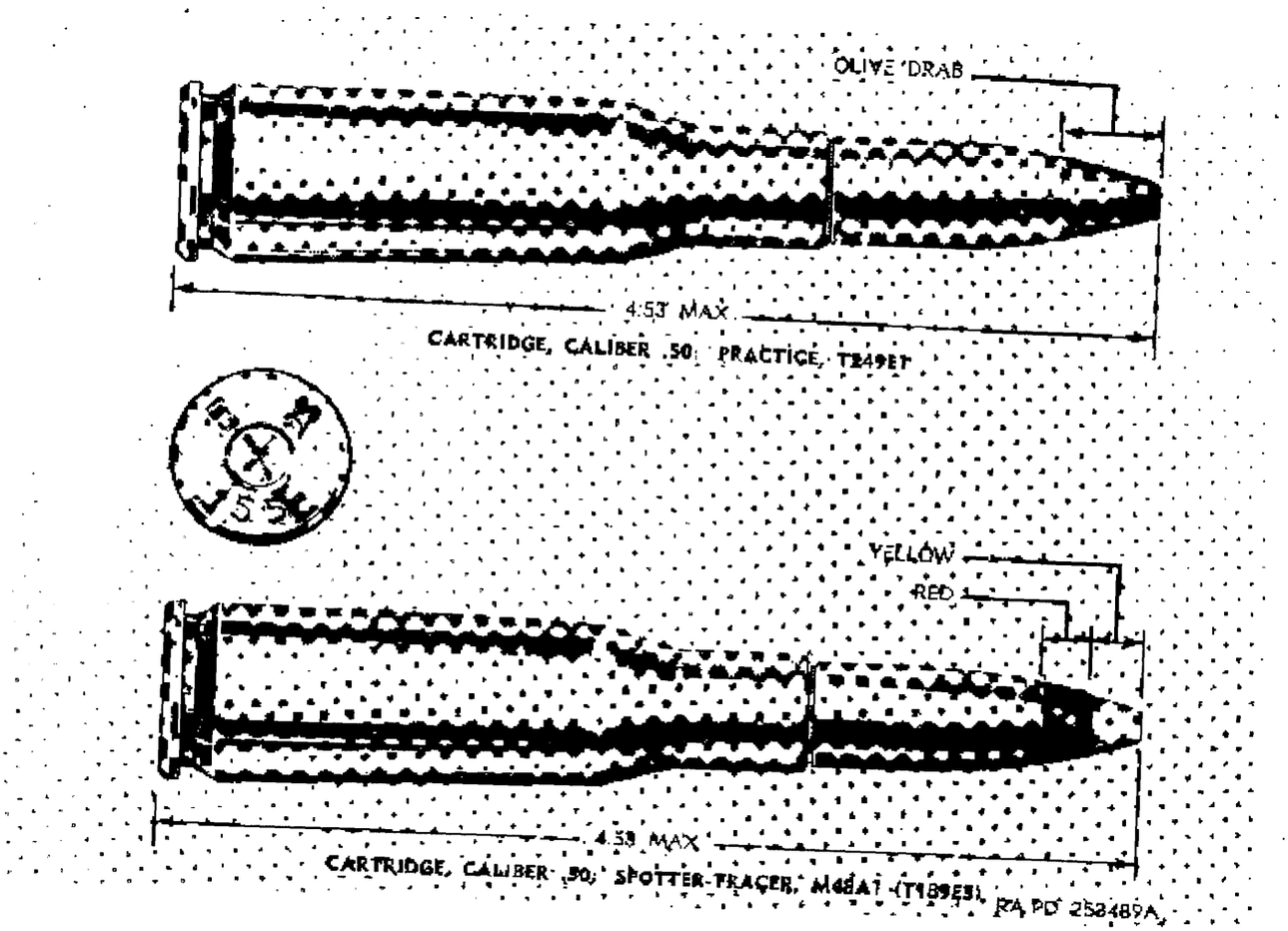

Figure 15. Cartridges for caliber .50 spotting rifle M8C.

44. Cartridge, Caliber .50: Practice, T249E1

This cartridge is similar externally to those described in paragraphs 42 and 43, except that it is assembled with the practice bullet. It utilizes the same brass cartridge case, propelling charge, and percussion primer as the spotter-tracer cartridge M48A1. The tip of the practice bullet is painted olive drab for purposes of identification.

CHAPTER 3

SUBCALIBER EQUIPMENT

45. Subcaliber Device for 57-mm Recoilless Rifles

This device (fig. 16) is for use in training personnel in the use of 57-mm recoilless rifles. The device consists essentially of modified metal parts of a 57-mm rifle cartridge (inert fuze, inert projectile, and empty cartridge case) assembled to a modified caliber .30 machinegun barrel with a barrel locking nut. Three screws, two fixed and one adjustable, with locknuts are used to hold the device firmly in place in the recoilless rifle. A regular caliber .30 ball cartridge is used for simulating the fire of a 57-mm cartridge. The gun barrel contains gas ports to vent the propellant gases. Effective training of personnel may be accomplished with the device at substantial savings. The device may also be used without the caliber .30 ball cartridge as a drill cartridge, that is, for practice in loading the weapon. The device is not an issue item; hence, it is not to be requisitioned as a complete assembly. It may be fabricated in the field by authorized units from components requisitioned in accordance with specific instructions contained in TM 9-3062-31.

46. Rifle, Subcaliber, Caliber .30, M7 (75-mm)

This "rifle" (fig. 17) is a subcaliber device for use in training personnel in the use of 75-mm recoilless rifles. It has the outward appearance of a 75-mm cartridge. It contains a modified vented caliber .30 machine gun barrel in which a regular caliber .30 ball cartridge is used for simulating the fire of a 75-mm cartridge. Effective training of personnel may be accomplished with this device at substantial savings. The device may also be used without the caliber .30 ball cartridge as a drill cartridge, that is, for practice in loading the weapon. The device, which is not an ammunition item of issue, is issued completely assembled, similar in appearance to a complete round. For further information on this device, see ORD 8 SNL C-33, section 18, which lists the component parts and equipment stocked for maintenance and rebuild of the device.

47. Rifle, Subcaliber, Caliber .30, M9 (106-mm)

This "rifle" (fig. 18) is a subcaliber device for use in training personnel in the use of 106-mm recoilless rifles. It has the outward appearance of a 106-mm cartridge case and the rear portion of a projectile with preengraved rotating band. This part is called the muzzle shell. The subcaliber rifle contains a modified caliber .30 machine gun barrel in which a regular caliber .30 ball cartridge is used for simulating the fire of a 106-mm cartridge. The barrel contains gas ports to vent the propellant gases. Effective training of personnel may be accomplished with this device at substantial savings. The device may also be used without the caliber .30 ball cartridge as a drill cartridge, that is, for practice in loading the weapon. The device, which is not an ammunition item of issue, is issued completely assembled, similar in appearance to a complete round. For further information on this device, see ORD 8 SNL C-33, section 20, which lists the component parts and equipment stocked for maintenance and rebuild of the device.

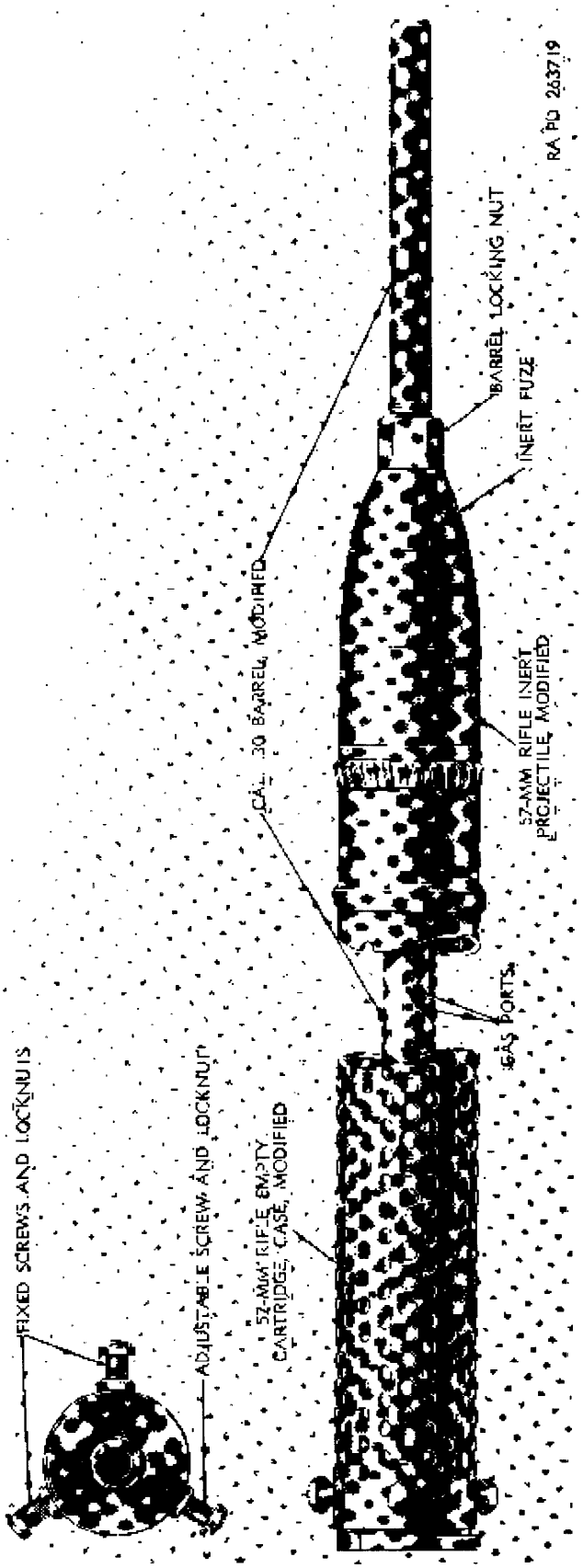

Figure 16. Subcaliber device for 57-millimeter recoilless rifles.

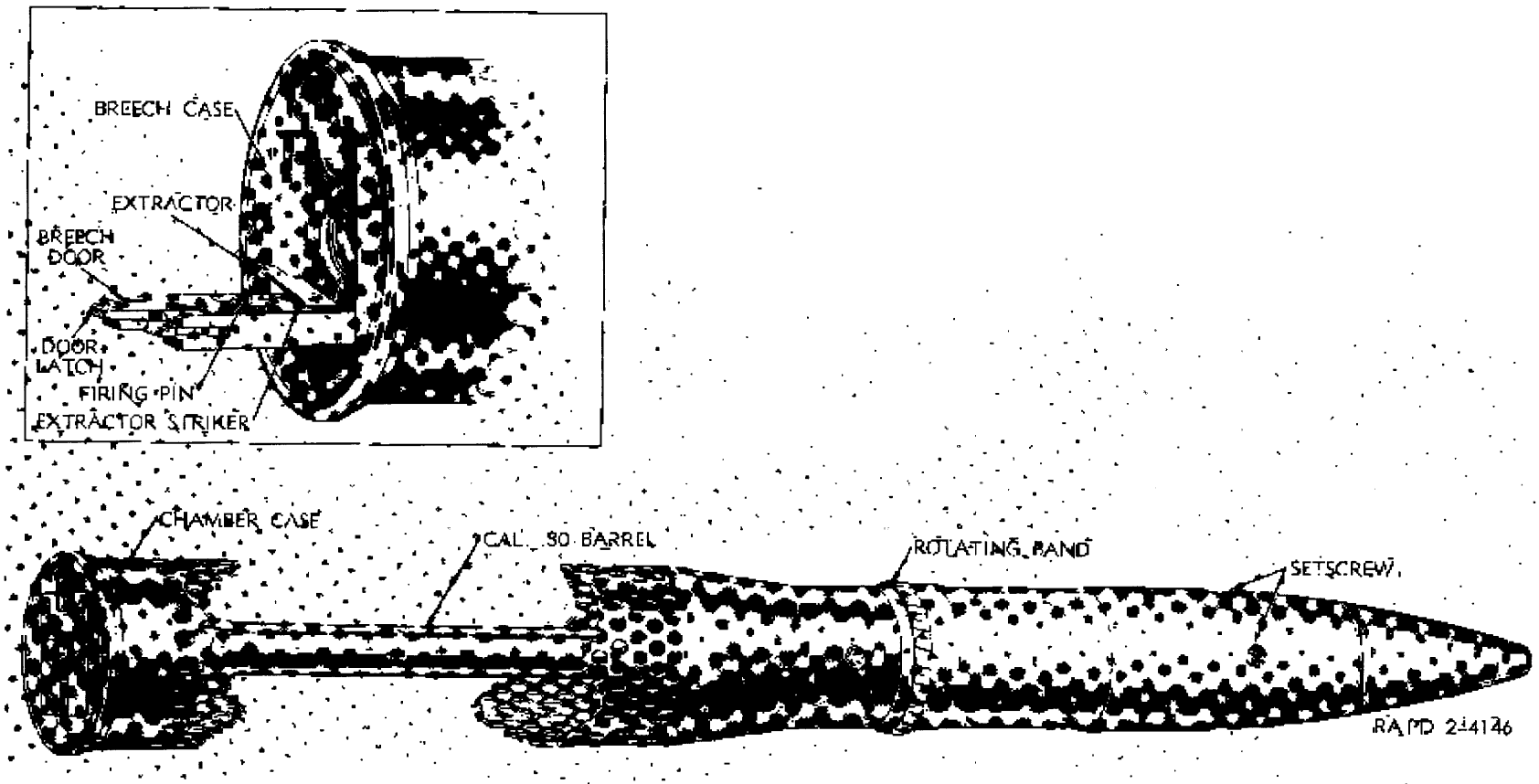

Figure 17. Rifle, subcaliber, caliber .50, M7 (75-MM).

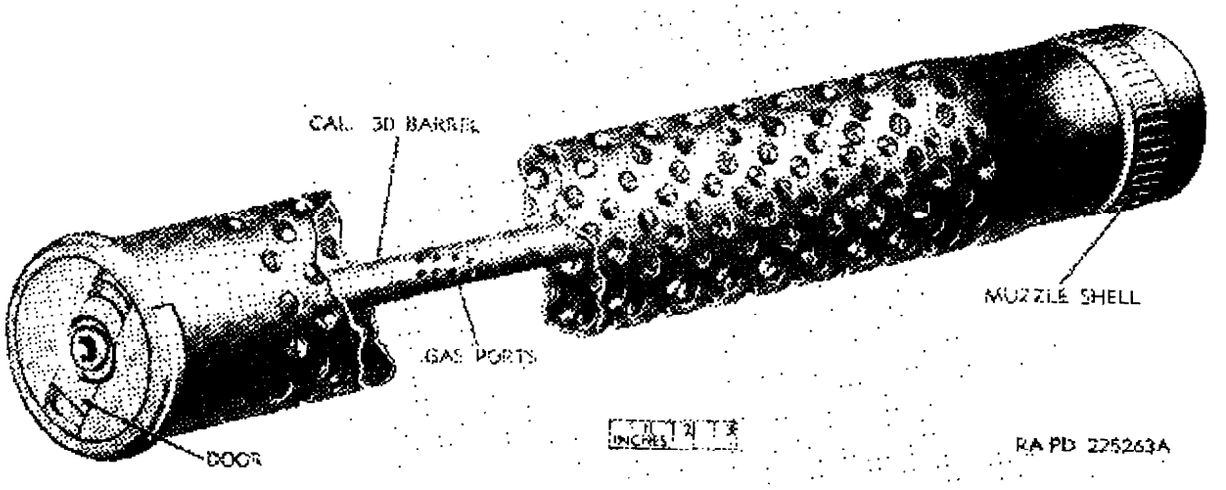

Figure 18. Rifle, subcaliber, caliber .30, M9 (106-MM).

CHAPTER 4

FUZES, PROPELLING CHARGES, PRIMERS, BOOSTERS, AND BURSTERS

Section I. FUZES

48. General

a. General Discussion. A fuze is a device used with a projectile to explode it at the time and under the circumstances desired. The fuze consists of a connected series (train) of small explosive charges together with an electrical or mechanical device (or combination of both) for initiating the action of the first charge in the train.

b. Classification. Recoilless rifle fuzes are classified according to their location on the projectile as base detonating (BD) and point-initiating base-detonating (PIBD), which are threaded to the bases of projectiles, and point-initiating (PI) and point-detonating (PD), which are threaded to the noses of projectiles. The fuzes are also classified according to their method of functioning as impact or combined time and impact. A time and impact fuze contains a clockwork mechanism, which may be set to a predetermined time prior to firing. The type of time and impact fuze used for recoilless rifle cartridges is designated mechanical-time and superquick (MTSQ). This is a selective-type fuze, which may be adjusted in the field to have time action or to function on impact. Impact fuzes are classified according to the quickness of action as superquick, nondelay, or delay. Superquick fuzes produce a burst immediately upon impact before any penetration occurs, thus giving maximum surface effect. Nondelay fuzes are inertia-operative and burst the projectile on ricochet or on a hard surface before complete penetration. The base-detonating fuzes are nondelay. Delay fuzes allow penetration of material targets before bursting or allow air bursts in ricochet fire. The time of action for impact fuzes is measured from the instant of its impact on a target, whereas the time of action of time fuzes is measured from the instant of firing the weapon.

c. Boresafety. To prevent accidental arming during handling and shipping, safety devices, such as safety wires, are used on fuzes when required. In certain types of fuzes, the mechanisms are arranged so that the fuzes are said to be "boresafe" (detonator-safe). A boresafe fuze is one in which the explosive train is interrupted so that, while the projectile still is in the bore of the weapon, premature action of the bursting charge is prevented if any of the more sensitive elements (primer or detonator) function.

d. Methods of Arming. A fuze is said to be armed when it is ready to detonate the projectile, that is, when all parts are in their proper positions so that the fuze may operate in its intended manner. The principal forces used in arming fuzes are *inertia* and *centrifugal.* In some fuzes, both these forces are used to activate safety devices; in others only one is used.

(1) *Inertia,* which is the tendency of an object to resist acceleration or deceleration, may be exhibited in several ways, each of which may be used to advantage or each of which must be guarded against.

(*a*) "Setback" is a manifestation of inertia which occurs when the projectile is accelerated on being fired. It may be used to unlock safety devices or lock them in place until the proper time for unlocking.

(*b*) "Creep" is a manifestation of inertia which occurs as the projectile

decelerates in flight. Fuzes are designed to prevent this force from causing a malfunction.

(c) "Set forward" is a manifestation of inertia which occurs on impact or sudden deceleration. This effect may be used to drive firing pins into primers or to drive primers against stationary firing pins.

(2) *Centrifugal* force, which is the force on an object moving in a circular path away from the center of the circle, occurs in spinning projectiles. (Centrifugal force is not present in fin-stabilized projectiles.) This force may be utilized to actuate gear trains and to move safety devices into their proper positions in fuzes and boosters. Such fuzes and boosters are designed to operate in rotational-velocity range of the projectile-rifle combination in which they are used. Fuzes utilizing centrifugal force also must be designed so that they will not become unarmed as the rotational velocity decreases during flight.

e. *Detonators.*

(1) *General.* A detonator (fig. 19) is used in the explosive train to transmit a detonation wave to the booster charge, booster lead, or burster. Two types of detonators are employed in recoilless rifle fuzes: one contains a primer mixture as the upper charge, for initiation by stab action of a firing pin; another contains a fine wire or other high-resistance electric circuit in physical contact with a heat-sensitive primer mixture. Passage of an electric current through the high-resistance circuit generates heat, which initiates detonation in the primer mixture. Most detonator cups and disks are of aluminum. Table I lists the various detonators used in fuzes and boosters for recoilless rifle ammunition, indicating their use, dimensions, color identification, and type of initiation.

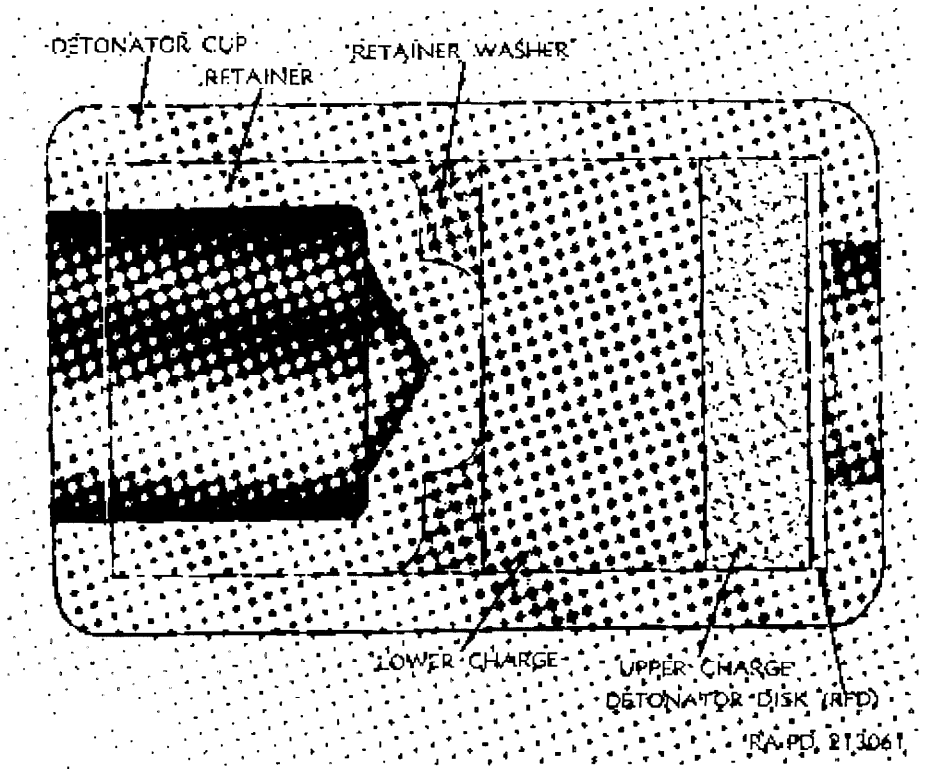

Figure 19. Typical detonator.

(2) *Identification.* Detonators make use of colors to indicate the insensitive end: yellow is used on detonators which do not contain primer mixture or igniting mixture and green is used on detonators containing primer mixture. 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 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 manufacture. The color scheme described above applies to latest detonator construction; discrepancies may be found on detonators of older manufacture.

Table I. Detonators

Model	Used in	Dimensions (in.)		Color identification		Type of
		Length	Diameter	Sensitive end	Insensitive end	
M22	FUZE, BD: M91A1 and M91 FUZE, MTSQ: M500A2 and M500	0.395	0.192	Red	Green	Firing pin
M34	FUZE, PD: M48A3 FUZE, PD: M51A6 and M51A4	.370	.241	Red	.....	Firing pin
M29	FUZE, PD: M89	.300	.145	Red	Green	Firing pin
M130	FUZE, PI M90A1, M90.	.300	.145	.....	Yellow	Firing pin
M42	FUZE, PD: M508A2, M508A1, M500.	.436	.239	Red	Green	Firing pin
M48	FUZE, PIBD M509.	.353	.266	.....	.....	Electric

* Significance of colors:
Green—Detonator contains primer mixture (stab type detonator).
Yellow—Detonator does not contain primer mixture or igniting mixture.
Red—Lacquer (red) used for sealing purposes constitutes a red color identification for the sensitive end.

f. Fuze Interchangeability.

(1) *Need for changing fuzes.*

(*a*) From a time fuze for burst above the target to a PD fuze for impact at the target as required by the tactical situation.

(*b*) As required by the supply situation.

(*c*) To replace or remove unsafe fuzes.

(*d*) In renovation activities, when the original fuze becomes unserviceable due to corrosion, general deterioration, or obsolction.

(2) *Authority and responsibility.* Assembly to and disassembly from 75-mm projectiles of point fuzes is normal operation in the field. In assembling fuzes to or disassembling fuzes from projectile, only the authorized fuze wrench should be used.

(3) *Authorized fuzes.* Authorized fuzes for recoilless rifle cartridges are described in paragraphs 49 through 61.

g. Fuze Wrenches and Setters.

(1) *Fuze wrenches.* Fuze wrench M18 (fig. 20) is provided for screwing and unscrewing fuzes from the projectile for the purposes described in *f*(1) above. The wrench is a box-type having two throat openings, the opening nearer the end being 2.16 inches and the other opening being 2.04 inches. The screwdriver end of this wrench is used for setting the selective setting sleeve of the fuzes M48 and M51 series from SQ to DELAY or vice versa. The wrench (2.04-inch opening) is used for PD fuzes M48 and M51 series and the MTSQ fuze M500 series.

(2) *Fuze setters.* Fuze setters M14 (fig. 21) and M27 are simple hand wrench types. They are used for setting MTSQ fuzes M500A1 and M500. For further information on fuze setters, see TM 9–2300 and TM 9–575.

h. Packing and Shipping. Packing and shipping data for separately issued fuzes appear in SM 9–5–1390.

i. Identification. Fuzes are identified by the stamping in the body metal. For general fuze identification information, see TM 9–1900.

49. Fuze, BD: M62A1

The fuze is similar to BD fuze M91 (par. 50) except that it does not have a tracer.

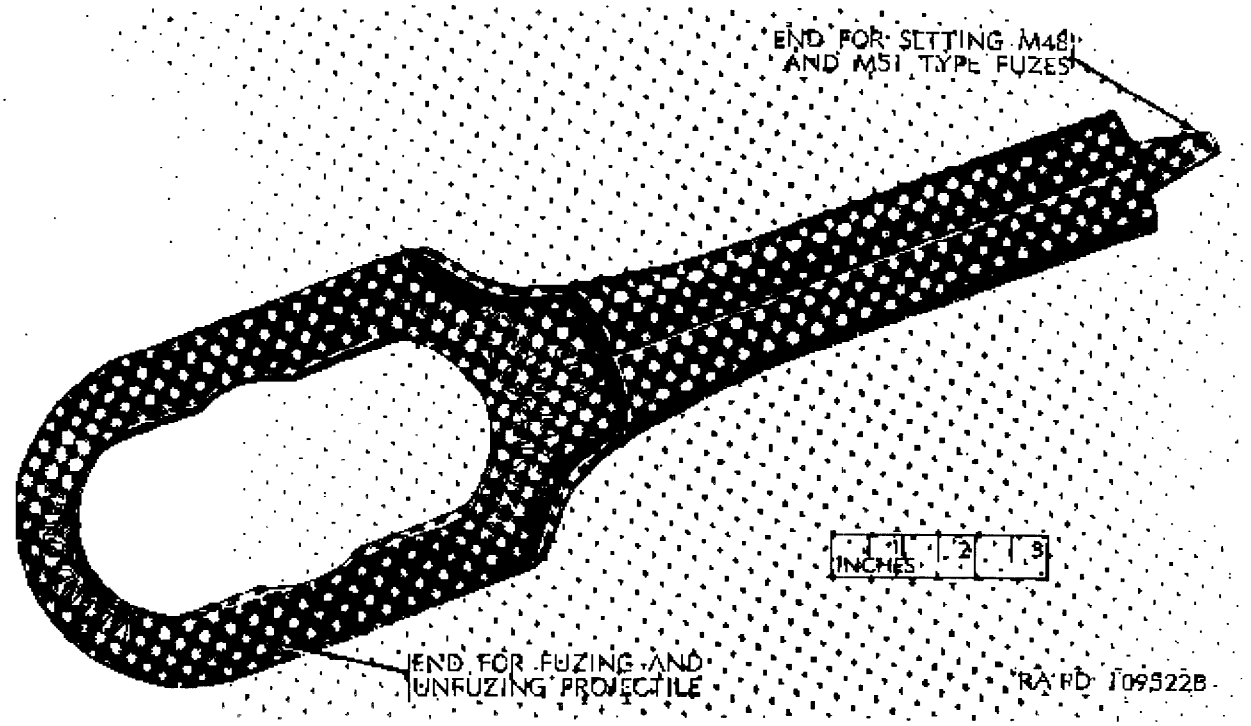

Figure 20. Wrench, fuze, M18.

50. Fuze, BD: M91A1 or M91

a. General. The BD fuze M91A1 (fig. 22) is a nondelay base detonating fuze provided for use with 75-mm and 106-mm projectiles. The fuze is externally threaded for assembly to the base of the projectile. When assembled in the base, the major portion of the fuze intrudes into the projectile; only the tracer end of the fuze extends from the projectile. The BD fuze M91 differs from the fuze M91A1 in that the fuze M91 has a nonreplaceable tracer.

b. Data.

Overall length	4.211 in.
Weight	1.40 lb
Thread size	1.5–12NS–1 LH

Note. The key letters shown in *c* and *d* below in parentheses refer to figure 22.

c. Description. The fuze consists of four parts: a steel head (N), a steel body (C), a brass booster cup (A), and the replaceable tracer M5 (P). The head holds a rotor firing pin (L) and inertia plunger (K). The body contains a detonator (H), a slider assembly (E) under restraint of spring (G) and with a slider charge (F), a booster pellet (B), and a booster lead (D). The booster cup when assembled to the body seals the booster pellet in its cavity. The replaceable tracer M5 is screwed in the base. Bore-safety is provided by the slider assembly.

d. Functioning. The rotor-firing pin (L) is held in the unarmed position in the plunger by a spring-held safety pin (M), which releases the rotor firing pin under the action of centrifugal force. The firing pin will not arm at 1,700 rpm or less. The slider assembly normally is positioned, under spring pressure, in its recess in the fuze body so that the slider

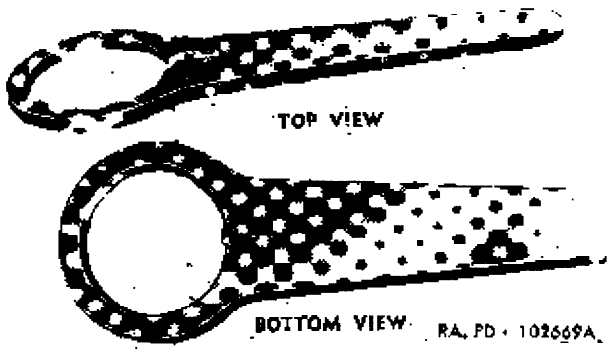

Figure 21. Setter, fuze, M14.

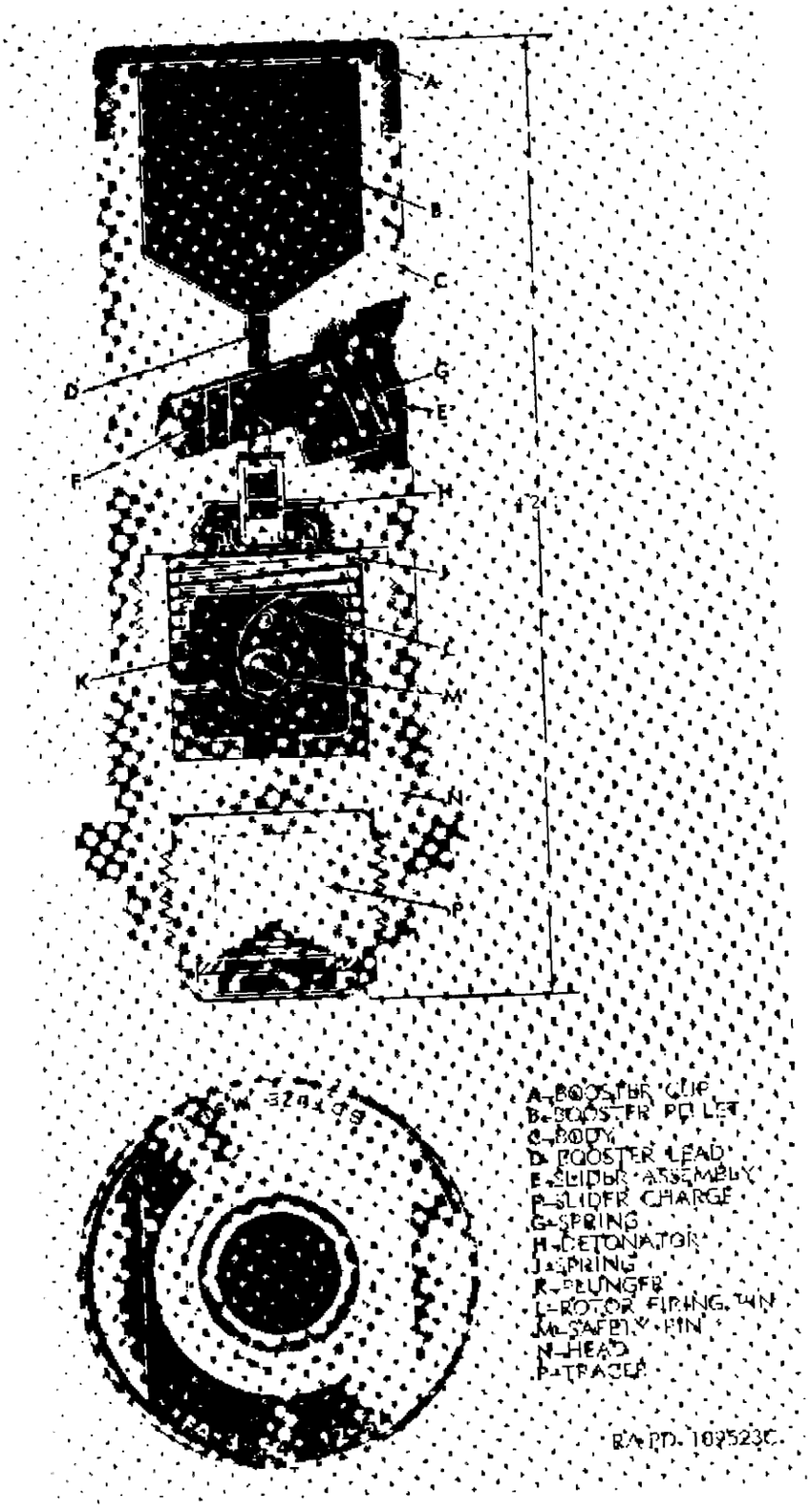

Figure 22. Fuze, RD: M91A1.

charge of the slider is out of alinement with the other explosive elements. When sufficient centrifugal force has been developed (i.e., the projectile is spinning sufficiently fast), the slider overcomes the resistance of its spring and moves outward, alining the slider charge with the detonator and booster lead. During the flight of the projectile, the inertia plunger assembly is prevented from "creeping" forward by the restraining spring (J). Upon impact, the plunger is driven forward, overcoming the resistance of the restraining spring and driving the firing pin into the detonator, which initiates the fuze explosive train. The tracer M5 contains pyrotechnic composition, which is ignited by the propellent gases, creating a luminous trace during the flight of the projectile.

51. Fuze, Dummy: M73

This fuze is an inert-type simulating the PD fuze M51A5 (par. 58). It is used with 75-mm TP cartridges having an inert projectile.

52. Fuze, Dummy: T126

This fuze is an inert-type used with 57-mm TP cartridges having an inert projectile.

53. Fuze, Inert: M89

This fuze is an inert-loaded-type utilizing the metal parts of the PD fuze M89. It is used with 57-mm TP cartridges having an inert projectile.

54. Fuze, MTSQ: M500A1 or M500

a. Description. The fuze M500A1 (fig. 23) is a combination mechanical-time and impact fuze with settings for time action (2 to 75 sec) and an impact element for superquick action. A pull wire, which extends through the fuze body and under the setback pin, provides positive safety during shipment and handling. The fuze M500 differs from the fuze M500A1 principally in having settings for time action from 3 to 75 seconds. The minimum functioning time of the fuze M500A1 is 1.5 seconds. The fuze M500A1 consists essentially of five components as described in (1) through (5) below:

(1) *Movement assembly.* The movement assembly provides for the mechanical-time action of the fuze. It is comprised of a firing pin and timing mechanism (clockwork).

(2) *Body.* The aluminum body has a time-setting ring. The body is externally threaded at its lower end to engage the booster M21A4.

(3) *Booster M21A4.* The booster M21A4 is assembled over the lower end of the fuze body. See paragraph 71, for booster details.

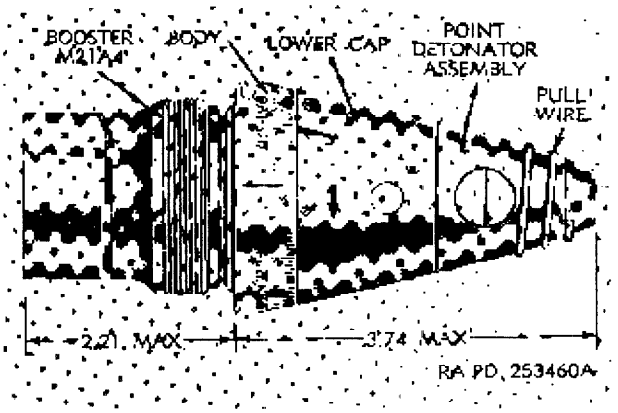

Figure 23. Fuze, MTSQ: M500A1

(4) *Lower cap.* The lower cap, of brass, contains the movement assembly and is internally threaded at its forward end to receive the point detonator assembly.

(5) *Point detonator assembly.* The point detonator assembly houses the superquick impact element of the fuze. It is externally threaded to engage the lower cap, completing the nose contour of the fuze.

b. Functioning.

(1) *Movement assembly.* When the fuze 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 mechaniam remain in position, since the gear train and escapement are locked by the safety lever assembly. Upon firing, setback causes the 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 toward 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 and the "kick-off" springs, actuates the weighted gear segments, which in mesh with the main driving pinion then drives the movements. 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 the spring. This initiates the action of the explosive train, which action is transmitted to the fuze booster and the projectile bursting charge.

(2) *Point detonator assembly.* The point detonator assembly functions independently of the movement assembly to provide superquick action. It will function if impact occurs before the set time or if the time setting is at "S" (safe) and impact occurs. Boresafety is provided in the point detonator assembly by a slider, which interrupts the passage between the detonator and the lead charges. When the projectile is spinning sufficiently fast, the slider is moved outward by centrifugal force, providing an open passage between the detonator and lead charge, thus arming the point detonator assembly.

c. Preparation for Firing.

(1) Remove the pull wire.

(2) Set the fuze to the desired time, using the fuze setter.

Note. If after the fuze is set preparatory to firing the round is not fired, the fuze will be reset to the safe position "S" and the pull wire installed in its proper position before returning the cartridge to its packing.

55. Fuze, PI: M90A1 or M90

a. General. The fuze M90A1 (fig. 24) is a single-action, superquick fuze designed for use with 57-mm HE, AT projectiles. The fuze differs from point-detonating fuzes in that initiation is by impact of the target directly against the fuze primer. The fuze is characterized by internal threads for engagement of the pro-

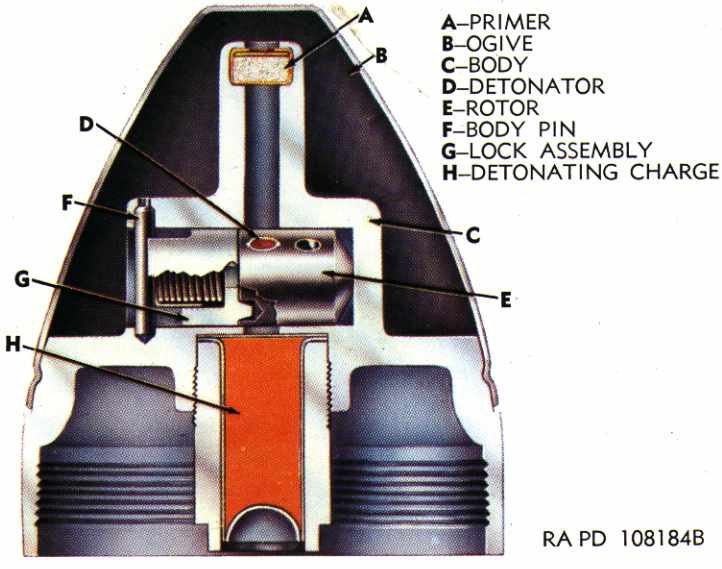

Figure 24. Fuze, PI: M90A1.

jectile and by a shaped auxiliary detonating charge.

b. Data.

Length	2.52 in.
Weight	0.256 lb
Thread	2.09–18 NS–1

Note. The key letters shown in *c* through *e* below in parentheses refer to figure 24.

c. Description. The fuze consists of a die-cast body (C) with a neck, which houses the primer (A). A cavity in the middle of the fuze body, extending across and perpendicular to the fuze axis, holds a rotor (E) and a lock assembly (G), consisting of a lock, lock cup, and lock spring. A body pin (F) serves to hold the lock cup and lock spring. An auxiliary detonator assembly screwed into the base of the fuze body holds a shaped auxiliary detonating charge (H). The entire forward part of the fuze body and its mechanism is covered by a thin steel ogive (B).

d. Safety Devices. Boresafety is provided for by the rotor and lock assembly, which holds the detonator (D) in the unarmed position prior to firing.

e. Functioning. When sufficient rotational (centrifugal) force is established, the lock moves outward against its spring, releasing the rotor to turn on its axis. After setback, the rotor turns to the armed position, in which the detonator is parallel to the fuze axis and alined with the firing pin. Upon impact, the ogive is crushed and the primer initiated. Action of the primer (A) is transmitted through the detonator (D) to the auxiliary detonating charge (H), which initiates the booster pellet at the base of the projectile flash tube, which causes the projectile to function.

f. Preparation for Firing. No preparation is required.

56. Fuze, PIBD: M509

a. General. The fuze (fig. 25) is a single-action, superquick, point-initiating, base-detonating type provided for use with HE, AT projectiles. The fuze, which is not visible when assembled in the cartridge due to its location in the projectile, is connected electrically to a piezoelectric element (polarized barium titanate) in the nose of the projectile. Impact

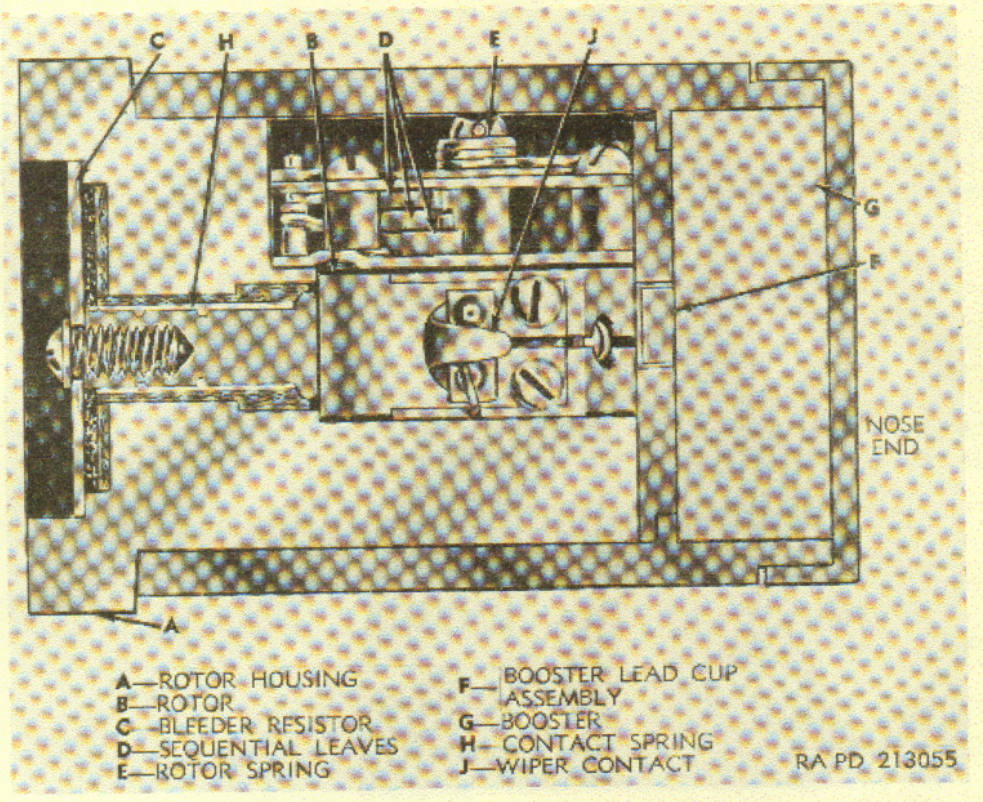

Figure 25. Fuze, PIBD: M509.

of the target on the nose of the projectile stresses the piezoelectric element, generating a surge of electricity which initiates the detonator, and thus, the explosive train of the projectile.

Note. The key letters shown in *b* through *d* below in parentheses refer to figure 25.

b. Description. The fuze consists essentially of a rotor housing (A), which contains a rotor (B) with a 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 bushing (H) and wiper contact (J) when the rotor is in the armed position.

c. Safety Devices. Boresafety is provided for by the sequential leaves and bleeder resistor. The sequential leaves lock the rotor in the unarmed position. In this position, the electrical circuit of the fuze is open and the bleeder resistor is connected across the detonator, draining off any charge that might build up and fire the detonator while the projectile is accelerated in the bore of the rifle.

d. Functioning. Setback force, incident to firing, acts to displace the sequential leaves (D) until the final leaf is locked in its rearmost position and the rotor is free to move to the armed position. The rotor spring (E), after acceleration has been reduced to approximately 200g's, causes the rotor (B) to turn 90° so that the wiper contact (J) in the rotor is connected to the contact bushing (H) in the rotor housing, completing the electrical circuit and arming the fuze. Upon impact, the piezoelectric element in the nose of projectile is stressed, generating an electrical impulse, which initiates the detonator M48, and thus, the explosive train of the projectile.

e. Preparation for Firing. No setting or other preparation is required.

57. Fuze, PD: M48A3, 0.05-Sec Delay

a. General. The fuze M48A3 is the same as the fuze M51A5 (par. 58) except that the fuze M48A3 does not include a booster. The fuze opening of 75-mm smoke projectiles are fitted with an adapter having 1.7-inch diameter internal threads.

b. Data.

Length:	
Visible	3.74 in.
Overall	4.55 in.
Weight	1.41 lb
Thread size	1.7–14 NS–1

58. Fuze, PD: M51A5 or M51A4, 0.05-Sec Delay

a. General. The fuze M51A5 (fig. 26) consists of the fuze M48A3 fitted with booster M21A4 (par. 71). The fuze M51A4 differs from the fuze M51A5 in having a delay plunger assembly, which is less sensitive, has less uniform burning time, and requires greater surveillance than the delay plunger assembly M1 which is used in the fuze M51A5.

b. Data.

Length:	
Visible	3.74 in.
Overall	5.93 in.
Weight	2.15 lb
Thread size	2–12 NS–1

Note. The key letters shown in *c* and *d* below in parentheses refer to figure 26.

c. Description. The fuze consists of a head (A), which holds a superquick element (B); and a body (H), which holds a delay plunger assembly and its housing (M); and a selective setting device (*d* below). These main assemblies are connected by a flash tube (G), which holds and supports the parts firmly in position; and by a thin-walled ogive (F), which gives further support and contour. The superquick element is comprised of a firing pin (D), supported by a cup-shaped gilding metal firing pin support (C); and a detonator (E). The firing pin support is sufficiently strong to withstand initial setback forces upon firing, but collapses under the impact of the target. The delay plunger assembly M1 (M) is an inertia-plunger-type and includes a firing pin (N), primer (P), black powder delay pellet (Q), and a relay charge (T). The booster M21A4 (U) (par. 71) is assembled to the body.

d. Setting. The setting device consists of an interrupter (K), interrupter spring (L), and the setting sleeve (J). The head of the setting sleeve is slotted to facilitate turning when changing the setting. To enable exact alinement, 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

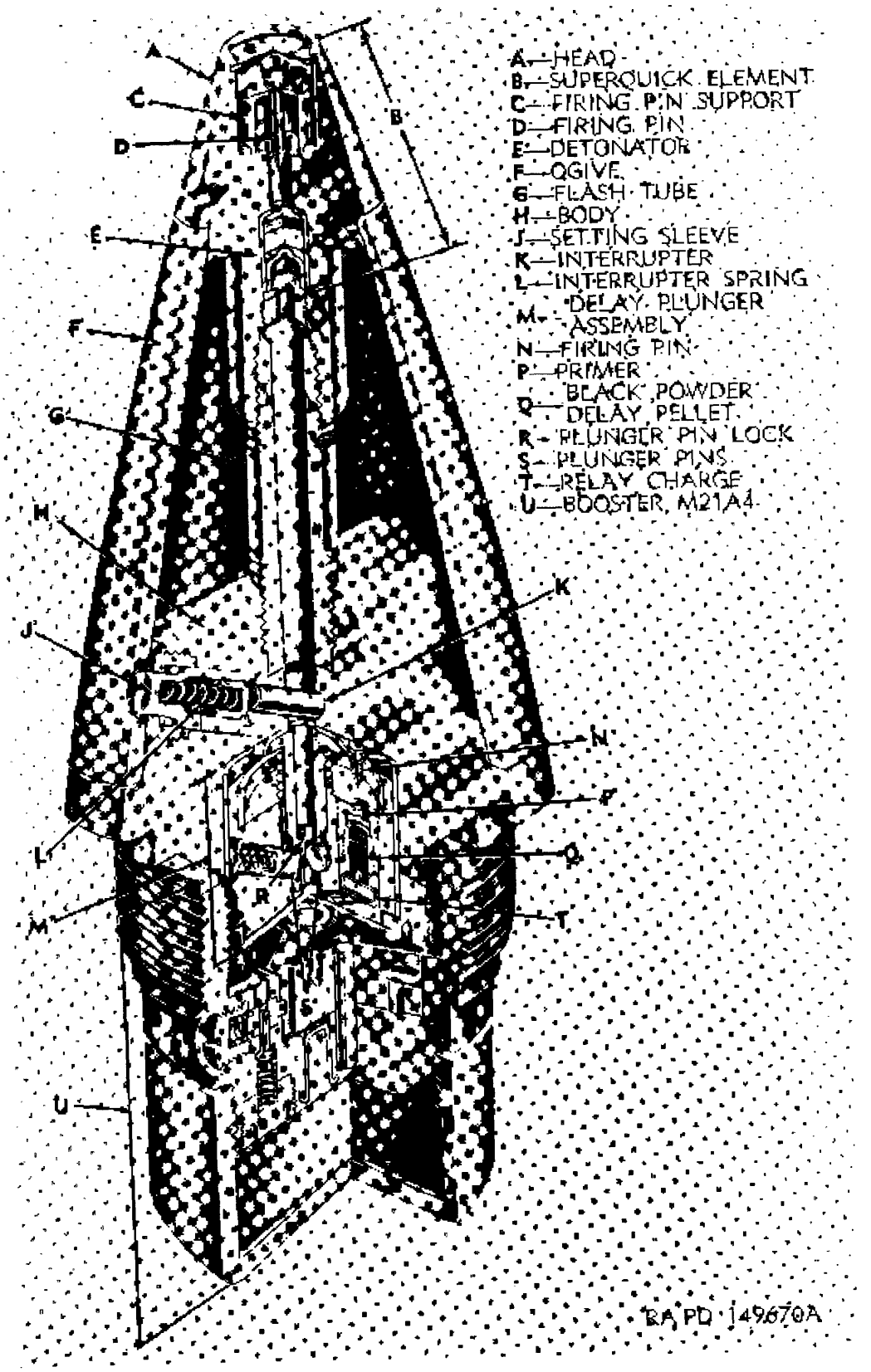

Figure 26. Fuze, PD: M51A5, 0.05-sec delay.

with the SQ line (parallel to the fuze axis) or within 15° 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 interrupter. The interrupter is free, therefore, to move outward under centrifugal force, thereby opening the passage for superquick action. When the slot is alined with the DELAY line (at right angles to the fuze axis) or within 15° thereto, a section on the setting sleeve rests against the interrupter, 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 herein refers to the fuze; for booster functioning, see paragraph 71. 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 superquick 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 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, thereby, preventing the return of the pins to the unarmed position. Upon impact, the firing pin of the superquick element is driven against the detonator, initiating the superquick action. Inertia causes the delay action plunger to move forward, driving the primer against the delay action 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. 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. The booster M21A4 (par. 71) contains a mechanism which provides boresafety.

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 feeling 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. If the PD fuze M51A5 or M51A1 is fired during extremely heavy rainfall, premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to the exceedingly heavy downpours which occur during summer thundershowers. Prematures may be prevented in these fuzes by setting for delay action, making the superquick action inoperative.

59. Fuze, PD: M57

a. General. The fuze is a single-action, superquick type used with 75-mm smoke projectiles. It is similar to the PD fuze M51A1 (par. 58), except that it has no booster and no delay element. The fuze requires no setting or other preparation for firing.

b. Data.

Length:	
Visible	3.78 in.
Overall	4.59 in.
Weight	1.41 lb
Thread size of fuze	1.7–14 NS–1

60. Fuze, PD: M89

a. General. The fuze is a single-action, superquick-type used with 57-mm projectiles. Boresafety is accomplished by a rotor and lock mechanism similar to that of the fuze M90 (par. 55).

b. Data.

Length:	
Visible	1.72 in.
Overall	2.52 in.
Weight	0.37 lb
Thread size	1.7–14 NS–1

c. Preparation for Firing. No setting or other preparation is required.

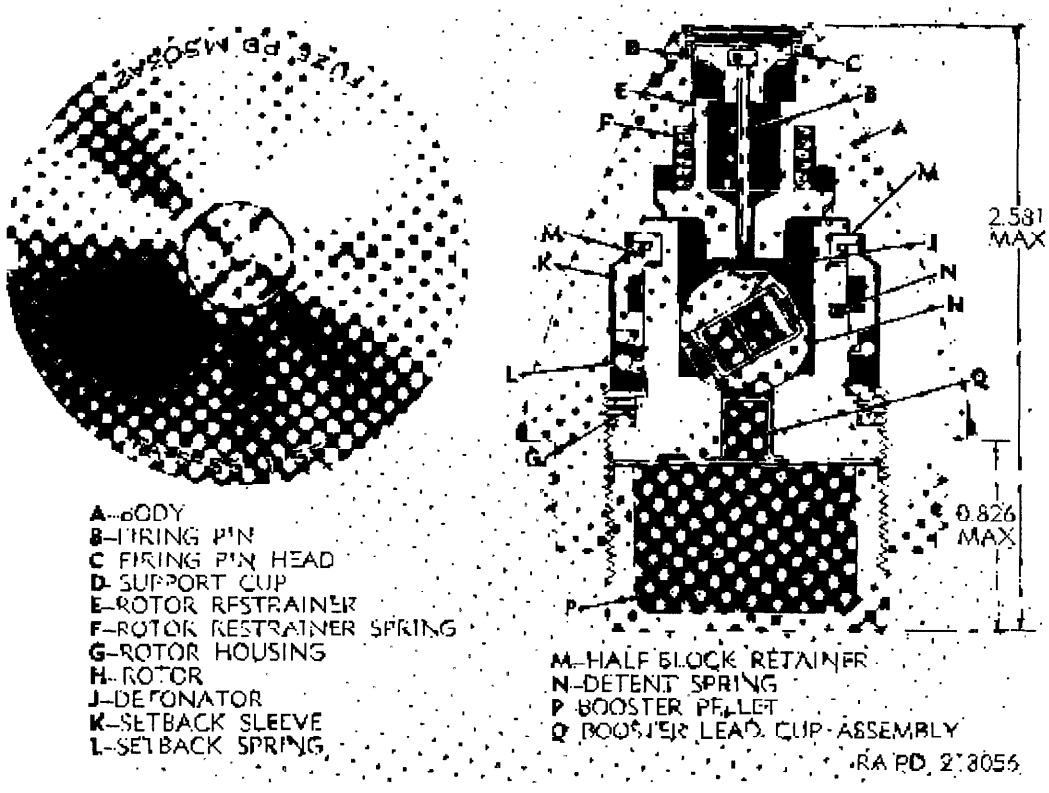

Figure 27. Fuze, PD: M503A2—rotor in unarmed position.

61. Fuze, PD: M503A2, M503A1, or M503

a. General. The fuze M503A2 (fig. 27) is a single-action, superquick type which functions by impact or graze after an arming delay, which is in effect for about 60 feet from the rifle; being reliably armed in 100 feet. The fuze is provided for use with 57-mm rifle projectiles. The fuze M503A2 differs from the fuzes M503 and M503A1, principally, in having a setback sleeve, a setback spring, and half-block retainers which provide added safety.

b. Data.

Length:	
Visible	1.755 in.
Overall	2.58 in.
Weight	0.34 lb
Thread size	1.7–14 NS–1

Note. The key letters shown below in parentheses refer to figure 27.

c. Description. The fuze has an aluminum body (A), recessed at the forward end to hold a steel firing pin (B), which is held in an aluminum firing pin head (C), and supported by a gilding metal support cup (D). Threaded to the rear of the body is a booster cup containing a booster pellet (P). The pointed end of the firing pin projects into an aluminum rotor restrainer (E), which is held in place by a rotor restrainer spring (F). An aluminum rotor housing (G) contains a brass spherical rotor (H) with a detonator (J) and a booster lead cup assembly (Q). An aluminum setback sleeve (K), which fits around the rotor housing, is held in its forward position against two half-block retainers (M) by a steel wire setback spring (L). The two half-block retainers are held in position against the rotor housing by its detent spring (N). In the unarmed position, four brass detents (not shown in cross section) are held against the rotor by the setback sleeve (K) and the detent spring (N), preventing the rotor from turning.

d. Functioning. Setback force, incident to firing, displaces the setback sleeve to the rear against the setback spring. In this position, the setback sleeve continues to hold the detents in the locked position, thereby preventing the rotor from turning. Centrifugal force, due to rotation of the projectile (approx. 9,000

rpm), causes the half-block retainers to move outward against their spring. Upon deceleration, the grooved setback sleeve moves forward against the half-blocks, occupying a new position in which the groove is opposite the detents. In this position, the four detents, acted on by centrifugal force, move outward against their detent spring into the groove in the setback sleeve, freeing the rotor. The rotor, being free to turn, alines the detonator with the firing pin. This is caused by unbalanced forces exerted on the rotor due to differences in density between the detonator and brass rotor. During flight, the rotor restrainer and its spring prevent the rotor from "creeping" forward and firing the detonator. The fuze can function in two ways—by direct "impact" or "graze." When "impact" of the nose of the fuze on the target occurs, the firing pin is driven into the detonator. When contact is made at a point to the rear of the nose "graze", the inertia of the rotor causes it to move forward, due to the sudden retardation of the projectile "set-forward", overcoming the resistance of the rotor restrainer spring and carrying the detonator forcibly against the firing pin. The firing pin, striking the detonator, initiates the explosive train of the projectile.

c. Preparation for Firing. No setting or other preparation is required.

Section II. PROPELLING CHARGES

62. General

a. General Discussion. The propelling charge used with recoilless rifle ammunition consists of a quantity of propellant M10 or M26 (T28) in the form of single or multiple perforated grains loaded in the cartridge case. Due to the rigid attachment of the cartridge case to the projectile, these propelling charges are considered "fixed"; that is, not adjustable. Single-base propellant composition M10 (consisting essentially of nitrocellulose) is used with most of these cartridges. In order to prevent loss of propellant through the perforations in the cartridge case wall during shipping and handling, a liner (usually of plastic) is provided in the cartridge case before the propellant is loaded. The liners burn when the propellant is ignited, permitting part of the propellant gases to be discharged through the perforations in the wall of the cartridge case. See TM 9–1900 and TM 9–1910 for more detailed information on propelling charges and propellants.

b. Determination of Propellant Weight. The weight of propellant loaded in a particular propelling charge varies from one ammunition lot to another. Ballistic tests conducted on each lot of propellant manufactured determines the weight of propellant which will give the ballistic performance desired. In this way, variations in ballistics due to variations in propellant are minimized.

63. Propelling Charge for 57-mm Cartridges

The propelling charge consists of about 1 pound of propellant M10 in the form of single perforated cylindrical grains. After the propellant is loaded into the cartridge case, the open end of the plastic cartridge case liner is heat-sealed.

64. Propelling Charge for 75-mm Cartridges

The propelling charge consists of from 3.19 to 3.42 pounds of propellant M10 in the form of multiperforated cylindrical grains. For the HE and TP cartridges, 3.30 pounds are used; for the HE, AT cartridge, 3.19 pounds; and for the smoke cartridge, 3.42 pounds. A supplementary igniter charge (black powder), attached to a notched cardboard disk, is positioned on top of the propellant. After the propellant and supplementary igniter charge have been loaded into the cartridge case, the open end of the plastic cartridge case liner is heat-sealed. The propelling charge is held in place in the cartridge case by a cardboard support, which acts as distance wadding.

65. Propelling Charge for 106-mm Cartridges

The propelling charge consists of 8.06 pounds of propellant M26 (T28) for the HE, AT cartridge M344A1; 8.10 pounds of propellant M10 for HE, AT cartridge M344; 8.25

pounds of propellant M10 for the HEP–T cartridge M346; and 8.00 pounds of propellant M26 (T28) for the HEP–T cartridge M346A1. The propellant is in the form of multiperforated cylindrical grains. After the propellant is loaded into the cartridge case, the open end of the plastic cartridge case liner is heat-sealed.

66. Propelling Charge for Caliber .50 Cartridges

The propelling charge consists of approximately 117.5 grains of extruded single-base tubular propellant except for the spotter-tracer cartridge M48. The propelling charge for the cartridge M48 consists of double-base small-arms propellant.

Section III. PRIMERS

67. General

a. General Description. A primer (fig. 28) is used in a propelling charge explosive train to initiate burning by supplying a flame. Primers used with recoilless rifle ammunition vary in size, depending upon the quantity of propellant to be ignited. For example, in 57-mm rifle ammunition, the propelling charge consisting of about 1 pound of propellant is ignited by a primer containing a 285-grain black powder charge. In 106-mm rifle ammunition, a primer containing a 1,000-grain black powder charge is used to ignite about 8 pounds of propellant. Where sufficient black powder cannot be loaded into the primer body to insure proper ignition, a separate bag of black powder (fig. 10), called an igniter charge, is assembled on top of the propelling charge. Primers used with recoilless rifle ammunition are of the percussion type—that is, they are initiated by a sharp blow. A caliber .50 small-arms percussion primer is used with the spotting rifle ammunition. Table II lists the various primers used with recoilless rifle cartridges, indicating their use, dimensions, and weights.

b. General Design. The primer is comprised of a head assembly and a body assembly. The head assembly consists of a head, into which is pressed a percussion element assembly; and a firing plug, which, in turn, is held by a battery cup pressed into the head. The head has a center flash hole, leading from the percussion element assembly to the primer charge. The body assembly consists of a brass or steel tube, with radially perforated flash holes or vents, lined internally by a paper liner, into which is assembled the loose black powder primer charge. Bodies vary in length and in the number of radial vents. The open forward end of these primers is closed by a cardboard diaphragm. The body assembly and head assembly are threaded together and crimped. The head diameter of the primer is such that it is assembled to the cartridge case by a press-fit.

c. Method of Functioning. A sharp blow

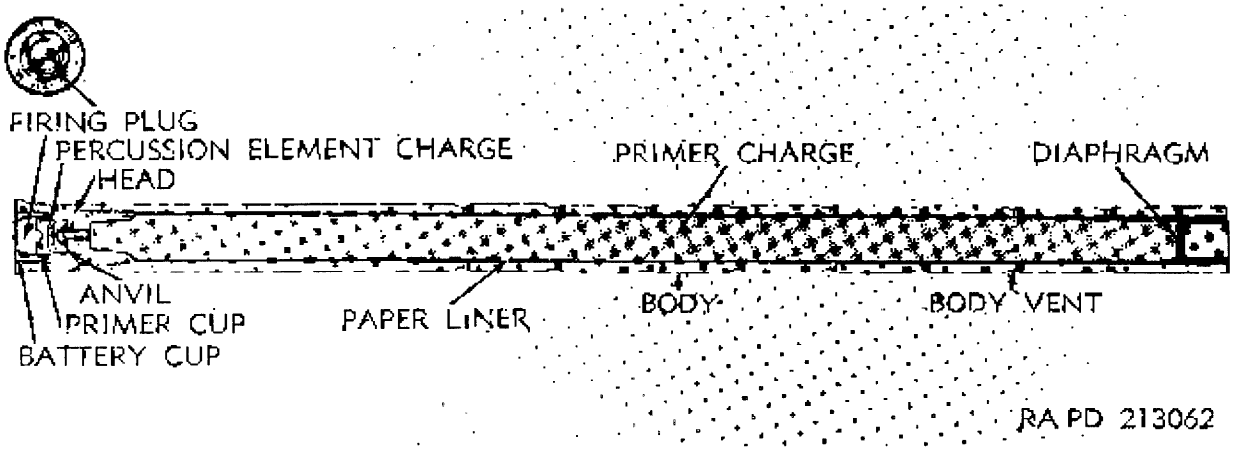

Figure 28. Typical primer.

from the firing pin of the rifle either is transmitted through the firing plug to the primer cup or strikes the primer cup directly. The cup bends inward under the force, squeezing the primer mixture (percussion element charge) between itself and the anvil, initiating the sensitive primer mixture by friction. The flame from the mixture travels around the anvil, through the flash hole in the head to the primer charge, igniting it. Flames from the burning primer charge jets through the radial flash holes into the propelling charge, thereby igniting it.

Table II. Primer

Model designation	Type	Length (in.)	Diameter: Head	Diameter: Body	Weight: Charge	Weight: Assembly	Ammunition with which used
M46	Percussion	1.68	0.62	0.541	200.0	1,760.0	57-mm rifle
M47, M47B2	Percussion	0.91	.62	.544	300.0	2,516.2	75 mm rifle
M57	Percussion	2.90	.82	.70	1,000.0	6,580.0	106 mm rifle
M60A1	Percussion	0.36	.63	.541	285.0	2,272.0	57-mm rifle

68. Primer, Percussion, M60A1

This primer is used with cartridges for the 57-mm rifle. It differs from the typical primer (fig. 28) in not having a firing plug or battery cup. The firing pin of the weapon strikes the primer cup directly. The primer M60A1 differs from the primer M60 in having improved metal parts. The primers M60 and M46 (200-grain primers) are used in 57-mm rifle cartridges of less recent manufacture.

69. Primer, Percussion, M47 or M47B2

This primer, which is used with recoilless rifle cartridges, is of the type generally described in paragraph 67. The primer M47 has a brass head and body; the primer M47B2, a steel head and body.

70. Primer, Percussion, M57

This primer, which is similar to that generally described in paragraph 67 is used with 106-mm rifle ammunition. The primer consists of a perforated steel tube and brass head. The tube, containing the black powder primer charge, is closed at one end and is force-fitted 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.

Section IV. BOOSTERS AND BURSTERS

71. Booster

a. General. Since the bursting charge of high-explosive projectiles is relatively insensitive to shock, a comparatively large detonating charge is necessary to insure a high-order detonation of the bursting charge. The use of more sensitive explosives, such as mercury fulminate or lead azide, in the quantities required for the purpose would create excessive hazards in handling and firing. Therefore, such explosives are used only in small amounts, as initiating and intermediate detonating charges. A separate charge of somewhat less sensitivity (usually tetryl) is provided for detonating the high-explosive charge of the projectile; because its function is to increase or "boost" the effectiveness of the explosive train, this charge is known as a booster charge. The booster charge may be incorporated within the fuze itself or it may be encased in a thin metal casing which is threaded permanently to the fuze and considered part of the fuze. The boosters adapt fuze threads, which are 1.7-inch diameter 14 TPI, to fit the nose threads of projectiles 75-mm and larger, which are 2-inch 12 TPI.

b. Booster M21A4.

Note. The key letters shown below in parentheses refer to figure 29.

(1) *General.* The booster M21A4 (fig. 29) is an integral part of PD fuzes M51A5 and M51A4 and MTSQ fuzes M500A1 and M500. The booster is provided with a boresafety mechanism to prevent accidental functioning in the weapon. The booster was originally fitted with a safety (cotter) pin 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

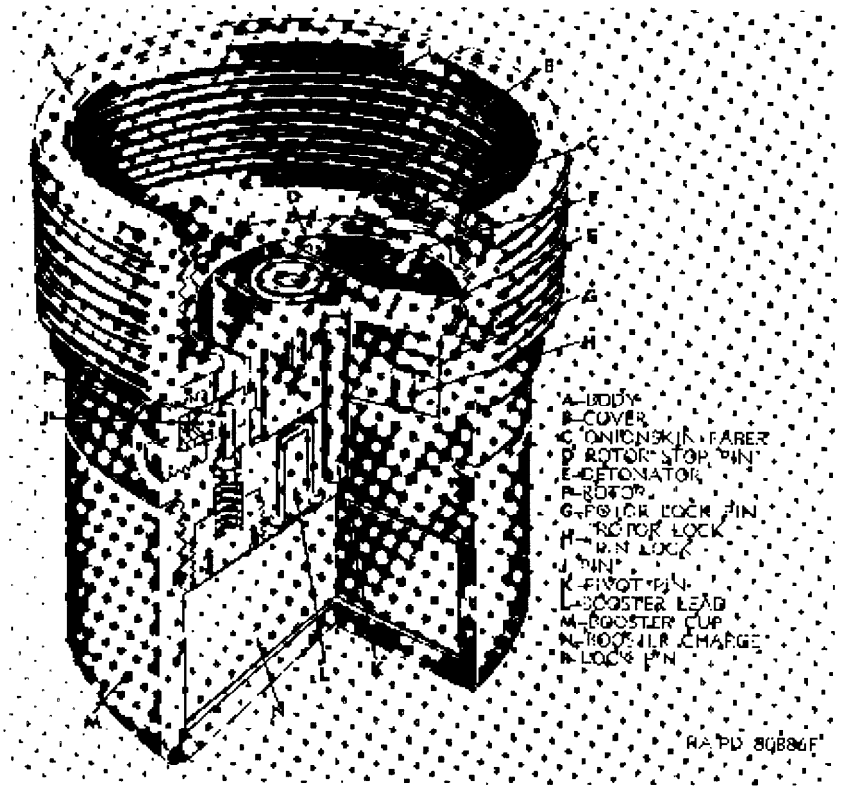

Figure 29. Booster, M21A4.

this safety pin is not necessary, as the centrifugally actuated pin (J) adequately provides the necessary safety.

(2) *Description.* The booster is comprised of two major parts: A rotor assembly and booster cup (M), which contains a tetryl booster charge (N) that screws onto a brass body (A) containing tetryl booster lead (L). 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 lockpin (P), which operates under setback; a rotor stop pin (D); a rotor lock pin (G); and a rotor lockpin lock (H). The rotor is seated on its pivot pin (K), so that the detonator normally is out of alinement with other explosive elements in the booster and the assembled fuze. The center of gravity of the rotor assembly is off the centerline of the pivot center, so that the assembly will rotate under centrifugal force. The rotor is locked in the unarmed position prior to firing by the spring-held centrifugal pin. The centrifugal pin, in turn, is held in the locking position by the centrifugal pin lockpin. The function of the rotor stop pin is to stop the rotor assembly when it has rotated to the alined or armed position. The boresafety mechanism is covered at the forward end of the booster 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 of the booster. The flash hole is covered by a thin disk of onionskin paper (C), to prevent foreign matter from entering the booster.

(3) *Functioning.* Upon firing, setback forces the centrifugal lockpin rearward against its spring, freeing the centrifugal pin. Centrifugal force moves the forward end of the lockpin under the shoulder in the lockpin cavity. This prevents the lock pin from

returning to its original position. When the projectile reaches the required rotational velocity, the centrifugal pin moves outward against its spring. This releases the rotor, which then rotates to the alined or armed position against the stop pin, whereupon the rotor lock pin moves partially outward radially under centrifugal force from its cavity in the rotor and into the hole in the booster body. Creep force causes the rotor lockpin lock to move axially forward into the space behind the rotor lockpin, preventing the rotor lockpin from returning to its original position. Thus, the booster is locked in the armed position throughout the flight of the projectile. Action of the booster detonator is initiated by the detonating elements of the fuze. Explosion of this detonator is transmitted through the booster lead to the booster charge. The booster charge, in turn, detonates the high-explosive charge of the projectile.

(4) *Preparation for firing.* For firing the booster M21A4, the safety (cotter) pin must be removed if present before assembling the fuze and booster to the projectile. Renovated and newly manufactured boosters M21A4 do not have the safety (cotter) pin and, as a consequence, no preparation for firing is required.

72. Bursters

a. General. In chemical projectiles, the function of the explosive charge is to burst the shell casing and disperse the contents. In chemical projectiles, the charges are known, generally, as burster charges and the assembly as a burster. The burster consists essentially of a high-explosive charge in a long thin-walled container. The burster extends into the projectile cavity in order to insure complete rupture and effective dispersion of the chemical filler.

b. Burster M8. This burster is assembled in the burster casing M6 and, in conjunction with the burster initiator M1, is intended to rupture the shell casing and disperse the smoke filler of the 75-mm smoke projectile. The burster casing is a press-fit in the projectile adapter and the burster charge is a loose-fit in the casing. The burster charge consists of a thin-walled aluminum tube, approximately 7.9 inches long and ½ inch in diameter, loaded with 28.9 grams of tetryl. The burster casing consists of a seamless steel tubing brazed at the forward end in a steel sleeve. The casing is approximately 1⅝ inches longer than the burster to allow space forward of the burster charge for the burster initiator M1. The burster initiator consists of a steel head and tube containing a 2.2-gram tetryl pellet and detonator M17 (in the head). The tube is closed at the rear end by a felt pad and aluminum cup. The burster initiator is held in position against the forward end of the burster by a retention device.

c. Burster M21. This burster is assembled in burster casing M9A1 to rupture the shell casing and disperse the smoke filler of the 57-mm smoke projectile. The burster casing is a press-fit in the projectile adapter and the burster charge is a loose-fit in the casing. The burster charge consists of a thin-walled aluminum tube, approximately 2.65 inches long and 0.39 inches in diameter, loaded with 5.3 grams of tetryl. The burster casing consists of a seamless steel tubing 2.85 inches long and 0.56 inch in diameter.

CHAPTER 5

DESTRUCTION OF AMMUNITION TO PREVENT ENEMY USE

73. General

a. Destruction of ammunition described herein when subject to capture or abandonment will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of or policy established by the Army commander.

b. The information which follows is for guidance only. The conditions under which destruction will be effected are command decisions and may vary in each case, dependent upon a number of factors, such as the tactical situation, security classification of the ammunition (AR 380–5), quantity and location of ammunition, facilities for accomplishing destruction, and time. In general, destruction of ammunition can be accomplished most effectively by burning, demolition, or gunfire or a combination of these. Selection of the particular method of destruction requires imagination and resourcefulness in utilization of the facilities at hand under the existing circumstances. Time usually is critical.

c. If destruction to prevent enemy use is resorted to, ammunition and its components must be damaged so badly that they cannot be restored to 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 greatest obstruction to enemy movement and, also, prevent hazard to friendly troops from fragments.

(2) Observance of appropriate safety precautions.

74. Methods

Ammunition can be destroyed most quickly by burning or demolition. The following methods, 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 destroyed by placing it in piles and detonating with TNT, COMP C, or other explosives of equivalent potential.

(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 using the required demolition blocks together with the necessary initiating items (detonating cord and blasting caps), and place the charge on the ammunition pile to be destroyed.

(*c*) Connect the charges for simultaneous detonation with detonating cord.

(*d*) Provide for dual priming to minimize the possibility of a misfire.

(*e*) Detonate the charges. For complete details on the use of demolition materials and methods of priming and detonating demolition charges, refer to FM 5–25. Training and careful planning are essential. The danger areas for piles of ammunition is a circular area of a

radius which varies according to the quantity of explosive ammunition to be destroyed. Quantity distance data are given in TM 9–1903.

b. Method No. 2—by Burning.

(1) *General.* Packed and unpacked high-explosive ammunition may be destroyed quickly and effectively by burning.

(2) *Method of destruction.*

(*a*) Stack the ammunition, either packed or unpacked, in piles. Place combustible material around and on top of the piles.

(*b*) Pour oil and gasoline over the entire pile.

(*c*) Ignite the pile by a paper or excelsior train and take cover.

Warning: **Cover must be taken without delay, since an early detonation of the high-explosive ammunition may be caused by the fire. Due consideration should be given to the flammable nature of gasoline and its vapor. Carelessness in its use may result in painful burns.**

75. Priority

Priority for destruction of ammunition should be in accordance with FM 9–6.

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 material 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 310–5
Index of Supply Manuals—Ordnance Corps.	DA Pam 310–29
Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.	DA Pam 310–4
Index of Training Publications	DA Pam 310–3

2. Supply Manuals

a. Ammunition.

Ammunition (Class 1310 Ammunition, over 30-Millimeter up to 75-Millimeter).	SM 9–5–1305
Ammunition (Class 1315 Ammunition, 75-Millimeter through 125-Millimeter).	SM 9–5–1315
Ammunition and Explosives (Class 1390, Fuzes and Primers).	SM 9–5–1390
Ammunition, through 30-Millimeter	SM 9–5–1310
Cartridge, Training, Subcaliber, M34	ORD 8 SNL C–33, Sec 18
Rifle, Subcaliber, Cal. .30, M9	ORD 8–9 SNL C–33, Sec 20

b. Destruction To Prevent Enemy Use.

Ammunition (Class 1375 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.	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 468, Unsatisfactory Equipment Report

DA Form 2028, Recommended Changes to DA Technical Manual Parts Lists of Supply Manual 7, 8, or 9 (cut sheet)

DD Form 6, Report of Damaged or Improper Shipment

4. Other Publications

The following explanatory publications pertain to this materiel:

a. Ammunition.

Ammunition for Training	TA 23–100
Ammunition, General	TM 9–1900 TO 11A–1–20
Ammunition Renovation	TM 9–1905
Ammunition; Restricted or Suspended.	TB 9–AMM–2
Ammunition Supply and Preservation.	ORDM 3–4
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 TO 11A–1–37
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 AFR 68–3
Military Explosives	TM 9–1910 TO 11A–1–34
Qualifications in Arms: Qualification and Familiarization.	AR 370–5

Coordination with Armed Services Explosive Safety Board.	SR 385-15 AFR 14-12
Identification of Inert Ammunition and Ammunition Components.	AR 385-65
Regulations for Firing Ammunition for Training, Target Practice, and Combat.	AR 385-63 AFR 50-13
Small-Arms Ammunition	TM 9-1990
Supply Control: Distribution of Ammunition for Training.	AR 710-1300-1
b. Camouflage.	
Camouflage, Basic Principles	FM 5-20
c. Decontamination.	
Decontamination	TM 3-220
Defense Against CBR Attack	FM 21-40
d. Destruction to Prevent Enemy Use.	
Explosives and Demolitions	FM 5-25
e. Firing Tables.	
12-Inch Graphical Firing Tables	TM 9-524
Graphical Firing Tables; M39, M40, M41, M42, M43, M44, M45, M46, M47, M48, M49, M50, and M51.	TM 9-525
f. General.	
Artillery Materiel and Associated Equipment.	TM 9-2300
Auxiliary Sighting and Fire Control Equipment.	TM 9-575
Inspection of Ordnance Materiel in the Hands of Troops.	TM 9-1100
Installations, Administration	AR 210-10
Report of Loss, Theft, and Recovery of Government Property in the Continental United States.	AR 210-84
Logistics (General):	
Malfunctions Involving Ammunition and Explosives.	AR 700-1300-8
Unsatisfactory Equipment Report.	AR 700-38
Military Chemistry and Chemical Agents.	TM 3-215
Military Security: Safeguarding Defense Information.	AR 380-5
Authorized Abbreviations and Brevity Code.	AR 320-50
Dictionary of United States Army Terms.	AR 320-5
Military Symbols	FM 21-30 AFM 55-3
Military Training	FM 21-5
Ordnance Ammunition Service in the Field.	FM 9-6
Ordnance Maintenance and General Supply in the Field.	FM 9-10
Ordnance Service in the Field	FM 9-5
Safety: Accident Reporting and Records.	AR 385-40
Supply and Service Installation and Activities: Administration, Operation, and Organization.	AR 780-10
Tactics and Techniques of Chemical, Biological, and Radiological Warfare.	FM 3-5
Targets, Target Material, and Training Course Lay-Outs.	TM 9-855
Techniques of Military Instruction	FM 21-6
g. Maintenance and Repair.	
Field Maintenance: 57-mm Rifle M18, M18A1, and T15E16 and Subcaliber Device.	TM 9-3062-34
Maintenance of Supplies and Equipment: Spot Check Inspection and Reports, Ordnance Corps Materiel.	AR 750-926
Operation and Organizational Maintenance:	
57-mm Rifles M18, M18A1, and T15E16; Tripod Mount M1917A2; and Weapon Tripod Mount M74.	TM 9-3062
75-mm Rifles M20 and T21E12, Tripod Mount M1917A2, and Weapon Tripod Mount M74.	TM 9-3140
Ordnance Maintenance: Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals, Lubricants, Indicators, and Hydraulic Fluids.	TM 9-1007
h. Shipment and Limited Storage.	
Instruction Guide: Ordnance Preservation, Packaging, Packing, Storage, and Shipping.	TM 9-1005
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[AG 471 (6 May 50)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE
Major General, United States Army,
The Adjutant General.

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Units organized under following TOE: 29–55 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

* U.S. GOVERNMENT PRINTING OFFICE: 1959 O—508810